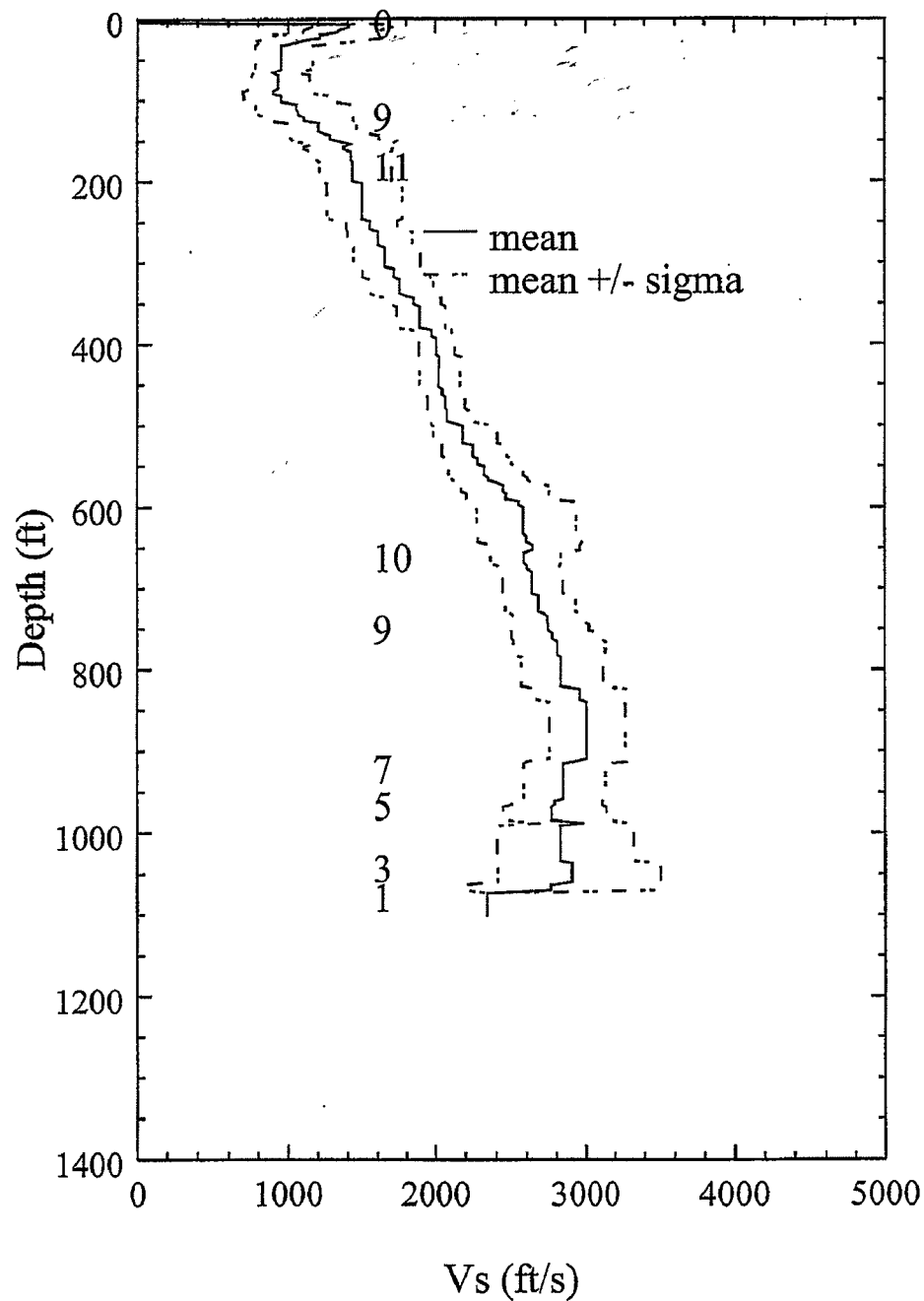




ASLBP #: 15-943-01-ESP-BD01
 Docket #: 05200043
 Exhibit #: PSEG004R-MA-BD01
 Admitted: 03/24/2016
 Rejected:
 Other:

Identified: 03/24/2016
 Withdrawn:
 Stricken:



Note:

Taken from Figure 7-14g, WSRC, 2007 (Reference 2.5.4.7-12).
 Numbers beside graph indicate number of tests in data set.

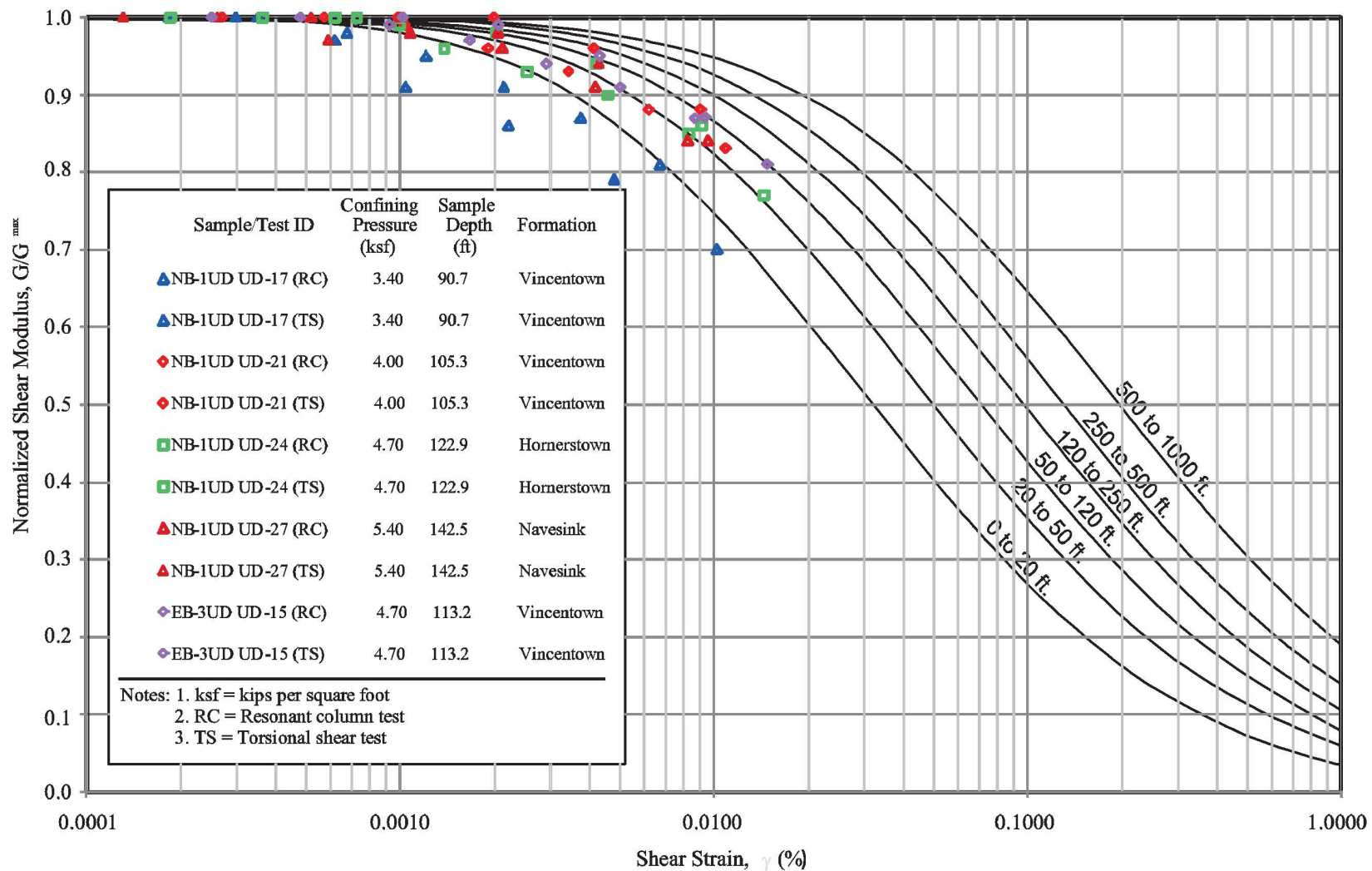
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Oyo Suspension Logger Shear Wave
 Measurements at Savannah River Site

FIGURE 2.5.4.7-16

Rev. 0

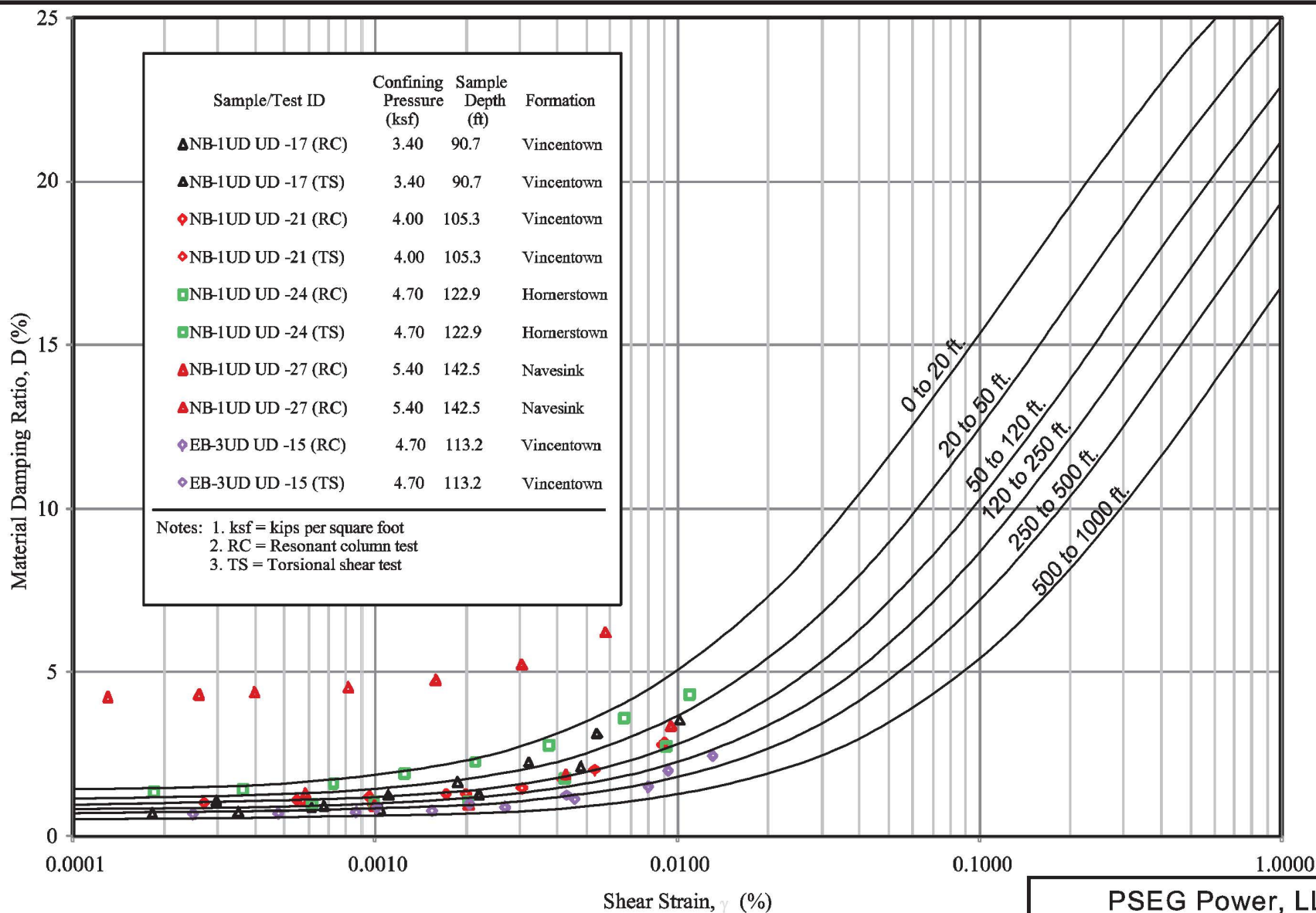


Note:
 Shear Modulus Reduction Curves are Generic Eastern
 North America Curves from EPRI, 1993 (Reference 2.5.4.7-3)

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 Shear Modulus Reduction Curves and
 RCTS Data at In-Situ Confining Stress

FIGURE 2.5.4.7-17

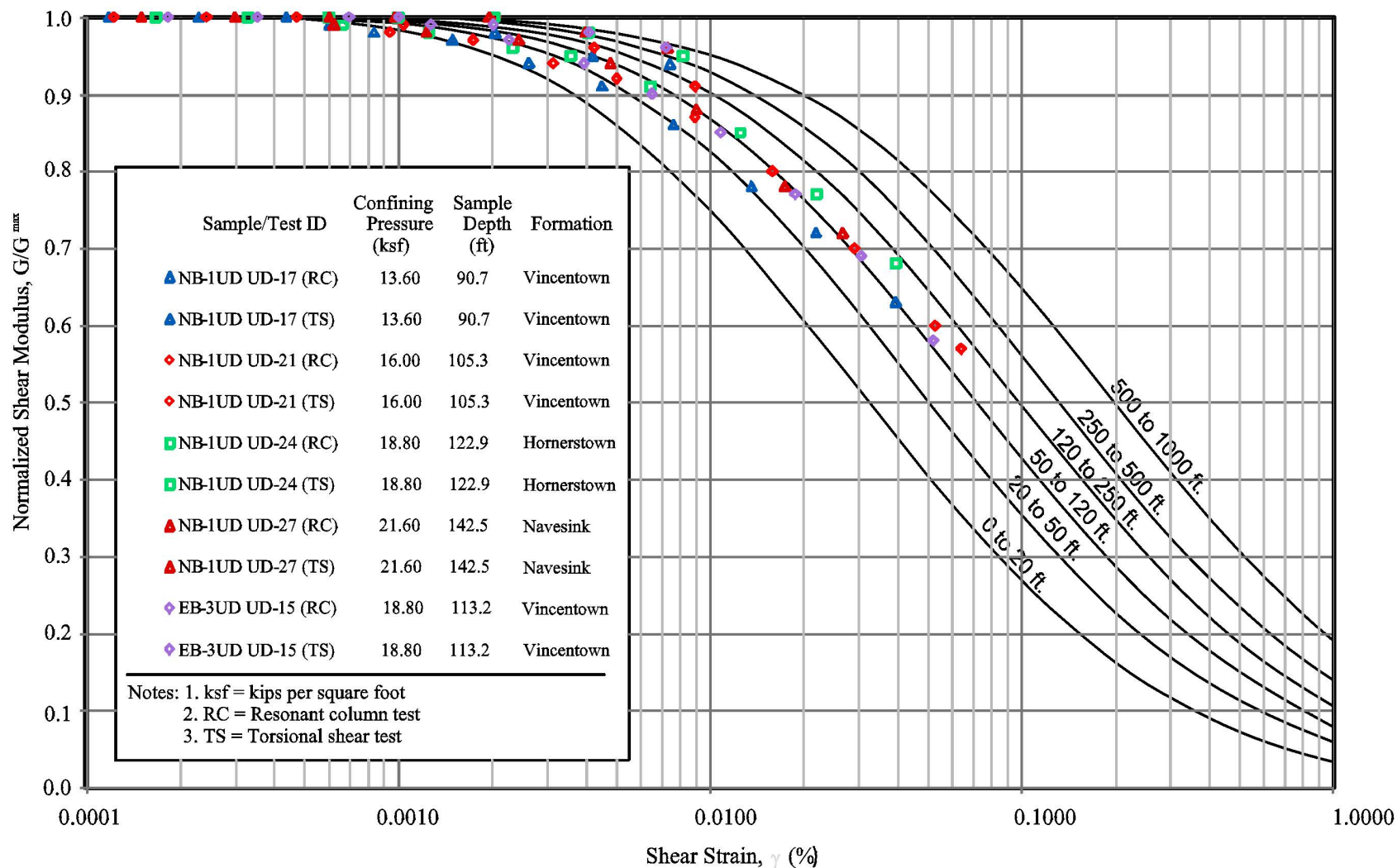
Rev 0



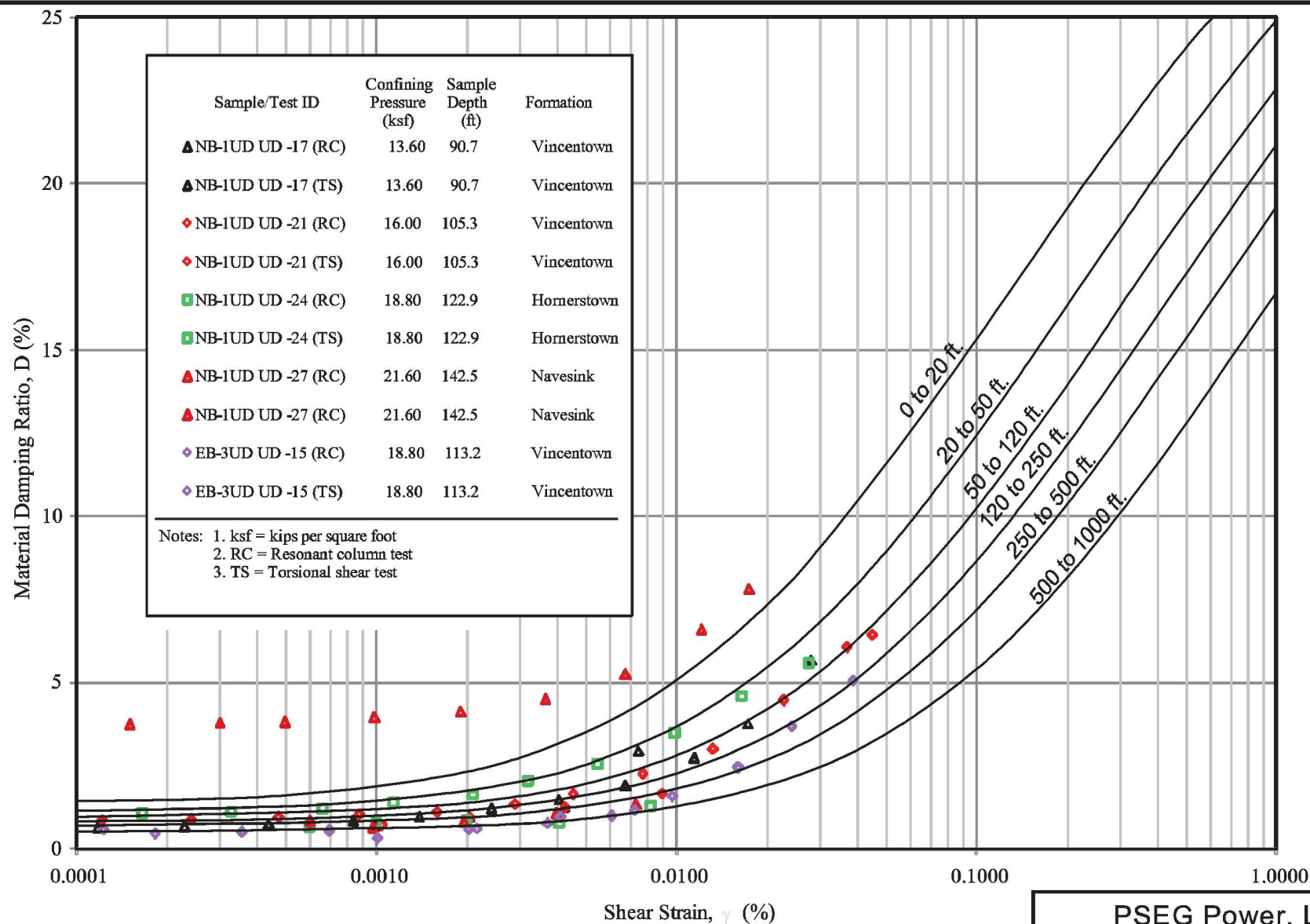
Note:
Shear Modulus Reduction Curves are Generic Eastern North
America Curves from EPRI, 1993 (Reference 2.5.4.7-3)

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Data at In-Situ Confining Stress

FIGURE 2.5.4.7-18
Rev 0



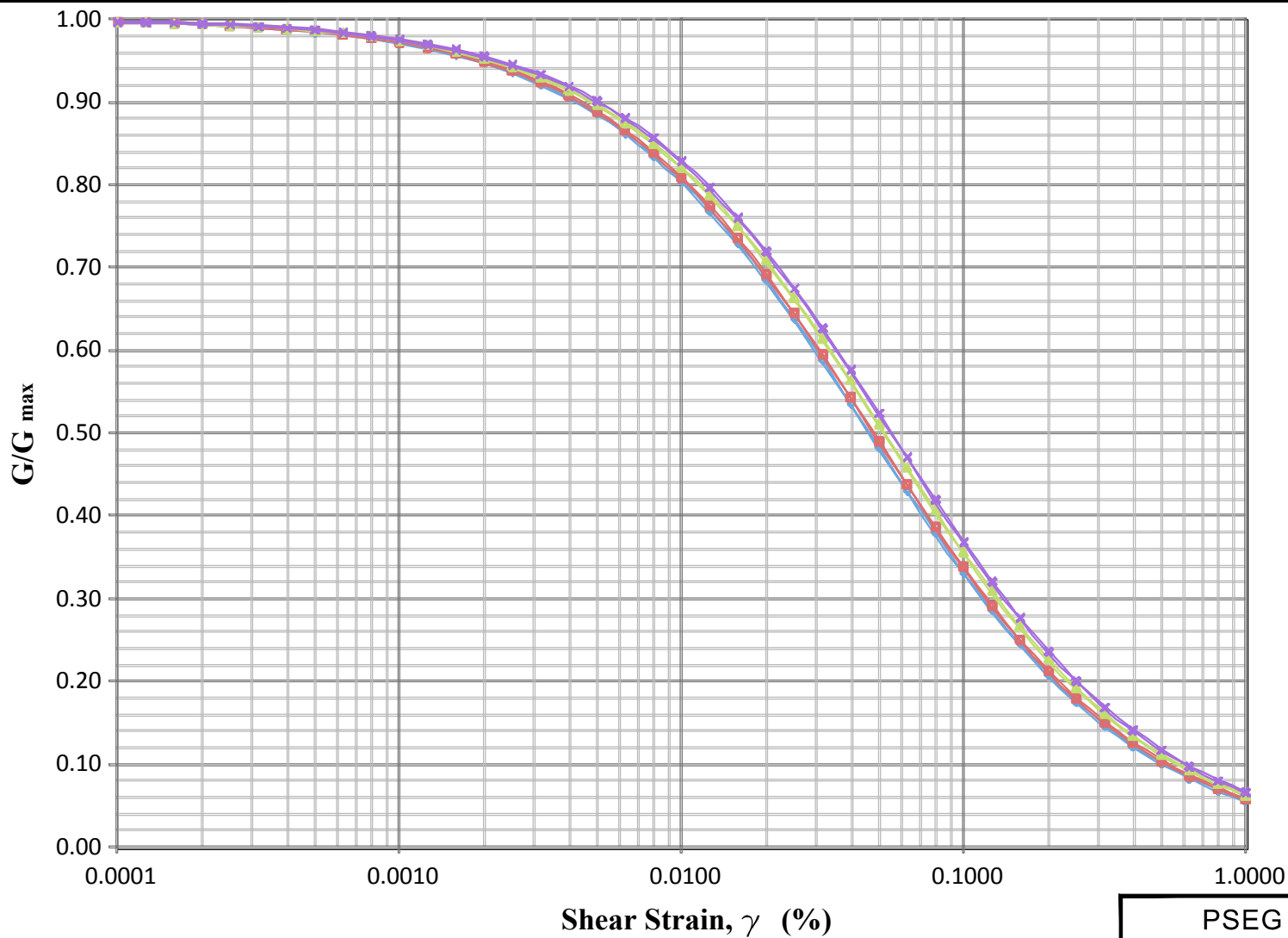
Note:
Shear Modulus Reduction Curves are Generic Eastern North America Curves from EPRI, 1993 (Reference 2.5.4.7-3)



Note:
Shear Modulus Reduction Curves are Generic Eastern North
America Curves from EPRI; 1993 (Reference 2.5.4.7-3)

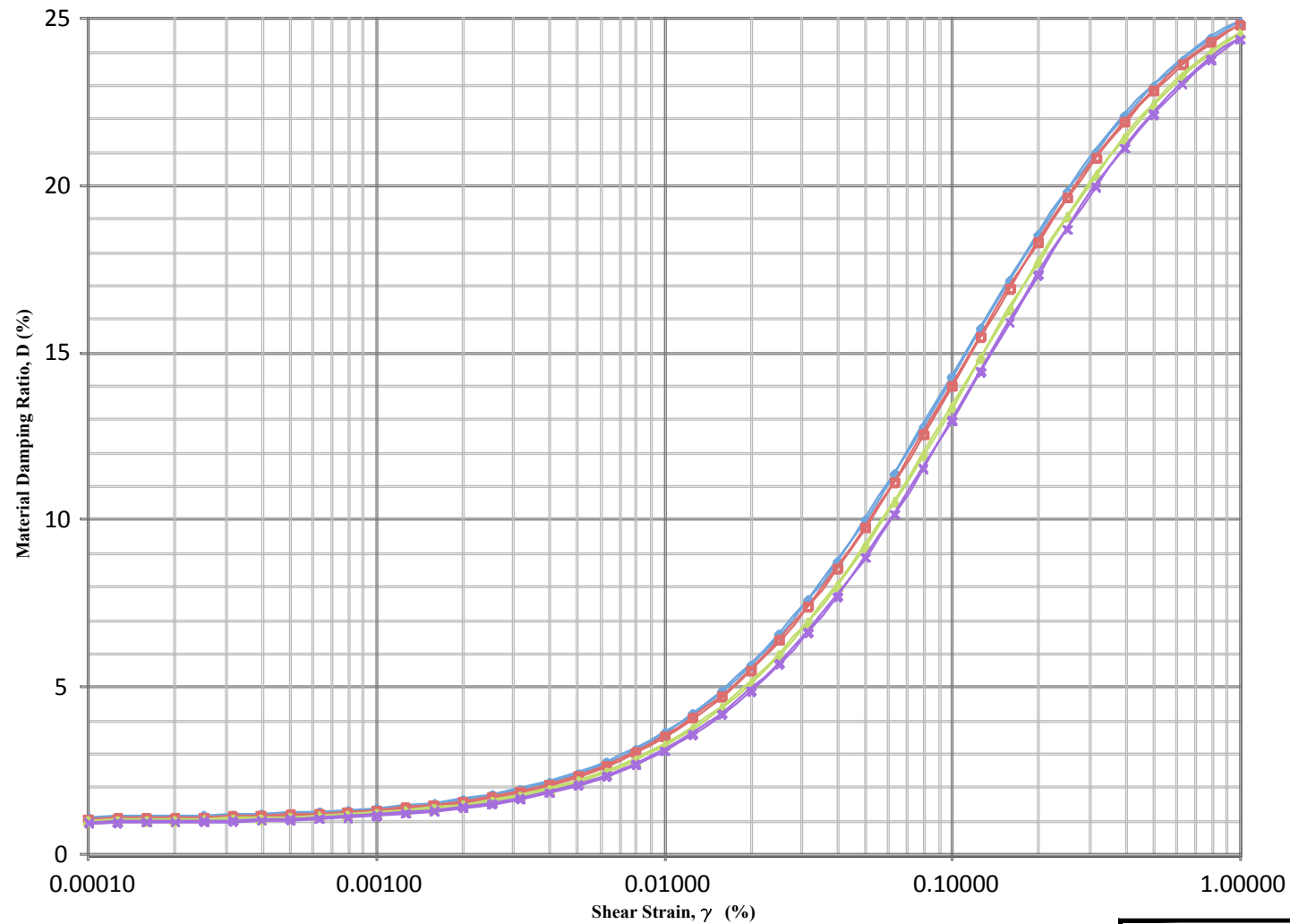
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Damping Ratio Curves and RCTS Data at
Four Times In-Situ Confining Stress

FIGURE 2.5.4.7-20
Rev 0



—◆— OCR=1, $K_o = 0.5$ —●— OCR= 4, $K_o = 0.92$
 —■— OCR = 2, $K_o = 0.6$ —×— OCR=6, $K_o = 1.17$

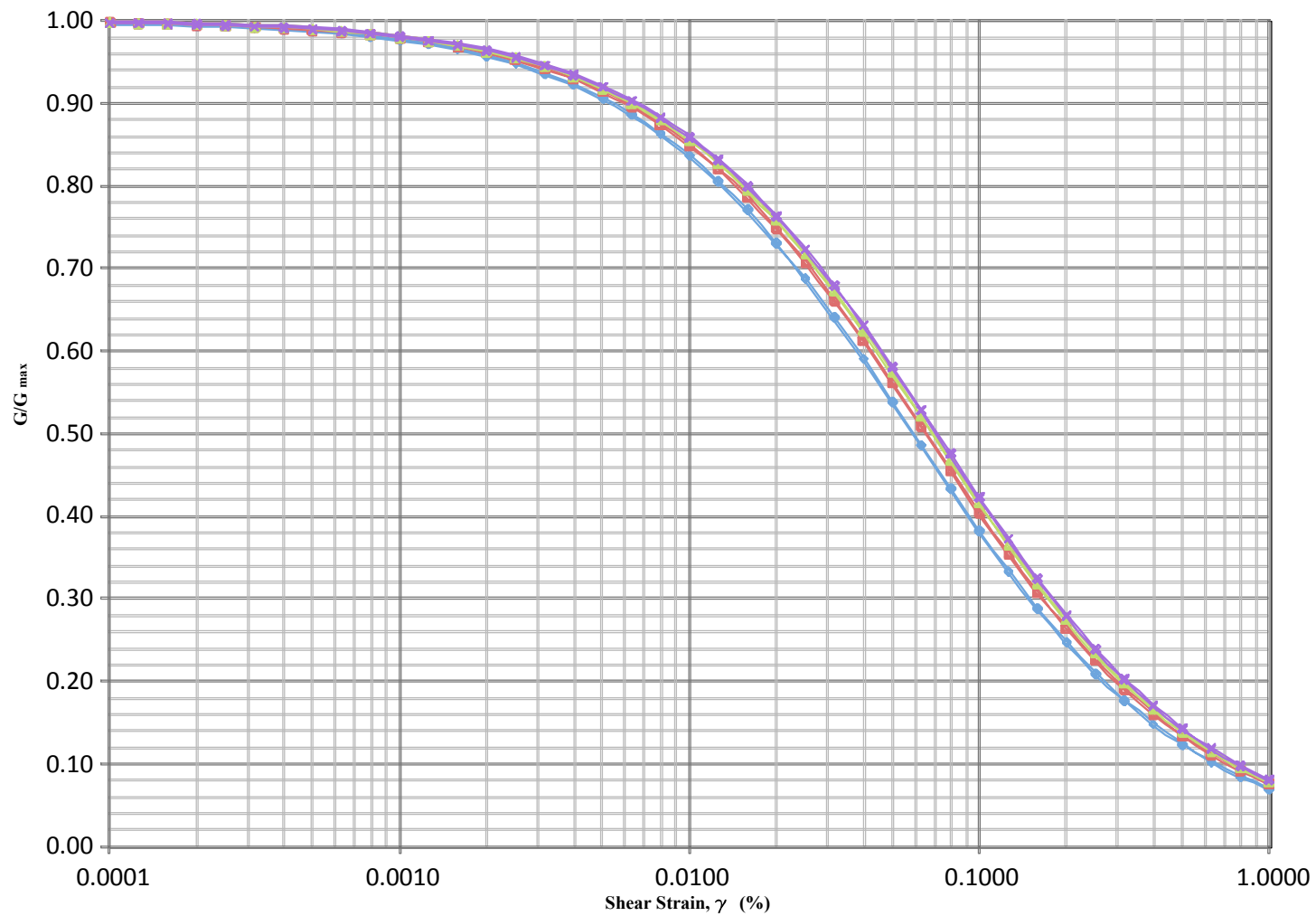
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 Computed Modulus Reduction
 Curve Layer A
FIGURE 2.5.4.7-21
 Rev 1



—◆— OCR=1, $K_o = 0.5$ —+— OCR= 4, $K_o = 0.92$
 —■— OCR = 2, $K_o = 0.6$ —x— OCR=6, $K_o = 1.17$

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 Computed Damping Variation
 Curve Layer A
FIGURE 2.5.4.7-22

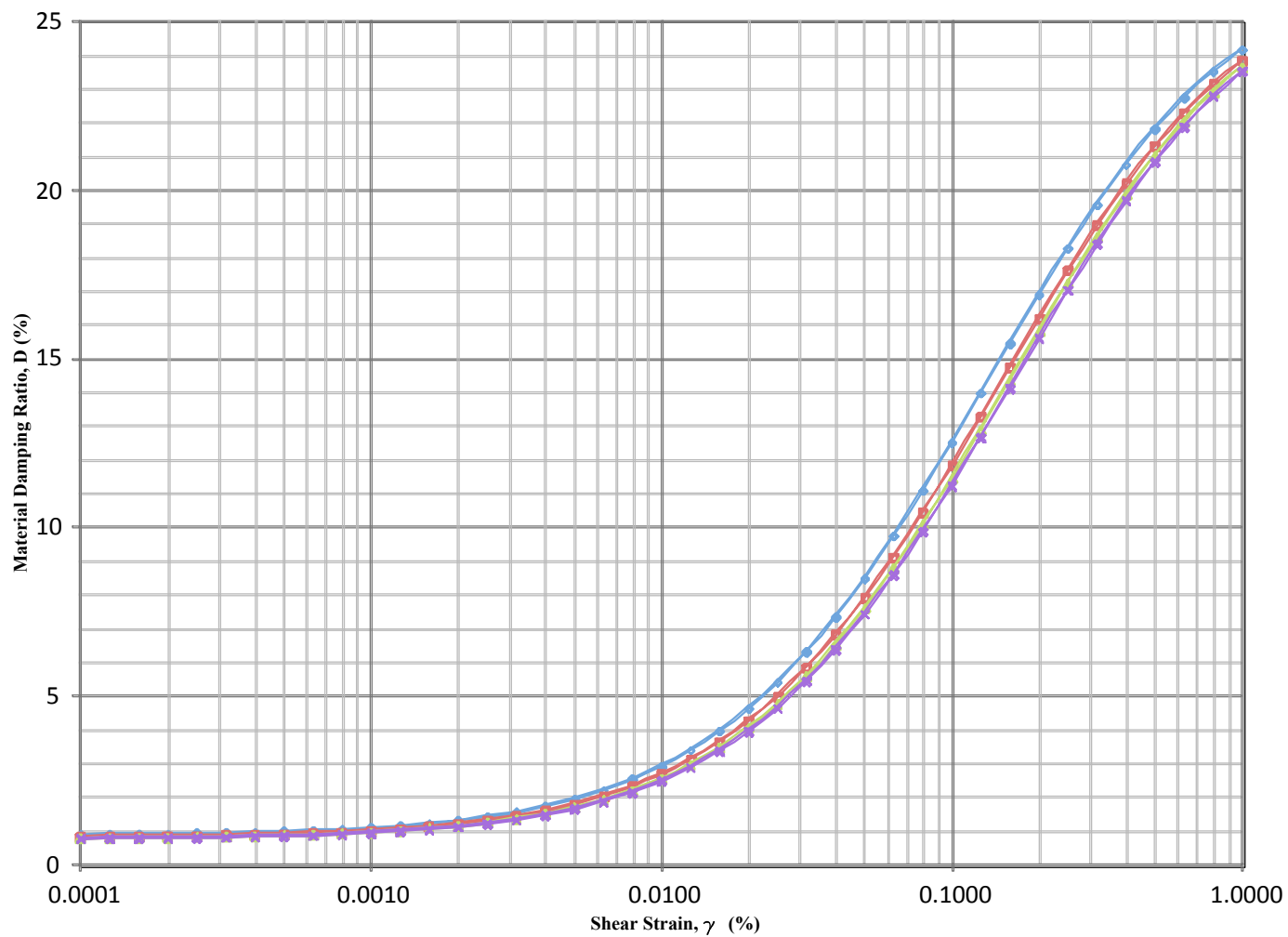
Rev 1



—○— OCR = 1, $K_o = 0.5$ —◇— OCR = 4, $K_o = 1.06$
—■— OCR = 2, $K_o = 0.83$ —×— OCR = 6, $K_o = 1.21$

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Computed Modulus Reduction
Curve Layer B
FIGURE 2.5.4.7-23

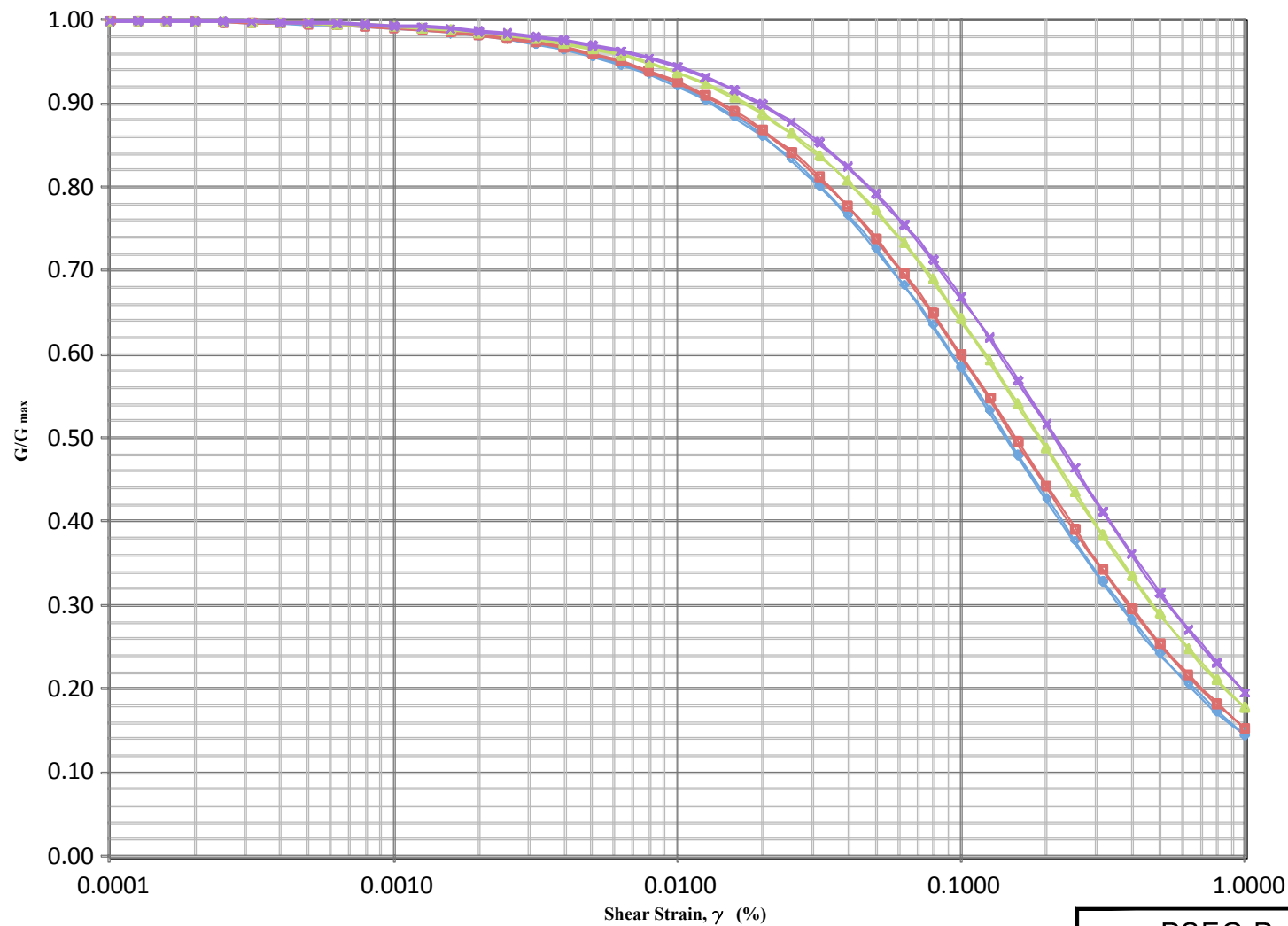
Rev 1



—○— OCR = 1, K_o = 0.5 —◇— OCR = 4, K_o = 1.06
 —■— OCR = 2, K_o = 0.83 —×— OCR = 6, K_o = 1.21

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 Computed Damping Variation
 Curve Layer B
FIGURE 2.5.4.7-24

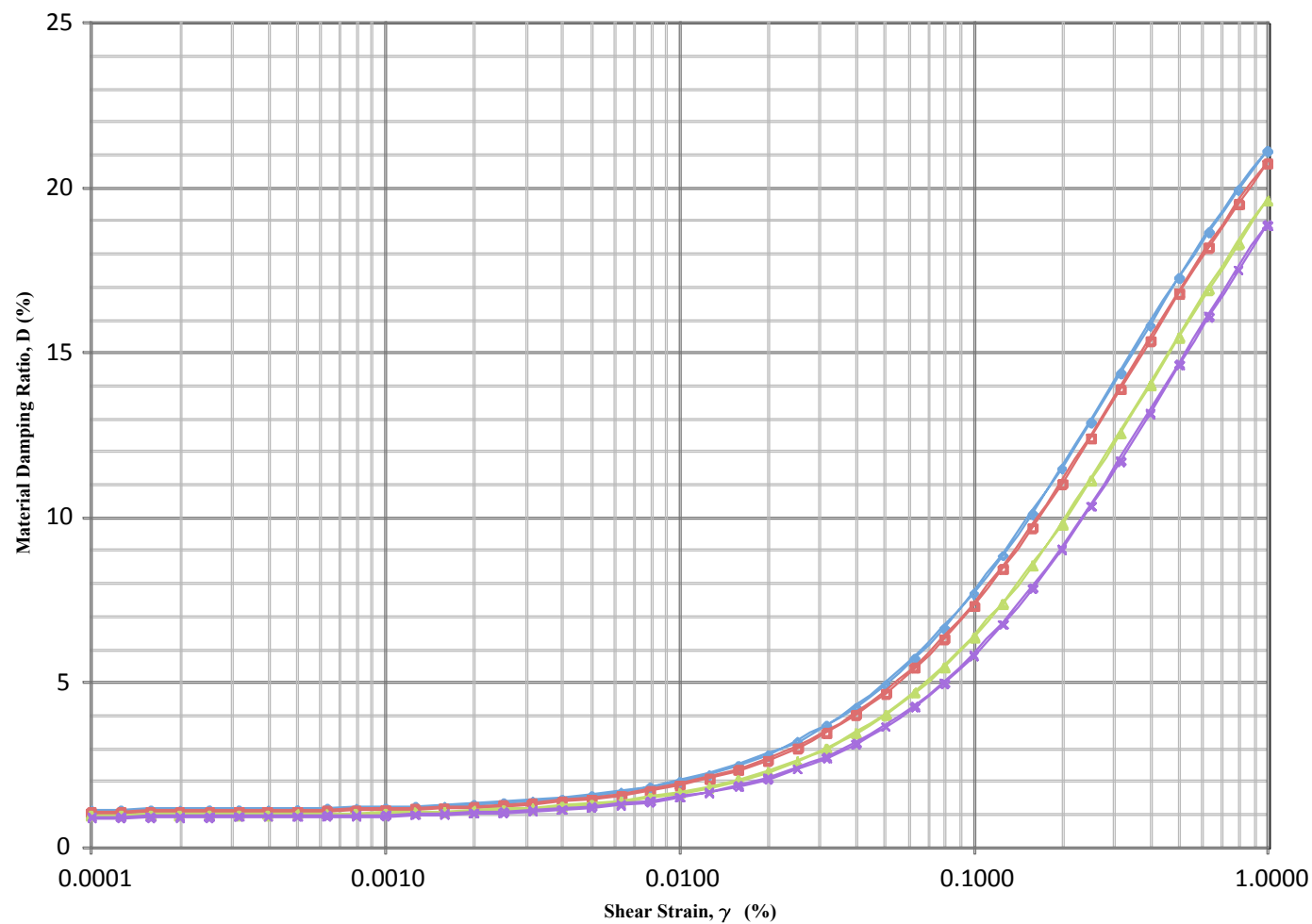
Rev 1



—◆— OCR = 2, K_o = 0.5 —▲— OCR = 4, K_o = 1.0
—■— OCR = 2, K_o = 0.71 —×— OCR = 6, K_o = 1.22

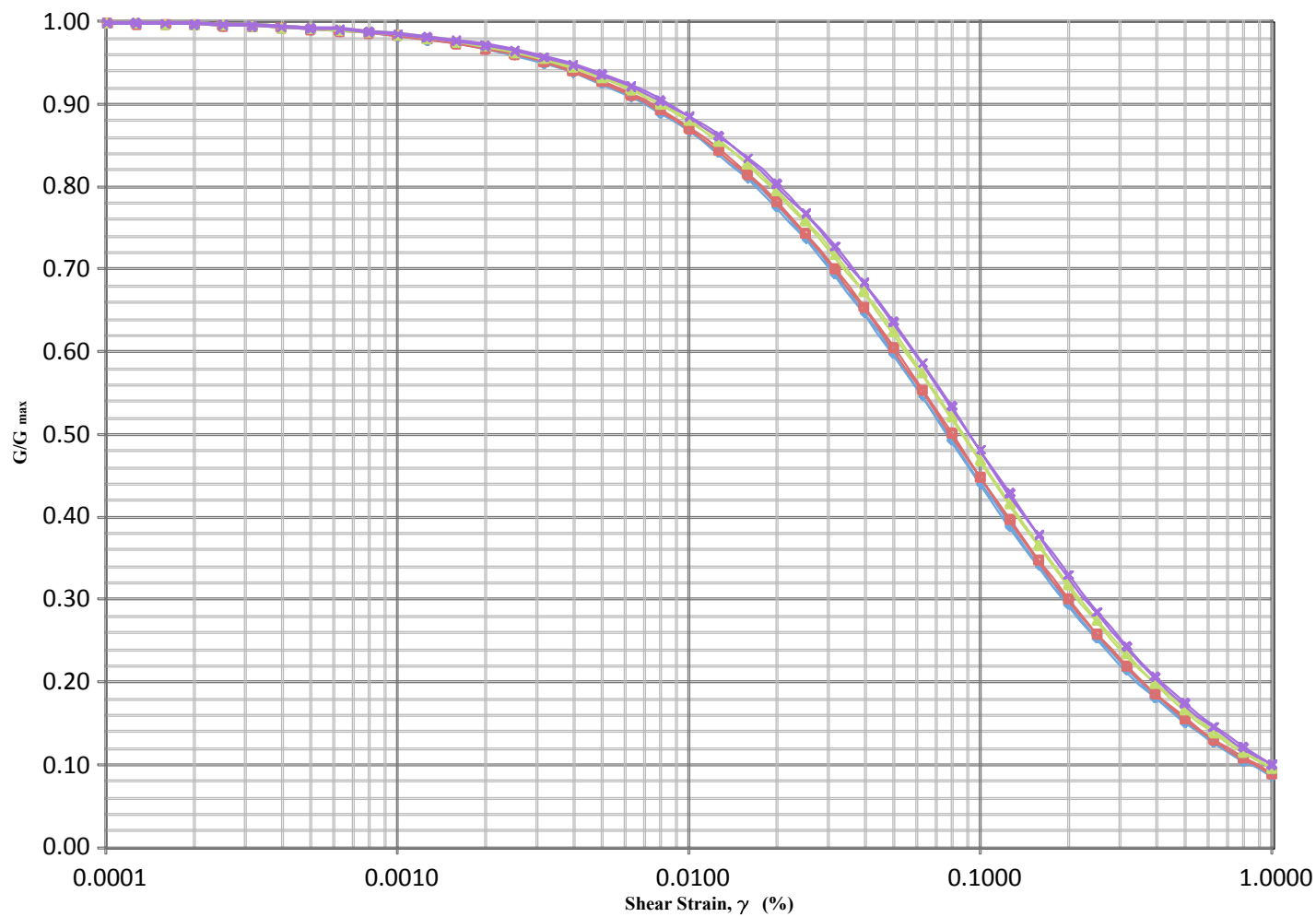
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Computed Modulus Reduction
Curve Layer C
FIGURE 2.5.4.7-25

Rev 1



—○— OCR = 2, K_o = 0.5 —△— OCR = 4, K_o = 1.0
 —□— OCR = 2, K_o = 0.71 —×— OCR = 6, K_o = 1.22

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 Computed Damping Variation
 Curve Layer C
FIGURE 2.5.4.7-26
 Rev 1



—◆— OCR = 1, K_o = 0.5

—■— OCR = 2, K_o = 0.6

—▲— OCR = 4, K_o = 0.92

—×— OCR = 6, K_o = 1.17

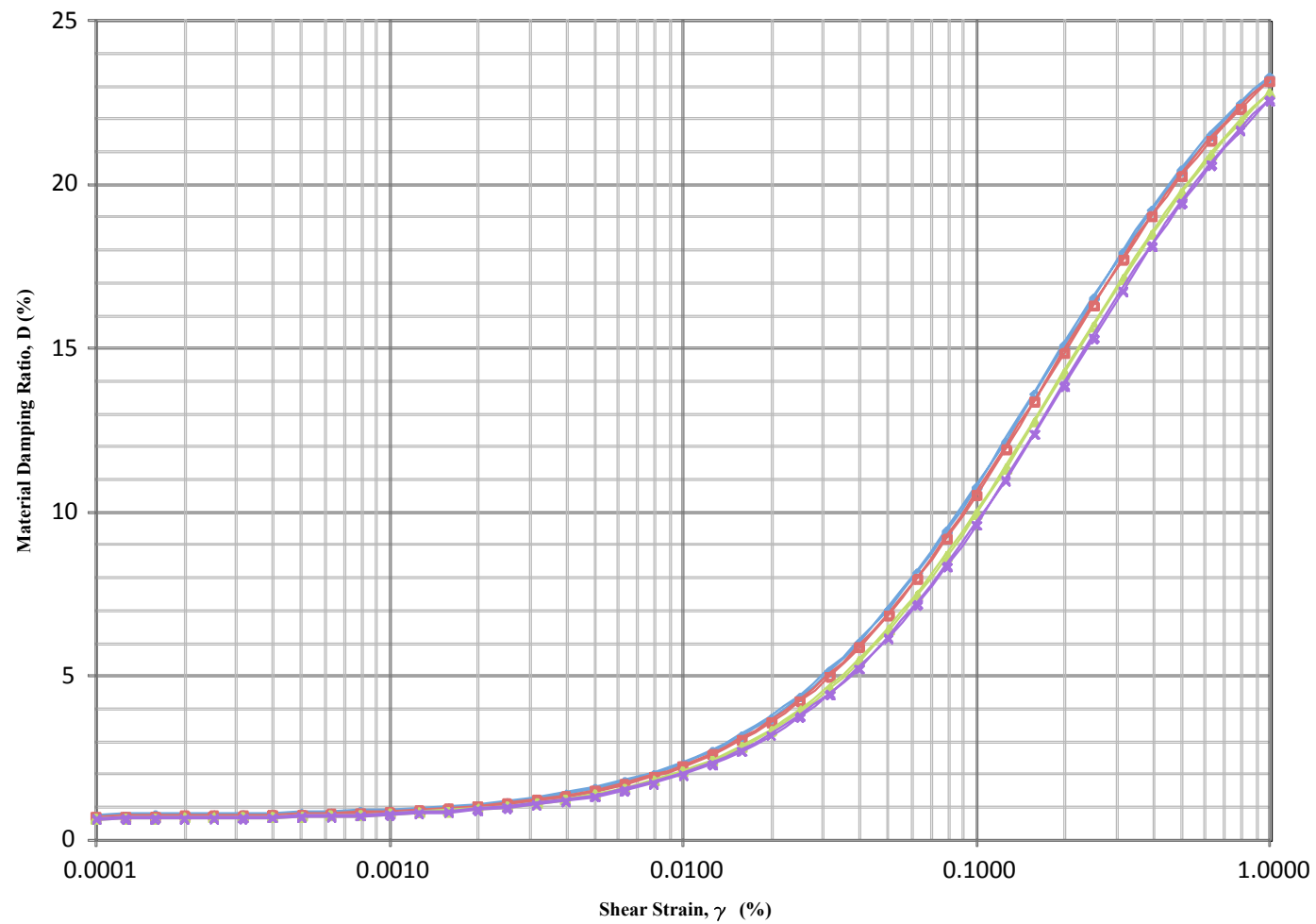
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Computed Modulus Reduction
Curve Layer D

FIGURE 2.5.4.7-27

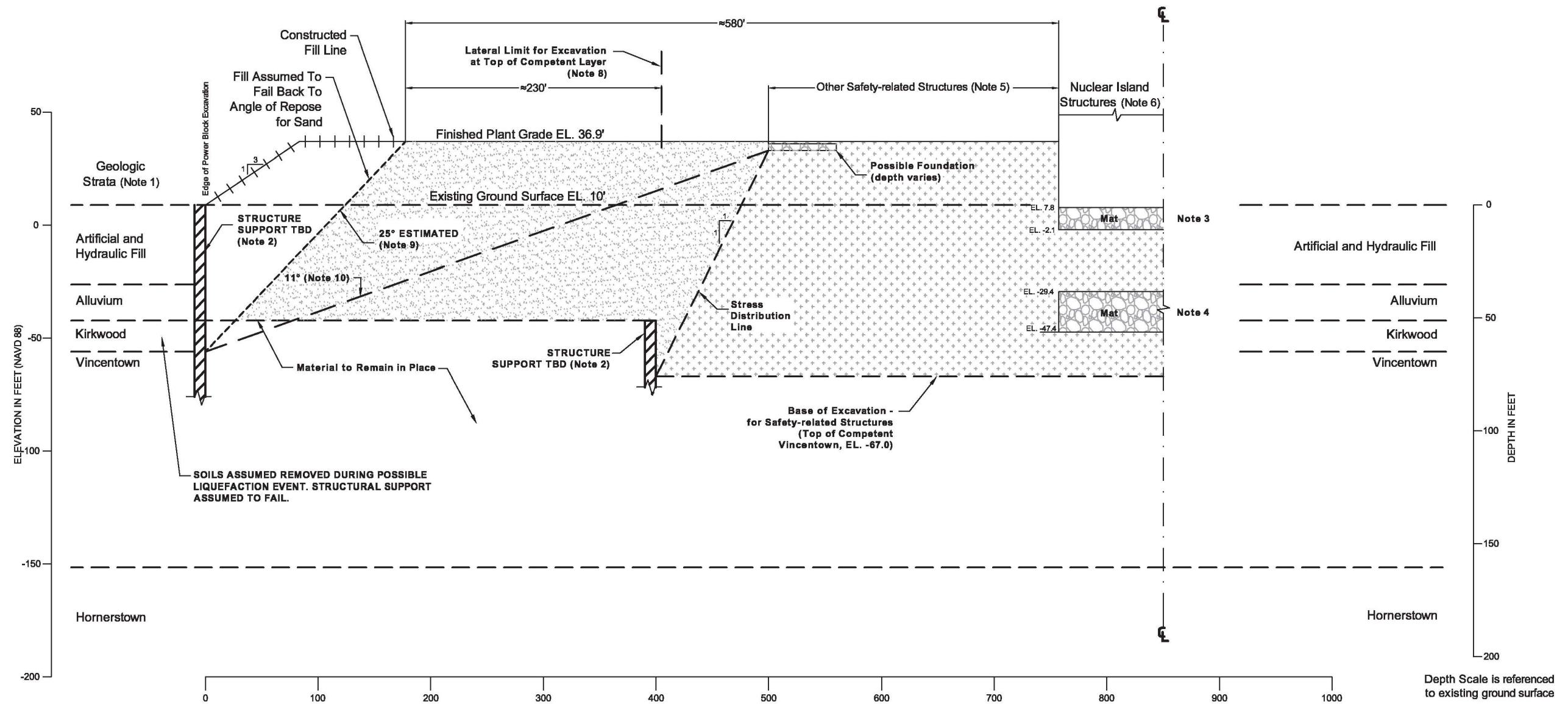
Rev 1



—●— OCR = 1, K_o = 0.5 —◆— OCR = 4, K_o = 0.92
 —■— OCR = 2, K_o = 0.6 —×— OCR = 6, K_o = 1.17

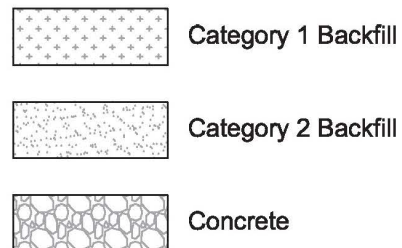
PSEG Power, LLC
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 Computed Damping Variation
 Curve Layer D
 FIGURE 2.5.4.7-28

Rev 1



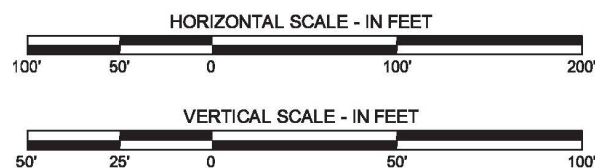
Consideration for loss of excavation support if soils outside the excavation were to be removed as a result of liquefaction and the excavation support structures were to fail.

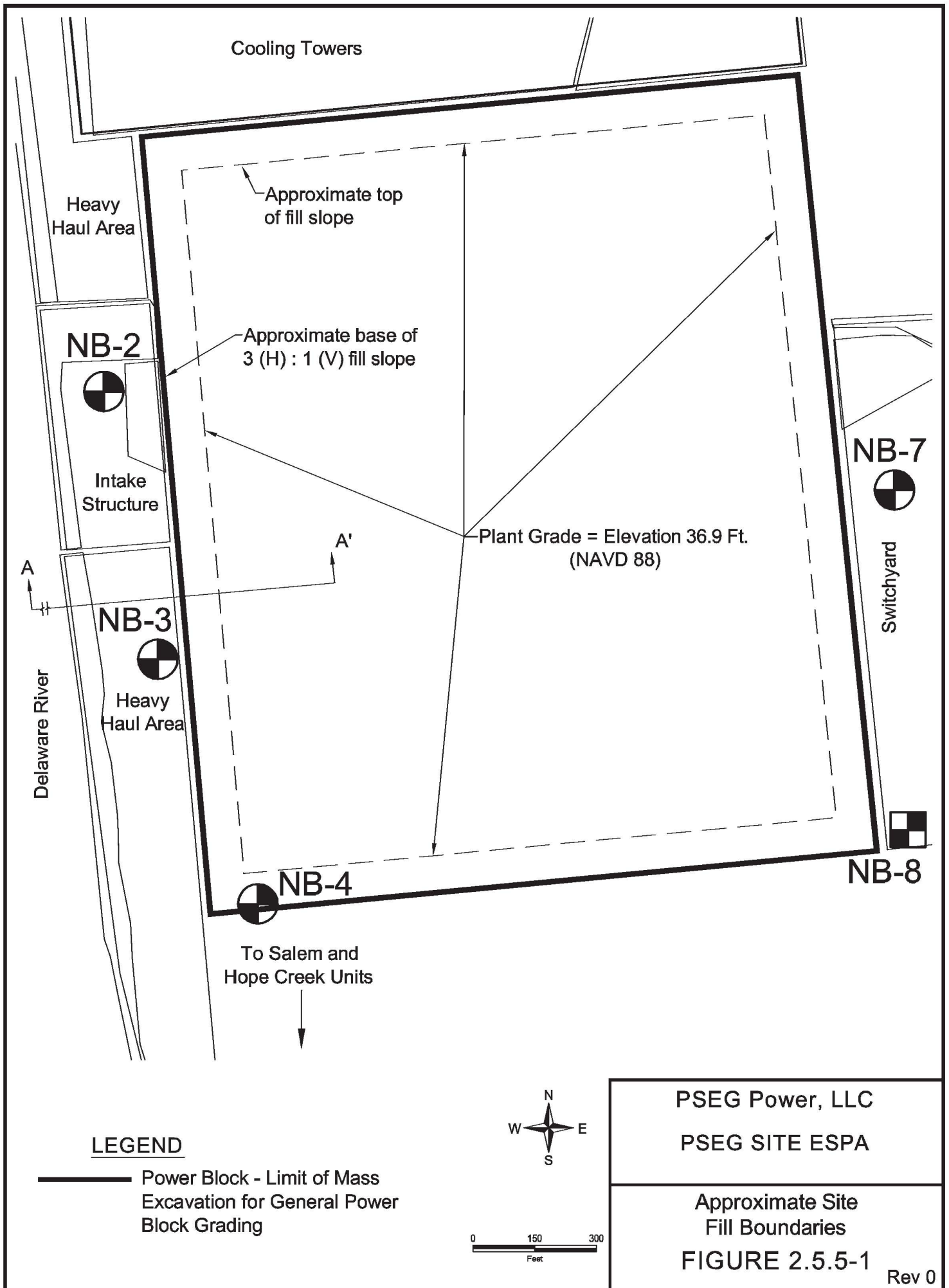
Legend:

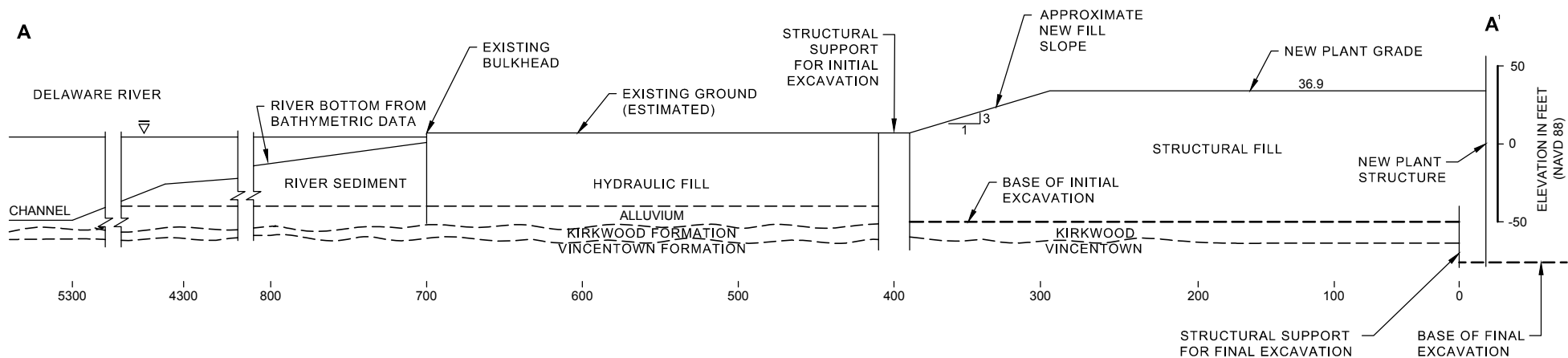


Notes:

1. Geologic Layers Based on Boring NB-1.
2. Structural support for excavation may consist of cellular cofferdams, sheet pile/tie-back walls or other methods as evaluated in the COLA.
3. Upper bound nuclear island mat (category 1 backfill below extends to top of competent Vincentown).
4. Lower bound nuclear island mat (category 1 backfill below extends to top of competent Vincentown).
5. Boundary of lateral extent of safety-related structures considering all technologies.
6. Width of nuclear island varies.
7. Category 1 backfill is placed below and against walls of Safety-Related structures. Category 1 backfill may include concrete fill, roller-compacted concrete or compacted granular material. Category 2 backfill is placed outside Safety-Related structure areas and may consist of Category 1 materials, materials removed from the excavation or other materials meeting engineering requirements.
8. The lateral excavation limit shown is determined at the top of the competent Vincentown formation and encompasses the estimated area of stress distribution below foundations.
9. Angle of repose for wet sand - estimated at 25°.
10. Angle of maximum material loss before affecting safety-related structures.







See Figure 2.5.5-1 for Section Location

BATHYMETRIC DATA FROM NOAA, ESTUARINE
BATHYMETRY OF DELAWARE BAY (M090), (REFERENCE 2.5.5-3)



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General Section A-A'
Slope Configuration
FIGURE 2.5.5-2

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**CHAPTER 3
DESIGN OF STRUCTURES, COMPONENTS, EQUIPMENT, AND SYSTEMS**

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3.5.1.6.1	Airports	3.5-1
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3.5.1.6.3	Airways	3.5-2
3.5.1.6.4	References	3.5-4

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3.5-2	Two-Mile Screening of Airways from the PSEG Site
3.5-3	DOE Input Values for CONUS Average
3.5-4	Calculated Effective Areas
3.5-5	Probability per Year of an Aircraft Crash for Each Reactor Technology
3.5-6	Small Aircraft Resultant Probability Determination
3.5-7	Five-Mile Screening of Low-Level Military Training Routes from PSEG Site
3.5-8	Flight Traffic per Year on the Low-Level Military Training Routes near the PSEG Site

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LIST OF FIGURES

Number

Title

None

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CHAPTER 3

DESIGN OF STRUCTURES, COMPONENTS, EQUIPMENT, AND SYSTEMS

3.5.1.6 Aircraft Hazards

Airports and airways near the PSEG Site are discussed in Subsection 2.2.2 and shown in Figure 2.2-2. Aircraft hazards related to these airports and airways are evaluated in this section in accordance with NUREG-0800, *Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plant: LWR Edition*, to show that the hazards do not meet the NUREG-0800 Section 3.5.1.6 criteria and are not incorporated into the plant design basis.

3.5.1.6.1 Airports

Plant-to-airport distance (D) is evaluated for each airport or helipad against its projected annual number of operations for distances between five and ten statute miles and distances greater than ten statute miles to determine whether the hazard probability requires further evaluation.

There are eight airports and helipads within five to ten miles of the new plant. Additionally, the Salem/Hope Creek helipad is located within five miles of the new plant and exists for corporate and emergency use. These facilities are listed in Table 2.2-11. The annual number of operations for each of these is described as sporadic. Due to the infrequent nature of these operations, these facilities do not present a safety hazard to the PSEG Site. There are no airports within five miles of the PSEG Site.

Table 2.2-11 lists six airports ten to thirty miles from the new plant along with the projected number of annual operations for the year 2025, where available. The hazard probability for these airports is considered acceptable if the projected annual number of operation is less than $1000 D^2$. The screening limits are listed in Table 3.5-1. None of these airports require additional hazard probability evaluations, as the projected number of operations for each airport does not exceed the respective screening limit.

3.5.1.6.2 Military Airports and Routes

New Castle County Airport is the closest facility with military operations (Air National Guard), and it is located 14.5 mi. northeast of the site. The closest dedicated military facility is Dover Air Force Base, located 23.8 miles from the site. The method of calculating hazard probabilities of these facilities are discussed in Subsection 3.5.1.6.3.

The closest military training routes (MTRs) are six slow speed low-altitude MTRs (SR800, SR805, SR844, SR845, SR846, and SR847). These MTRs are used by the Delaware Air National Guard (DANG). The nearest edge of these MTRs is located within approximately five statute miles of the PSEG Site (see Table 3.5-7). The annual traffic for these six MTRs is provided by the DANG and shown in Table 3.5-8. Military training route VR1709 is located 37 miles from the plant. The flight data for this route is not available from the Federal Aviation Administration (FAA) to verify that the number of flights does not exceed 1000 per year.

However, the distance from the PSEG Site to the nearest edge of any military base and MTR VR1709 significantly exceeds the five statute miles stated in the NUREG-0800, Section 3.5.1.6,

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acceptance criteria. Therefore military flight operations on VR1709 do not present a safety hazard to the PSEG Site.

3.5.1.6.3 Airways

Any federal airway, holding pattern, or approach pattern with a nearest edge greater than 2 statute miles from the PSEG Site is screened out from requiring additional hazard probability evaluations per the NUREG-0800 Section 3.5.1.6, acceptance criteria.

A review of public airports within twenty miles of the PSEG Site indicates that there are no holding or approach patterns within two miles of the PSEG Site.

Figure 2.2-2 shows six airways (federal and jet) and their corresponding centerlines within ten miles of the PSEG Site center. Each airway is conservatively evaluated from its nearest edge to the edge of the PSEG Site, which is two-tenths of a mile from the PSEG Site center. As listed in Table 3.5-2, three of the identified airways (V123-312, V29 and J42-150) are within the two-mile screening criteria, thus a detailed review is performed.

NUREG-0800, Section 3.5.1.6, Item III.2 provides a method for estimating the probability per year of an aircraft crashing into the plant.

The number of flights per year along airways centered within ten miles of the new plant and its breakdown into aircraft type was requested from the FAA to complete SRP Item III.2 methodology. The FAA response does not contain the number of flights per year from military aircraft and from non-military aircraft for each airway. The response contains radar hits on a 20-nautical mile grid centered on the site. This defeats the purpose of evaluating each airway separately, because several airways overlap in this grid area. The FAA also provided the flight plan data for each of the airways. However, a comparison of the flight plan data to the radar-hit data indicates that the flight plan data is incomplete. Discussions with the FAA confirm that the flight plan data is not complete and therefore is not used for the analysis.

Due to the unavailability of specific information required to perform the analysis using the NUREG-0800, Section 3.5.1.6, formula, an alternate methodology outlined in Department of Energy (DOE) Standard DOE-STD-3014-96 (Reference 3.5-1) utilizing crash rates for non-airport operations is used for each of the four reactor technologies under consideration.

The non-airport crash impact frequency evaluation is determined from Reference 3.5-1 using the following "four-factor formula":

$$F_j = N_j P_j f_j(x,y) A_j \quad \text{(Equation 3.5-1)}$$

Where:

- F_j = crash impact frequency
- j = each type of aircraft suggested in the DOE Standard
- $N_j P_j$ = expected number of in-flight crashes per year
- $f_j(x,y)$ = probability, given a crash, that the crash occurs in a 1-square-mile area surrounding the facility
- A_j = effective plant area

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Tables B-14 and B-15 of DOE-STD-3014-96 provide $N_j P_{fj}(x,y)$ values applicable for specific DOE sites. In addition, DOE-STD-3014-96 also includes crash probabilities for unspecified locations in the Continental United States (CONUS) in Tables B-14 and B-15 of that document. Therefore, CONUS Average values are used for the new plant and are listed in Table 3.5-3. (Reference 3.5-1)

The effective plant area (A_j) for the new plant depends on the length, width, and height of the facility, as well as the aircraft's wingspan, skid distance, and impact angle as explained below: (Reference 3.5-1)

$$A_j = A_f + A_s \quad \text{(Equation 3.5-2)}$$

Where:

$$A_f = (WS + R) \cdot H \cdot \cot\Phi + (2 \cdot L \cdot W \cdot WS) / R + L \cdot W \quad \text{(Equation 3.5-3)}$$

And:

$$A_s = (WS + R) \cdot S \quad \text{(Equation 3.5-4)}$$

Where:

A_f = effective fly-in area

A_s = effective skid area

WS = aircraft wingspan (Table 3.5-3)

R = length of the diagonal of the facility = $(L^2 + W^2)^{0.5}$

H = facility height, facility-specific

$\cot\Phi$ = mean of the cotangent of the aircraft impact angle (Table 3.5-3)

L = length of facility, facility-specific

W = width of facility, facility-specific

S = aircraft skid distance (mean value) (Table 3.5-3)

The total effective areas for each reactor technology are provided in Table 3.5-4.

Crash impact probabilities for the five aircraft types are added to determine the overall probability for small and large aircraft. Small aircraft consist of air taxis, general aviation and small military. Large aircraft consist of air carriers and large military. Results of this analysis are listed in Table 3.5-5 for small and large aircraft.

The NUREG-0800, Section 3.5.1.6, acceptance criteria for aircraft accident probability of occurrence that could lead to radiological consequences in excess of 10 CFR 100 exposure guidelines is less than an order of magnitude of $1E-07$ per year. The analysis determined that large aircraft meet the NUREG-0800, Section 3.5.1.6, acceptance criteria. The calculated crash probability for large aircraft is less than $1E-07$ for all reactor technologies.

The calculated crash probability for small aircraft alone does not meet the NUREG-0800, Section 3.5.1.6, acceptance criteria for each of the reactor technologies. However, the potential for a small aircraft crash to cause a radiological release is much less than for large aircraft. The crash probabilities for each reactor technology are used to conservatively determine the core damage frequency (CDF) caused by a small aircraft crash. The resultant CDFs (Table 3.5-6) for

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each of the reactor technologies meet the NUREG-0800, Section 3.5.1.6 acceptance criteria of less than 1E-07.

3.5.1.6.4 References

- 3.5-1 DOE-STD-3014-96, "Accident Analysis for Aircraft Crash into Hazardous Facilities,"
U.S. Department of Energy, October 1996, Reaffirmed May, 2006

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**Table 3.5-1
Comparison of Projected Operations to Screening Limit for Nearby Airports**

Airport	Listed Distance (miles)	Number of Operations (Year 2025)	Screening Limit = $1000 \cdot D^2$
Summit Airport	10.4	77,819	108,160
New Castle Airport	14.5	108,881	210,250
Delaware Airpark	17.2	53,697	295,840
Dover Air Force Base	23.8	123,735 ^(a)	566,440
Millville Airport	25.4	42,610	645,160
Philadelphia International Airport	32.2	696,178	1,036,840

a) Number of operations is provided for the year 2007.

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**Table 3.5-2
Two-Mile Screening of Airways from the PSEG Site**

Airway	Distance from Airway Centerline to PSEG Site Center	Distance from Airway Centerline to PSEG Site Edge	Airway Width	Distance from edge of airway to site edge
	miles ^(a)	miles ^(a)	miles ^(a)	miles ^(a)
V123-312	0.5	0.3	9.2	(b)
V29	1.1	0.9	9.2	(b)
V157	7.1	6.9	9.2	2.3
V213	9.4	9.2	9.2	4.6
J42-150	0.8	0.6	11.5	(b)
J191	9.7	9.5	11.5	3.8

a) statute miles

b) PSEG Site is within the airway width

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**Table 3.5-3
DOE Input Values for CONUS Average**

N_jP_jf_j(x,y) Values

	N_jP_jf_j(x,y) Value^(a) (1/mi²)
Air Carrier	4E-7
Air Taxi	1E-6
General Aviation	2E-4
Small Military	4E-6
Large Military	2E-7

Effective Area Input Values

	WS^(b) (ft.)	cotΦ^(c)	S^(d) (ft.)
Air Carrier	98	10.2	1440
Air Taxi	59	10.2	60
General Aviation	50	8.2	60
Small Military	110	10.4	447
Large Military	223	9.7	368

- a) Reference 3.5-1, Tables B-14 and B-15
- b) Reference 3.5-1, Table B-16
- c) Reference 3.5-1, Table B-17
- d) Reference 3.5-1, Table B-18

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**Table 3.5-4
Calculated Effective Areas (sq. mi.)**

	AP1000	ABWR	US-APWR	U.S. EPR
Air Carrier	5.29E-02	1.05E-01	1.08E-01	1.48E-01
Air Taxi	2.86E-02	4.30E-02	6.04E-02	6.81E-02
General Aviation	2.27E-02	3.51E-02	4.88E-02	5.61E-02
Small Military	4.02E-02	6.75E-02	8.25E-02	1.01E-01
Large Military	4.89E-02	8.13E-02	9.86E-02	1.21E-01

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**Table 3.5-5
Probability per Year of an Aircraft Crash for Each Reactor Technology**

AP1000^(a)		ABWR		US-APWR		U.S. EPR	
Small Aircraft	Large Aircraft	Small Aircraft	Large Aircraft	Small Aircraft	Large Aircraft	Small Aircraft	Large Aircraft
4.74E-06	3.12E-08	7.33E-06	5.85E-08	1.01E-05	6.65E-08	1.17E-05	9.36E-08

- a) For AP1000, calculated probability is for a single unit. PSEG is considering construction of dual units for this reactor technology at the PSEG Site.

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**Table 3.5-6
Small Aircraft Resultant Probability Determination**

Reactor Technology	AP1000^(a)	ABWR	US-APWR	U.S. EPR
Small Aircraft Crash Probability	4.74E-06	7.33E-06	1.01E-05	1.17E-05
CDF Probability	2.77E-13 ^(b)	2.33E-08 ^(b)	2.2E-08 ^(b)	1.03E-08 ^(b)

- a) For AP1000, calculated probability is for a single unit. PSEG is considering construction of dual units for this reactor technology at the PSEG Site.
- b) Less than NUREG-0800, Section 3.5.1.6 acceptance criteria of 1E-07.

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**Table 3.5-7
Five-Mile Screening of Low-Level Military Training Routes from PSEG Site**

Low-Level Military Training Route (MTR)	Distance from MTR Centerline to PSEG Site Center (mi.)	Distance from MTR Centerline to PSEG Site Edge (mi.)	Distance from MTR Edge to MTR Centerline (mi.)	Distance from Edge of MTR to Site Edge (mi.)
SR800	7.75	7.55	3.45	4.10
SR805	5.90	5.70	3.45	2.25
SR844	6.62	6.42	4.6	1.82
SR845	4.84	4.64	4.6	0.04
SR846	6.62	6.42	4.6	1.82
SR847	5.27	5.07	5.75	(a)

Notes:

a) PSEG Site is within the airway width.

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**Table 3.5-8
Flight Traffic per Year on the Low-Level Military Training Routes near the PSEG Site**

Low-Level Military Training Routes	Flights per Year
SR800	48
SR805 ^(a)	48
SR844 ^(b)	0
SR845 ^(b)	0
SR846 ^(a)	48
SR847	144

Notes:

- a) The traffic on MTRs SR805 and SR846 is 8 flights per month. The DANG alternates the use of these routes. During the six months including the summer, MTR SR805 is used and during the six months including the winter, MTR SR846 is used. For the aircraft crash probability evaluation it was assumed that all 96 flights per year are on MTR SR846 since this MTR is closer to the PSEG site than MTR SR805.
- b) This MTR is not used.

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**CHAPTER 11
RADIOACTIVE WASTE MANAGEMENT**

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CHAPTER 11

RADIOACTIVE WASTE MANAGEMENT

11.2.3 LIQUID RADIOACTIVE RELEASES

During normal operation of the new plant at the PSEG Site, small amounts of radioactive liquids and gases are released into the environment. In order to analyze the effects of such releases on individuals and population groups, a wide variety of potential pathways are considered. These pathways allow transport of the radioactive material from the release points to the receptors of interest. The significance of a given pathway is determined by the type and amount of radioactivity released, the transport mechanism, and the consumption or usage factors of the receptor.

A maximally exposed individual (MEI) is the theoretical individual who is positioned to receive a maximum possible calculated dose. Consideration of the dose to the MEI is useful for conservative comparison to the regulations for doses to the public. The analytical methods and exposure pathways considered for calculating doses to the MEI and the collective population in the area surrounding the PSEG Site are based on NRC Regulatory Guide (RG) 1.109, *Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR 50, Appendix I*, Revision 1, 1977.

11.2.3.1 Exposure Pathways

The new plant releases liquid effluents to the Delaware River. The NRC-endorsed LADTAP II computer program (NUREG/CR-4013, *LADTAP II – Technical Reference and Users Guide*) is used to calculate the doses from these effluents. This program uses radiological exposure models, as described in RG 1.109, to determine the doses from radioactive releases in the liquid effluent. Exposure pathways considered are the ingestion of aquatic organisms as food and recreational activity on and near the Delaware River. The drinking water pathway is not considered because the Delaware River is composed of brackish water, and is not a potable source of drinking water.

Liquid effluent activity releases are given in Table 11.2-1. Values for liquid effluent releases from the existing units at the PSEG Site are obtained from the *2008 Annual Radioactive Effluent Release Report for the Salem and Hope Creek Generating Stations*, (RERR) (Reference 11.2.3-1). Annual releases vary from year to year, and 2008 is considered to be representative of average releases, since releases from this year are similar to releases from 2006 and 2007. Bounding plant parameter envelope (PPE) values for liquid effluent releases from a new unit are taken from Table 1.3-8. In order to determine if these releases meet the effluent concentration limits (ECLs) of 10 CFR 20, Appendix B, Table 2, Column 2, they must be converted to concentrations. To do this, the release rates are divided by the discharge rate (given in Table 11.2-3), multiplied by the inverse of the dilution factor, and then converted to units of $\mu\text{Ci}/\text{ml}$. The amount of near-field dilution between the radwaste system and the discharge point at the receiving water body (Delaware River) is based on the NUREG-0133, *Preparation of Radiological Effluent Technical Specifications for Nuclear Power Plants*, assumption that the blowdown rate (cubic feet per second [cfs]) multiplied by the dilution factor is less than or equal to 1000 cfs. The minimum (most conservative) blowdown rate for the new plant is 45 cfs (20,000 gallons per minute [gpm]), equating to a dilution factor of 20. The effluent concentrations are

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well below the limits specified in 10 CFR 20, Appendix B, Table 2, Column 2, and the sum of the ECL fractions is less than one, as shown in Table 11.2-2. Note that the site concentrations given in Table 11.2-2 include releases from Salem Generating Station (SGS), Hope Creek Generating Station (HCGS), and a new dual unit plant.

11.2.3.2 Liquid Pathway Doses

Radiological impacts to individuals and collective population groups are examined in this section, and compared to federal limits. The LADTAP II code is used to calculate doses to the MEI for the liquid pathway. The results of the calculation are shown in Tables 11.2-5 and 11.2-9. These results are based on the inputs found in Tables 11.2-1, 11.2-3, and 11.2-4. The results in Table 11.2-5 are given in terms of total body dose, thyroid dose, and maximum organ dose for each age group. The results in Table 11.2-9 summarize doses for all organs and age groups from all pathways. Doses to infants are always zero because they are not directly exposed to the conventional pathways (i.e., fish and invertebrate ingestion), and other pathways such as ingestion of a mother's breast milk are not modeled in the LADTAP II computer code.

Compliance with 10 CFR 50, Appendix I is shown in Table 11.2-6 on a per unit basis. Comparison to 40 CFR 190 criteria requires that direct and gaseous effluent doses also be considered. Liquid effluent dose contributions are listed in Table 11.2-7, while compliance with 40 CFR 190 (including direct, liquid, and gaseous dose contributions) is shown in Table 11.3-9. Comparison to 40 CFR 190 is on a site-wide basis, including all SGS, HCGS, and all potential units at the new plant. Since 40 CFR 190 is more conservative than 10 CFR 20.1301, compliance with 40 CFR 190 demonstrates compliance with 10 CFR 20.1301. Collective doses from the new plant to the population within 50 miles (mi.) of the PSEG Site are shown in Table 11.2-8, on a per unit basis.

11.2.3.3 References

- 11.2.3-1 PSEG Nuclear LLC, "2008 Annual Radioactive Effluent Release Report for the Salem and Hope Creek Generating Stations," 2009.

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**Table 11.2-1 (Sheet 1 of 3)
Liquid Release Source Terms**

Isotope^(c)	New Unit(s)			
	Single Unit^(a) (Ci/yr)	Dual Unit (Ci/yr)	Existing Site^(b) (Ci/yr)	Total (Ci/yr)
Ag-110m	1.80E-03	3.60E-03	6.67E-05	3.67E-03
Ba-140	5.80E-03	1.16E-02	-	1.16E-02
Br-84	2.00E-05	4.00E-05	-	4.00E-05
Ce-141	2.97E-04	5.94E-04	1.37E-04	7.31E-04
Ce-143	6.10E-04	1.22E-03	-	1.22E-03
Ce-144	5.60E-03	1.12E-02	-	1.12E-02
Co-57	-	-	1.42E-05	1.42E-05
Co-58	9.80E-03	1.96E-02	2.03E-02	3.99E-02
Co-60	1.54E-02	3.08E-02	5.84E-03	3.66E-02
Cr-51	1.70E-02	3.40E-02	1.05E-06	3.40E-02
Cs-134	1.20E-02	2.40E-02	3.99E-04	2.44E-02
Cs-136	2.20E-02	4.40E-02	-	4.40E-02
Cs-137	1.80E-02	3.60E-02	4.17E-03	4.02E-02
Cs-138	8.00E-07	1.60E-06	-	1.60E-06
Cu-64	1.26E-02	2.52E-02	-	2.52E-02
Fe-55	9.46E-03	1.89E-02	1.25E-02	3.14E-02
Fe-59	2.30E-03	4.60E-03	3.10E-07	4.60E-03
H-3	1.66E+03	3.32E+03	6.98E+02	4.02E+03
I-131	3.40E-02	6.80E-02	6.63E-06	6.80E-02
I-132	1.93E-03	3.86E-03	-	3.86E-03
I-133	3.73E-02	7.46E-02	7.25E-07	7.46E-02
I-134	8.10E-04	1.62E-03	-	1.62E-03

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**Table 11.2-1 (Sheet 2 of 3)
Liquid Release Source Terms**

Isotope^(c)	New Unit(s)		Existing Site^(b) (Ci/yr)	Total (Ci/yr)
	Single Unit^(a) (Ci/yr)	Dual Unit (Ci/yr)		
I-135	1.50E-02	3.00E-02	-	3.00E-02
La-140	8.00E-03	1.60E-02	2.86E-04	1.63E-02
Mn-54	4.50E-03	9.00E-03	9.28E-04	9.93E-03
Mn-56	2.04E-03	4.08E-03	-	4.08E-03
Mo-99	2.61E-03	5.22E-03	-	5.22E-03
Na-24	6.10E-03	1.22E-02	-	1.22E-02
Nb-95	2.00E-03	4.00E-03	5.62E-08	4.00E-03
Nb-97	-	-	2.36E-05	2.36E-05
Nd-147	2.00E-06	4.00E-06	-	4.00E-06
Ni-63	1.70E-03	3.40E-03	-	3.40E-03
Np-239	9.49E-03	1.90E-02	-	1.90E-02
P-32	5.68E-04	1.14E-03	-	1.14E-03
Pr-143	1.30E-04	2.60E-04	-	2.60E-04
Pr-144	3.16E-03	6.32E-03	-	6.32E-03
Rb-88	2.80E-02	5.60E-02	-	5.60E-02
Ru-103	4.93E-03	9.86E-03	-	9.86E-03
Ru-106	7.35E-02	1.47E-01	-	1.47E-01
Sb-124	4.30E-04	8.60E-04	-	8.60E-04
Sb-125	-	-	1.24E-04	1.24E-04
Sn-117m	-	-	2.11E-04	2.11E-04
Sr-89	3.14E-04	6.28E-04	-	6.28E-04
Sr-90	2.68E-05	5.36E-05	-	5.36E-05

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**Table 11.2-1 (Sheet 3 of 3)
Liquid Release Source Terms**

Isotope^(c)	New Unit(s)			
	Single Unit^(a) (Ci/yr)	Dual Unit (Ci/yr)	Existing Site^(b) (Ci/yr)	Total (Ci/yr)
Sr-91	1.25E-03	2.50E-03	-	2.50E-03
Sr-92	4.43E-04	8.86E-04	-	8.86E-04
Tc-99m	5.68E-03	1.14E-02	-	1.14E-02
Te-129	3.10E-04	6.20E-04	-	6.20E-04
Te-129m	1.20E-04	2.40E-04	-	2.40E-04
Te-131	7.60E-05	1.52E-04	-	1.52E-04
Te-131m	3.10E-04	6.20E-04	-	6.20E-04
Te-132	4.80E-04	9.60E-04	-	9.60E-04
W -187	4.60E-04	9.20E-04	-	9.20E-04
Xe-133	-	-	1.38E-03	1.38E-03
Xe-135	-	-	4.48E-05	4.48E-05
Y-91	2.35E-04	4.70E-04	-	4.70E-04
Y-91m	5.00E-05	1.00E-04	-	1.00E-04
Y-92	1.69E-03	3.38E-03	-	3.38E-03
Y-93	1.36E-03	2.72E-03	-	2.72E-03
Zn-65	4.41E-04	8.82E-04	1.17E-04	9.99E-04
Zr-95	1.30E-03	2.60E-03	-	2.60E-03
Total	1.66E+03	3.32E+03	6.98E+02	4.02E+03

- a) Single unit is the PPE value from SSAR Table 1.3-8, and is included for single unit analysis throughout the section.
- b) Existing site consists of one boiling water reactor (BWR) (HCGS) and two pressurized water reactors (PWRs) (SGS).
- c) Radionuclides Ag-110, Ba-137m, Rh-103m, and Rh-106 are short lived and their emissions attributed to their parent radionuclides. Therefore, they are not included in this table.

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**Table 11.2-2 (Sheet 1 of 3)
Site Concentrations Comparison to 10 CFR 20, Appendix B, Table 2, Column 2
Effluent Concentration Limits (ECLs)**

Isotope	Site Concentration ($\mu\text{Ci/ml}$)	ECL ($\mu\text{Ci/ml}$)	ECL Fraction
Ag-110m	4.61E-12	6.00E-06	7.68E-07
Ba-140	1.46E-11	8.00E-06	1.82E-06
Br-84	5.03E-14	4.00E-04	1.26E-10
Ce-141	9.18E-13	3.00E-05	3.06E-08
Ce-143	1.53E-12	2.00E-05	7.66E-08
Ce-144	1.41E-11	3.00E-06	4.69E-06
Co-57	1.79E-14	6.00E-05	2.98E-10
Co-58	5.02E-11	2.00E-05	2.51E-06
Co-60	4.60E-11	3.00E-06	1.53E-05
Cr-51	4.27E-11	5.00E-04	8.54E-08
Cs-134	3.07E-11	9.00E-07	3.41E-05
Cs-136	5.53E-11	6.00E-06	9.21E-06
Cs-137	5.05E-11	1.00E-06	5.05E-05
Cs-138	2.01E-15	4.00E-04	5.03E-12
Cu-64	3.17E-11	2.00E-04	1.58E-07
Fe-55	3.94E-11	1.00E-04	3.94E-07
Fe-59	5.78E-12	1.00E-05	5.78E-07
H-3	5.05E-06	1.00E-03	5.05E-03
I-131	8.55E-11	1.00E-06	8.55E-05
I-132	4.85E-12	1.00E-04	4.85E-08
I-133	9.37E-11	7.00E-06	1.34E-05
I-134	2.04E-12	4.00E-04	5.09E-09

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**Table 11.2-2 (Sheet 2 of 3)
Site Concentrations Comparison to 10 CFR 20, Appendix B, Table 2, Column 2
Effluent Concentration Limits (ECLs)**

Isotope	Site Concentration ($\mu\text{Ci/ml}$)	ECL ($\mu\text{Ci/ml}$)	ECL Fraction
I-135	3.77E-11	3.00E-05	1.26E-06
La-140	2.05E-11	9.00E-06	2.27E-06
Mn-54	1.25E-11	3.00E-05	4.16E-07
Mn-56	5.13E-12	7.00E-05	7.32E-08
Mo-99	6.56E-12	2.00E-05	3.28E-07
Na-24	1.53E-11	5.00E-05	3.07E-07
Nb-95	5.03E-12	3.00E-05	1.68E-07
Nb-97	2.96E-14	3.00E-04	9.86E-11
Nd-147	5.03E-15	2.00E-05	2.51E-10
Ni-63	4.27E-12	1.00E-04	4.27E-08
Np-239	2.38E-11	2.00E-05	1.19E-06
P-32	1.43E-12	9.00E-06	1.59E-07
Pr-143	3.27E-13	2.00E-05	1.63E-08
Pr-144	7.94E-12	6.00E-04	1.32E-08
Rb-88	7.04E-11	4.00E-04	1.76E-07
Ru-103	1.24E-11	3.00E-05	4.13E-07
Ru-106	1.85E-10	3.00E-06	6.16E-05
Sb-124	1.08E-12	7.00E-06	1.54E-07
Sb-125	1.56E-13	3.00E-05	5.21E-09
Sn-117m	2.65E-13	3.00E-05	8.84E-09
Sr-89	7.89E-13	8.00E-06	9.86E-08
Sr-90	6.73E-14	5.00E-07	1.35E-07

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**Table 11.2-2 (Sheet 3 of 3)
Site Concentrations Comparison to 10 CFR 20, Appendix B, Table 2, Column 2
Effluent Concentration Limits (ECLs)**

Isotope	Site Concentration ($\mu\text{Ci/ml}$)	ECL ($\mu\text{Ci/ml}$)	ECL Fraction
Sr-91	3.14E-12	2.00E-05	1.57E-07
Sr-92	1.11E-12	4.00E-05	2.78E-08
Tc-99m	1.43E-11	1.00E-03	1.43E-08
Te-129	7.79E-13	4.00E-04	1.95E-09
Te-129m	3.02E-13	7.00E-06	4.31E-08
Te-131	1.91E-13	8.00E-05	2.39E-09
Te-131m	7.79E-13	8.00E-06	9.74E-08
Te-132	1.21E-12	9.00E-06	1.34E-07
W -187	1.16E-12	3.00E-05	3.85E-08
Xe-133	1.73E-12	1.00E-08	1.73E-04
Xe-135	5.62E-14	1.00E-08	5.62E-06
Y-91	5.91E-13	8.00E-06	7.38E-08
Y-91m	1.26E-13	2.00E-03	6.28E-11
Y-92	4.25E-12	4.00E-05	1.06E-07
Y-93	3.42E-12	2.00E-05	1.71E-07
Zn-65	1.26E-12	5.00E-06	2.51E-07
Zr-95	3.27E-12	2.00E-05	1.63E-07
Total			5.55E-03

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**Table 11.2-3
Liquid Pathway Parameters**

Parameter	Value
Discharge Rate	20,000 gpm
Dilution Factor	20
Transit Time to Receptor	0 hr.
Impoundment Reconcentration Model	None
50 mi. Population	8,138,635 people
50 mi. Sport Fish Harvest ^(a)	5.62E+07 kg/yr
50 mi. Invertebrate Harvest ^(a)	8.14E+06 kg/yr
50 mi. Shoreline Usage ^(a)	3.83E+08 person-hr/yr
50 mi. Swimming Usage ^(a)	7.65E+07 person-hr/yr
50 mi. Boating Usage ^(a)	7.65E+07 person-hr/yr

a) Parameter is based on LADTAP II default value

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**Table 11.2-4
Liquid Pathway Consumption Factors for Maximally Exposed Individual**

Consumption Factor^(a)	Annual Rate			
	Adult	Teen	Child	Infant
Fish Consumption (kg/yr)	21.0	16.0	6.9	0.0
Invertebrate Consumption (kg/yr)	5.0	3.8	1.7	0.0
Shoreline Usage (hr/yr)	12.0	67.0	14.0	0.0
Swimming (hr/yr)	2.4	13.4	2.8	0.0
Boating (hr/yr)	2.4	13.4	2.8	0.0
Drinking Water Consumption (L/yr)	0.0	0.0	0.0	0.0

a) Consumption factors are based on LADTAP II default values.

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**Table 11.2-5
Liquid Pathway Doses for Maximally Exposed Individuals (per Unit)**

Dose Pathway	Adult (mrem/yr)	Teen (mrem/yr)	Child (mrem/yr)
Total Body Dose			
Fish Ingestion	1.02E-02	8.73E-03	8.49E-03
Invertebrate Ingestion	5.17E-03	5.02E-03	5.62E-03
Shoreline	2.84E-04	1.59E-03	3.31E-04
Swimming	1.66E-06	9.26E-06	1.94E-06
Boating	8.29E-07	4.63E-06	9.68E-07
Total	1.57E-02	1.54E-02	1.44E-02

Limiting Organ Dose			
	(GI-LLI)	(GI-LLI)	(Bone)
Fish Ingestion	6.55E-02	4.76E-02	1.19E-01
Invertebrate Ingestion	1.11E-01	8.78E-02	3.81E-02
Shoreline	2.84E-04	1.59E-03	3.31E-04
Swimming	1.66E-06	9.26E-06	1.94E-06
Boating	8.29E-07	4.63E-06	9.68E-07
Total	1.77E-01	1.37E-01	1.57E-01

Thyroid Dose			
Fish Ingestion	1.98E-02	1.82E-02	1.88E-02
Invertebrate Ingestion	2.14E-02	2.00E-02	2.17E-02
Shoreline	2.84E-04	1.59E-03	3.31E-04
Swimming	1.66E-06	9.26E-06	1.94E-06
Boating	8.29E-07	4.63E-06	9.68E-07
Total	4.15E-02	3.98E-02	4.08E-02

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**Table 11.2-6
Comparison of Annual Maximally Exposed Individual Doses
with 10 CFR 50, Appendix I Criteria**

Type of Dose	Annual Dose	
	Single New Unit	Limit
Total Body (mrem)	1.57E-02	3
Maximum Organ – GI-LLI-Adult (mrem)	1.77E-01	10

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**Table 11.2-7
Liquid Contributions to Maximally Exposed Individual Doses
with Regards to 40 CFR 190 Criteria^(a)**

Dose Type	New Unit(s)	
	Single Unit	Dual Unit
Total Body (mrem/yr)	1.57E-02	3.14E-02
Thyroid (mrem/yr)	4.15E-02	8.30E-02
Other Organ – GI-LLI (mrem/yr)	1.77E-01	3.54E-01

- a) Comparison to 40 CFR 190 limits is only appropriate when considering contributions from gaseous effluents in addition to liquid effluents and direct radiation. Comparison to 40 CFR 190 limits including contributions from direct radiation, liquid and gaseous effluents, as well as contributions from SGS and HCGS is shown in Table 11.3-9.

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**Table 11.2-8
Collective Annual Doses from a New Unit to Population within 50 Miles, Liquid Pathway**

Pathway	Dose (person-rem/yr)	
	Total Body	Thyroid
Fish Ingestion	2.72E+01	3.59E+01
Invertebrate Ingestion	9.22E+00	2.22E+01
Shoreline	9.05E+00	9.05E+00
Swimming	5.29E-02	5.29E-02
Boating	2.64E-02	2.64E-02
Total	4.55E+01	6.72E+01

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**Table 11.2-9
Liquid Effluent Individual Doses^(a)**

Adult Pathway	Skin (mrem/year)	Bone (mrem/year)	Liver (mrem/year)	Total Body (mrem/year)	Thyroid (mrem/year)	Kidney (mrem/year)	Lung (mrem/year)	GI-LLI (mrem/year)
Fish		8.51E-02	1.58E-02	1.02E-02	1.98E-02	4.47E-03	4.10E-03	6.55E-02
Invertebrate		2.67E-02	1.01 E-02	5.17E-03	2.14E-02	4.83E-03	2.69E-03	1.11E-01
Shoreline	3.33E-04	2.84E-04	2.84E-04	2.84E-04	2.84E-04	2.84E-04	2.84E-04	2.84E-04
Swimming		1.66E-06	1.66E-06	1.66E-06	1.66E-06	1.66E-06	1.66E-06	1.66E-06
Boating		8.29E-07	8.29E-07	8.29E-07	8.29E-07	8.29E-07	8.29E-07	8.29E-07
Total	3.33E-04	1.12E-01	2.62E-02	1.57E-02	4.15E-02	9.59E-03	7.08E-03	1.77E-01
Teenager Pathway								
Fish		9.25E-02	1.60E-02	8.73E-03	1.82E-02	3.95E-03	3.90E-03	4.76E-02
Invertebrate		2.87E-02	1.02E-02	5.02E-03	2.00E-02	4.83E-03	2.97E-03	8.78E-02
Shoreline	1.86E-03	1.59E-03	1.59E-03	1.59E-03	1.59E-03	1.59E-03	1.59E-03	1.59E-03
Swimming		9.26E-06	9.26E-06	9.26E-06	9.26E-06	9.26E-06	9.26E-06	9.26E-06
Boating		4.63E-06	4.63E-06	4.63E-06	4.63E-06	4.63E-06	4.63E-06	4.63E-06
Total	1.86E-03	1.23E-01	2.78E-02	1.54E-02	3.98E-02	1.04E-02	8.47E-03	1.37E-01
Child Pathway								
Fish		1.19E-01	1.44E-02	8.49E-03	1.88E-02	3.27E-03	3.22E-03	1.85E-02
Invertebrate		3.81 E-02	9.37E-03	5.62E-03	2.17E-02	4.28E-03	2.57E-03	3.75E-02
Shoreline	3.89E-04	3.31 E-04	3.31 E-04	3.31 E-04	3.31 E-04	3.31 E-04	3.31 E-04	3.31 E-04
Swimming		1.94E-06	1.94E-06	1.94E-06	1.94E-06	1.94E-06	1.94E-06	1.94E-06
Boating		9.68E-07	9.68E-07	9.68E-07	9.68E-07	9.68E-07	9.68E-07	9.68E-07
Total	3.89E-04	1.57E-01	2.41 E-02	1.44E-02	4.08E-02	7.89E-03	6.12E-03	5.63E-02

a) The doses are based on a single unit liquid effluent

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11.3.3 GASEOUS RADIOACTIVE RELEASES

During normal operation of a new plant at the PSEG Site, small amounts of radioactive gases are released into the environment. In order to analyze the effects of such releases on individuals and population groups, a wide variety of potential pathways are considered. These pathways facilitate transport of the radioactive material from the release points to the receptors of interest. The significance of a given pathway is determined by the type and amount of radioactivity released, the transport mechanism, and the consumption or usage factors of the receptor.

An MEI is the theoretical individual who is positioned to receive a maximum possible calculated dose. Consideration of the dose to the MEI is useful for conservative comparison to regulations for doses to the public. The analytical methods, exposure pathways, and atmospheric dispersion models considered for calculating doses to the MEI and the collective population in the area surrounding the PSEG Site are based on RG 1.109 and RG 1.111, *Methods for Estimating Atmospheric Transport and Dispersion of Gaseous Effluents in Routine Releases from Light-Water-Cooled Reactors*, Revision 1, 1977.

11.3.3.1 Exposure Pathways

The new plant at the PSEG Site releases gaseous effluents to the atmosphere. The NRC-endorsed GASPAR II computer program is used to calculate the doses to off-site receptors due to postulated gaseous effluent releases from the new plant. This program uses radiological exposure models, as described in RG 1.109, to determine the doses from radioactive releases in gaseous effluent. The gaseous exposure pathways modeled in GASPAR II (NUREG/CR-4653, *GASPAR II – Technical Reference and User Guide*) are:

- External exposure to airborne activity in the plume
- External exposure to deposited activity on the ground
- Inhalation of airborne activity in the plume
- Ingestion of contaminated agricultural products

MEI locations and corresponding atmospheric dispersion factors (χ/Q values) and ground deposition factors (D/Q values) are listed in Table 11.3-1. The fractions of animal daily intake from pasture or fresh green chop during the grazing season and other factors used as input in the GASPAR II calculation are listed in Table 11.3-2. Annual agricultural product consumption rates are listed in Table 11.3-3. Total agricultural production, as shown in Table 11.3-4, is assumed to be the maximum consumption for each agricultural product multiplied by the projected population. This population projection for the year 2081 is listed in Table 2.1-2 and shown in Figure 2.1-20 along with the population distribution by sector and distance from the PSEG Site. Based on population projections, the population estimate (and the accompanying maximum agricultural consumption estimate) for 2081 is bounding.

Gaseous effluent activity releases are given in Table 11.3-5. Values for gaseous effluent releases from the existing units at the PSEG Site are obtained from the 2008 RERR for SGS and HCGS (Reference 11.3.3-1). Annual releases vary from year to year, and 2008 is considered to be representative of average releases. Releases from 2006 and 2007 were also examined, and do not vary significantly from 2008 releases. Bounding PPE values for gaseous effluent releases from a new unit are taken from SSAR Table 1.3-7, and multiplied by two to

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account for the possibility of dual units. In order to determine if these releases meet ECLs of 10 CFR 20, Appendix B, Table 2, Column 1, they must be converted to concentrations. To do this, the release rates are multiplied by the maximum χ/Q value at the site boundary (as found in Table 11.3-1), and then converted to units of $\mu\text{Ci}/\text{ml}$. The effluent concentrations are well below the limits specified in 10 CFR 20, Appendix B, Table 2, Column 1, as shown in Table 11.3-6. Furthermore, the sum of the concentration fractions of the ECLs is less than one. Site concentrations given in Table 11.3-6 include releases from SGS, HCGS, and a new dual unit plant.

11.3.3.2 Gaseous Pathway Doses

The GASPAR II code is used to calculate doses to the MEI for each pathway at various locations. The results of this calculation are shown in Table 11.3-7. These results are based on the inputs found in Tables 11.3-1 to 11.3-5. Compliance with 10 CFR 50, Appendix I is shown in Table 11.3-8 on a per unit basis. Gaseous effluent doses are calculated at the site-boundary assuming continuous occupancy for the duration of a year. Compliance with 40 CFR 190 (including both liquid and gaseous dose contributions) is shown in Table 11.3-9. Comparison to 40 CFR 190 is on a site-wide basis, including all SGS, HCGS, and all potential units at the new plant. Doses from direct radiation, inhalation, ground plane, and plume exposure are considered at the nearest residence. Since 40 CFR 190 is more conservative than 10 CFR 20.1301, compliance with 40 CFR 190 demonstrates compliance with 10 CFR 20.1301. The doses from the new units are much higher than from the existing units because doses from the existing units are based on actual measurements, compared to the conservatively calculated, bounding PPE theoretical doses from the new units. Collective doses from new units to the population within 50 mi. of the PSEG Site are shown in Table 11.3-10 and Table 11.3-11.

11.3.3.3 References

- 11.3.3-1 PSEG Nuclear LLC, "2008 Annual Radioactive Effluent Release Report for the Salem and Hope Creek Generating Stations," 2009.

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**Table 11.3-1
Maximally Exposed Individual Locations and Associated χ/Q and D/Q Values**

MEI Location	Sector	Distance (mi.)	χ/Q			D/Q (1/m ²)
			No Decay / Undepleted (s/m ³)	2.26-Day Half-life / Undepleted (s/m ³)	8-Day Half-life / Depleted (s/m ³)	
Nearest Meat Animal ^(a)	NW	4.9	1.1E-07	1.1E-07	8.2E-08	3.5E-10
Nearest Milk- Producing Animals (Cow/Goat) ^{(a)(b)}	NW	4.9	1.1E-07	1.1E-07	8.2E-08	3.5E-10
Nearest Residence	NW	2.8	2.4E-07	2.4E-07	1.9E-07	9.6E-10
Nearest Vegetable Garden ^(a)	NW	4.9	1.1E-07	1.1E-07	8.2E-08	3.5E-10
Nearest Site Boundary	ENE	0.24	1.0E-05	1.0E-05	9.5E-06	4.1E-08

- a) Meat animals, milk producing animals, and vegetable gardens are assumed to exist at the closest farm.
- b) Goats are assumed to be the milk producing animals, as the goat pathway is more conservative.

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**Table 11.3-2
Grazing Season Daily Intakes**

Value^(a)	Description
1.0	Fraction of the year that leafy vegetables are grown.
1.0	Fraction of the year that milk cows are on pasture.
0.76	Fraction of the maximum individual's vegetable intake that is from a garden.
1.0	Fraction of milk-cow feed intake that is from pasture while on pasture.
8.0	Average absolute humidity over the growing season (g/m ³)
1.0	Fraction of the year that goats are on pasture.
1.0	Fraction of the goat-feed intake that is from pasture while on pasture
1.0	Fraction of the year that beef cattle are on pasture.
1.0	Fraction of beef-cattle feed intake that is from pasture while the cattle are on pasture.

a) Values are based on GASPAR II default values.

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**Table 11.3-3
Annual Agricultural Consumption^(a)**

Parameter	Non-Leafy Vegetables (kg/yr)	Leafy Vegetables (kg/yr)	Milk (L/yr)	Meat (kg/yr)
Average Adult	190	30	110	95
Average Teen	240	20	200	59
Average Child	200	10	170	37
Maximum Adult	520	64	310	110
Maximum Teen	630	42	400	65
Maximum Child	520	26	330	41
Maximum Infant	0	0	330	0
Maximum All ^(b)	630	64	400	110

a) Values are based on GASPAR II default values.

b) Maximum refers to the maximum value from any age group in each consumption category.

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**Table 11.3-4
Total Annual Agricultural Production**

	Total Vegetables^(a) (kg/yr)	Milk (L/yr)	Meat (kg/yr)
Max Consumption	6.94E+02	4.00E+02	1.10E+02
Production ^(b)	5.65E+09	3.26E+09	8.95E+08

- a) Total vegetable consumption is the sum of non-leafy vegetable and leafy vegetable consumption from Table 11.3-3 (e.g., 630 kg/yr+ 64 kg/yr = 694 kg/yr).
- b) Annual production is the population (from Figure 2.1-20) multiplied by the maximum food consumption.

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**Table 11.3-5 (Sheet 1 of 3)
Gaseous Release Source Terms**

Isotope^(c,d)	New Unit(s)		Existing Site^(b) (Ci/yr)	Total (Ci/yr)
	Single Unit^(a) (Ci/yr)	Dual Unit (Ci/yr)		
Ag-110m	2.00E-06	4.00E-06	-	4.00E-06
Ar-41	3.40E+01	6.80E+01	5.39E-01	6.85E+01
Ba-139	-	-	3.44E+00	3.44E+00
Ba-140	2.70E-02	5.41E-02	2.56E-03	5.66E-02
Br-82	-	-	5.27E-06	5.27E-06
C-14	1.89E+01	3.78E+01	-	3.78E+01
Ce-141	9.19E-03	1.84E-02	7.11E-05	1.84E-02
Ce-144	1.89E-05	3.78E-05	-	3.78E-05
Co-57	8.20E-06	1.64E-05	-	1.64E-05
Co-58	2.30E-02	4.60E-02	1.76E-04	4.62E-02
Co-60	1.30E-02	2.59E-02	8.30E-05	2.60E-02
Cr-51	3.51E-02	7.03E-02	-	7.03E-02
Cs-134	6.22E-03	1.24E-02	-	1.24E-02
Cs-136	5.95E-04	1.19E-03	-	1.19E-03
Cs-137	9.46E-03	1.89E-02	-	1.89E-02
Cs-138	1.70E-04	3.41E-04	-	3.41E-04
Cu-64	1.00E-02	2.00E-02	-	2.00E-02
Fe-55	6.49E-03	1.30E-02	-	1.30E-02
Fe-59	8.11E-04	1.62E-03	-	1.62E-03
H-3	3.5E+02	7.0E+02	2.79E+02	9.79E+02
I-131	2.59E-01	5.19E-01	7.26E-03	5.26E-01
I-132	2.19E+00	4.38E+00	-	4.38E+00
I-133	1.70E+00	3.41E+00	7.53E-02	3.48E+00
I-134	3.78E+00	7.57E+00	-	7.57E+00

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**Table 11.3-5 (Sheet 2 of 3)
Gaseous Release Source Terms**

Isotope^(c,d)	New Unit(s)		Existing Site^(b) (Ci/yr)	Total (Ci/yr)
	Single Unit^(a) (Ci/yr)	Dual Unit (Ci/yr)		
I-135	2.41E+00	4.81E+00	-	4.81E+00
Kr-83m	8.38E-04	1.68E-03	-	1.68E-03
Kr-85	4.10E+03	8.20E+03	-	8.20E+03
Kr-85m	1.50E+02	3.00E+02	1.14E-03	3.00E+02
Kr-87	5.30E+01	1.06E+02	-	1.06E+02
Kr-88	1.80E+02	3.60E+02	-	3.60E+02
Kr-89	2.41E+02	4.81E+02	-	4.81E+02
La-140	1.81E-03	3.62E-03	1.01E-03	4.64E-03
Mn-54	5.41E-03	1.08E-02	-	1.08E-02
Mn-56	3.51E-03	7.03E-03	-	7.03E-03
Mo-99	5.95E-02	1.19E-01	1.08E-05	1.19E-01
Na-24	4.05E-03	8.11E-03	-	8.11E-03
Nb-95	8.38E-03	1.68E-02	-	1.68E-02
Ni-63	6.49E-06	1.30E-05	-	1.30E-05
Np-239	1.19E-02	2.38E-02	-	2.38E-02
P-32	9.19E-04	1.84E-03	-	1.84E-03
Pr-144	1.89E-05	3.78E-05	-	3.78E-05
Rb-89	4.32E-05	8.65E-05	-	8.65E-05
Ru-103	3.51E-03	7.03E-03	-	7.03E-03
Ru-106	7.80E-05	1.56E-04	-	1.56E-04
Sb-124	1.81E-04	3.62E-04	-	3.62E-04
Sb-125	6.10E-05	1.22E-04	-	1.22E-04
Sr-89	5.68E-03	1.14E-02	-	1.14E-02
Sr-90	1.20E-03	2.40E-03	-	2.40E-03

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**Table 11.3-5 (Sheet 3 of 3)
Gaseous Release Source Terms**

Isotope^(c,d)	New Unit(s)			
	Single Unit^(a) (Ci/yr)	Dual Unit (Ci/yr)	Existing Site^(b) (Ci/yr)	Total (Ci/yr)
Sr-91	1.00E-03	2.00E-03	1.72E-02	1.92E-02
Sr-92	7.84E-04	1.57E-03	4.10E-02	4.26E-02
Tc-99m	2.97E-04	5.95E-04	1.09E-05	6.06E-04
Te-129m	2.19E-04	4.38E-04	-	4.38E-04
Te-131m	7.57E-05	1.51E-04	1.86E-05	1.70E-04
Te-132	1.89E-05	3.78E-05	-	3.78E-05
W-187	1.89E-04	3.78E-04	-	3.78E-04
Xe-131m	2.70E+03	5.40E+03	2.68E-04	5.40E+03
Xe-133	7.20E+03	1.44E+04	9.99E-01	1.44E+04
Xe-133m	1.70E+02	3.40E+02	1.19E-02	3.40E+02
Xe-135	1.20E+03	2.40E+03	1.15E+00	2.40E+03
Xe-135m	4.05E+02	8.11E+02	-	8.11E+02
Xe-137	5.14E+02	1.03E+03	-	1.03E+03
Xe-138	4.32E+02	8.65E+02	-	8.65E+02
Y-90	4.59E-05	9.19E-05	-	9.19E-05
Y-91	2.41E-04	4.81E-04	-	4.81E-04
Y-91m	-	-	2.40E+00	2.40E+00
Y-92	6.22E-04	1.24E-03	-	1.24E-03
Y-93	1.11E-03	2.22E-03	-	2.22E-03
Zn-65	1.11E-02	2.22E-02	-	2.22E-02
Zr-95	1.59E-03	3.19E-03	-	3.19E-03
Total	1.78E+04	3.56E+04	2.87E+02	3.59E+04

- a) Single unit is the PPE value from SSAR Table 1.3-7, and is included for single unit analysis throughout the section.
- b) Existing site consists of one BWR (HCGS) and two PWRs (SGS).
- c) Radionuclides Kr-90 and Xe-139 are short lived and will decay prior to release to the environment and are therefore, not included in this table.
- d) The emissions from Rh-103m, Rh-106, and Ba-137m are attributed to their parent radionuclides and therefore, are not included in this table.

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**Table 11.3-6 (Sheet 1 of 3)
Site Concentrations Comparison to 10 CFR 20, Appendix B, Table 2, Column 1
Effluent Concentration Limits (ECLs)**

Isotope	Site Concentration ($\mu\text{Ci/ml}$)	ECL ($\mu\text{Ci/ml}$)	Fraction ECL
Ag-110m	1.27E-18	3.00E-10	4.23E-09
Ar-41	2.17E-11	1.00E-08	2.17E-03
Ba-139	1.09E-12	4.00E-08	2.72E-05
Ba-140	1.80E-14	2.00E-09	8.98E-06
Br-82	1.67E-18	6.00E-09	2.79E-10
C-14	1.20E-11	3.00E-09	4.00E-03
Ce-141	5.85E-15	8.00E-10	7.31E-06
Ce-144	1.20E-17	2.00E-11	6.00E-07
Co-57	5.20E-18	9.00E-10	5.78E-09
Co-58	1.46E-14	1.00E-09	1.46E-05
Co-60	8.25E-15	5.00E-11	1.65E-04
Cr-51	2.23E-14	3.00E-08	7.43E-07
Cs-134	3.94E-15	2.00E-10	1.97E-05
Cs-136	3.77E-16	9.00E-10	4.19E-07
Cs-137	6.00E-15	2.00E-10	3.00E-05
Cs-138	1.08E-16	8.00E-08	1.35E-09
Cu-64	6.34E-15	3.00E-08	2.11E-07
Fe-55	4.11E-15	3.00E-09	1.37E-06
Fe-59	5.14E-16	5.00E-10	1.03E-06
H-3	3.10E-10	1.00E-07	3.10E-03
I-131	1.67E-13	2.00E-10	8.34E-04
I-132	1.39E-12	2.00E-08	6.94E-05
I-133	1.10E-12	1.00E-09	1.10E-03
I-134	2.40E-12	6.00E-08	4.00E-05
I-135	1.53E-12	6.00E-09	2.54E-04

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**Table 11.3-6 (Sheet 2 of 3)
Site Concentrations Comparison to 10 CFR 20, Appendix B, Table 2, Column 1
Effluent Concentration Limits (ECLs)**

Isotope	Site Concentration ($\mu\text{Ci/ml}$)	ECL ($\mu\text{Ci/ml}$)	Fraction ECL
Kr-83m	5.31E-16	5.00E-05	1.06E-11
Kr-85	2.60E-09	7.00E-07	3.71E-03
Kr-85m	9.51E-11	1.00E-07	9.51E-04
Kr-87	3.36E-11	2.00E-08	1.68E-03
Kr-88	1.14E-10	9.00E-09	1.27E-02
Kr-89	1.53E-10	1.00E-09	1.53E-01
La-140	1.47E-15	2.00E-09	7.35E-07
Mn-54	3.43E-15	1.00E-09	3.43E-06
Mn-56	2.23E-15	2.00E-08	1.11E-07
Mo-99	3.77E-14	2.00E-09	1.89E-05
Na-24	2.57E-15	7.00E-09	3.67E-07
Nb-95	5.31E-15	2.00E-09	2.66E-06
Ni-63	4.11E-18	4.00E-09	1.03E-09
Np-239	7.54E-15	3.00E-09	2.51E-06
P-32	5.83E-16	5.00E-10	1.17E-06
Pr-144	1.20E-17	2.00E-07	6.00E-11
Rb-89	2.74E-17	2.00E-07	1.37E-10
Ru-103	2.23E-15	9.00E-10	2.48E-06
Ru-106	4.95E-17	2.00E-11	2.47E-06
Sb-124	1.15E-16	3.00E-10	3.83E-07
Sb-125	3.87E-17	7.00E-10	5.53E-08
Sr-89	3.60E-15	2.00E-10	1.80E-05
Sr-90	7.61E-16	6.00E-12	1.27E-04
Sr-91	6.09E-15	5.00E-09	1.22E-06
Sr-92	1.35E-14	9.00E-09	1.50E-06

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**Table 11.3-6 (Sheet 3 of 3)
Site Concentrations Comparison to 10 CFR 20, Appendix B, Table 2, Column 1
Effluent Concentration Limits (ECLs)**

Isotope	Site Concentration ($\mu\text{Ci/ml}$)	ECL ($\mu\text{Ci/ml}$)	Fraction ECL
Tc-99m	1.92E-16	2.00E-07	9.60E-10
Te-129m	1.39E-16	3.00E-10	4.63E-07
Te-131m	5.39E-17	1.00E-09	5.39E-08
Te-132	1.20E-17	9.00E-10	1.33E-08
W-187	1.20E-16	1.00E-08	1.20E-08
Xe-131m	1.71E-09	2.00E-06	8.56E-04
Xe-133	4.57E-09	5.00E-07	9.13E-03
Xe-133m	1.08E-10	6.00E-07	1.80E-04
Xe-135	7.61E-10	7.00E-08	1.09E-02
Xe-137	3.26E-10	1.00E-09	3.26E-01
Xe-135m	2.57E-10	4.00E-08	6.43E-03
Xe-138	2.74E-10	2.00E-08	1.37E-02
Y-90	2.91E-17	9.00E-10	3.24E-08
Y-91	1.53E-16	2.00E-10	7.63E-07
Y-91m	7.61E-13	2.00E-07	3.81E-06
Y-92	3.94E-16	1.00E-08	3.94E-08
Y-93	7.03E-16	3.00E-09	2.34E-07
Zn-65	7.03E-15	4.00E-10	1.76E-05
Zr-95	1.01E-15	4.00E-10	2.53E-06
Total			5.51E-01

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**Table 11.3-7 (Sheet 1 of 2)
Doses to Maximally Exposed Individual from Gaseous Effluent Releases**

MEI Location	Pathway	MEI	Dose per Unit (mrem/yr)			
			T. Body	GI-Tract	Bone	Liver
Nearest Meat Animal	Meat	Adult	4.90E-03	6.26E-03	2.26E-02	5.03E-03
		Teen	4.03E-03	4.78E-03	1.90E-02	4.17E-03
		Child	7.36E-03	7.69E-03	3.57E-02	7.56E-03
Nearest Milk-Producing animals (Goat)	Milk	Adult	9.93E-03	6.41E-03	2.92E-02	1.16E-02
		Teen	1.45E-02	1.10E-02	5.32E-02	2.02E-02
		Child	2.83E-02	2.47E-02	1.30E-01	4.08E-02
		Infant	5.44E-02	4.99E-02	2.47E-01	8.24E-02
Nearest Residence	Ground Plane		1.53E-02	1.53E-02	1.53E-02	1.53E-02
	Plume		9.52E-02	9.52E-02	9.52E-02	9.52E-02
	Inhalation	Adult	2.14E-03	2.35E-03	5.03E-04	2.44E-03
		Teen	2.20E-03	2.43E-03	6.52E-04	2.64E-03
		Child	2.00E-03	2.03E-03	8.35E-04	2.38E-03
		Infant	1.18E-03	1.15E-03	5.33E-04	1.58E-03
Nearest Vegetable Garden	Vegetable	Adult	1.55E-02	1.56E-02	7.30E-02	1.61E-02
		Teen	2.32E-02	2.35E-02	1.15E-01	2.50E-02
		Child	5.21E-02	5.11E-02	2.72E-01	5.56E-02
Nearest Site Boundary	Ground Plane		6.55E-01	6.55E-01	6.55E-01	6.55E-01
	Plume		3.97E+00	3.97E+00	3.97E+00	3.97E+00
	Inhalation	Adult	9.03E-02	1.01E-01	2.41E-02	1.04E-01
		Teen	9.31E-02	1.04E-01	3.11E-02	1.13E-01
		Child	8.44E-02	8.62E-02	3.97E-02	1.02E-01
		Infant	4.97E-02	4.85E-02	2.51E-02	6.83E-02

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**Table 11.3-7 (Sheet 2 of 2)
Doses to Maximally Exposed Individual from Gaseous Effluent Releases**

MEI Location	Pathway	MEI	Dose per Unit (mrem/yr)			
			Kidney	Thyroid	Lung	Skin
Nearest Meat Animal	Meat	Adult	4.87E-03	1.17E-02	4.69E-03	4.66E-03
		Teen	4.04E-03	9.04E-03	3.91E-03	3.88E-03
		Child	7.39E-03	1.50E-02	7.24E-03	7.20E-03
Nearest Milk-Producing animals (Goat)	Milk	Adult	8.93E-03	2.53E-01	6.45E-03	5.92E-03
		Teen	1.56E-02	4.02E-01	1.14E-02	1.03E-02
		Child	3.29E-02	8.05E-01	2.58E-02	2.42E-02
		Infant	6.35E-02	1.94E+00	5.21E-02	4.92E-02
Nearest Residence	Ground Plane		1.53E-02	1.53E-02	1.53E-02	1.80E-02
	Plume		9.52E-02	9.52E-02	9.79E-02	2.92E-01
	Inhalation	Adult	2.68E-03	5.78E-02	3.08E-03	1.91E-03
		Teen	2.98E-03	7.51E-02	3.71E-03	1.93E-03
		Child	2.67E-03	9.23E-02	3.19E-03	1.70E-03
		Infant	1.60E-03	8.36E-02	2.10E-03	9.80E-04
Nearest Vegetable Garden	Vegetable	Adult	1.51E-02	1.77E-01	1.37E-02	1.35E-02
		Teen	2.35E-02	2.25E-01	2.15E-02	2.11E-02
		Child	5.31E-02	4.29E-01	4.99E-02	4.94E-02
Nearest Site Boundary	Ground Plane		6.55E-01	6.55E-01	6.55E-01	7.69E-01
	Plume		3.97E+00	3.97E+00	4.08E+00	1.22E+01
	Inhalation	Adult	1.15E-01	2.61E+00	1.38E-01	7.97E-02
		Teen	1.28E-01	3.40E+00	1.69E-01	8.04E-02
		Child	1.15E-01	4.18E+00	1.45E-01	7.10E-02
		Infant	6.93E-02	3.79E+00	9.68E-02	4.09E-02

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**Table 11.3-8
Comparison of Maximally Exposed Individual Doses with 10 CFR 50, Appendix I Criteria**

Dose Type	Annual Dose^(a)	Limit
Gamma Air (mrad/yr)	6.10	10
Beta Air (mrad/yr)	11.0	20
Total Body (mrem/yr)	4.62	5
Skin (mrem/yr)	12.2	15
Limiting Organ – Child Thyroid (mrem/yr)	7.22	15

- a) Annual doses are based on the member of the public that is situated on the nearest site boundary for the entire duration of a year.

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**Table 11.3-9
Comparison of Maximally Exposed Individual Doses with 40 CFR 190 Criteria**

Dose Type	New Unit(s)^(g)				Existing Units^(g)	Total^(f)	Limit
	Gaseous Single Unit	Gaseous Dual Unit	Liquid Dual Unit^(e)	Direct Radiation^(h)			
Total Body (mrem/yr)	2.00E-01 ^(a)	4.00E-01	3.14E-02	2.50E+00	5.36E-03	2.94E+00	25
Thyroid (mrem/yr)	2.13E+00 ^(b)	4.26E+00	8.30E-02	2.50E+00	2.04E-02	6.86E+00	75
Other Organ – Bone (mrem/yr)	5.49E-01 ^(c)	1.10E+00	3.54E-01	2.50E+00	2.04E-02 ^(d)	3.97E+00	25

- a) Gaseous MEI for this case is a child. Value is the sum of child total body doses from meat, milk, vegetable, and inhalation exposure plus the ground plane and plume exposure from Table 11.3-7.
- b) Gaseous MEI for this case is an infant. Value is the sum of infant thyroid doses from milk and inhalation exposure plus the ground plane and plume exposure from Table 11.3-7.
- c) Gaseous MEI for this case is a child. Value is the sum of child bone doses from meat, milk, vegetable, and inhalation exposure plus the ground plane and plume exposure from Table 11.3-7.
- d) Doses to other organs are less than the dose to the thyroid, so the thyroid dose is used.
- e) Liquid dose contributions are obtained from Table 11.2-7.
- f) Total doses are the sum of the values from the direct radiation, gaseous dual unit, liquid dual unit, and existing units.
- g) The doses from the new units are much higher than from the existing units because doses from the existing units are based on actual measurements, compared to the conservatively calculated, bounding PPE theoretical doses from the new unit(s).
- h) The bounding direct radiation dose at the PSEG Site is from a single unit ABWR configuration. The direct doses from the other reactor technology configurations presented in Subsection 1.2.2 are less than the ABWR.

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**Table 11.3-10
Collective Annual Doses from a New Unit to Population within 50 Miles, by Pathway**

Pathway	Dose (person-rem)	
	Total Body	Thyroid (Worst Case Organ)
Meat	3.61E+00	6.86E+00
Milk (cow)	3.62E+00	6.06E+01
Ground Plane	1.04E+00	1.04E+00
Plume	3.89E+00	3.89E+00
Inhalation	4.57E-01	1.04E+01
Vegetable	7.76E+00	8.12E+00
Total	2.04E+01	9.10E+01

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**Table 11.3-11
Collective Annual Total Body Doses from New Units to Population
within 50 Miles, by Group**

Group	<u>Total Body Dose (person-rem)</u>	
	Single Unit	Dual Unit
Noble Gases	3.89E+00	7.78E+00
Iodines & Particulates	2.01E+00	4.02E+00
C-14 & H-3	1.44E+01	2.88E+01
<hr/>		
Total	2.03E+01	4.06E+01

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CONDUCT OF OPERATIONS**

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CHAPTER 13

CONDUCT OF OPERATIONS

13.3 EMERGENCY PLAN

This section, in conjunction with Part 5, Emergency Plan, of the early site permit application (ESPA), describes emergency planning for the addition of a new plant at the PSEG Site. PSEG is submitting a complete and integrated emergency plan for approval by the U.S. Nuclear Regulatory Commission (NRC) in accordance with 10 CFR 52.17(b)(2)(ii). This section contains the information required by 10 CFR 52.17, *Contents of applications; technical information*, or provides a reference to Part 5 of the ESPA for additional information. The Emergency Plan complies with 10 CFR 50.47(b) and 10 CFR 50 Appendix E. The PSEG Site Emergency Plan is based on the existing Salem Generating Station (SGS) and Hope Creek Generating Station (HCGS) Emergency Plan.

PSEG has not selected a reactor technology to be built at the PSEG Site. Therefore, attachments to the Emergency Plan are developed to address information specific to the four (4) proposed technologies

- U.S. Evolutionary Power Reactor (U.S. EPR)
- Advanced Boiling-Water Reactor (ABWR)
- U.S. Advanced Pressurized-Water Reactor (US-APWR)
- Advanced Passive 1000 (AP1000)

The Emergency Plan will be revised following the selection of the reactor technology. At COL, PSEG will update the Emergency Plan to identify the specific monitoring capability for the radiological parameters identified in Regulatory Guide 1.97.

The demonstration of Emergency Plan performance cannot be completed until portions of the facility have been constructed. To support demonstration, Inspections, Tests, Analyses, and Acceptance Criteria (ITAAC) are included as an attachment to the Emergency Plan (Part 5) per 10 CFR 52.17(b)(3).

Certain aspects of the technology-specific Emergency Action Levels (EALs) required by 10 CFR 50.47(b)(4) and 10 CFR 50 Appendix E Section IV.B cannot be completed until actual as-built information is available, and the Technical Specifications are finalized. PSEG will adopt an EAL scheme using the guidance in the NRC approved version of NEI 99-01, Rev. 5 and NEI 07-01, Rev. 0 (for AP1000) at least 180 days prior to initial fuel load of the unit.

NUREG-0654/FEMA-REP-1, *Criteria for Preparation and Evaluation of Radiological Emergency Response Plans and Preparedness in Support of Nuclear Power Plants*, Revision 1, November 1980, Criterion II.B.5 and Table B-1 define augmentation times for the on-site emergency organization of 30 and 60 minutes upon declaration of an emergency. The existing Salem/Hope Creek Nuclear Generating Station's Emergency Plan describes an Emergency Response Organization (ERO) augmentation time of 90 minutes to augment the affected unit on-shift staff upon the declaration of an Alert or higher classification (Emergency Plan Section 3 Table 3-2). The existing on-shift staffing, as augmented by the capabilities for additions in 90 minutes, satisfies the staffing requirements of NUREG-0654, Table B-1. In the Safety Evaluation Report

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(SER) for the revision to the Emergency Plan that approved the on-shift ERO capabilities, as well as the 90 minute augmentation time capabilities, the NRC found that the ERO augmentation (response) time of 90 minutes meets the intent of the NRC-approved Emergency Plan, and continues to meet the standards of 10 CFR 50.47(b) and the requirements of Appendix E to 10 CFR Part 50. The NRC Safety Evaluation Report is dated June 26, 2008 (Reference 13.3-1).

13.3.1 PHYSICAL CHARACTERISTICS

13.3.1.1 Site Description

The existing 734 acre PSEG property is located on the southern part of Artificial Island on the east bank of the Delaware River in Lower Alloways Creek Township, Salem County, New Jersey (NJ). PSEG is developing an agreement in principle with the U. S. Army Corps of Engineers (USACE) to acquire an additional 85 acres immediately to the north of HCGS. Therefore, with the land acquisition, the PSEG Site will be 819 acres. The specific timing of land acquisition is not currently known and is subject to further PSEG and USACE actions. However the agreement in principle with the USACE will serve to establish the basis for eventual land acquisition and Exclusion Area Boundary (EAB) control, necessary to support the issuance of a future combined license.

Subsequent to the agreement in principle with the USACE, PSEG will develop a lease agreement for the USACE Confined Disposal Facility (CDF) land to the north of the PSEG Site, depicted on the Site Utilization Plan for the concrete batch plant and temporary construction/laydown use. At the completion of construction, the leased land will be returned to the USACE, subject to any required long-term EAB control conditions.

The PSEG Site lies on the low coastal plain of New Jersey, surrounded by extensive marshlands and meadowlands. The Exclusion Area Boundary (EAB) is shown in Figure 1.2-3. The closest primary public road is NJ Highway 49, and vehicle access to the site is from Alloway Creek Neck Road.

There are no physical characteristics, unique to the PSEG Site, which pose a significant impediment to development of the Emergency Plan. An Evacuation Time Estimate (ETE) Report is provided in Part 5 of the ESPA. The road network is modeled in the ETE and is shown to be robust enough to handle the volume of traffic in the event of an emergency.

13.3.1.2 Area Population

The population for each Emergency Response Planning Area (ERPA) is provided in ESPA Part 5, Emergency Plan, Attachment 11, Table 3-1. Additional details are provided in the ETE. The ETE did not identify any impediments to the development of the Emergency Plan.

13.3.2 EMERGENCY PLAN

Part 5 of the ESPA contains the complete and integrated Emergency Plan.

13.3.3 EMERGENCY PLANNING ZONES

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The Emergency Planning Zones (EPZs) for the new plant at the PSEG Site are based on the requirements contained in 10 CFR 50 Appendix E. The plume exposure pathway EPZ for the PSEG Site is an area surrounding the plant within a radius of approximately 10 miles. The ingestion exposure pathway EPZ is an area surrounding the plant within a radius of approximately 50 miles. The existing EPZ for the Salem/Hope Creek Nuclear Generating Stations is used for the new plant. The center-point of the EPZ is located at Latitude 39° 27' 50.4" and Longitude 75° 32' 08.7". (Exact boundaries are determined in concurrence with state and county authorities). An illustration of the plume exposure pathway EPZ is provided in Part 5, Emergency Plan, Figure 1-3. The figure includes all areas approximately 10 miles from the PSEG Site, including portions of Salem and Cumberland counties in NJ and New Castle and Kent counties in DE.

13.3.4 EVACUATION TIME ESTIMATES

An independent ETE study has been performed to provide estimates of the time required to evacuate resident and transient populations surrounding the PSEG Site for various times of the year under favorable and adverse conditions. The ETE for evacuation of the plume exposure EPZ is summarized in Part 5, Emergency Plan, Attachment 11 and detailed in the ETE report provided in Part 5.

13.3.5 CONTACTS AND AGREEMENTS

Surrounding emergency response organizations currently support SGS and HCGS. The addition of a new facility does not change the number of organizations or their level of support. Letters of agreement reflecting contacts and arrangements made with local, State, Federal and other organizations with supporting emergency responsibilities are provided in Part 5, Emergency Plan, Attachment 2.

13.3.6 REFERENCES

- 13.3-1 U. S. Nuclear Regulatory Commission, "Safety Evaluation by the Office of Nuclear Reactor Regulation Related to Emergency Plan Changes for Hope Creek Generating Station and Salem Nuclear Generating Station, Unit Nos. 1 and 2 Docket Nos. 50-354, 50-272 and 50-311," June 26, 2008 (ML081690552).

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13.6 INDUSTRIAL SECURITY

The area to be developed for the new plant at the PSEG Site is located to the north of HCGS. There will be a protected area encompassing the new plant. The physical protection of the new plant, as with the existing units, is based on:

- Controlling access to the PSEG Site and all units
- Screening plant personnel
- Monitoring security equipment
- Designing and arranging station features
- Obtaining assistance from local law enforcement personnel

Prior to taking possession of nuclear fuel at the new plant, a vehicle barrier system will be implemented at the appropriate stand-off distance.

The characteristics of the new plant footprint are such that the requirements of 10 CFR 73.55, *Requirements for physical protection of licensed activities in nuclear power reactors against radiological sabotage*, are met. In addition, PSEG will conform to the applicable industry guidance in the following documents:

- NRC Regulatory Guide 4.7, *General Site Suitability Criteria for Nuclear Stations*, Revision 2, 1998
- NEI 03-12, *Template for Security Plan and Training and Qualification Plan*
- EA-03-086, *Revised Design Basis Threat Order*
- 10 CFR 52.17(a)(1)(x)

The PSEG Site is sufficiently large to provide adequate distances between structures and the probable location of the security boundaries. The layout of the PSEG Site is provided in Figure 1.2-3. The PSEG Site is bordered on the west and the south by the Delaware River. There is an approved comprehensive security plan in place for the SGS and HCGS that is in compliance with the post-9/11 NRC Orders. When PSEG proceeds with construction and operation of a new plant, the existing security boundary will be extended to include the new plant. The security plan and defensive strategy will be updated to incorporate the new plant and ensure that the above referenced security requirements are met.

In accordance with 10 CFR 100, *Reactor Site Criteria*, paragraph 21(f), PSEG will ensure that site characteristics are adequate to support security plans and measures. When a reactor technology selection is made and a combined license (COL) application is prepared, the specific design features to assure site security in compliance with 10 CFR 73.55, will be defined. Design features will assure that the existing security spatial distances for SGS and HCGS are met during construction and operation of the new plant. The new plant design will include physical barriers, access requirements, security monitoring equipment and methods to screen station operating personnel, communications, and testing and maintenance.

Based on review of nearby facilities, there are no potential hazards in the vicinity of the PSEG Site. Additional details on site hazards are provided in Section 2.2. The new plant is located at a sufficient distance from HCGS to meet the minimum requirements of Regulatory Guide 4.7,

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such that provisions for construction activities at the new plant ensure that the ability of SGS and HCGS to meet NRC security requirements is not adversely affected.

The PSEG Site is located in Lower Alloways Creek Township, NJ. A written letter of agreement with local law enforcement is currently in place to establish a single point of contact for law enforcement response to SGS and HCGS. In addition, arrangements are in place by a letter of agreement with the United States Coast Guard for the control of the Delaware River in the vicinity of SGS and HCGS. These agreements will be modified to include the new plant at the PSEG Site.

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TRANSIENT AND ACCIDENT ANALYSIS**

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CHAPTER 15

TRANSIENT AND ACCIDENT ANALYSES

15.1 SELECTION OF ACCIDENTS

This chapter contains an analysis of the radiological consequences of design basis accidents at the new plant. This analysis demonstrates the acceptability of the site with respect to the radiological consequence factors identified in 10 CFR 50.34(a)(1) as related to mitigating the radiological consequences of an accident in accordance with 10 CFR 52.17(a)(1). This analysis is performed to exhibit that the new plant can be located at the PSEG Site without undue risk to the health and safety of the public in compliance with the requirements of 10 CFR Part 100.

PSEG is considering constructing an ABWR, AP1000 (dual unit), U.S. EPR, or US-APWR light water reactor (LWR) at the PSEG Site. Although PSEG is using the plant parameter envelope (PPE) approach discussed in Chapter 1, each technology is evaluated individually within this chapter. The analysis is performed for a broad spectrum of representative postulated design basis accidents (DBA) to determine the bounding radiological consequences that affect the safe design and siting of an advanced light-water reactor. The selected accidents are based on the LWR technologies being considered for development and the regulatory guidance for performing DBA analysis. The following accidents are selected from NUREG-0800, *Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR Edition*, and Regulatory Guide (RG) 1.183, *Alternative Radiological Source Terms for Evaluating Design Basis Accidents at Nuclear Power Reactors*, Revision 0, 2000, to cover a spectrum of reactor transients and accidents.

- STEAM SYSTEM PIPING FAILURES INSIDE AND OUTSIDE OF CONTAINMENT (AP1000, U.S. EPR, US-APWR), (SRP 15.1.5)
- REACTOR COOLANT PUMP ROTOR SEIZURE (ABWR, AP1000, U.S. EPR, US-APWR), (SRP 15.3.3)
- SPECTRUM OF ROD EJECTION ACCIDENTS (ABWR, AP1000, U.S. EPR, US-APWR), (SRP 15.4.8)
- SPECTRUM OF ROD DROP ACCIDENTS (ABWR), (SRP 15.4.9)
- RADIOLOGICAL CONSEQUENCES OF THE FAILURE OF SMALL LINES CARRYING PRIMARY COOLANT OUTSIDE CONTAINMENT (ABWR, AP1000, U.S. EPR, US-APWR), (SRP 15.6.2)
- RADIOLOGICAL CONSEQUENCES OF STEAM GENERATOR TUBE FAILURE (AP1000, U.S. EPR, US-APWR), (SRP 15.6.3)
- RADIOLOGICAL CONSEQUENCES OF MAIN STEAM LINE FAILURE OUTSIDE CONTAINMENT (ABWR), (SRP 15.6.4)

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- LOSS-OF-COOLANT ACCIDENTS RESULTING FROM SPECTRUM OF POSTULATED PIPING BREAKS WITHIN THE REACTOR COOLANT PRESSURE BOUNDARY (ABWR, AP1000, U.S. EPR, US-APWR), (SRP 15.6.5)
- RADIOLOGICAL CONSEQUENCES OF FUEL HANDLING ACCIDENTS (ABWR, AP1000, U.S. EPR, US-APWR), (SRP 15.7.4)

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15.2 EVALUATION METHODOLOGY

Doses for selected accidents involving possible fission product release from a new plant at the PSEG Site are evaluated at the Exclusion Area Boundary (EAB) and at the outer boundary of the low population zone (LPZ) to demonstrate the new plant's capabilities to mitigate the radiological consequences of an accident. Although the emergency safeguard features are expected to prevent core damage and mitigate the release of radioactivity, the bounding Loss of Coolant Accident (LOCA) analysis presumes substantial damage to the core with the release of fission products. Other DBAs of lesser magnitude but greater frequencies of occurrence are not expected to approach the limits of 10 CFR 50.34 or 10 CFR 100 as closely as a LOCA. For these accidents, the more restrictive dose limits in RG 1.183 and NUREG-0800 are invoked to determine that the accidents are acceptable from an overall risk perspective. Accident doses to an individual are evaluated at any point on the EAB and at any point on the outer boundary of the LPZ to meet limits specified in 10 CFR 50.34 and 10 CFR 100. Radiological consequences related to control room personnel will be evaluated as part of the combined license (COL) review.

The dose to an individual located on the EAB or the outer boundary of the LPZ is calculated based on the amount of activity released to the environment, the atmospheric dispersion of the activity during transport from the release point to the dose point, the breathing rate of the individual at the dose point location and the activity-to-dose conversion factors. The atmospheric dispersion factor (χ/Q) is the only site-specific parameter required for determining the dose to an individual. The Design Control Documents (DCDs) have developed χ/Q s that are not expected to be exceeded at most reactor sites. For this evaluation, the accident doses at the EAB and the outer boundary of the LPZ for the new plant at the PSEG Site are obtained using the ratio of the site-specific and design certified χ/Q s for each respective technology and compared to the acceptance criteria in RG 1.183 and NUREG-0800. Site-specific χ/Q values are based on on-site meteorology and developed within Section 2.3. The PSEG Site specific short-term directional dependent χ/Q s are calculated using on-site meteorological data and the methodology of RG 1.145, *Atmospheric Dispersion Models for Potential Accident Consequence Assessments at Nuclear Power Plants*, Revision 1, 1983.

The accident dose evaluations are performed using χ/Q s and activity releases for the following intervals. The zero to two hour χ/Q value is used for the two hour release duration with the greatest dose consequence at the EAB.

<u>EAB</u>	<u>LPZ</u>
0 to 2 hr.	0 to 8 hr.
	8 to 24 hr.
	24 to 96 hr.
	96 to 720 hr.

Accident doses for the ABWR are expressed as whole body and thyroid doses consistent with 10 CFR 100. Accident doses for all other technologies evaluated are expressed in total effective dose equivalent (TEDE) consistent with 10 CFR 50.34.

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15.3 SOURCE TERMS

Dose estimates are calculated using time-dependent activities released to the environment for each DBA. The activities are based on the analyses used to support the reactor standard safety analysis reports. The different reactor technologies use different source terms and approaches in defining the activity releases.

The US-APWR source terms are calculated using the guidance in NUREG-0800 and RG 1.183. Activity releases are calculated for a reactor power level of 4555 MWt (102 percent of rated NSSS power of 4466 MWt). Source terms for the US-APWR are listed in Tables 15.3-1 to 15.3-9.

The ABWR source terms are calculated using the following guidance:

- RG 1.3, *Assumptions Used for Evaluating the Potential Radiological Consequences of a Loss of Coolant Accident for Boiling Water Reactors*, Revision 2, 1974
- RG 1.25, *Assumptions Used for Evaluating the Potential Radiological Consequences of a Fuel Handling Accident in the Fuel Handling and Storage Facility for Boiling and Pressurized Water Reactors*, Revision 0, 1972
- TID-14844, *Calculation of Distance Factors for Power and Test Reactor Sites*, 1962

The ABWR DCD source terms are given for a reactor power level of 4005 MWt. An uprated, 4300 MWt version of the ABWR is being considered for the PSEG Site. Source terms are calculated for a reactor power level of 4386 MWt (102 percent of the uprated 4300 MWt) by multiplying the source terms in the DCD by a factor of 4386/4005, since activity releases scale directly with power. This is only done for accidents that involved postulated fuel damage (LOCA and fuel handling accidents). The source terms for the ABWR are listed in Tables 15.3-10 to 15.3-14.

There are no radiological consequences for either the control rod drop/rod ejection accident or the reactor internal pump rotor seizure accident for the ABWR. The fine motion control rod drive (FMCRD) system has several new features that are unique compared with locking piston control rod drives. This system removes the basis for the control rod accidents to occur and thus removes the need for any radiological analysis. Further detail on this specific design is provided in ABWR DCD Subsections 15.4.9 and 15.4.10. The reactor internal pump rotor seizure accident does not result in any fuel failures or safety/relief valve (SRV) actuation, and radiological consequences are thus not considered. Further detail on this accident can be found in ABWR DCD Subsection 15.3.3.

The AP1000 source terms and approaches to assessing accidents are based on the Alternate Source Term (AST) methods as described in NUREG-1465, *Accident Source Terms for Light-Water Nuclear Power Plants*, and are in accordance with RG 1.183. Activity releases are calculated at a power level of 3468 MWt (102 percent of rated core power of 3400 MWt). The source terms for the AP1000 are listed in Tables 15.3-15 to 15.3-23.

The U.S. EPR source terms and approaches to assessing accidents are calculated in accordance with NUREG-0800 and RG 1.183. Activity releases are calculated for a reactor power level of 4612 MWt (4590 MWt rated core power + 22 MWt heat balance measurement uncertainty). The source terms for the U.S. EPR are listed in Tables 15.3-24 to 15.3-33.

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**Table 15.3-1 (Sheet 1 of 2)
US-APWR Source Terms
Time Dependent Released Activity during LOCA (Ci)**

Nuclide	0 to 8 hr.	8 to 24 hr.	24 to 96 hr.	96 to 720 hr.	Total
Noble Gases					
Kr-85	7.75E+02	1.74E+03	3.92E+03	3.35E+04	3.99E+04
Kr-85m	9.16E+03	4.37E+03	1.99E+02	0.00E+00	1.37E+04
Kr-87	3.54E+03	7.83E+01	0.00E+00	0.00E+00	3.62E+03
Kr-88	1.68E+04	3.68E+03	3.70E+01	0.00E+00	2.05E+04
Xe-133	1.26E+05	2.76E+05	4.93E+05	9.77E+05	1.87E+06
Xe-135	3.79E+04	4.05E+04	9.60E+03	4.41E+01	8.80E+04
Iodines					
I-131	1.42E+03	5.61E+02	1.85E+03	5.60E+03	9.43E+03
I-132	1.50E+03	1.01E+02	2.22E+02	2.48E+02	2.07E+03
I-133	2.67E+03	7.37E+02	8.09E+02	8.07E+01	4.30E+03
I-134	4.22E+02	1.84E-01	0.00E+00	0.00E+00	4.22E+02
I-135	1.95E+03	2.44E+02	4.67E+01	1.20E-01	2.24E+03
Alkali Metals					
Rb-86	1.44E+00	1.60E-02	0.00E+00	0.00E+00	1.45E+00
Cs-134	1.44E+02	1.62E+00	0.00E+00	0.00E+00	1.46E+02
Cs-136	3.90E+01	4.31E-01	0.00E+00	0.00E+00	3.94E+01
Cs-137	8.19E+01	9.21E-01	1.00E-03	0.00E+00	8.28E+01
Tellurium Group					
Sb-127	1.04E+01	1.26E-01	1.00E-05	0.00E+00	1.05E+01
Sb-129	1.99E+01	6.87E-02	0.00E+00	0.00E+00	2.00E+01
Te-127	1.04E+01	1.30E-01	0.00E+00	0.00E+00	1.05E+01
Te-127m	1.39E+00	1.80E-02	0.00E+00	0.00E+00	1.40E+00
Te-129	2.30E+01	1.12E-01	0.00E+00	0.00E+00	2.31E+01
Te-129m	4.75E+00	6.13E-02	0.00E+00	0.00E+00	4.81E+00
Te-131m	1.36E+01	1.44E-01	0.00E+00	0.00E+00	1.37E+01
Te-132	1.41E+02	1.71E+00	1.00E-04	0.00E+00	1.43E+02
Strontium and Barium					
Sr-89	4.74E+01	6.12E-01	0.00E+00	0.00E+00	4.80E+01
Sr-90	3.93E+00	5.10E-02	0.00E+00	0.00E+00	3.98E+00
Sr-91	5.01E+01	3.54E-01	1.00E-03	0.00E+00	5.05E+01
Sr-92	3.11E+01	4.95E-02	0.00E+00	0.00E+00	3.11E+01
Ba-139	1.96E+01	5.04E-03	0.00E+00	0.00E+00	1.96E+01
Ba-140	7.49E+01	9.53E-01	0.00E+00	0.00E+00	7.59E+1

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**Table 15.3-1 (Sheet 2 of 2)
US-APWR Source Terms
Time Dependent Released Activity during LOCA (Ci)**

Nuclide	0 to 8 hr.	8 to 24 hr.	24 to 96 hr.	96 to 720 hr.	Total
Noble Metals					
Co-58	3.36E-03	4.50E-08	0.00E+00	0.00E+00	3.36E-03
Co-60	1.59E-02	2.00E-04	1.01E-06	0.00E+00	1.61E-02
Mo-99	9.57E+00	1.11E-01	1.00E-04	0.00E+00	9.68E+00
Tc-99m	8.50E+00	1.04E-01	1.00E-04	0.00E+00	8.60E+00
Ru-103	7.62E+00	9.83E-02	1.01E-04	0.00E+00	7.72E+00
Ru-105	3.14E+00	1.12E-02	0.00E+00	0.00E+00	3.15E+00
Ru-106	2.67E+00	3.46E-02	0.00E+00	0.00E+00	2.70E+00
Rh-105	4.61E+00	5.41E-02	0.00E+00	0.00E+00	4.67E+00
Lanthanides					
Y-90	7.44E-02	5.12E-03	6.06E-06	0.00E+00	7.96E-02
Y-91	6.00E-01	8.54E-03	0.00E+00	0.00E+00	6.09E-01
Y-92	4.13E+00	1.04E-01	0.00E+00	0.00E+00	4.24E+00
Y-93	5.90E-01	4.32E-03	0.00E+00	0.00E+00	5.94E-01
Zr-95	7.55E-01	9.76E-03	0.00E+00	0.00E+00	7.65E-01
Zr-97	6.65E-01	6.12E-03	0.00E+00	0.00E+00	6.71E-01
Nb-95	7.60E-01	9.85E-03	1.01E-05	0.00E+00	7.69E-01
La-140	1.76E+00	1.43E-01	2.02E-04	0.00E+00	1.90E+00
La-141	4.25E-01	1.29E-03	0.00E+00	0.00E+00	4.27E-01
La-142	2.01E-01	7.07E-05	0.00E+00	0.00E+00	2.01E-01
Pr-143	6.74E-01	8.91E-03	1.00E-05	0.00E+00	6.83E-01
Nd-147	2.80E-01	3.55E-03	0.00E+00	0.00E+00	2.83E-01
Am-241	7.51E-05	9.77E-07	0.00E+00	0.00E+00	7.60E-05
Cm-242	1.86E-02	2.41E-04	0.00E+00	0.00E+00	1.88E-02
Cm-244	2.26E-03	2.93E-05	0.00E+00	0.00E+00	2.29E-03
Cerium Group					
Ce-141	1.78E+00	2.29E-02	0.00E+00	0.00E+00	1.80E+00
Ce-143	1.63E+00	1.78E-02	0.00E+00	0.00E+00	1.65E+00
Ce-144	1.35E+00	1.75E-02	0.00E+00	0.00E+00	1.36E+00
Np-239	1.85E+01	2.16E-01	1.00E-05	0.00E+00	1.87E+01
Pu-238	5.30E-03	6.88E-05	0.00E+00	0.00E+00	5.37E-03
Pu-239	4.00E-04	5.19E-06	0.00E+00	0.00E+00	4.05E-04
Pu-240	6.28E-04	8.14E-06	1.01E-08	0.00E+00	6.36E-04
Pu-241	1.39E-01	1.81E-03	0.00E+00	0.00E+00	1.41E-01
Total	2.03E+05	3.28E+05	5.09E+05	1.02E+06	2.06E+06

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**Table 15.3-2
US-APWR Source Terms
Time Dependent Released Activity during Steam System Piping Failure (Ci)
(Transient-Initiated Iodine Spike)**

Nuclide	0 to 8 hr.	8 to 24 hr.	24 to 96 hr.	96 to 720 hr.	Total
Noble Gases					
Kr-85	3.21E+01	2.40E+01	0.00E+00	0.00E+00	5.61E+01
Kr-85m	3.56E-01	8.77E-02	0.00E+00	0.00E+00	4.43E-01
Kr-87	9.12E-02	1.13E-03	0.00E+00	0.00E+00	9.23E-02
Kr-88	5.10E-01	6.46E-02	0.00E+00	0.00E+00	5.74E-01
Xe-133	1.08E+02	8.03E+01	0.00E+00	0.00E+00	1.88E+02
Xe-135	7.61E+00	1.33E+01	0.00E+00	0.00E+00	2.09E+01
Iodines					
I-131	5.05E+01	6.50E+01	0.00E+00	0.00E+00	1.16E+02
I-132	9.89E+00	1.49E+00	0.00E+00	0.00E+00	1.14E+01
I-133	7.65E+01	8.09E+01	0.00E+00	0.00E+00	1.57E+02
I-134	3.77E+00	9.11E-03	0.00E+00	0.00E+00	3.78E+00
I-135	3.77E+01	2.45E+01	0.00E+00	0.00E+00	6.21E+01
Alkali Metals					
Rb-86	8.64E-02	1.62E-03	0.00E+00	0.00E+00	8.80E-02
Cs-134	8.80E+00	1.68E-01	0.00E+00	0.00E+00	8.97E+00
Cs-136	2.32E+00	4.33E-02	0.00E+00	0.00E+00	2.37E+00
Cs-137	5.01E+00	9.56E-02	0.00E+00	0.00E+00	5.11E+00
Total	3.43E+02	2.90E+02	0.00E+00	0.00E+00	6.33E+02

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**Table 15.3-3
US-APWR Source Terms
Time Dependent Released Activity during Steam System Piping Failure (Ci)
(Pre-Transient Iodine Spike)**

Nuclide	0 to 8 hr.	8 to 24 hr.	24 to 96 hr.	96 to 720 hr.	Total
Noble Gases					
Kr-85	3.21E+01	2.40E+01	0.00E+00	0.00E+00	5.61E+01
Kr-85m	3.56E-01	8.77E-02	0.00E+00	0.00E+00	4.43E-01
Kr-87	9.12E-02	1.13E-03	0.00E+00	0.00E+00	9.23E-02
Kr-88	5.10E-01	6.46E-02	0.00E+00	0.00E+00	5.74E-01
Xe-133	1.07E+02	7.75E+01	0.00E+00	0.00E+00	1.85E+02
Xe-135	4.38E+00	3.39E+00	0.00E+00	0.00E+00	7.78E+00
Iodines					
I-131	1.72E+01	7.25E+00	0.00E+00	0.00E+00	2.44E+01
I-132	6.18E+00	1.66E-01	0.00E+00	0.00E+00	6.35E+00
I-133	2.79E+01	9.03E+00	0.00E+00	0.00E+00	3.69E+01
I-134	3.49E+00	1.01E-03	0.00E+00	0.00E+00	3.49E+00
I-135	1.62E+01	2.73E+00	0.00E+00	0.00E+00	1.89E+01
Alkali Metals					
Rb-86	8.64E-02	1.62E-03	0.00E+00	0.00E+00	8.80E-02
Cs-134	8.80E+00	1.68E-01	0.00E+00	0.00E+00	8.97E+00
Cs-136	2.32E+00	4.33E-02	0.00E+00	0.00E+00	2.37E+00
Cs-137	5.01E+00	9.56E-02	0.00E+00	0.00E+00	5.11E+00
Total	2.32E+02	1.25E+02	0.00E+00	0.00E+00	3.56E+02

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**Table 15.3-4
US-APWR Source Terms
Time Dependent Released Activity during Steam Generator Tube Rupture (Ci)
(Transient-Initiated Iodine Spike)**

Nuclide	0 to 8 hr.	8 to 24 hr.	24 to 96 hr.	96 to 720 hr.	Total
Noble Gases					
Kr-85	3.43E+03	4.64E+01	2.06E+02	1.59E+03	5.27E+03
Kr-85m	6.17E+01	9.70E-02	8.00E-03	0.00E+00	6.18E+01
Kr-87	3.40E+01	0.00E+00	0.00E+00	0.00E+00	3.40E+01
Kr-88	1.11E+02	6.00E-02	1.00E-02	0.00E+00	1.11E+02
Xe-133	1.16E+04	1.45E+02	5.06E+02	9.44E+02	1.32E+04
Xe-135	3.70E+02	3.82E+00	6.70E-01	0.00E+00	3.74E+02
Iodines					
I-131	1.10E+02	1.03E+01	0.00E+00	0.00E+00	1.20E+02
I-132	5.24E+01	2.12E-01	0.00E+00	0.00E+00	5.26E+01
I-133	1.87E+02	1.27E+01	0.00E+00	0.00E+00	2.00E+02
I-134	3.05E+01	1.06E-03	0.00E+00	0.00E+00	3.05E+01
I-135	1.19E+02	3.74E+00	0.00E+00	0.00E+00	1.23E+02
Alkali Metals					
Rb-86	4.54E-03	5.44E-04	0.00E+00	0.00E+00	5.09E-03
Cs-134	4.63E-01	5.63E-02	0.00E+00	0.00E+00	5.19E-01
Cs-136	1.22E-01	1.45E-02	0.00E+00	0.00E+00	1.37E-01
Cs-137	2.64E-01	3.21E-02	0.00E+00	0.00E+00	2.96E-01
Total	1.61E+04	2.22E+02	7.12 E+02	2.53E+03	1.96E+04

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**Table 15.3-5
US-APWR Source Terms
Time Dependent Released Activity during Steam Generator Tube Rupture (Ci)
(Pre-Transient Iodine Spike)**

Nuclide	0 to 8 hr.	8 to 24 hr.	24 to 96 hr.	96 to 720 hr.	Total
Noble Gases					
Kr-85	3.43E+03	4.64E+01	2.06E+02	1.59E+03	5.27E+03
Kr-85m	6.17E+01	9.70E-02	8.00E-03	0.00E+00	6.18E+01
Kr-87	3.40E+01	0.00E+00	0.00E+00	0.00E+00	3.40E+01
Kr-88	1.11E+02	6.00E-02	1.00E-02	0.00E+00	1.11E+02
Xe-133	1.16E+04	1.44E+02	5.06E+02	9.44E+02	1.32E+04
Xe-135	3.75E+02	2.18E+00	6.70E-01	0.00E+00	3.78E+02
Iodines					
I-131	4.18E+02	1.81E+00	0.00E+00	0.00E+00	4.20E+02
I-132	2.09E+02	3.92E-02	0.00E+00	0.00E+00	2.09E+02
I-133	7.16E+02	2.24E+00	0.00E+00	0.00E+00	7.18E+02
I-134	1.28E+02	6.00E-05	0.00E+00	0.00E+00	1.28E+02
I-135	4.61E+02	6.70E-01	0.00E+00	0.00E+00	4.62E+02
Alkali Metals					
Rb-86	4.54E-03	5.44E-04	0.00E+00	0.00E+00	5.09E-03
Cs-134	4.63E-01	5.63E-02	0.00E+00	0.00E+00	5.19E-01
Cs-136	1.22E-01	1.45E-02	0.00E+00	0.00E+00	1.37E-01
Cs-137	2.64E-01	3.21E-02	0.00E+00	0.00E+00	2.96E-01
Total	1.76E+04	1.98E+02	7.12E+02	2.53E+03	2.10E+04

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**Table 15.3-6
US-APWR Source Terms
Time Dependent Released Activity during RCP Rotor Seizure (Ci)**

Nuclide	0 to 8 hr.	8 to 24 hr.	24 to 96 hr.	96 to 720 hr.	Total
Noble Gases					
Kr-85	1.12E+02	8.40E+01	0.00E+00	0.00E+00	1.96E+02
Kr-85m	6.40E+02	1.58E+02	0.00E+00	0.00E+00	7.98E+02
Kr-87	5.02E+02	6.21E+00	0.00E+00	0.00E+00	5.08E+02
Kr-88	1.37E+03	1.74E+02	0.00E+00	0.00E+00	1.55E+03
Xe-133	6.87E+03	4.96E+03	0.00E+00	0.00E+00	1.18E+04
Xe-135	1.61E+03	7.67E+02	0.00E+00	0.00E+00	2.37E+03
Iodines					
I-131	8.81E+01	2.32E+02	0.00E+00	0.00E+00	3.20E+02
I-132	1.94E+01	8.35E+00	0.00E+00	0.00E+00	2.77E+01
I-133	9.85E+01	2.17E+02	0.00E+00	0.00E+00	3.15E+02
I-134	6.46E+00	1.10E-01	0.00E+00	0.00E+00	6.57E+00
I-135	6.38E+01	9.16E+01	0.00E+00	0.00E+00	1.55E+02
Alkali Metals					
Rb-86	3.23E-02	8.66E-02	0.00E+00	0.00E+00	1.19E-01
Cs-134	3.24E+00	8.78E+00	0.00E+00	0.00E+00	1.20E+01
Cs-136	8.72E-01	2.33E+00	0.00E+00	0.00E+00	3.21E+00
Cs-137	1.84E+00	5.00E+00	0.00E+00	0.00E+00	6.84E+00
Total	1.14E+04	6.71E+03	0.00E+00	0.00E+00	1.81E+04

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**Table 15.3-7
US-APWR Source Terms
Time Dependent Released Activity during Rod Ejection Accident (Ci)**

Nuclide	0 to 8 hr.	8 to 24 hr.	24 to 96 hr.	96 to 720 hr.	Total
Noble Gases					
Kr-85	2.63E+02	2.50E+02	1.90E+02	1.63E+03	2.33E+03
Kr-85m	3.59E+03	9.58E+02	9.86E+00	0.00E+00	4.56E+03
Kr-87	2.81E+03	3.50E+01	0.00E+00	0.00E+00	2.85E+03
Kr-88	7.70E+03	1.02E+03	2.05E+00	0.00E+00	8.72E+03
Xe-133	3.81E+04	3.46E+04	2.11E+04	4.22E+04	1.36E+05
Xe-135	9.31E+03	5.32E+03	5.40E+02	2.81E+00	1.52E+04
Iodines					
I-131	5.82E+02	7.17E+02	2.58E+02	7.79E+02	2.34E+03
I-132	4.62E+02	3.93E+01	1.40E-02	0.00E+00	5.01E+02
I-133	1.12E+03	1.06E+03	1.13E+02	1.13E+01	2.30E+03
I-134	4.95E+02	5.15E-01	0.00E+00	0.00E+00	4.95E+02
I-135	8.75E+02	4.39E+02	6.60E+00	4.00E-03	1.32E+03
Alkali Metals					
Rb-86	4.16E-01	9.65E-02	0.00E+00	0.00E+00	5.13E-01
Cs-134	4.15E+01	9.79E+00	1.01E-03	0.00E+00	5.13E+01
Cs-136	1.13E+01	2.60E+00	1.00E-06	0.00E+00	1.39E+01
Cs-137	2.36E+01	5.57E+00	0.00E+00	0.00E+00	2.92E+01
Total	6.53E+04	4.45E+04	2.22E+04	4.46E+04	1.77E+05

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**Table 15.3-8
US-APWR Source Terms
Time Dependent Released Activity during Fuel Handling Accident (Ci)**

Nuclide	0 to 8 hr.	8 to 24 hr.	24 to 96 hr.	96 to 720 hr.	Total
Noble Gases					
Kr-85	1.20E+03	0.00E+00	0.00E+00	0.00E+00	1.20E+03
Kr-85m	3.90E+02	0.00E+00	0.00E+00	0.00E+00	3.90E+02
Kr-87	5.98E-02	0.00E+00	0.00E+00	0.00E+00	5.98E-02
Kr-88	1.25E+02	0.00E+00	0.00E+00	0.00E+00	1.25E+02
Xe-133	9.90E+04	0.00E+00	0.00E+00	0.00E+00	9.90E+04
Xe-135	2.21E+04	0.00E+00	0.00E+00	0.00E+00	2.21E+04
Iodines					
I-131	3.67E+02	0.00E+00	0.00E+00	0.00E+00	3.67E+02
I-132	2.75E+02	0.00E+00	0.00E+00	0.00E+00	2.75E+02
I-133	2.31E+02	0.00E+00	0.00E+00	0.00E+00	2.31E+02
I-134	2.71E-06	0.00E+00	0.00E+00	0.00E+00	2.71E-06
I-135	3.80E+01	0.00E+00	0.00E+00	0.00E+00	3.80E+01
Total	1.24E+05	0.00E+00	0.00E+00	0.00E+00	1.24E+05

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**Table 15.3-9
US-APWR Source Terms
Time Dependent Released Activity during Failure of Small Lines Carrying Primary
Coolant Outside Containment (Ci)^(a)**

Nuclide	0 to 8 hr.	8 to 24 hr.	24 to 96 hr.	96 to 720 hr.	Total
Noble Gases					
Kr-85	6.84E+02	0.00E+00	0.00E+00	0.00E+00	6.84E+02
Kr-85m	1.25E+01	0.00E+00	0.00E+00	0.00E+00	1.25E+01
Kr-87	7.05E+00	0.00E+00	0.00E+00	0.00E+00	7.05E+00
Kr-88	2.26E+01	0.00E+00	0.00E+00	0.00E+00	2.26E+01
Xe-133	2.32E+03	0.00E+00	0.00E+00	0.00E+00	2.32E+03
Xe-135	7.70E+01	0.00E+00	0.00E+00	0.00E+00	7.70E+01
Iodines					
I-131	1.72E+02	0.00E+00	0.00E+00	0.00E+00	1.72E+02
I-132	7.98E+01	0.00E+00	0.00E+00	0.00E+00	7.98E+01
I-133	2.93E+02	0.00E+00	0.00E+00	0.00E+00	2.93E+02
I-134	4.33E+01	0.00E+00	0.00E+00	0.00E+00	4.33E+01
I-135	1.85E+02	0.00E+00	0.00E+00	0.00E+00	1.85E+02
Total	3.90E+03	0.00E+00	0.00E+00	0.00E+00	3.90E+03

a) Source terms are calculated for 4540 MWt (102 percent of core thermal power 4451 MWt)

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**Table 15.3-10 (Sheet 1 of 2)
ABWR Source Terms
Iodine Activity Release to the Environment during a LOCA**

Isotope	1 min.	10 min.	1 hr.	2 hr.	4 hr.
A. Release from Reactor Building to Environment (megabecquerel)					
I-131	3.2E+04	2.9E+06	1.1E+07	1.1E+07	1.1E+07
I-132	4.5E+04	4.1E+06	1.4E+07	1.4E+07	1.5E+07
I-133	6.5E+04	6.1E+06	2.2E+07	2.2E+07	2.3E+07
I-134	7.3E+04	6.1E+06	2.1E+07	2.1E+07	2.1E+07
I-135	6.1E+04	5.7E+06	2.1E+07	2.1E+07	2.2E+07
Total	2.8E+05	2.5E+07	8.9E+07	8.9E+07	9.2E+07
B.1 MSIV Pathway Release to Environment—Elemental (megabecquerel)					
I-131	0.0E+00	0.0E+00	6.1E+01	1.0E+03	1.0E+04
I-132	0.0E+00	0.0E+00	6.9E+01	9.3E+02	6.1E+03
I-133	0.0E+00	0.0E+00	1.2E+02	2.1E+03	1.9E+04
I-134	0.0E+00	0.0E+00	6.9E+01	6.9E+02	2.5E+03
I-135	0.0E+00	0.0E+00	1.1E+02	1.8E+03	1.4E+04
Total	0.0E+00	0.0E+00	4.3E+02	6.5E+03	5.2E+04
B.2 MSIV Pathway Release to Environment—Organic (megabecquerel)					
I-131	0.0E+00	0.0E+00	7.3E+02	1.2E+04	1.2E+05
I-132	0.0E+00	0.0E+00	8.1E+02	1.1E+04	7.3E+04
I-133	0.0E+00	0.0E+00	1.4E+03	2.5E+04	2.3E+05
I-134	0.0E+00	0.0E+00	8.5E+02	8.5E+03	3.1E+04
I-135	0.0E+00	0.0E+00	1.3E+03	2.1E+04	1.8E+05
Total	0.0E+00	0.0E+00	5.1E+03	7.8E+04	6.3E+05
B.3 MSIV Pathway Release to Environment—Resuspended Organic (megabecquerel)					
I-131	0.0E+00	0.0E+00	7.3E+00	3.0E+01	2.4E+02
I-132	0.0E+00	0.0E+00	6.1E+00	2.3E+01	8.9E+01
I-133	0.0E+00	0.0E+00	1.4E+01	5.7E+01	4.5E+02
I-134	0.0E+00	0.0E+00	4.5E+00	1.4E+01	3.1E+01
I-135	0.0E+00	0.0E+00	1.2E+01	4.5E+01	2.9E+02
Total	0.0E+00	0.0E+00	4.4E+01	1.7E+02	1.1E+03
B.4 Release from Condenser to Environment—Sum of B.1+B.2+B.3 (megabecquerel)					
I-131	0.0E+00	0.0E+00	7.7E+02	1.3E+04	1.3E+05
I-132	0.0E+00	0.0E+00	8.9E+02	1.2E+04	7.7E+04
I-133	0.0E+00	0.0E+00	1.6E+03	2.6E+04	2.5E+05
I-134	0.0E+00	0.0E+00	9.3E+02	9.3E+03	3.3E+04
I-135	0.0E+00	0.0E+00	1.4E+03	2.3E+04	1.9E+05
Total	0.0E+00	0.0E+00	5.6E+03	8.3E+04	6.8E+05

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**Table 15.3-10 (Sheet 2 of 2)
ABWR Source Terms
Iodine Activity Release to the Environment during a LOCA**

Isotope	8 hr.	12 hr.	1 day	4 days	30 days
A. Release from Reactor Building to Environment (megabecquerel)					
I-131	1.4E+07	1.9E+07	3.9E+07	2.1E+08	7.3E+08
I-132	1.5E+07	1.6E+07	1.6E+07	1.6E+07	1.6E+07
I-133	2.9E+07	3.6E+07	6.1E+07	1.3E+08	1.4E+08
I-134	2.1E+07	2.1E+07	2.1E+07	2.1E+07	2.1E+07
I-135	2.5E+07	2.9E+07	3.4E+07	3.8E+07	3.8E+07
Total	1.0E+08	1.2E+08	1.7E+08	7.7E+08	9.5E+08
B.1 MSIV Pathway Release to Environment—Elemental (megabecquerel)					
I-131	6.9E+04	2.0E+05	9.8E+05	1.1E+07	3.3E+07
I-132	2.0E+04	3.0E+04	3.6E+04	3.7E+04	3.7E+04
I-133	1.2E+05	3.3E+05	1.2E+06	5.3E+06	6.1E+06
I-134	3.9E+03	4.1E+03	4.1E+03	1.4E+02	4.1E+03
I-135	7.7E+04	1.8E+05	4.1E+05	6.1E+05	6.1E+05
Total	2.9E+05	7.4E+05	2.6E+06	1.7E+07	4.0E+07
B.2 MSIV Pathway Release to Environment—Organic (megabecquerel)					
I-131	8.5E+05	2.4E+06	1.2E+07	1.8E+08	1.5E+09
I-132	2.4E+05	3.6E+05	4.5E+05	4.5E+05	4.5E+05
I-133	1.5E+06	3.9E+06	1.5E+07	7.7E+07	8.9E+07
I-134	4.8E+04	4.8E+04	4.8E+04	4.8E+04	4.8E+04
I-135	9.3E+05	2.1E+06	4.8E+06	7.7E+06	7.7E+06
Total	3.6E+06	8.8E+06	3.2E+07	2.7E+08	1.6E+09
B.3 MSIV Pathway Release to Environment—Resuspended Organic (megabecquerel)					
I-131	1.5E+03	5.3E+03	4.1E+04	6.9E+06	5.7E+08
I-132	3.2E+02	4.8E+02	7.3E+02	7.7E+02	7.7E+02
I-133	2.6E+03	8.1E+03	4.8E+04	1.5E+06	3.6E+06
I-134	5.3E+01	6.1E+01	6.1E+01	6.1E+01	6.1E+01
I-135	1.5E+03	3.5E+03	1.2E+04	3.7E+04	3.8E+04
Total	6.0E+03	1.7E+04	1.0E+05	8.4E+06	5.7E+08
B.4 Release from Condenser to Environment—Sum of B.1+B.2+B.3 (megabecquerel)					
I-131	9.3E+05	2.6E+06	1.3E+07	2.0E+08	2.2E+09
I-132	2.6E+05	3.8E+05	4.8E+05	4.8E+05	4.8E+05
I-133	1.6E+06	4.1E+06	1.6E+07	8.1E+07	9.8E+07
I-134	5.3E+04	5.3E+04	5.3E+04	5.3E+04	5.3E+04
I-135	1.0E+06	2.2E+06	5.7E+06	8.1E+06	8.1E+06
Total	3.8E+06	9.3E+06	3.5E+07	2.9E+08	2.3E+09

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**Table 15.3-11 (Sheet 1 of 2)
ABWR Source Terms
Noble Gas Activity Release to the Environment during a LOCA**

Isotope	1 min.	10 min.	1 hr.	2 hr.	4 hr.
A. Reactor Building Release to Environment (megabecquerel)					
Kr-83m	3.0E+04	2.5E+06	1.0E+07	1.3E+07	2.1E+07
Kr-85	2.8E+03	2.5E+05	1.1E+06	1.6E+06	3.9E+06
Kr-85m	6.1E+04	5.7E+06	2.3E+07	3.4E+07	6.5E+07
Kr-87	1.2E+05	1.0E+07	3.9E+07	4.8E+07	6.9E+07
Kr-88	1.8E+05	1.5E+07	6.1E+07	8.5E+07	1.5E+08
Kr-89	1.9E+05	5.3E+06	7.3E+06	7.3E+06	7.3E+06
Xe-131m	1.4E+03	1.3E+05	5.7E+05	8.5E+05	2.1E+06
Xe-133	5.3E+05	4.5E+07	2.0E+08	3.1E+08	7.3E+08
Xe-133m	2.2E+04	2.0E+06	8.1E+06	1.2E+07	3.0E+07
Xe-135	6.5E+04	6.1E+06	2.5E+07	3.7E+07	8.1E+07
Xe-135m	9.3E+04	6.5E+06	1.9E+07	2.0E+07	2.0E+07
Xe-137	4.1E+05	1.4E+07	2.1E+07	2.1E+07	2.1E+07
Xe-138	4.1E+05	2.8E+07	8.1E+07	8.1E+07	8.1E+07
Total	2.1E+06	1.4E+08	4.7E+08	6.2E+08	1.3E+09
B. Condenser Release to Environment (megabecquerel)					
Kr-83m	0.0E+00	0.0E+00	6.5E+03	8.5E+04	4.8E+05
Kr-85	0.0E+00	0.0E+00	8.1E+02	1.4E+04	1.4E+05
Kr-85m	0.0E+00	0.0E+00	1.6E+04	2.5E+05	2.0E+06
Kr-87	0.0E+00	0.0E+00	2.2E+04	2.6E+05	1.2E+06
Kr-88	0.0E+00	0.0E+00	4.1E+04	6.1E+05	4.1E+06
Kr-89	0.0E+00	0.0E+00	4.5E+00	4.5E+00	4.5E+00
Xe-131m	0.0E+00	0.0E+00	4.5E+02	7.3E+03	7.3E+04
Xe-133	0.0E+00	0.0E+00	1.5E+05	2.6E+06	2.5E+07
Xe-133m	0.0E+00	0.0E+00	6.1E+03	1.1E+05	1.0E+06
Xe-135	0.0E+00	0.0E+00	1.9E+04	3.0E+05	2.6E+06
Xe-135m	0.0E+00	0.0E+00	3.2E+03	1.1E+04	1.4E+04
Xe-137	0.0E+00	0.0E+00	3.7E+01	3.8E+01	3.8E+01
Xe-138	0.0E+00	0.0E+00	1.1E+04	3.5E+04	4.1E+04
Total	0.0E+00	0.0E+00	2.7E+05	4.3E+06	3.7E+07

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**Table 15.3-11 (Sheet 2 of 2)
ABWR Source Terms
Noble Gas Activity Release to the Environment during a LOCA**

Isotope	8 hr.	12 hr.	1 day	4 days	30 days
A. Reactor Building Release to Environment (megabecquerel)					
Kr-83m	3.1E+07	3.5E+07	3.6E+07	3.6E+07	3.6E+07
Kr-85	1.3E+07	2.6E+07	8.9E+07	7.3E+08	6.1E+09
Kr-85m	1.4E+08	2.1E+08	3.0E+08	3.2E+08	3.2E+08
Kr-87	8.5E+07	8.9E+07	8.9E+07	8.9E+07	8.9E+07
Kr-88	2.7E+08	3.4E+08	3.9E+08	4.1E+08	4.1E+08
Kr-89	7.3E+06	7.3E+06	7.3E+06	7.3E+06	7.3E+06
Xe-131m	6.5E+06	1.4E+07	4.5E+07	3.3E+08	1.5E+09
Xe-133	2.3E+09	4.8E+09	1.5E+10	9.7E+10	2.7E+11
Xe-133m	9.3E+07	1.9E+08	5.7E+08	2.8E+09	4.5E+09
Xe-135	2.1E+08	3.6E+08	7.3E+08	1.1E+09	1.1E+09
Xe-135m	2.0E+07	2.0E+07	2.0E+07	2.0E+07	2.0E+07
Xe-137	2.1E+07	2.1E+07	2.1E+07	2.1E+07	2.1E+07
Xe-138	8.1E+07	8.1E+07	8.1E+07	8.1E+07	8.1E+07
Total	3.3E+09	6.2E+09	1.8E+10	1.0E+11	2.8E+11
B. Condenser Release to Environment (megabecquerel)					
Kr-83m	1.4E+06	1.9E+06	2.1E+06	2.1E+06	2.1E+06
Kr-85	1.0E+06	2.8E+06	1.4E+07	2.5E+08	6.5E+09
Kr-85m	9.3E+06	1.8E+07	3.3E+07	3.9E+07	3.9E+07
Kr-87	2.6E+06	3.0E+06	3.1E+06	3.1E+06	3.1E+06
Kr-88	1.5E+07	2.5E+07	3.4E+07	3.5E+07	3.5E+07
Kr-89	4.5E+00	4.5E+00	4.5E+00	4.5E+00	4.5E+00
Xe-131m	5.3E+05	1.4E+06	7.3E+06	1.1E+08	1.4E+09
Xe-133	1.8E+08	4.8E+08	2.4E+09	3.3E+10	2.0E+11
Xe-133m	7.3E+06	2.0E+07	8.9E+07	8.9E+08	2.2E+09
Xe-135	1.5E+07	3.6E+07	1.1E+08	2.2E+08	2.2E+08
Xe-135m	1.4E+04	1.4E+04	1.4E+04	1.4E+04	1.4E+04
Xe-137	3.8E+01	3.8E+01	3.8E+01	3.8E+01	3.8E+01
Xe-138	4.1E+04	4.1E+04	4.1E+04	4.1E+04	4.1E+04
Total	2.3E+08	5.9E+08	2.7E+09	3.5E+10	2.1E+11

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**Table 15.3-12
ABWR Source Terms
Activity Released to Environment during a Main Steamline Break Accident
(megabecquerel)**

Isotope	Case 1^(a)	Case 2^(a)
I-131	7.29E+04	1.46E+06
I-132	7.10E+05	1.42E+07
I-133	5.00E+05	9.99E+06
I-134	1.40E+06	2.79E+07
I-135	7.29E+05	1.46E+07
Total Halogens	3.41E+06	6.81E+07
Kr-83m	4.07E+02	2.44E+03
Kr-85m	7.18E+02	4.29E+03
Kr-85	2.26E+00	1.36E+01
Kr-87	2.44E+03	1.47E+04
Kr-88	2.46E+03	1.48E+04
Kr-89	9.88E+03	5.92E+04
Kr-90	2.55E+03	1.55E+04
Xe-131m	1.76E+00	1.06E+01
Xe-133m	3.39E+01	2.04E+02
Xe-133	9.47E+02	5.70E+03
Xe-135m	2.89E+03	1.74E+04
Xe-135	2.70E+03	1.62E+04
Xe-137	1.23E+04	7.40E+04
Xe-138	9.44E+03	5.66E+04
Xe-139	4.33E+03	2.59E+04
Total Noble Gases	5.11E+04	3.07E+05

- a) The level of activity is consistent with an offgas release rate of 3.7 GBq/s for Case 1 and 14.8 GBq/s for Case 2 referenced to a 30 minute decay. The iodine concentrations in the reactor coolant are tabulated below for each case.

Isotope	MBq/g	
	Case 1	Case 2
I-131	0.001739	0.03515
I-132	0.01536	0.30747
I-133	0.01206	0.24161
I-134	0.02634	0.52688
I-135	0.01647	0.3293

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**Table 15.3-13
ABWR Source Terms
Isotopic Releases during an Instrument Line Break Accident
(megabecqueral)**

Isotope	1 min.	10 min.	1 hr.	2 hr.	4 hr.	8 hr.
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Reactor Building Inventory

I-131	3.77E+01	3.27E+02	2.60E+04	1.73E+04	1.38E+04	4.59E+00
I-132	3.68E+02	3.11E+03	2.31E+05	1.44E+05	1.17E+05	1.17E+01
I-133	2.59E+02	2.24E+03	1.75E+05	1.16E+05	9.29E+04	2.72E+01
I-134	7.22E+02	5.92E+03	3.89E+05	2.26E+05	1.86E+05	2.65E+00
I-135	3.77E+02	3.25E+03	2.52E+05	1.64E+05	1.32E+05	2.90E+01

Total	1.76E+03	1.48E+04	1.07E+06	6.68E+05	5.41E+05	7.52E+01
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Isotopic Releases to Environment

I-131	6.36E-01	5.77E+01	2.77E+04	6.81E+04	1.27E+05	1.41E+05
I-132	6.18E+00	5.51E+02	2.52E+05	5.96E+05	1.09E+06	1.19E+06
I-133	4.37E+00	3.96E+02	1.87E+05	4.59E+05	8.51E+05	9.44E+05
I-134	1.21E+01	1.06E+03	4.44E+05	9.92E+05	1.76E+06	1.90E+06
I-135	6.36E+00	5.74E+02	2.71E+05	6.59E+05	1.21E+06	1.34E+06

Total	2.97E+01	2.64E+03	1.18E+06	2.77E+06	5.04E+06	5.51E+06
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**Table 15.3-14
ABWR Source Terms
Isotopic Release to Environment during a Fuel Handling Accident
(megabecquerel)**

Isotope	1 min.	10 min.	1 hr.	2 hr.
I-131	3.12E+05	2.80E+06	4.98E+06	4.98E+06
I-132	4.02E+05	3.53E+06	6.15E+06	6.15E+06
I-133	3.23E+05	2.89E+06	5.15E+06	5.15E+06
I-134	1.75E-02	1.49E-01	2.50E-01	2.50E-01
I-135	5.31E+04	4.70E+05	8.34E+05	8.34E+05
Total	1.09E+06	9.69E+06	1.71E+07	1.71E+07
Kr-83m	1.66E+04	1.45E+05	2.55E+05	2.61E+05
Kr-85m	2.12E+05	1.88E+06	3.37E+06	3.46E+06
Kr-85	1.15E+06	1.04E+07	1.88E+07	1.94E+07
Kr-87	3.29E+01	2.84E+02	4.94E+02	4.98E+02
Kr-88	6.15E+04	5.39E+05	9.65E+05	9.85E+05
Kr-89	7.17E-07	3.03E-06	3.30E-06	3.30E-06
Xe-131m	2.02E+05	1.81E+06	3.29E+06	3.38E+06
Xe-133m	2.67E+06	2.39E+07	4.34E+07	4.46E+07
Xe-133	6.81E+07	6.12E+08	1.11E+09	1.14E+09
Xe-135m	7.94E+05	5.96E+06	8.96E+06	8.96E+06
Xe-135	1.56E+07	1.39E+08	2.51E+08	2.58E+08
Xe-137	1.59E-06	7.41E-06	8.39E-06	8.39E-06
Xe-138	1.60E-06	1.17E-05	1.74E-05	1.74E-05
Total	8.88E+07	7.95E+08	1.45E+09	1.48E+09

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**Table 15.3-15
AP1000 Source Terms
Activity Releases for Steam System Piping Failure
with Pre-Existing Iodine Spike (Ci)**

Isotope	0 to 2 hr.	2 to 8 hr.	8 to 24 hr.	24 to 72 hr.	Total
Kr-85m	6.86E-02	1.14E-01	6.80E-02	6.18E-03	2.57E-01
Kr-85	2.82E-01	8.46E-01	2.25E+00	6.69E+00	1.01E+01
Kr-87	2.76E-02	1.34E-02	5.29E-04	8.60E-08	4.15E-02
Kr-88	1.12E-01	1.37E-01	4.04E-02	8.27E-04	2.91E-01
Xe-131m	1.28E-01	3.79E-01	9.81E-01	2.70E+00	4.19E+00
Xe-133m	1.59E-01	4.51E-01	1.04E+00	2.05E+00	3.70E+00
Xe-133	1.18E+01	3.45E+01	8.64E+01	2.16E+02	3.49E+02
Xe-135m	3.04E-03	1.33E-05	0.00E+00	0.00E+00	3.06E-03
Xe-135	3.10E-01	6.90E-01	8.35E-01	3.38E-01	2.17E+00
Xe-138	3.99E-03	1.14E-05	0.00E+00	0.00E+00	4.00E-03
I-130	3.59E-01	1.42E-01	2.09E-01	1.33E-01	8.44E-01
I-131	2.40E+01	1.21E+01	3.10E+01	8.22E+01	1.49E+02
I-132	3.05E+01	4.14E+00	8.06E-01	6.55E-03	3.55E+01
I-133	4.34E+01	1.90E+01	3.53E+01	3.98E+01	1.37E+02
I-134	6.74E+00	1.63E-01	1.43E-03	4.54E-09	6.91E+00
I-135	2.60E+01	8.16E+00	7.54E+00	1.71E+00	4.34E+01
Cs-134	1.90E+01	1.95E-01	5.19E-01	1.54E+00	2.12E+01
Cs-136	2.82E+01	2.86E-01	7.43E-01	2.06E+00	3.13E+01
Cs-137	1.37E+01	1.41E-01	3.74E-01	1.11E+00	1.53E+01
Cs-138	1.01E+01	1.02E-03	4.42E-07	0.00E+00	1.01E+01
Total	2.15E+02	8.15E+01	1.68E+02	3.56E+02	8.21E+02

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**Table 15.3-16
AP1000 Source Terms
Activity Releases for Steam System Piping Failure
with Accident-Initiated Iodine Spike (Ci)**

Isotope	0 to 2 hr.	2 to 8 hr.	8 to 24 hr.	24 to 72 hr.	Total
Kr-85m	6.86E-02	1.14E-01	6.80E-02	6.18E-03	2.57E-01
Kr-85	2.82E-01	8.46E-01	2.25E+00	6.69E+00	1.01E+01
Kr-87	2.76E-02	1.34E-02	5.29E-04	8.60E-08	4.15E-02
Kr-88	1.12E-01	1.37E-01	4.04E-02	8.27E-04	2.91E-01
Xe-131m	1.28E-01	3.79E-01	9.81E-01	2.70E+00	4.19E+00
Xe-133m	1.59E-01	4.51E-01	1.04E+00	2.05E+00	3.70E+00
Xe-133	1.18E+01	3.45E+01	8.64E+01	2.16E+02	3.49E+02
Xe-135m	3.04E-03	1.33E-05	0.00E+00	0.00E+00	3.06E-03
Xe-135	3.10E-01	6.90E-01	8.35E-01	3.38E-01	2.17E+00
Xe-138	3.99E-03	1.14E-05	0.00E+00	0.00E+00	4.00E-03
I-130	4.20E-01	9.95E-01	1.58E+00	1.01E+00	4.01E+00
I-131	2.60E+01	5.73E+01	1.56E+02	4.13E+02	6.53E+02
I-132	4.62E+01	9.74E+01	2.24E+01	1.82E-01	1.66E+02
I-133	4.91E+01	1.14E+02	2.27E+02	2.55E+02	6.45E+02
I-134	1.34E+01	1.86E+01	2.65E-01	8.42E-07	3.23E+01
I-135	3.24E+01	7.74E+01	7.83E+01	1.77E+01	2.06E+02
Cs-134	1.90E+01	1.95E-01	5.19E-01	1.54E+00	2.12E+01
Cs-136	2.82E+01	2.86E-01	7.43E-01	2.06E+00	3.13E+01
Cs-137	1.37E+01	1.41E-01	3.74E-01	1.11E+00	1.53E+01
Cs-138	1.01E+01	1.02E-03	4.42E-07	0.00E+00	1.01E+01
Total	2.51E+02	4.03E+02	5.78E+02	9.20E+02	2.15E+03

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**Table 15.3-17
AP1000 Source Terms
Activity Releases for Reactor Coolant Pump Shaft Seizure (Ci)**

	No Feedwater	Feedwater Available			
Isotope	0 to 1.5 hr.	0 to 2 hr.	2 to 8 hr.	6 to 8 hr.	Total
Kr-85m	8.16E+01	1.05E+02	1.74E+02	4.13E+01	2.79E+02
Kr-85	7.58E+00	1.01E+01	3.03E+01	1.01E+01	4.04E+01
Kr-87	1.20E+02	1.43E+02	6.97E+01	5.43E+00	2.13E+02
Kr-88	2.08E+02	2.62E+02	3.20E+02	6.05E+01	5.82E+02
Xe-131m	3.77E+00	5.03E+00	1.49E+01	4.95E+00	1.99E+01
Xe-133m	2.02E+01	2.69E+01	7.64E+01	2.48E+01	1.03E+02
Xe-133	6.66E+02	8.87E+02	2.60E+03	8.57E+02	3.49E+03
Xe-135m	3.24E+01	3.28E+01	1.43E-01	2.68E-06	3.30E+01
Xe-135	1.59E+02	2.08E+02	4.64E+02	1.32E+02	6.72E+02
Xe-138	1.29E+02	1.30E+02	3.72E-01	3.01E-06	1.30E+02
I-130	8.45E-01	1.17E-01	1.33E+00	5.65E-01	1.45E+00
I-131	3.77E+01	5.39E+00	7.51E+01	3.46E+01	8.05E+01
I-132	2.79E+01	3.45E+00	1.48E+01	3.95E+00	1.83E+01
I-133	4.86E+01	6.86E+00	8.29E+01	3.64E+01	8.98E+01
I-134	2.88E+01	2.76E+00	2.98E+00	2.09E-01	5.74E+00
I-135	4.19E+01	5.68E+00	5.22E+01	2.05E+01	5.79E+01
Cs-134	1.29E+00	1.82E-01	2.40E+00	1.11E+00	2.59E+00
Cs-136	5.63E-01	8.45E-02	7.79E-01	3.47E-01	8.63E-01
Cs-137	7.74E-01	1.10E-01	1.41E+00	6.51E-01	1.52E+00
Cs-138	6.08E+00	7.29E-01	3.35E+00	1.13E+00	4.08E+00
Rb-86	1.33E-02	1.83E-03	2.73E-02	1.27E-02	2.91E-02
Total	1.62E+03	1.84E+03	3.99E+03	1.23E+03	5.82E+03

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**Table 15.3-18
AP1000 Source Terms
Activity Releases for Spectrum of Rod Cluster Control Assembly Ejection Accidents (Ci)**

Isotope	0 to hr.	2 to 8 hr.	8 to 24 hr.	24 to 96 hr.	96 to 720 hr.	Total
Kr-85m	1.12E+02	6.48E+01	3.87E+01	1.77E+00	2.51E-05	2.18E+02
Kr-85	5.01E+00	5.60E+00	1.49E+01	3.35E+01	2.88E+02	3.47E+02
Kr-87	1.82E+02	2.60E+01	1.03E+00	8.37E-05	0.00E+00	2.09E+02
Kr-88	2.91E+02	1.18E+02	3.49E+01	3.59E-01	8.41E-09	4.45E+02
Xe-131m	4.94E+00	5.46E+00	1.42E+01	2.86E+01	1.16E+02	1.69E+02
Xe-133m	2.67E+01	2.81E+01	6.49E+01	8.45E+01	5.31E+01	2.57E+02
Xe-133	8.79E+02	9.58E+02	2.40E+03	4.27E+03	8.45E+03	1.70E+04
Xe-135m	7.34E+01	5.30E-02	4.33E-09	0.00E+00	0.00E+00	7.35E+01
Xe-135	2.15E+02	1.72E+02	2.09E+02	4.35E+01	1.79E-01	6.39E+02
Xe-138	2.99E+02	1.38E-01	3.19E-09	0.00E+00	0.00E+00	2.99E+02
I-130	4.90E+00	7.28E+00	4.32E+00	2.03E-01	2.95E-04	1.67E+01
I-131	1.36E+02	2.45E+02	2.31E+02	3.10E+01	1.68E+01	6.60E+02
I-132	1.53E+02	9.94E+01	9.85E+00	8.24E-03	0.00E+00	2.62E+02
I-133	2.72E+02	4.40E+02	3.18E+02	2.28E+01	2.41E-01	1.05E+03
I-134	1.66E+02	2.85E+01	1.37E-01	4.48E-08	0.00E+00	1.95E+02
I-135	2.39E+02	2.97E+02	1.19E+02	2.39E+00	7.32E-05	6.57E+02
Cs-134	3.08E+01	6.22E+01	6.03E+01	7.76E+00	5.16E+00	1.66E+02
Cs-136	8.79E+00	1.75E+01	1.67E+01	2.05E+00	6.58E-01	4.57E+01
Cs-137	1.79E+01	3.62E+01	3.51E+01	4.52E+00	3.05E+00	9.68E+01
Cs-138	1.09E+02	7.05E+00	1.68E-03	0.00E+00	0.00E+00	1.16E+02
Rb-86	3.62E-01	7.27E-01	6.96E-01	8.67E-02	3.42E-02	1.91E+00
Total	3.23E+03	2.62E+03	3.58E+03	4.53E+03	8.93E+03	2.29E+04

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**Table 15.3-19
AP1000 Source Terms
Activity Releases for Failure of Small Lines Carrying
Primary Coolant Outside Containment (Ci)**

Isotope	0 to 2 hr.
Kr-85m	1.24E+01
Kr-85	4.40E+01
Kr-87	7.05E+00
Kr-88	2.21E+01
Xe-131m	1.99E+01
Xe-133m	2.50E+01
Xe-133	1.84E+03
Xe-135m	2.59E+00
Xe-135	5.20E+01
Xe-138	3.65E+00
I-130	1.89E+00
I-131	9.26E+01
I-132	3.49E+02
I-133	2.01E+02
I-134	1.58E+02
I-135	1.68E+02
Cs-134	4.16E+00
Cs-136	6.16E+00
Cs-137	3.00E+00
Cs-138	2.21E+00
Total	3.02E+03

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**Table 15.3-20
AP1000 Source Terms
Activity Releases for Steam Generator Tube Rupture with Pre-Existing Iodine Spike (Ci)**

Isotope	0 to 2 hr.	2 to 8 hr.	8 to 24 hr.	Total
Kr-85m	5.53E+01	1.93E+01	7.53E-03	7.46E+01
Kr-85	2.20E+02	1.09E+02	1.34E-01	3.29E+02
Kr-87	2.39E+01	3.61E+00	9.12E-05	2.75E+01
Kr-88	9.22E+01	2.65E+01	5.43E-03	1.19E+02
Xe-131m	9.96E+01	4.88E+01	5.91E-02	1.48E+02
Xe-133m	1.24E+02	5.91E+01	6.61E-02	1.83E+02
Xe-133	9.19E+03	4.47E+03	5.29E+00	1.37E+04
Xe-135m	3.44E+00	5.86E-03	0.00E+00	3.45E+00
Xe-135	2.46E+02	1.02E+02	7.10E-02	3.47E+02
Xe-138	4.56E+00	5.07E-03	0.00E+00	4.57E+00
I-130	1.79E+00	5.39E-02	2.68E-01	2.12E+00
I-131	1.21E+02	5.27E+00	3.06E+01	1.56E+02
I-132	1.42E+02	7.43E-01	1.92E+00	1.44E+02
I-133	2.16E+02	7.63E+00	4.06E+01	2.64E+02
I-134	2.74E+01	4.40E-03	4.23E-03	2.74E+01
I-135	1.27E+02	2.70E+00	1.17E+01	1.42E+02
Cs-134	1.63E+00	6.05E-02	2.16E-01	1.90E+00
Cs-136	2.42E+00	8.86E-02	3.14E-01	2.82E+00
Cs-137	1.17E+00	4.37E-02	1.56E-01	1.37E+00
Cs-138	5.64E-01	2.91E-06	5.73E-07	5.64E-01
Total	1.07E+04	4.85E+03	9.14E+01	1.56E+04

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**Table 15.3-21
AP1000 Source Terms**

Activity Releases for Steam Generator Tube Rupture with Accident-Initiated Iodine Spike (Ci)

Isotope	0 to 2 hr.	2 to 8 hr.	8 to 24 hr.	Total
Kr-85m	5.53E+01	1.93E+01	7.53E-03	7.46E+01
Kr-85	2.20E+02	1.09E+02	1.34E-01	3.29E+02
Kr-87	2.39E+01	3.61E+00	9.12E-05	2.75E+01
Kr-88	9.22E+01	2.65E+01	5.43E-03	1.19E+02
Xe-131m	9.96E+01	4.88E+01	5.91E-02	1.48E+02
Xe-133m	1.24E+02	5.91E+01	6.61E-02	1.83E+02
Xe-133	9.19E+03	4.47E+03	5.29E+00	1.37E+04
Xe-135m	3.44E+00	5.86E-03	0.00E+00	3.45E+00
Xe-135	2.46E+02	1.02E+02	7.10E-02	3.47E+02
Xe-138	4.56E+00	5.07E-03	0.00E+00	4.57E+00
I-130	8.87E-01	1.62E-01	8.24E-01	1.87E+00
I-131	4.36E+01	1.14E+01	6.76E+01	1.23E+02
I-132	1.47E+02	4.86E+00	1.29E+01	1.65E+02
I-133	9.33E+01	2.00E+01	1.08E+02	2.22E+02
I-134	5.59E+01	6.04E-02	5.94E-02	5.60E+01
I-135	7.61E+01	9.88E+00	4.38E+01	1.30E+02
Cs-134	1.63E+00	6.05E-02	2.16E-01	1.90E+00
Cs-136	2.42E+00	8.86E-02	3.14E-01	2.82E+00
Cs-137	1.17E+00	4.37E-02	1.56E-01	1.37E+00
Cs-138	5.64E-01	2.91E-06	5.73E-07	5.64E-01
Total	1.05E+04	4.88E+03	2.40E+02	1.56E+04

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**Table 15.3-22 (Sheet 1 of 2)
AP1000 Source Terms
Activity Releases for LOCA Resulting from a Spectrum of Postulated Piping Breaks
within the Reactor Coolant Pressure Boundary (Ci)**

Isotope	1.4 to 3.4 hr.	0 to 8 hr.	8 to 24 hr.	24 to 96 hr.	96 to 720 hr.	Total
I-130	5.64E+01	1.12E+02	5.37E+00	7.10E-01	1.27E-02	1.18E+02
I-131	1.68E+03	3.49E+03	2.66E+02	2.39E+02	7.19E+02	4.71E+03
I-132	1.23E+03	2.14E+03	1.64E+01	1.46E-02	0.00E+00	2.15E+03
I-133	3.23E+03	6.54E+03	3.83E+02	1.04E+02	1.04E+01	7.04E+03
I-134	6.60E+02	1.14E+03	2.96E-01	6.79E-08	0.00E+00	1.14E+03
I-135	2.56E+03	4.89E+03	1.58E+02	6.09E+00	3.16E-03	5.06E+03
Kr-85m	1.42E+03	3.77E+03	1.87E+03	8.56E+01	1.22E-03	5.73E+03
Kr-85	8.31E+01	2.97E+02	7.06E+02	1.59E+03	1.36E+04	1.62E+04
Kr-87	1.10E+03	1.95E+03	4.97E+01	4.05E-03	0.00E+00	1.99E+03
Kr-88	3.11E+03	7.26E+03	1.70E+03	1.75E+01	4.09E-07	8.97E+03
Xe-131m	8.26E+01	2.94E+02	6.79E+02	1.37E+03	5.57E+03	7.91E+03
Xe-133m	4.43E+02	1.54E+03	3.15E+03	4.11E+03	2.58E+03	1.14E+04
Xe-133	1.47E+04	5.19E+04	1.16E+05	2.06E+05	4.07E+05	7.80E+05
Xe-135m	1.06E+01	3.59E+01	2.14E-07	0.00E+00	0.00E+00	3.59E+01
Xe-135	3.15E+03	9.64E+03	1.01E+04	2.11E+03	8.68E+00	2.19E+04
Xe-138	3.11E+01	1.20E+02	1.58E-07	0.00E+00	0.00E+00	1.20E+02
Rb-86	3.04E+00	6.32E+00	2.99E-01	9.83E-02	5.13E-01	7.23E+00
Cs-134	2.58E+02	5.38E+02	2.57E+01	9.11E+00	7.74E+01	6.50E+02
Cs-136	7.33E+01	1.52E+02	7.16E+00	2.28E+00	9.88E+00	1.72E+02
Cs-137	1.51E+02	3.13E+02	1.50E+01	5.32E+00	4.57E+01	3.79E+02
Cs-138	1.50E+02	3.30E+02	2.18E-03	0.00E+00	0.00E+00	3.30E+02
Sb-127	2.42E+01	4.80E+01	2.29E+00	5.67E-01	7.82E-01	5.16E+01
Sb-129	5.10E+01	8.94E+01	1.51E+00	4.95E-03	4.90E-08	9.09E+01
Te-127m	3.15E+00	6.30E+00	3.16E-01	1.11E-01	8.71E-01	7.60E+00
Te-127	2.05E+01	3.83E+01	1.15E+00	2.75E-02	1.33E-04	3.94E+01
Te-129m	1.07E+01	2.15E+01	1.07E+00	3.65E-01	2.36E+00	2.52E+01
Te-129	1.88E+01	2.83E+01	2.69E-02	3.54E-08	0.00E+00	2.84E+01
Te-131m	3.17E+01	6.20E+01	2.64E+00	3.35E-01	7.81E-02	6.50E+01
Te-132	3.23E+02	6.40E+02	3.02E+01	7.04E+00	7.83E+00	6.85E+02
Sr-89	9.23E+01	1.85E+02	9.24E+00	3.19E+00	2.26E+01	2.20E+02
Sr-90	7.95E+00	1.59E+01	7.99E-01	2.84E-01	2.44E+00	1.94E+01
Sr-91	9.68E+01	1.81E+02	5.46E+00	1.35E-01	7.06E-04	1.87E+02
Sr-92	6.83E+01	1.13E+02	1.01E+00	5.15E-04	0.00E+00	1.14E+02
Ba-139	5.44E+01	8.30E+01	1.49E-01	9.91E-07	0.00E+00	8.32E+01
Ba-140	1.63E+02	3.25E+02	1.61E+01	5.11E+00	2.17E+01	3.68E+02
Mo-99	2.15E+01	4.25E+01	1.98E+00	4.29E-01	3.78E-01	4.53E+01
Tc-99m	1.47E+01	2.66E+01	6.05E-01	5.27E-03	1.33E-06	2.72E+01

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**Table 15.3-22 (Sheet 2 of 2)
AP1000 Source Terms
Activity Releases for LOCA Resulting from a Spectrum of Postulated Piping Breaks
within the Reactor Coolant Pressure Boundary (Ci)**

Isotope	1.4 to 3.4 hr.	0 to 8 hr.	8 to 24 hr.	24 to 96 hr.	96 to 720 hr.	Total
Ru-103	1.73E+01	3.46E+01	1.73E+00	5.93E-01	3.99E+00	4.09E+01
Ru-105	8.18E+00	1.44E+01	2.48E-01	8.86E-04	1.17E-08	1.46E+01
Ru-106	5.70E+00	1.14E+01	5.73E-01	2.03E-01	1.70E+00	1.39E+01
Rh-105	1.03E+01	2.02E+01	8.81E-01	1.29E-01	4.14E-02	2.12E+01
Ce-141	3.89E+00	7.78E+00	3.88E-01	1.32E-01	8.45E-01	9.15E+00
Ce-143	3.46E+00	6.78E+00	2.93E-01	4.05E-02	1.14E-02	7.13E+00
Ce-144	2.94E+00	5.89E+00	2.96E-01	1.05E-01	8.68E-01	7.15E+00
Pu-238	9.16E-03	1.83E-02	9.21E-04	3.27E-04	2.82E-03	2.24E-02
Pu-239	8.06E-04	1.61E-03	8.10E-05	2.88E-05	2.48E-04	1.97E-03
Pu-240	1.18E-03	2.37E-03	1.19E-04	4.22E-05	3.63E-04	2.89E-03
Pu-241	2.66E-01	5.31E-01	2.67E-02	9.48E-03	8.14E-02	6.49E-01
Np-239	4.48E+01	8.87E+01	4.08E+00	8.15E-01	5.70E-01	9.41E+01
Y-90	8.08E-02	1.60E-01	7.44E-03	1.59E-03	1.35E-03	1.70E-01
Y-91	1.19E+00	2.37E+00	1.19E-01	4.12E-02	3.00E-01	2.83E+00
Y-92	7.89E-01	1.35E+00	1.80E-02	2.86E-05	0.00E+00	1.37E+00
Y-93	1.21E+00	2.28E+00	7.08E-02	1.98E-03	1.42E-05	2.35E+00
Nb-95	1.60E+00	3.19E+00	1.59E-01	5.44E-02	3.55E-01	3.76E+00
Zr-95	1.59E+00	3.18E+00	1.59E-01	5.52E-02	4.08E-01	3.80E+00
Zr-97	1.43E+00	2.74E+00	1.03E-01	6.73E-03	3.71E-04	2.85E+00
La-140	1.67E+00	3.29E+00	1.46E-01	2.36E-02	9.62E-03	3.47E+00
La-141	1.03E+00	1.79E+00	2.71E-02	6.41E-05	2.01E-10	1.81E+00
La-142	5.38E-01	8.31E-01	2.09E-03	3.39E-08	0.00E+00	8.33E-01
Nd-147	6.16E-01	1.23E+00	6.06E-02	1.90E-02	7.29E-02	1.38E+00
Pr-143	1.39E+00	2.78E+00	1.37E-01	4.40E-02	1.94E-01	3.15E+00
Am-241	1.20E-04	2.39E-04	1.20E-05	4.27E-06	3.68E-05	2.92E-04
Cm-242	2.82E-02	5.65E-02	2.83E-03	9.98E-04	8.08E-03	6.84E-02
Cm-244	3.46E-03	6.93E-03	3.48E-04	1.24E-04	1.06E-03	8.47E-03
Total	3.53E+04	9.85E+04	1.35E+05	2.15E+05	4.30E+05	8.79E+05

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**Table 15.3-23
AP1000 Source Terms
Activity Releases for Fuel Handling Accident (Ci)**

Isotope	0 to 2 hr.
Kr-85m	3.42E+02
Kr-85	1.11E+03
Kr-87	6.00E-02
Kr-88	1.07E+02
Xe-131m	5.54E+02
Xe-133m	2.80E+03
Xe-133	9.66E+04
Xe-135m	1.26E+03
Xe-135	2.49E+04
I-130	2.51E+00
I-131	3.76E+02
I-132	3.01E+02
I-133	2.40E+02
I-135	3.94E+01
Total	1.29E+05

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**Table 15.3-24
U.S. EPR Source Terms
Radionuclide Releases to Atmosphere for Main Steamline Break with
Pre-Accident Iodine Spike (Ci)**

Isotope	0 to 2 hr.	2 to 8 hr.	8 to 24 hr.	Total
Kr-83m	2.167E-02	2.145E-02	3.182E-04	4.344E-02
Kr-85m	1.115E-01	1.858E-01	4.350E-03	3.016E-01
Kr-85	1.205E+00	3.613E+00	1.505E-01	4.969E+00
Kr-87	4.505E-02	2.194E-02	9.099E-05	6.709E-02
Kr-88	1.849E-01	2.258E-01	3.674E-03	4.144E-01
Kr-89	2.093E-04	8.419E-16	1.370E-50	2.093E-04
Xe-131m	2.446E-01	7.271E-01	3.027E-02	1.002E+00
Xe-133m	3.042E-01	8.850E-01	3.985E-02	1.229E+00
Xe-133	2.140E+01	6.307E+01	2.646E+00	8.711E+01
Xe-135m	3.843E-01	8.821E-01	8.834E-02	1.355E+00
Xe-135	9.137E-01	3.733E+00	4.540E-01	5.100E+00
Xe-137	4.777E-04	1.767E-13	2.237E-42	4.777E-04
Xe-138	6.324E-03	1.790E-05	9.525E-14	6.341E-03
Br-83	2.522E-01	4.130E-03	7.641E-05	2.564E-01
Br-84	4.771E-02	4.524E-05	7.550E-09	4.775E-02
Br-85	6.133E-04	1.092E-18	1.546E-56	6.133E-04
I-129	7.539E-07	3.757E-08	1.301E-09	7.928E-07
I-130	6.787E-01	2.685E-02	8.749E-04	7.064E-01
I-131	1.516E+01	8.621E+00	1.226E+00	2.501E+01
I-132	4.788E+00	1.069E+00	4.889E-02	5.906E+00
I-133	2.350E+01	1.244E+01	1.602E+00	3.754E+01
I-134	1.620E+00	1.135E-01	5.052E-04	1.734E+00
I-135	1.246E+01	5.510E+00	5.515E-01	1.852E+01
Rb-86m	1.353E-09	1.255E-45	0.000E+00	1.353E-09
Rb-86	1.398E-03	7.207E-04	1.024E-04	2.221E-03
Rb-88	1.915E-01	2.517E-01	4.103E-03	4.474E-01
Rb-89	1.838E-03	3.266E-06	1.619E-13	1.841E-03
Cs-134	1.609E-01	8.300E-02	1.185E-02	2.557E-01
Cs-136	3.808E-02	1.963E-02	2.782E-03	6.048E-02
Cs-137	6.160E-02	3.177E-02	4.536E-03	9.791E-02
Cs-138	2.051E-02	1.254E-03	1.886E-07	2.177E-02
Sr-89	7.189E-07	2.557E-06	3.082E-07	3.584E-06
Ba-137m	5.786E-02	3.006E-02	4.291E-03	9.220E-02
Total	8.386E+01	1.016E+02	6.875E+00	1.923E+02

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**Table 15.3-25
U.S. EPR Source Terms
Radionuclide Releases to Atmosphere for Main Steamline Break with
Accident-Induced (Coincident) Iodine Spike (Ci)**

Isotope	0 to 2 hr.	2 to 8 hr.	8 to 24 hr.	Total
Kr-83m	2.167E-02	2.145E-02	3.182E-04	4.344E-02
Kr-85m	1.115E-01	1.858E-01	4.350E-03	3.016E-01
Kr-85	1.205E+00	3.613E+00	1.505E-01	4.969E+00
Kr-87	4.505E-02	2.194E-02	9.099E-05	6.709E-02
Kr-88	1.849E-01	2.258E-01	3.674E-03	4.144E-01
Kr-89	2.093E-04	8.419E-16	1.370E-50	2.093E-04
Xe-131m	2.446E-01	7.308E-01	3.188E-02	1.007E+00
Xe-133m	3.045E-01	9.837E-01	8.092E-02	1.369E+00
Xe-133	2.140E+01	6.448E+01	3.237E+00	8.912E+01
Xe-135m	7.205E-01	1.136E+01	2.616E+00	1.470E+01
Xe-135	1.023E+00	1.721E+01	5.434E+00	2.367E+01
Xe-137	4.777E-04	1.767E-13	2.237E-42	4.777E-04
Xe-138	6.324E-03	1.790E-05	9.525E-14	6.341E-03
Br-83	2.522E-01	4.130E-03	7.641E-05	2.564E-01
Br-84	4.771E-02	4.524E-05	7.550E-09	4.775E-02
Br-85	6.133E-04	1.092E-18	1.546E-56	6.133E-04
I-129	7.539E-07	3.757E-08	1.301E-09	7.928E-07
I-130	6.787E-01	2.685E-02	8.749E-04	7.064E-01
I-131	1.627E+01	6.254E+01	1.557E+01	9.438E+01
I-132	8.145E+00	3.962E+01	6.683E+00	5.445E+01
I-133	2.653E+01	1.129E+02	2.685E+01	1.663E+02
I-134	5.642E+00	2.468E+01	2.899E+00	3.322E+01
I-135	1.595E+01	7.814E+01	1.675E+01	1.108E+02
Rb-86m	1.353E-09	1.255E-45	0.000E+00	1.353E-09
Rb-86	1.398E-03	7.207E-04	1.024E-04	2.221E-03
Rb-88	1.915E-01	2.517E-01	4.103E-03	4.474E-01
Rb-89	1.838E-03	3.266E-06	1.619E-13	1.841E-03
Cs-134	1.609E-01	8.300E-02	1.185E-02	2.557E-01
Cs-136	3.808E-02	1.963E-02	2.782E-03	6.048E-02
Cs-137	6.160E-02	3.177E-02	4.536E-03	9.791E-02
Cs-138	2.051E-02	1.254E-03	1.886E-07	2.177E-02
Sr-89	7.189E-07	2.557E-06	3.082E-07	3.584E-06
Ba-137m	5.786E-02	3.006E-02	4.291E-03	9.220E-02
Total	9.932E+01	4.172E+02	8.034E+01	5.968E+02

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**Table 15.3-26A
U.S. EPR Source Terms
Radionuclide Releases to Atmosphere for Main Steam Line Break with
Accident-Induced 3.3 Percent Clad Failure (Ci)**

Isotope	0 to 2 hr.	2 to 8 hr.	8 to 24 hr.	Total
Kr-83m	3.280E+01	3.559E+01	1.238E+00	6.963E+01
Kr-85m	8.444E+01	1.407E+02	3.320E+00	2.285E+02
Kr-85	1.031E+01	3.093E+01	1.288E+00	4.253E+01
Kr-87	1.192E+02	5.806E+01	2.408E-01	1.775E+02
Kr-88	2.202E+02	2.688E+02	4.376E+00	4.934E+02
Kr-89	1.332E+01	5.359E-11	8.719E-46	1.332E+01
Xe-131m	3.583E+00	1.068E+01	4.523E-01	1.472E+01
Xe-133m	1.946E+01	5.604E+01	2.403E+00	7.790E+01
Xe-133	6.466E+02	1.908E+03	8.055E+01	2.635E+03
Xe-135m	4.150E+01	4.615E+01	4.800E+00	9.245E+01
Xe-135	1.998E+02	5.351E+02	3.532E+01	7.702E+02
Xe-137	2.515E+01	9.302E-09	1.178E-37	2.515E+01
Xe-138	9.017E+01	2.552E-01	1.358E-09	9.042E+01
Br-83	1.094E+01	9.155E+00	4.542E-01	2.055E+01
Br-84	1.069E+01	5.777E-01	1.566E-04	1.126E+01
Br-85	1.663E+00	2.161E-13	3.269E-51	1.663E+00
I-129	6.476E-06	1.488E-05	2.258E-06	2.362E-05
I-130	9.312E+00	1.780E+01	2.217E+00	2.933E+01
I-131	1.643E+02	3.897E+02	5.846E+01	6.125E+02
I-132	1.121E+02	8.941E+01	4.225E+00	2.057E+02
I-133	2.124E+02	4.391E+02	5.933E+01	7.109E+02
I-134	1.242E+02	2.356E+01	1.065E-01	1.479E+02
I-135	1.789E+02	2.877E+02	2.996E+01	4.966E+02
Rb-86m	1.764E-03	2.996E-39	0.000E+00	1.764E-03
Rb-86	9.539E-01	2.456E+00	3.714E-01	3.781E+00
Rb-88	2.406E+02	2.999E+02	4.885E+00	5.454E+02
Rb-89	8.269E+01	2.451E-01	1.281E-08	8.293E+01
Cs-134	1.069E+02	2.768E+02	4.209E+01	4.258E+02
Cs-136	2.650E+01	6.805E+01	1.026E+01	1.048E+02
Cs-137	4.081E+01	1.057E+02	1.607E+01	1.626E+02
Cs-138	2.696E+02	2.276E+01	4.151E-03	2.923E+02
Sr-89	5.497E-02	1.946E-01	2.451E-02	2.741E-01
Ba-137m	3.860E+01	1.000E+02	1.520E+01	1.538E+02
Total	3.138E+03	5.224E+03	3.776E+02	8.739E+03

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**Table 15.3-26B
U.S. EPR Source Terms
Radionuclide Releases to Atmosphere for Main Steam Line Break with
Accident-Induced 0.58 Percent Fuel Overheat (Ci)**

Isotope	0 to 2 hr.	2 to 8 hr.	8 to 24 hr.	Total
Kr-83m	1.098E+02	1.038E+02	2.549E+00	2.162E+02
Kr-85m	2.957E+02	4.928E+02	1.158E+01	8.001E+02
Kr-85	1.721E+01	5.163E+01	2.150E+00	7.099E+01
Kr-87	4.179E+02	2.035E+02	8.440E-01	6.223E+02
Kr-88	7.737E+02	9.445E+02	1.537E+01	1.733E+03
Kr-89	4.684E+01	1.884E-10	3.065E-45	4.684E+01
Xe-131m	1.197E+01	3.560E+01	1.483E+00	4.905E+01
Xe-133m	6.769E+01	1.938E+02	8.011E+00	2.695E+02
Xe-133	2.213E+03	6.514E+03	2.708E+02	8.997E+03
Xe-135m	1.112E+02	8.124E+01	8.435E+00	2.008E+02
Xe-135	6.807E+02	1.677E+03	8.537E+01	2.443E+03
Xe-137	8.839E+01	3.271E-08	4.140E-37	8.839E+01
Xe-138	3.178E+02	8.992E-01	4.786E-09	3.187E+02
Br-83	1.904E+01	1.609E+01	7.982E-01	3.592E+01
Br-84	1.875E+01	1.015E+00	2.752E-04	1.976E+01
Br-85	2.922E+00	3.798E-13	5.745E-51	2.922E+00
I-129	1.081E-05	2.613E-05	3.967E-06	4.091E-05
I-130	1.585E+01	3.127E+01	3.897E+00	5.102E+01
I-131	1.792E+02	4.277E+02	6.411E+01	6.709E+02
I-132	1.943E+02	1.571E+02	7.425E+00	3.588E+02
I-133	3.595E+02	7.712E+02	1.043E+02	1.235E+03
I-134	2.175E+02	4.141E+01	1.872E-01	2.591E+02
I-135	3.073E+02	5.054E+02	5.265E+01	8.654E+02
Rb-86m	1.290E-03	2.191E-39	0.000E+00	1.290E-03
Rb-86	7.010E-01	1.804E+00	2.727E-01	2.777E+00
Rb-88	6.770E+02	1.053E+03	1.716E+01	1.747E+03
Rb-89	9.740E+01	3.763E-01	1.278E-08	9.778E+01
Cs-134	7.845E+01	2.031E+02	3.087E+01	3.124E+02
Cs-136	1.947E+01	4.995E+01	7.537E+00	7.696E+01
Cs-137	2.990E+01	7.740E+01	1.177E+01	1.191E+02
Cs-138	4.164E+02	5.014E+01	5.701E-03	4.666E+02
Sr-89	7.331E-02	2.692E-01	2.321E-02	3.657E-01
Ba-137m	2.829E+01	7.327E+01	1.113E+01	1.127E+02
Total	7.814E+03	1.376E+04	7.187E+02	2.229E+04

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**Table 15.3-27
U.S. EPR Source Terms
Radionuclide Releases to Atmosphere for Pump Locked Rotor Accident (LRA)
with Accident-Induced 9.5 Percent Clad Failure (Ci)**

Isotope	0 to 2 hr.	2 to 8 hr.	Total
Kr-83m	6.864E+01	5.405E+01	1.227E+02
Kr-85m	1.905E+02	3.030E+02	4.935E+02
Kr-85	2.146E+01	6.173E+01	8.319E+01
Kr-87	2.742E+02	1.254E+02	3.996E+02
Kr-88	5.001E+02	5.806E+02	1.081E+03
Kr-89	3.803E+01	1.158E-10	3.803E+01
Xe-131m	7.701E+00	2.195E+01	2.966E+01
Xe-133m	4.324E+01	1.182E+02	1.615E+02
Xe-133	1.423E+03	4.010E+03	5.433E+03
Xe-135m	5.836E+01	1.167E+01	7.003E+01
Xe-135	4.279E+02	9.442E+02	1.372E+03
Xe-137	7.127E+01	2.011E-08	7.127E+01
Xe-138	2.288E+02	5.516E-01	2.293E+02
Br-83	4.263E+00	2.041E+00	6.304E+00
Br-84	6.306E+00	8.774E-02	6.394E+00
Br-85	2.332E+00	2.497E-14	2.332E+00
I-129	2.293E-06	3.969E-06	6.262E-06
I-130	3.307E+00	4.570E+00	7.877E+00
I-131	5.682E+01	1.029E+02	1.597E+02
I-132	4.404E+01	1.982E+01	6.386E+01
I-133	7.514E+01	1.144E+02	1.896E+02
I-134	6.060E+01	4.122E+00	6.472E+01
I-135	6.439E+01	7.163E+01	1.360E+02
Rb-86m	2.540E-03	3.391E-40	2.540E-03
Rb-86	3.151E-01	6.410E-01	9.561E-01
Rb-88	4.415E+02	6.471E+02	1.089E+03
Rb-89	8.974E+01	1.757E-01	8.992E+01
Cs-134	3.527E+01	7.231E+01	1.076E+02
Cs-136	8.757E+00	1.775E+01	2.651E+01
Cs-137	1.347E+01	2.761E+01	4.108E+01
Cs-138	2.872E+02	2.755E+01	3.147E+02
Sr-89	3.289E-02	1.374E-01	1.702E-01
Ba-137m	1.008E+01	2.612E+01	3.620E+01
Total	4.557E+03	7.371E+03	1.193E+04

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**Table 15.3-28
U.S. EPR Source Terms
Radionuclide Releases to Atmosphere for Design Basis Small Line Break (Ci)**

Isotope	0 to 2 hr.
Kr-83m	1.653E+00
Kr-85m	7.066E+00
Kr-85	6.827E+01
Kr-87	3.672E+00
Kr-88	1.247E+01
Kr-89	4.810E-02
Xe-131m	1.389E+01
Xe-133m	1.750E+01
Xe-133	1.219E+03
Xe-135m	1.652E+02
Xe-135	6.941E+01
Xe-137	1.093E-01
Xe-138	1.111E+00
Br-83	1.514E-01
Br-84	6.319E-02
Br-85	1.447E-03
I-129	2.360E-07
I-130	2.521E-01
I-131	9.400E+01
I-132	1.132E+02
I-133	1.828E+02
I-134	1.347E+02
I-135	1.502E+02
Rb-86	1.881E-02
Rb-88	5.174E+00
Rb-89	1.458E-01
Cs-134	2.150E+00
Cs-136	5.140E-01
Cs-137	8.228E-01
Cs-138	1.032E+00
Sr-89	2.485E-05
Ba-137m	7.775E-01
Total	2.27E+03

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**Table 15.3-29
U.S. EPR Source Terms
Radionuclide Releases to Atmosphere for Steam Generator Tube Rupture
with Pre-Accident Spike (Ci)**

Isotope	0 to 2 hr.	2 to 8 hr.	8 to 24 hr.	24 to 96 hr.	96 to 720 hr.	Total
Kr-83m	5.579E+01	5.208E+01	1.113E+01	1.110E-01	1.024E-10	1.191E+02
Kr-85m	2.745E+01	9.737E-02	5.647E-02	5.168E-03	7.391E-08	2.761E+01
Kr-85	2.693E+02	1.875E+00	4.878E+00	2.172E+01	1.734E+02	4.711E+02
Kr-87	1.365E+01	1.170E-02	4.390E-04	7.132E-08	6.326E-25	1.366E+01
Kr-88	4.786E+01	1.186E-01	3.368E-02	6.881E-04	1.565E-11	4.801E+01
Kr-89	1.260E-01	4.744E-16	2.768E-50	0.000E+00	0.000E+00	1.260E-01
Xe-131m	5.483E+01	7.018E-01	1.810E+00	7.458E+00	3.116E+01	9.596E+01
Xe-133m	7.072E+01	7.102E+00	1.379E+01	2.108E+01	4.983E+00	1.177E+02
Xe-133	4.829E+03	1.262E+02	2.600E+02	5.499E+02	6.459E+02	6.411E+03
Xe-135m	1.530E+03	3.263E+03	3.062E+03	7.187E+02	4.064E-01	8.574E+03
Xe-135	4.299E+02	5.069E+02	4.845E+02	1.206E+02	1.232E-01	1.542E+03
Xe-137	2.887E-01	9.932E-14	4.492E-42	0.000E+00	0.000E+00	2.887E-01
Xe-138	3.434E+00	9.959E-06	2.041E-13	8.199E-34	0.000E+00	3.434E+00
Br-83	2.004E+00	2.840E-03	7.849E-04	1.620E-05	4.395E-14	2.008E+00
Br-84	5.904E-01	4.270E-05	1.939E-08	4.027E-17	1.788E-57	5.904E-01
Br-85	6.852E-04	1.190E-18	2.448E-56	0.000E+00	0.000E+00	6.852E-04
I-129	3.454E-06	1.964E-08	8.140E-08	1.077E-06	4.192E-05	4.655E-05
I-130	3.616E+00	1.503E-02	3.374E-02	5.191E-02	2.304E-03	3.719E+00
I-131	5.578E+01	3.103E-01	1.236E+00	1.376E+01	1.542E+02	2.253E+02
I-132	2.339E+01	3.417E-02	8.312E-03	1.407E-04	1.667E-13	2.343E+01
I-133	9.220E+01	4.337E-01	1.242E+00	3.997E+00	9.448E-01	9.882E+01
I-134	1.140E+01	3.079E-03	3.155E-05	2.442E-10	1.584E-34	1.140E+01
I-135	5.584E+01	1.805E-01	2.463E-01	1.167E-01	1.685E-04	5.639E+01
Rb-86	4.589E-03	2.766E-05	1.086E-04	1.305E-03	2.814E-02	3.417E-02
Rb-88	1.105E+00	1.286E-03	6.410E-04	2.976E-05	2.261E-12	1.107E+00
Rb-89	1.257E-02	4.677E-08	4.331E-15	1.140E-33	0.000E+00	1.257E-02
Cs-134	5.246E-01	3.196E-03	1.275E-02	1.648E-01	6.259E+00	6.964E+00
Cs-136	1.253E-01	7.520E-04	2.931E-03	3.415E-02	5.875E-01	7.507E-01
Cs-137	2.008E-01	1.224E-03	4.884E-03	6.322E-02	2.436E+00	2.706E+00
Cs-138	1.397E-01	9.813E-06	5.129E-09	1.405E-17	2.046E-57	1.397E-01
Ba-137m	1.883E-01	1.148E-03	4.579E-03	5.927E-02	2.284E+00	2.537E+00
Total	7.580E+03	3.959E+03	3.841E+03	1.458E+03	1.023E+03	1.786E+04

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**Table 15.3-30
U.S. EPR Source Terms
Radionuclide Releases to Atmosphere for Steam Generator Tube Rupture
with Accident-Induced (Coincident) Iodine Spike (Ci)**

Isotope	0 to 2 hr.	2 to 8 hr.	8 to 24 hr.	24 to 96 hr.	96 to 720 hr.	Total
Kr-83m	5.286E+01	6.506E+01	2.614E+01	5.395E-01	1.229E-09	1.446E+02
Kr-85m	2.938E+01	2.475E-01	2.560E-01	2.342E-02	3.350E-07	2.990E+01
Kr-85	2.693E+02	1.875E+00	4.878E+00	2.172E+01	1.734E+02	4.711E+02
Kr-87	1.365E+01	1.170E-02	4.390E-04	7.132E-08	6.326E-25	1.366E+01
Kr-88	4.786E+01	1.186E-01	3.368E-02	6.881E-04	1.565E-11	4.801E+01
Kr-89	1.260E-01	4.744E-16	2.768E-50	0.000E+00	0.000E+00	1.260E-01
Xe-131m	5.476E+01	5.269E-01	1.550E+00	9.473E+00	8.667E+01	1.530E+02
Xe-133m	6.924E+01	4.025E+00	1.188E+01	4.107E+01	2.417E+01	1.504E+02
Xe-133	4.808E+03	8.294E+01	2.349E+02	9.134E+02	1.558E+03	7.597E+03
Xe-135m	9.009E+02	2.273E+03	2.859E+03	1.054E+03	1.262E+00	7.088E+03
Xe-135	3.154E+02	3.712E+02	6.204E+02	3.471E+02	1.427E+00	1.655E+03
Xe-137	2.887E-01	9.932E-14	4.492E-42	0.000E+00	0.000E+00	2.887E-01
Xe-138	3.434E+00	9.959E-06	2.041E-13	8.199E-34	0.000E+00	3.434E+00
Br-83	3.105E+00	2.064E-02	3.304E-02	1.187E-03	4.062E-12	3.159E+00
Br-84	3.844E+00	4.306E-03	7.921E-04	7.298E-12	4.404E-52	3.849E+00
Br-85	7.119E-01	4.381E-05	6.904E-07	0.000E+00	0.000E+00	7.120E-01
I-129	1.942E-06	3.838E-08	4.662E-07	9.049E-06	3.973E-04	4.088E-04
I-130	2.679E+00	3.998E-02	3.041E-01	6.765E-01	3.436E-02	3.734E+00
I-131	3.199E+01	6.194E-01	7.305E+00	1.192E+02	1.500E+03	1.659E+03
I-132	3.721E+01	2.421E-01	3.626E-01	1.103E-02	1.671E-11	3.782E+01
I-133	6.155E+01	1.022E+00	9.383E+00	4.389E+01	1.163E+01	1.275E+02
I-134	4.170E+01	9.438E-02	3.336E-02	7.756E-07	6.711E-31	4.183E+01
I-135	5.032E+01	6.126E-01	3.161E+00	2.185E+00	3.747E-03	5.629E+01
Rb-86	4.589E-03	2.766E-05	1.086E-04	1.305E-03	2.814E-02	3.417E-02
Rb-88	1.105E+00	1.286E-03	6.410E-04	2.976E-05	2.261E-12	1.107E+00
Rb-89	1.257E-02	4.677E-08	4.331E-15	1.140E-33	0.000E+00	1.257E-02
Cs-134	5.246E-01	3.196E-03	1.275E-02	1.648E-01	6.259E+00	6.964E+00
Cs-136	1.253E-01	7.520E-04	2.931E-03	3.415E-02	5.875E-01	7.507E-01
Cs-137	2.008E-01	1.224E-03	4.884E-03	6.322E-02	2.436E+00	2.706E+00
Cs-138	1.397E-01	9.813E-06	5.129E-09	1.405E-17	2.046E-57	1.397E-01
Ba-137m	1.883E-01	1.148E-03	4.579E-03	5.927E-02	2.284E+00	2.537E+00
Total	6.801E+03	2.802E+03	3.780E+03	2.554E+03	3.368E+03	1.930E+04

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**Table 15.3-31 (Sheet 1 of 6)
U.S. EPR Source Terms
Radionuclide Releases to Atmosphere for Design Basis LOCA (Ci)**

Isotope	0 to 1.5 hr.	1.5 to 3.5 hr.	3.5 to 8 hr.
Kr-83m	7.297E+02	2.751E+03	4.641E+03
Kr-85m	1.709E+03	6.303E+03	8.876E+03
Kr-85	1.126E+02	4.307E+02	9.847E+02
Kr-87	2.224E+03	4.925E+03	2.337E+03
Kr-88	4.382E+03	1.434E+04	1.548E+04
Kr-89	9.523E+00	3.044E-06	1.461E-17
Xe-131m	7.277E+01	3.151E+02	7.225E+02
Xe-133m	4.023E+02	1.806E+03	4.148E+03
Xe-133	1.326E+04	5.898E+04	1.353E+05
Xe-135m	1.676E+03	1.283E+04	5.187E+04
Xe-135	4.390E+03	2.130E+04	5.958E+04
Xe-137	2.238E+01	1.730E-04	7.545E-14
Xe-138	6.229E+02	9.854E+01	3.005E-01
Br-83	3.714E+00	7.476E+00	5.922E+00
Br-84	3.206E+00	1.399E+00	1.010E-01
Br-85	7.005E-01	3.783E-10	1.011E-22
I-129	2.143E-06	6.460E-06	1.204E-05
I-130	3.160E+00	8.910E+00	1.395E+01
I-131	3.558E+01	1.070E+02	1.971E+02
I-132	3.928E+01	8.453E+01	8.515E+01
I-133	7.134E+01	2.071E+02	3.479E+02
I-134	4.192E+01	4.308E+01	1.043E+01
I-135	6.120E+01	1.615E+02	2.183E+02
Rb-86m	2.457E-04	8.331E-31	2.805E-66
Rb-86	1.268E-01	3.249E-01	5.175E-01
Rb-88	6.288E+01	1.545E+02	1.636E+02
Rb-89	1.126E+01	5.235E-01	1.960E-03
Cs-134	1.418E+01	3.636E+01	5.818E+01
Cs-136	3.511E+00	9.004E+00	1.431E+01
Cs-137	5.419E+00	1.389E+01	2.223E+01
Cs-138	4.511E+01	2.603E+01	1.839E+00
Sb-125	7.674E-02	3.605E-01	5.787E-01

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**Table 15.3-31 (Sheet 2 of 6)
U.S. EPR Source Terms
Radionuclide Releases to Atmosphere for Design Basis LOCA (Ci)**

Isotope	8 to 24 hr.	24 to 96 hr.	96 to 720 hr.	Total
Kr-83m	4.187E+03	1.072E+02	3.150E-07	1.242E+04
Kr-85m	8.074E+03	3.703E+02	5.366E-03	2.533E+04
Kr-85	3.497E+03	7.845E+03	6.661E+04	7.948E+04
Kr-87	2.199E+02	1.791E-02	1.613E-19	9.706E+03
Kr-88	7.580E+03	7.766E+01	1.794E-06	4.186E+04
Kr-89	3.346E-43	0.000E+00	0.000E+00	9.523E+00
Xe-131m	2.650E+03	8.448E+03	8.304E+04	9.525E+04
Xe-133m	1.551E+04	3.840E+04	2.689E+04	8.716E+04
Xe-133	4.923E+05	1.172E+06	2.331E+06	4.202E+06
Xe-135m	1.495E+05	6.371E+04	8.257E+01	2.797E+05
Xe-135	2.402E+05	1.708E+05	9.095E+02	4.971E+05
Xe-137	4.529E-35	0.000E+00	0.000E+00	2.238E+01
Xe-138	5.518E-07	1.111E-27	0.000E+00	7.217E+02
Br-83	1.578E+00	9.943E-03	7.939E-12	1.870E+01
Br-84	2.106E-04	1.010E-13	1.200E-54	4.706E+00
Br-85	3.330E-51	0.000E+00	0.000E+00	7.005E-01
I-129	2.778E-05	8.971E-05	6.739E-04	8.120E-04
I-130	1.919E+01	9.181E+00	1.557E-01	5.455E+01
I-131	4.395E+02	1.216E+03	3.310E+03	5.305E+03
I-132	8.672E+01	1.646E+02	1.700E+02	6.303E+02
I-133	5.859E+02	5.389E+02	5.089E+01	1.802E+03
I-134	2.466E-01	4.949E-07	8.736E-32	9.568E+01
I-135	2.005E+02	3.195E+01	1.584E-02	6.735E+02
Rb-86m	0.000E+00	0.000E+00	0.000E+00	2.457E-04
Rb-86	6.158E-01	1.784E-01	3.473E-02	1.798E+00
Rb-88	8.009E+01	8.460E-01	1.980E-08	4.619E+02
Rb-89	4.966E-09	5.198E-29	0.000E+00	1.178E+01
Cs-134	7.012E+01	2.128E+01	5.202E+00	2.053E+02
Cs-136	1.694E+01	4.810E+00	8.548E-01	4.943E+01
Cs-137	2.679E+01	8.142E+00	2.002E+00	7.848E+01
Cs-138	3.106E-03	3.645E-13	3.186E-55	7.298E+01
Sb-125	6.973E-01	2.117E-01	5.185E-02	1.977E+00

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**Table 15.3-31 (Sheet 3 of 6)
U.S. EPR Source Terms
Radionuclide Releases to Atmosphere for Design Basis LOCA (Ci)**

Isotope	0 to 1.5 hr.	1.5 to 3.5 hr.	3.5 to 8 hr.
Sb-127	3.566E-01	1.658E+00	2.602E+00
Sb-129	8.062E-01	3.074E+00	3.076E+00
Te-127m	5.087E-02	2.290E-01	3.677E-01
Te-127	3.679E-01	1.678E+00	2.678E+00
Te-129m	1.475E-01	6.643E-01	1.065E+00
Te-129	9.137E-01	3.758E+00	4.244E+00
Te-131m	4.117E-01	1.808E+00	2.706E+00
Te-131	4.731E-01	6.764E-01	6.180E-01
Te-132	4.076E+00	1.819E+01	2.841E+01
Te-134	1.637E+00	2.306E+00	2.992E-01
Sr-89	1.295E+00	6.070E+00	9.727E+00
Sr-90	1.352E-01	6.346E-01	1.019E+00
Sr-91	1.523E+00	6.489E+00	8.369E+00
Sr-92	1.273E+00	4.299E+00	3.300E+00
Ba-137m	4.246E+00	1.310E+01	2.103E+01
Ba-139	1.252E+00	2.933E+00	1.185E+00
Ba-140	2.011E+00	9.409E+00	1.500E+01
Mo-99	6.680E-01	1.185E+00	1.843E+00
Tc-99m	4.054E-01	1.062E+00	1.685E+00
Ru-103	2.419E-01	1.134E+00	1.816E+00
Ru-105	1.639E-01	6.263E-01	6.347E-01
Ru-106	1.433E-01	6.720E-01	1.079E+00
Rh-103m	2.180E-01	1.022E+00	1.637E+00
Rh-105	1.753E-01	8.191E-01	1.284E+00
Rh-106	1.433E-01	6.720E-01	1.079E+00
Ce-141	4.504E-02	2.100E-01	3.363E-01
Ce-143	4.473E-02	2.032E-01	3.060E-01
Ce-144	3.421E-02	1.595E-01	2.560E-01
Np-239	7.573E-01	3.479E+00	5.379E+00
Pu-238	2.937E-04	1.371E-03	2.200E-03
Pu-239	1.236E-05	5.767E-05	9.263E-05
Pu-240	2.817E-05	1.315E-04	2.110E-04

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U.S. EPR Source Terms
Radionuclide Releases to Atmosphere for Design Basis LOCA (Ci)**

Isotope	8 to 24 hr.	24 to 96 hr.	96 to 720 hr.	Total
Sb-127	2.947E+00	7.152E-01	6.814E-02	8.347E+00
Sb-129	1.172E+00	1.262E-02	9.903E-09	8.142E+00
Te-127m	4.432E-01	1.345E-01	3.221E-02	1.257E+00
Te-127	3.139E+00	8.103E-01	9.679E-02	8.769E+00
Te-129m	1.276E+00	3.779E-01	8.132E-02	3.612E+00
Te-129	2.219E+00	2.610E-01	5.294E-02	1.145E+01
Te-131m	2.700E+00	4.296E-01	9.844E-03	8.066E+00
Te-131	6.079E-01	9.670E-02	2.216E-03	2.474E+00
Te-132	3.181E+01	7.423E+00	6.147E-01	9.053E+01
Te-134	1.926E-03	2.642E-11	1.491E-43	4.244E+00
Sr-89	1.167E+01	3.484E+00	7.831E-01	3.303E+01
Sr-90	1.228E+00	3.731E-01	9.176E-02	3.481E+00
Sr-91	5.720E+00	3.029E-01	1.462E-04	2.240E+01
Sr-92	7.207E-01	1.556E-03	1.220E-12	9.594E+00
Ba-137m	2.535E+01	7.702E+00	1.894E+00	7.332E+01
Ba-139	7.377E-02	2.809E-06	3.953E-23	5.444E+00
Ba-140	1.775E+01	5.031E+00	8.876E-01	5.008E+01
Mo-99	2.036E+00	4.535E-01	3.193E-02	6.218E+00
Tc-99m	1.916E+00	4.358E-01	3.075E-02	5.535E+00
Ru-103	2.175E+00	6.463E-01	1.417E-01	6.155E+00
Ru-105	2.485E-01	2.881E-03	3.096E-09	1.676E+00
Ru-106	1.299E+00	3.939E-01	9.568E-02	3.683E+00
Rh-103m	1.961E+00	5.827E-01	1.277E-01	5.549E+00
Rh-105	1.375E+00	2.453E-01	7.574E-03	3.907E+00
Rh-106	1.299E+00	3.939E-01	9.568E-02	3.683E+00
Ce-141	4.027E-01	1.191E-01	2.551E-02	1.139E+00
Ce-143	3.105E-01	5.212E-02	1.426E-03	9.179E-01
Ce-144	3.085E-01	9.342E-02	2.261E-02	8.743E-01
Np-239	5.860E+00	1.242E+00	7.389E-02	1.679E+01
Pu-238	2.652E-03	8.060E-04	1.984E-04	7.522E-03
Pu-239	1.118E-04	3.413E-05	8.458E-06	3.171E-04
Pu-240	2.543E-04	7.729E-05	1.901E-05	7.212E-04

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**Table 15.3-31 (Sheet 5 of 6)
U.S. EPR Source Terms
Radionuclide Releases to Atmosphere for Design Basis LOCA (Ci)**

Isotope	0 to 1.5 hr.	1.5 to 3.5 hr.	3.5 to 8 hr.
Pu-241	5.110E-03	2.385E-02	3.828E-02
Y-90	3.140E-03	2.339E-02	6.936E-02
Y-91m	5.663E-01	3.441E+00	5.191E+00
Y-91	1.652E-02	8.019E-02	1.426E-01
Y-92	3.112E-01	2.236E+00	3.968E+00
Y-93	1.749E-02	7.414E-02	9.685E-02
Zr-95	1.861E-02	8.589E-02	1.377E-01
Zr-97	1.877E-02	8.243E-02	1.169E-01
Nb-95	1.862E-02	8.599E-02	1.380E-01
La-140	6.044E-02	4.868E-01	1.509E+00
La-141	1.590E-02	5.866E-02	5.613E-02
La-142	1.132E-02	2.986E-02	1.382E-02
Pr-143	1.844E-02	8.551E-02	1.384E-01
Pr-144	3.272E-02	1.590E-01	2.560E-01
Nd-147	7.658E-03	3.525E-02	5.615E-02
Am-241	2.343E-06	1.083E-05	1.740E-05
Cm-242	1.065E-03	4.917E-03	7.889E-03
Cm-244	5.651E-04	2.610E-03	4.190E-03
Total	3.005E+04	1.250E+05	2.852E+05

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U.S. EPR Source Terms
Radionuclide Releases to Atmosphere for Design Basis LOCA (Ci)**

Isotope	8 to 24 hr.	24 to 96 hr.	96 to 720 hr.	Total
Pu-241	4.613E-02	1.402E-02	3.446E-03	1.308E-01
Y-90	1.818E-01	1.423E-01	7.603E-02	4.961E-01
Y-91m	3.634E+00	1.924E-01	9.288E-05	1.302E+01
Y-91	2.021E-01	7.064E-02	1.656E-02	5.286E-01
Y-92	2.181E+00	2.160E-02	1.599E-09	8.719E+00
Y-93	6.832E-02	3.943E-03	2.631E-06	2.607E-01
Zr-95	1.654E-01	4.955E-02	1.135E-02	4.685E-01
Zr-97	1.014E-01	1.051E-02	5.726E-05	3.300E-01
Nb-95	1.664E-01	5.053E-02	1.232E-02	4.719E-01
La-140	3.941E+00	2.736E+00	9.057E-01	9.639E+00
La-141	1.940E-02	1.590E-04	3.935E-11	1.502E-01
La-142	1.118E-03	1.026E-07	7.220E-23	5.612E-02
Pr-143	1.698E-01	5.241E-02	1.030E-02	4.748E-01
Pr-144	3.085E-01	9.343E-02	2.261E-02	8.722E-01
Nd-147	6.621E-02	1.857E-02	3.127E-03	1.870E-01
Am-241	2.105E-05	6.475E-06	1.695E-06	5.978E-05
Cm-242	9.495E-03	2.870E-03	6.862E-04	2.692E-02
Cm-244	5.049E-03	1.534E-03	3.772E-04	1.432E-02
Total	9.254E+05	1.463E+06	2.512E+06	5.341E+06

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**Table 15.3-32
U.S. EPR Source Terms
Radionuclide Releases to Atmosphere for Fuel Handling Accident (Ci)**

Isotope	0 to 2 hr.	2 to 8 hr.	8 to 24 hr.	24 to 96 hr.	96 to 720 hr.	Total
Kr-83m	1.437E+00	2.129E-01	4.404E-02	4.294E-04	3.665E-13	1.694E+00
Kr-85m	7.810E+01	3.881E-01	4.693E-08	1.678E-26	0.000E+00	7.849E+01
Kr-85	1.471E+03	9.977E+00	3.052E-06	1.296E-23	0.000E+00	1.481E+03
Kr-87	2.330E-04	5.290E-07	6.148E-15	4.260E-36	0.000E+00	2.335E-04
Kr-88	1.016E+01	4.220E-02	2.983E-09	2.549E-28	0.000E+00	1.020E+01
Xe-131m	5.637E+02	1.475E+01	2.813E+01	1.084E+02	3.282E+02	1.043E+03
Xe-133m	2.609E+03	8.098E+01	1.193E+02	1.540E+02	1.538E+01	2.979E+03
Xe-133	9.442E+04	1.533E+03	1.684E+03	2.174E+03	2.171E+02	1.000E+05
Xe-135m	1.089E+03	1.975E+03	1.834E+03	4.211E+02	2.219E-01	5.319E+03
Xe-135	1.407E+04	7.705E+02	6.412E+02	1.472E+02	7.759E-02	1.563E+04
Xe-138	1.825E-39	3.471E-44	2.388E-58	4.092E-96	0.000E+00	1.825E-39
Br-83	1.610E-03	6.097E-06	3.273E-13	1.343E-32	0.000E+00	1.616E-03
Br-84	2.046E-18	1.009E-21	1.206E-31	4.188E-58	0.000E+00	2.047E-18
I-129	1.459E-05	9.898E-08	3.028E-14	1.286E-31	0.000E+00	1.469E-05
I-130	3.363E+00	2.038E-02	4.453E-09	7.713E-27	0.000E+00	3.383E+00
I-131	3.443E+02	2.319E+00	6.942E-07	2.784E-24	0.000E+00	3.466E+02
I-132	1.118E-02	4.139E-05	2.076E-12	7.100E-32	0.000E+00	1.122E-02
I-133	1.615E+02	1.025E+00	2.567E-07	6.398E-25	0.000E+00	1.625E+02
I-134	8.997E-10	1.249E-12	3.325E-21	4.528E-44	0.000E+00	9.009E-10
I-135	1.282E+01	7.041E-02	1.148E-08	9.113E-27	0.000E+00	1.289E+01
Rb-88	4.884E+00	4.672E-02	3.332E-09	2.846E-28	0.000E+00	4.931E+00
Cs-138	6.206E-40	1.019E-42	1.379E-52	6.210E-79	0.000E+00	6.216E-40
Total	1.148E+05	4.388E+03	4.307E+03	3.005E+03	5.610E+02	1.271E+05

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**Table 15.3-33
U.S. EPR Source Terms
Radionuclide Releases to Atmosphere for Rod Ejection (REA)
with Accident-Induced 36.7 Percent Clad Failure (Ci)**

Isotope	0 to 2 hr.	2 to 8 hr.	Total
Kr-83m	6.655E+02	5.477E+02	1.213E+03
Kr-85m	1.872E+03	3.118E+03	4.990E+03
Kr-85	1.026E+02	3.074E+02	4.100E+02
Kr-87	2.651E+03	1.290E+03	3.941E+03
Kr-88	4.894E+03	5.970E+03	1.086E+04
Kr-89	2.967E+02	1.193E-09	2.967E+02
Xe-131m	7.443E+01	2.209E+02	2.953E+02
Xe-133m	4.246E+02	1.209E+03	1.633E+03
Xe-133	1.390E+04	4.078E+04	5.467E+04
Xe-135m	4.932E+02	8.973E+01	5.829E+02
Xe-135	4.202E+03	9.607E+03	1.381E+04
Xe-137	5.606E+02	2.073E-07	5.606E+02
Xe-138	2.009E+03	5.684E+00	2.015E+03
Br-83	3.270E+00	1.566E+01	1.893E+01
Br-84	1.892E+00	6.754E-01	2.567E+00
Br-85	2.564E-02	1.917E-13	2.564E-02
I-129	2.042E-06	3.009E-05	3.213E-05
I-130	2.985E+00	3.487E+01	3.786E+01
I-131	3.385E+01	4.915E+02	5.254E+02
I-132	3.305E+01	1.520E+02	1.851E+02
I-133	6.775E+01	8.692E+02	9.369E+02
I-134	2.896E+01	3.175E+01	6.071E+01
I-135	5.703E+01	5.471E+02	6.042E+02
Rb-86m	4.849E-06	1.306E-39	4.849E-06
Rb-86	1.683E-01	2.480E+00	2.648E+00
Rb-88	4.004E+03	6.652E+03	1.066E+04
Rb-89	2.983E+02	1.662E+00	2.999E+02
Cs-134	1.887E+01	2.796E+02	2.985E+02
Cs-136	4.672E+00	6.863E+01	7.330E+01
Cs-137	7.195E+00	1.067E+02	1.139E+02
Cs-138	1.765E+03	2.733E+02	2.038E+03
Sr-89	2.739E-01	1.163E+00	1.437E+00
Ba-137m	6.794E+00	1.009E+02	1.077E+02
Total	3.848E+04	7.277E+04	1.113E+05

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15.4 RADIOLOGICAL CONSEQUENCES

PSEG Site specific radiation doses at EAB and LPZ are calculated for the applicable postulated design basis accidents for the four reactor technologies. These PSEG Site specific doses are calculated by multiplying the reactor DCD dose by the ratio of the site χ/Q value to the DCD χ/Q value. All PSEG Site specific χ/Q values are bounded by the DCD χ/Q values. All site-specific doses are bounded by DCD doses. The results of the site-specific analysis demonstrate that all accident doses for the US-APWR, AP1000, and U.S. EPR meet the site acceptance criteria of 10 CFR 50.34. The results also demonstrate that all accident doses for the ABWR meet the site acceptance criteria of 10 CFR 100.

The ABWR DCD doses are calculated for a reactor power level of 4005 MWt. An uprated, 4300 MWt version of the ABWR is being considered at the PSEG Site. The power uprate only affects doses for accidents that involve fuel damage (LOCA and fuel handling accidents). Doses for these two accidents are calculated for a reactor power level of 4386 MWt (102 percent of the uprated 4300 MWt) by multiplying the site-specific doses by a factor of 4386/4005, since activity releases and thus doses are proportional to power. There are no radiological consequences for either the control rod drop/rod ejection accident or the reactor internal pump rotor seizure accident of the ABWR as discussed in Section 15.3.

Atmospheric dispersion factors for the US-APWR are given in Table 15.4-1. Doses for the US-APWR are listed in Table 15.4-2. Atmospheric dispersion factors for the ABWR are listed in Table 15.4-3. Doses are summarized for the ABWR in Table 15.4-4, and are calculated in Tables 15.4-5 to 15.4-8. Atmospheric dispersion factors for the AP1000 are given in Table 15.4-9. Doses are listed for the AP1000 in Table 15.4-10, and are calculated in Tables 15.4-11 to 15.4-17. Atmospheric dispersion factors for the U.S. EPR are listed in Table 15.4-18. Doses are listed for the U.S. EPR in Table 15.4-19.

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**Table 15.4-1
US-APWR Radiological Consequences
Atmospheric Dispersion Factors**

Location	Time (hr.)	DCD χ/Q (s/m³)	Site χ/Q (s/m³)	χ/Q Ratio (Site/DCD)
EAB	0 to 2	5.00E-04	4.71E-04	0.942
LPZ	0 to 8	2.10E-04	8.47E-06	0.040
	8 to 24	1.30E-04	5.50E-06	0.042
	24 to 96	6.90E-05	2.15E-06	0.031
	96 to 720	2.80E-05	5.60E-07	0.020

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**Table 15.4-2
US-APWR Radiological Consequences
Dose Summary**

Accident	DCD Dose (rem TEDE)		χ/Q ratio (Site/DCD)		Site Dose (rem TEDE)		Limit
	EAB	LPZ	EAB	LPZ^(a)	EAB	LPZ	
Steam System Piping Failure - Pre-Existing Iodine Spike	0.19	0.11	0.942	0.042	0.18	0.00	25
Steam System Piping Failure - Accident-Initiated Iodine Spike	0.32	0.28	0.942	0.042	0.30	0.01	2.5
Reactor Coolant Pump Rotor Seizure	0.49	0.7	0.942	0.042	0.46	0.03	2.5
Spectrum of Rod Cluster Control Assembly Ejection Accidents	5.1	4.5	0.942	0.042	4.80	0.19	6.3
Failure of Small Lines Carrying Primary Coolant Outside Containment	1.5	0.6	0.942	0.042	1.41	0.03	2.5
Steam Generator Tube Rupture - Pre-Existing Iodine Spike	3.6	1.5	0.942	0.042	3.39	0.06	25
Steam Generator Tube Rupture - Accident-Initiated Iodine Spike	0.96	0.43	0.942	0.042	0.90	0.02	2.5
LOCA	13	13	0.942	0.042	12.25	0.55	25
Fuel Handling Accident	3.3	1.4	0.942	0.042	3.11	0.06	6.3

a) As LPZ doses are not given in time-dependent form, the most conservative Site/DCD χ/Q ratio (from the 8-24 hour interval) is used.

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**Table 15.4-3
ABWR Radiological Consequences
Atmospheric Dispersion Factors**

Accident	Location	Time (hr.)	DCD χ/Q (s/m³)	Site χ/Q (s/m³)	χ/Q Ratio (Site/DCD)
All Accidents	EAB	0 to 2	1.37E-03	4.71E-04	0.344
	LPZ	0 to 2	4.11E-04	8.47E-06	0.021
LOCA Only		0 to 8	1.56E-04	8.47E-06	0.054
		8 to 24	9.61E-05	5.50E-06	0.057
		24 to 96	3.36E-05	2.15E-06	0.064
		96 to 720	7.42E-06	5.60E-07	0.075

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**Table 15.4-4
ABWR Radiological Consequences
Dose Summary**

Accident	Thyroid Dose (Sv)	Whole Body Dose (Sv)	Thyroid Limit (Sv)	Whole Body Limit (Sv)
Failure of Small Lines Carrying Primary Coolant Outside Containment	1.65E-02	3.23E-04	3.00E-01	2.50E-02
LOCA - EAB	7.15E-01	1.54E-02	3.00E+00	2.50E-01
LOCA - LPZ	1.77E-01	2.61E-03	3.00E+00	2.50E-01
Fuel Handling Accident ^(a)	2.82E-01	4.52E-03	7.50E-01	6.25E-02
Main Steamline Break Case 1 ^{(a)(b)}	8.94E-03	2.13E-04	3.00E-01	2.50E-02
Main Steamline Break Case 2 ^{(a)(b)}	1.75E-01	4.47E-03	3.00E+00	2.50E-01

- a) The dose is calculated for the maximum 2-hour EAB meteorology, only, based on the DCD.
- b) The level of activity is consistent with an offgas release rate of 3.7 GBq/s for Case 1 and 14.8 GBq/s for Case 2 referenced to a 30 minute decay. The iodine concentrations in the reactor coolant are tabulated below for each case.

Isotope	MBq/g	
	Case 1	Case 2
I-131	0.001739	0.03515
I-132	0.01536	0.30747
I-133	0.01206	0.24161
I-134	0.02634	0.52688
I-135	0.01647	0.3293

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**Table 15.4-5
ABWR Radiological Consequences
Doses for an Instrument Line Break Accident**

DCD			Site	
Thyroid Dose (Sv)	Whole Body Dose (Sv)	χ/Q Ratio (Site/DCD)	Thyroid Dose (Sv)	Whole Body Dose (Sv)
4.80E-02	9.40E-04	0.344	1.65E-02	3.23E-04

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**Table 15.4-6
ABWR Radiological Consequences
Doses for a Fuel Handling Accident**

DCD				Site	
Thyroid Dose (Sv)	Whole Body Dose (Sv)	χ/Q Ratio (Site/DCD)	Uprate Ratio	Thyroid Dose (Sv)	Whole Body Dose (Sv)
7.50E-01	1.20E-02	0.344	1.095	2.82E-01	4.52E-03

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**Table 15.4-7
ABWR Radiological Consequences
Doses for a LOCA**

Location	Time (hr.)	DCD		χ/Q Ratio (Site/DCD)	Uprate Ratio	Site	
		Thyroid Dose (Sv)	Whole Body Dose (Sv)			Thyroid Dose (Sv)	Whole Body Dose (Sv)
EAB	0 to 2	1.90E+00	4.10E-02	0.344	1.095	7.15E-01	1.54E-02
LPZ	0 to 8	3.10E-01	1.00E-02	0.054	1.095	1.84E-02	5.95E-04
	0 to 24	5.10E-01	1.80E-02	0.057	1.095	3.10E-02	1.10E-03
	0 to 96	1.30E+00	2.90E-02	0.064	1.095	8.63E-02	1.87E-03
	0 to 720	2.40E+00	3.80E-02	0.075	1.095	1.77E-01	2.61E-03

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**Table 15.4-8
ABWR Radiological Consequences
Doses for a Main Steamline Break**

	DCD		χ/Q Ratio (Site/DCD)	Site	
	Thyroid Dose (Sv)	Whole Body Dose (Sv)		Thyroid Dose (Sv)	Whole Body Dose (Sv)
Case 1	2.60E-02	6.20E-04	0.344	8.94E-03	2.13E-04
Case 2	5.10E-01	1.30E-02	0.344	1.75E-01	4.47E-03

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**Table 15.4-9
AP1000 Radiological Consequences
Atmospheric Dispersion Factors**

Accident	Location	Time (hr.)	DCD χ/Q (s/m³)	Site χ/Q (s/m³)	χ/Q Ratio (Site/DCD)
LOCA	EAB	0 to 2	5.10E-04	4.71E-04	0.924
	LPZ	0 to 8	2.20E-04	8.47E-06	0.039
		8 to 24	1.60E-04	5.50E-06	0.034
		24 to 96	1.00E-04	2.15E-06	0.022
		96 to 720	8.00E-05	5.60E-07	0.007
Other Accidents	EAB	0 to 2	8.00E-04	4.71E-04	0.589
	LPZ	0 to 8	5.00E-04	8.47E-06	0.017
		8 to 24	3.00E-04	5.50E-06	0.018
		24 to 96	1.50E-04	2.15E-06	0.014
		96 to 720	8.00E-05	5.60E-07	0.007

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**Table 15.4-10
AP1000 Radiological Consequences
Dose Summary**

Subcategory	Site Dose (rem TEDE)		
	EAB	LPZ	Limit
Steam System Piping Failure - Pre-Existing Iodine Spike	0.59	0.01	25
Steam System Piping Failure - Accident-Initiated Iodine Spike	0.65	0.03	2.5
Reactor Coolant Pump Shaft Seizure - No Feedwater	0.47	0.01	2.5
Reactor Coolant Pump Shaft Seizure - Feedwater Available	0.35	0.01	2.5
Spectrum of Rod Cluster Control Assembly Ejection Accidents	2.12	0.09	6.3
Failure of Small Lines Carrying Primary Coolant Outside Containment	1.24	0.02	2.5
Steam Generator Tube Rupture - Pre-Existing Iodine Spike	1.30	0.02	25
Steam Generator Tube Rupture - Accident-Initiated Iodine Spike	0.65	0.01	2.5
LOCA	22.44	0.88	25
Fuel Handling Accident	3.06	0.06	6.3

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**Table 15.4-11
AP1000 Radiological Consequences
Doses for a Steam System Piping Failure**

Doses for Steam System Piping Failure with Pre-Existing Iodine Spike

Time (hr.)	DCD Dose (rem TEDE)		χ/Q Ratio (Site/DCD)	Site Dose (rem TEDE)	
	EAB	LPZ		EAB	LPZ
0 to 2	1.00E+00		0.589	5.89E-01	
0 to 8		5.81E-01	0.017		9.84E-03
8 to 24		7.18E-02	0.018		1.32E-03
24 to 96		1.08E-01	0.014		1.55E-03
96 to 720		0.00E+00	0.007		0.00E+00
Total	1.00E+00	7.61E-01		5.89E-01	1.27E-02
Limit				25	25

Doses for Steam System Piping Failure with Accident-Initiated Iodine Spike

Time (hr.)	DCD Dose (rem TEDE)		χ/Q Ratio (Site/DCD)	Site Dose (rem TEDE)	
	EAB	LPZ		EAB	LPZ
0 to 2	1.10E+00		0.589	6.48E-01	
0 to 8		1.02E+00	0.017		1.73E-02
8 to 24		3.77E-01	0.018		6.91E-03
24 to 96		5.36E-01	0.014		7.68E-03
96 to 720		0.00E+00	0.007		0.00E+00
Total	1.10E+00	1.93E+00		6.48E-01	3.19E-02
Limit				2.5	2.5

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**Table 15.4-12
AP1000 Radiological Consequences
Doses for a Reactor Coolant Pump Shaft Seizure Accident**

Doses for Reactor Coolant Pump Shaft Seizure with No Feedwater

Time (hr.)	DCD Dose (rem TEDE)		χ/Q Ratio (Site/DCD)	Site Dose (rem TEDE)	
	EAB	LPZ		EAB	LPZ
0 to 2	8.00E-01		0.589	4.71E-01	
0 to 8		3.89E-01	0.017		6.59E-03
8 to 24		0.00E+00	0.018		0.00E+00
24 to 96		0.00E+00	0.014		0.00E+00
96 to 720		0.00E+00	0.007		0.00E+00
Total	8.00E-01	3.89E-01		4.71E-01	6.59E-03
Limit				2.5	2.5

Doses for Reactor Coolant Pump Shaft Seizure with Feedwater Available

Time (hr.)	DCD Dose (rem TEDE)		χ/Q Ratio (Site/DCD)	Site Dose (rem TEDE)	
	EAB	LPZ		EAB	LPZ
0 to 2	6.00E-01		0.589	3.53E-01	
0 to 8		7.94E-01	0.017		1.35E-02
8 to 24		0.00E+00	0.018		0.00E+00
24 to 96		0.00E+00	0.014		0.00E+00
96 to 720		0.00E+00	0.007		0.00E+00
Total	6.00E-01	7.94E-01		3.53E-01	1.35E-02
Limit				2.5	2.5

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**Table 15.4-13
AP1000 Radiological Consequences
Doses for Spectrum of Rod Cluster Control Assembly Ejection Accidents**

Time (hr.)	DCD Dose (rem TEDE)		χ/Q Ratio (Site/DCD)	Site Dose (rem TEDE)	
	EAB	LPZ		EAB	LPZ
0 to 2	3.60E+00		0.589	2.12E+00	
0 to 8		4.58E+00	0.017		7.76E-02
8 to 24		7.84E-01	0.018		1.44E-02
24 to 96		6.32E-02	0.014		9.06E-04
96 to 720		2.06E-02	0.007		1.44E-04
Total	3.60E+00	5.45E+00		2.12E+00	9.30E-02
Limit				6.3	6.3

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**Table 15.4-14
AP1000 Radiological Consequences
Doses for Failure of Small Lines Carrying Primary Coolant Outside Containment**

Time (hr.)	DCD Dose (rem TEDE)		χ/Q Ratio (Site/DCD)	Site Dose (rem TEDE)	
	EAB	LPZ		EAB	LPZ
0 to 2	2.10E+00		0.589	1.24E+00	
0 to 8		1.02E+00	0.017		1.73E-02
8 to 24		0.00E+00	0.018		0.00E+00
24 to 96		0.00E+00	0.014		0.00E+00
96 to 720		0.00E+00	0.007		0.00E+00
Total	2.10E+00	1.02E+00		1.24E+00	1.73E-02
Limit				2.5	2.5

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**Table 15.4-15
AP1000 Radiological Consequences
Doses for Steam Generator Tube Rupture**

Doses for Steam Generator Tube Rupture with Pre-Existing Iodine Spike

Time (hr.)	DCD Dose (rem TEDE)		χ/Q Ratio (Site/DCD)	Site Dose (rem TEDE)	
	EAB	LPZ		EAB	LPZ
0 to 2	2.20E+00		0.589	1.30E+00	
0 to 8		1.16E+00	0.017		1.97E-02
8 to 24		7.24E-02	0.018		1.33E-03
24 to 96		0.00E+00	0.014		0.00E+00
96 to 720		0.00E+00	0.007		0.00E+00
Total	2.20E+00	1.23E+00		1.30E+00	2.10E-02
Limit				25	25

Doses for Steam Generator Tube Rupture with Accident-Initiated Iodine Spike

Time (hr.)	DCD Dose (rem TEDE)		χ/Q Ratio (Site/DCD)	Site Dose (rem TEDE)	
	EAB	LPZ		EAB	LPZ
0 to 2	1.10E+00		0.589	6.48E-01	
0 to 8		6.27E-01	0.017		1.06E-02
8 to 24		1.69E-01	0.018		3.10E-03
24 to 96		0.00E+00	0.014		0.00E+00
96 to 720		0.00E+00	0.007		0.00E+00
Total	1.10E+00	7.96E-01		6.48E-01	1.37E-02
Limit				2.5	2.5

**PSEG Site
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**Table 15.4-16
AP1000 Radiological Consequences
Doses for LOCA**

Time (hr.)	DCD Dose (rem TEDE)		χ/Q Ratio (Site/DCD)	Site Dose (rem TEDE)	
	EAB	LPZ		EAB	LPZ
0 to 2	2.43E+01		0.924	2.24E+01	
0 to 8		2.17E+01	0.039		8.35E-01
8 to 24		7.69E-01	0.034		2.64E-02
24 to 96		3.71E-01	0.022		7.98E-03
96 to 720		8.70E-01	0.007		6.09E-03
Total	2.43E+01	2.37E+01		2.24E+01	8.76E-01
Limit				25	25

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**Table 15.4-17
AP1000 Radiological Consequences
Doses for a Fuel Handling Accident**

Time (hr.)	DCD Dose (rem TEDE)		χ/Q Ratio (Site/DCD)	Site Dose (rem TEDE)	
	EAB	LPZ		EAB	LPZ
0 to 2	5.20E+00		0.589	3.06E+00	
0 to 8		3.44E+00	0.017		5.83E-02
8 to 24		0.00E+00	0.018		0.00E+00
24 to 96		0.00E+00	0.014		0.00E+00
96 to 720		0.00E+00	0.007		0.00E+00
Total	5.20E+00	3.44E+00		3.06E+00	5.83E-02
Limit				25	25

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**Table 15.4-18
U.S. EPR Radiological Consequences
Atmospheric Dispersion Factors**

Location	Time (hr.)	DCD χ/Q (s/m³)	Site χ/Q (s/m³)	χ/Q Ratio (Site/DCD)
EAB	0 to 2	1.00E-03	4.71E-04	0.471
LPZ	0 to 8	1.35E-04	8.47E-06	0.063
	8 to 24	1.00E-04	5.50E-06	0.055
	24 to 96	5.40E-05	2.15E-06	0.040
	96 to 720	2.20E-05	5.60E-07	0.025

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**Table 15.4-19
U.S. EPR Radiological Consequences
Dose Summary**

Accident	DCD Dose (rem TEDE)		χ/Q ratio (Site/DCD)		Site Dose (rem TEDE)		Max
	EAB	LPZ	EAB	LPZ^(a)	EAB	LPZ	
Main Steam Line Break - Pre-Existing Iodine Spike	0.2	0.1	0.471	0.063	9.42E-02	5.50E-03	25
Main Steam Line Break - Accident-Initiated Iodine Spike	0.3	0.2	0.471	0.063	1.41E-01	1.10E-02	2.5
Main Steam Line Break - Fuel Rod Clad Failure	5.3	2.6	0.471	0.063	2.50E+00	1.43E-01	25
Main Steam Line Break - Fuel Overheat	5.8	2.8	0.471	0.063	2.73E+00	1.54E-01	25
Reactor Coolant Pump Shaft Seizure	2.3	0.9	0.471	0.063	1.08E+00	4.95E-02	2.5
Spectrum of Rod Cluster Control Assembly Ejection Accidents	5.7	3.5	0.471	0.063	2.68E+00	1.93E-01	6.3
Failure of Small Lines Carrying Primary Coolant Outside Containment	1.8	0.3	0.471	0.063	8.48E-01	1.65E-02	2.5
Steam Generator Tube Rupture - Pre-Existing Iodine Spike	1.1	0.3	0.471	0.063	5.18E-01	1.65E-02	25
Steam Generator Tube Rupture - Accident-Initiated Iodine Spike	0.7	0.5	0.471	0.063	3.30E-01	2.75E-02	2.5
LOCA	12.2	11.1	0.471	0.063	5.75E+00	6.11E-01	25
Fuel Handling Accident	5.6	1	0.471	0.063	2.64E+00	5.50E-02	6.3

a) As LPZ doses are not given in time-dependent form, the most conservative Site/DCD χ/Q ratio (from the 0-8 hour interval) is used.

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**CHAPTER 17
QUALITY ASSURANCE**

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CHAPTER 17

QUALITY ASSURANCE

17.1 ESPA QUALITY ASSURANCE

The Quality Assurance Program implemented during the development of this early site permit application (ESPA) is described in the PSEG Power, LLC Nuclear Development Quality Assurance Program Description (QAPD). The QAPD and associated procedures provide for control of PSEG Power, LLC activities that have the potential to affect the quality of safety-related nuclear plant structures, systems and components of the proposed new units. The QAPD is a separately controlled document therefore; it does not conform to the ESPA formatting.

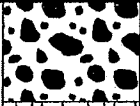

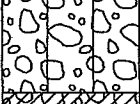

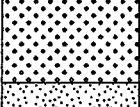
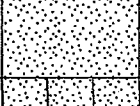
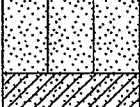








APPENDIX 2AA

BORING LOGS

FROM

ESPA INVESTIGATION

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS		TYPICAL DESCRIPTIONS
			GRAPH	LETTER	
COARSE GRAINED SOILS MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVEL AND GRAVELLY SOILS MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
				GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
		GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
	SAND AND SANDY SOILS MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
				SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
		SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS LIQUID LIMIT LESS THAN 50			ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS LIQUID LIMIT GREATER THAN 50			MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS





KEY TO CLASSIFICATION OF SOILS					
Soils classified under the Unified Soil Classification System (USCS) and in accordance with ASTM D 2488-06					
CORRELATION OF SPT RESISTANCE WITH RELATIVE DENSITY-CONSISTENCY				<u>MOISTURE CONTENT</u>	
<u>GRANULAR MATERIAL</u>			<u>SILTS AND CLAYS</u>		DRY-Absence of moisture
RELATIVE DENSITY	SPT N Value (blows/ft)		CONSISTENCY	SPT N Value (blows/ft)	MOIST-Damp/no visible H2O
VERY LOOSE	0 - 4		VERY SOFT	0 - 2	WET-Visible free water
LOOSE	5 - 10		SOFT	3 - 4	
MEDIUM DENSE	11 - 30		MED. STIFF	5 - 8	<u>HCl Reaction</u>
DENSE	31 - 50		STIFF	9 - 15	NONE - No visible reaction
VERY DENSE	> 50		VERY STIFF	16 - 30	WEAK - Some reaction/slow
			HARD	> 30	STRONG - Violent reaction
<u>MODIFIERS</u>			<u>INDURATION</u>		
Modifiers provide an estimate of the percentages of gravel, sand, and fines (silt or clay size particles) or other material such as organics, shells, gluaconite, indurated material, etc.			For sedimentary rocks, induration is the hardening of the material by cementing, heat, pressure, etc.		
TRACE	<5%	FRIABLE	Rubbing with finger frees numerous grains; gentle blow by hammer disintegrates sample.		
FEW	5 to 10%	MODERATELY INDURATED	Grains can be separated from sample with steel probe/knife; breaks easily when hit with hammer.		
LITTLE	15 to 25%	INDURATED	Grains are difficult to separate with steel probe/knife; difficult to break with hammer.		
SOME	30 to 45%	EXTREMELY INDURATED	Sharp hammer blows required to break sample; sample breaks across grains.		
MOSTLY	50 to 100%	SPT Sample Numbering: SS-1, SS-2, SS-3, etc.			
		Undisturbed Sample Numbering: UD-1, UD-2, UD-3, etc.			
COLOR of Soil: see Munsell Soil Color Charts		MEASUREMENTS: Horizontal measurements and vertical measurements, such as SPT sample recovery or penetration, sample depths, etc., are rounded to nearest tenth of a foot (0.1 ft).			
Particle Size Range for Sand: Fine, Medium, Coarse					
Particle Size Range for Gravel: Fine or Coarse					
GROUND WATER: Fluid level observations were recorded at the boring locations at the start of each work day, when possible. Due to the use of drilling fluid additives, these values may not represent the ground water conditions at the site. See observation wells for measured ground water levels.		HORIZONTAL COORDINATES (Northing and Easting) = NAD83 (2007), New Jersey State Plane Coordinate System Zone (2900), US Survey Feet.			
		ELEVATIONS = North American Vertical Datum of 1988 (NAVD88), US Survey Feet.			
FLUID LEVELS (ft) : 0 HR = Measured fluid level in boring immediately after drilling completed 24 HR = Measured fluid level in boring prior to grouting		ABBREVIATIONS USED: Run = Soil cored length during rotasonic drilling TV = Torvane Test (tsf) PP = Pocket Penetrometer Test (tsf) tsf = tons per square foot ND = Not Determined			



GEOTECHNICAL BORING LOG

Prepared By MAN Date 7/10/09Checked By JAS Date 7/10/09

SHEET 1 OF 11

PERMIT NO.: P200900084		DRILLER: G. McAneny / R. Bartholomew		NJ LICENSE NO.: 0024058 / 0001383		GEOLOGIST: R. Clark / S. Johnson								
SITE DESCRIPTION: PSEG SITE ESP APPLICATION			COUNTY: Salem, NJ		MACTEC PROJECT NO.: 6468-08-2251		FLUID LEVEL (ft)							
BORING NO.: NB-1		DRILL METHOD: Mud Rotary		SAMPLE METHODS: SPT		0 HR. ND								
GROUND SURFACE ELEV.: 12.8 US ft (NAVD88)		NORTHING: 234567.6 US ft (NAD83)		EASTING: 198469.1 US ft (NAD83)		24 HR. 11.0								
TOTAL DEPTH: 600.9 ft		DRILL MACHINE: CME-75 Truck		CASING DEPTH: 13.5 ft		HAMMER (ID): 140 lb Auto. (CTB-2)								
DATE STARTED: 1/13/09		COMPLETED: 2/9/09		HOLE DIA.: 4"		ROD TYPE: NWJ								
						BITS USED: 3-7/8" Drag Bit								
ELEV. (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION		
		0.5ft	0.5ft	0.5ft	0	20	40	60	80	100				
12.8					Ground Surface							12.8	0.0	
12.8	0.0	4	7	8							SS-1		ARTIFICIAL FILL: Clayey SAND (SC), grayish brown (2.5Y 5/2), medium dense, moist, little angular gravel, trace organics	2.0
10.3	2.5	3	6	6							SS-2		HYDRAULIC FILL: FAT CLAY (CH), dark greenish gray (10Y 3/1), stiff, moist, trace angular gravel, trace organics, no HCl reaction	
7.8	5.0	2	4	6							SS-3		7.0	5.8
5.3	7.5	WOH	WOH	WOH							SS-4		HYDRAULIC FILL: Clayey SAND (SC), olive brown (2.5Y 5/3), loose, moist, trace angular gravel, no HCl reaction	7.0
2.8	10.0	WOH	8	12							SS-5		HYDRAULIC FILL: FAT CLAY (CH), greenish gray (10Y 5/1), very soft, moist, little subrounded gravel, no HCl reaction	9.5
0.3	12.5	7	16	20							SS-6		HYDRAULIC FILL: Clayey SAND (SC), very dark greenish gray (10Y 3/1), medium dense, moist, little subrounded coarse sand and fine gravel, no HCl reaction	12.0
-2.2	15.0	WOH	WOH	WOH							SS-7		HYDRAULIC FILL: FAT CLAY with sand (CH), very dark greenish gray (10Y 3/1), hard, moist, trace gravel, some organics, no HCl reaction	
-7.2	20.0	WOH	WOH	WOH							SS-8		20.0ft: Moist to wet	
-12.2	25.0	WOH	WOH	WOH							SS-9		25.0ft: Moist	
-17.2	30.0	WOH	WOH	WOH							SS-10		30.0ft: Dark greenish gray (10Y 4/1)	
-22.2	35.0	1	2	2							SS-11		35.0ft: Moist to wet	
-27.2	40.0	WOH	WOH	WOH							SS-12		40.0ft: Moist	
-32.2	45.0	WOH	4	12							SS-13A/B		ALLUVIUM: Clayey SAND (SC), greenish gray (10Y 5/1), medium dense, wet, fine sand, no HCl reaction	46.0
-37.2	50.0	6	16	18							SS-14		ALLUVIUM: Poorly graded SAND with silt (SP-SM), grayish brown (2.5Y 5/2), dense, wet, fine sand, no HCl reaction	48.0
-42.2	55.0	WOH	WOH	WOH							SS-15		54.0ft: Slight bit chatter to 55.0ft	55.0

PSEG ESP BORE PSEG ESP 7-07-09 GPI PSEG ESP GDI 7/10/09



PERMIT NO.: P200900084		DRILLER: G. McAneny / R. Bartholomew			NJ LICENSE NO.: 0024058 / 0001383		GEOLOGIST: R. Clark / S. Johnson						
SITE DESCRIPTION: PSEG SITE ESP APPLICATION				COUNTY: Salem, NJ		MACTEC PROJECT NO.: 6468-08-2251		FLUID LEVEL (ft)					
BORING NO.: NB-1		DRILL METHOD: Mud Rotary			SAMPLE METHODS: SPT			0 HR. ND					
GROUND SURFACE ELEV.: 12.8 US ft (NAVD88)		NORTHING: 234567.6 US ft (NAD83)			EASTING: 198469.1 US ft (NAD83)			24 HR. 11.0					
TOTAL DEPTH: 600.9 ft		DRILL MACHINE: CME-75 Truck			CASING DEPTH: 13.5 ft			HAMMER (ID): 140 lb Auto. (CTB-2)					
DATE STARTED: 1/13/09		COMPLETED: 2/9/09		HOLE DIA.: 4"		ROD TYPE: NWJ		BITS USED: 3-7/8" Drag Bit					
ELEV. (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION	
		0.5ft	0.5ft	0.5ft	0	20	40	60	80	100			
-43.3					Continued from previous page								
-47.2	60.0	WOH	WOH	WOH	WOH						SS-16		KIRKWOOD FORMATION: FAT CLAY (CH), olive (5Y 5/3), very soft, moist, no HCl reaction (continued)
-52.2	65.0	5	12	17							SS-17		60.0ft: Dark gray (5Y 4/1), trace fine sand
-57.2	70.0	6	5	5							SS-18		KIRKWOOD FORMATION: Silty SAND (SM), olive gray (5Y 5/2), medium dense, wet, fine sand, little subrounded to rounded gravel, no HCl reaction
-62.2	75.0	9	15	15							SS-19		VINCENTOWN FORMATION: Clayey SAND (SC), brown (7.5YR 4/3), loose, wet, fine sand, trace subrounded to rounded gravel, weak HCl reaction, strongly oxidized
-67.2	80.0	2	4	11							SS-20		VINCENTOWN FORMATION: Silty SAND (SM), light olive brown (2.5Y 5/4), medium dense, wet, fine sand, weak HCl reaction, strongly oxidized
-72.2	85.0	12	8	9							SS-21		80.0ft: Yellowish brown (10YR 5/4), fine to medium sand, weak HCl reaction, moderately oxidized
-77.2	90.0	2	5	9							SS-22		85.0ft: Greenish gray (10Y 5/1), trace friable to moderately indurated layers, trace glauconite, no oxidation
-82.2	95.0	9	8	9							SS-23		VINCENTOWN FORMATION: Silty, clayey SAND (SC-SM), greenish gray (10Y 6/1), medium dense, wet, fine to medium sand, weak HCl reaction, trace glauconite
-87.2	100.0	21	14	12							SS-24		95.0ft: Trace moderately indurated layers, strong HCl reaction
-92.2	105.0	11	8	16							SS-25		100.0ft: Greenish gray (10Y 5/1), little friable to moderately indurated layers
-97.2	110.0	7	8	18							SS-26		105.0ft: Trace friable layers



SHEET 3 OF 11

PERMIT NO.: P200900084		DRILLER: G. McAneny / R. Bartholomew			NJ LICENSE NO.: 0024058 / 0001383		GEOLOGIST: R. Clark / S. Johnson						
SITE DESCRIPTION: PSEG SITE ESP APPLICATION				COUNTY: Salem, NJ		MACTEC PROJECT NO.: 6468-08-2251		FLUID LEVEL (ft)					
BORING NO.: NB-1		DRILL METHOD: Mud Rotary			SAMPLE METHODS: SPT			0 HR. ND					
GROUND SURFACE ELEV.: 12.8 US ft (NAVD88)		NORTHING: 234567.6 US ft (NAD83)		EASTING: 198469.1 US ft (NAD83)		24 HR. 11.0							
TOTAL DEPTH: 600.9 ft		DRILL MACHINE: CME-75 Truck			CASING DEPTH: 13.5 ft			HAMMER (ID): 140 lb Auto. (CTB-2)					
DATE STARTED: 1/13/09		COMPLETED: 2/9/09		HOLE DIA.: 4"		ROD TYPE: NWJ		BITS USED: 3-7/8" Drag Bit					
ELEV. (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION	
		0.5ft	0.5ft	0.5ft	0	20	40	60	80	100			
-99.4					Continued from previous page								
-102.2	115.0	8	10	16							SS-27		VINCENTOWN FORMATION: Silty, clayey SAND (SC-SM), greenish gray (10Y 6/1), medium dense, wet, fine to medium sand, weak HCl reaction, trace glauconite (continued) 115.0ft: Dark greenish gray (10Y 4/1)
-107.2	120.0	18	50/0.3								SS-28		HORNERSTOWN FORMATION: Silty SAND (SM), greenish gray (10Y 5/1), very dense, wet, fine to medium sand, strong HCl reaction, trace to few glauconite
-112.2	125.0	4	6	12							SS-29		125.0ft: Medium dense
-117.2	130.0	6	11	15							SS-30		
-122.2	135.0	9	11	20							SS-31		135.0ft: Dense, few to little glauconite
-127.2	140.0	16	23	25							SS-32		NAVESINK FORMATION: Clayey SAND (SC), very dark greenish gray (10GY 3/1), dense, wet, few shell fragments, strong HCl reaction, mostly glauconite
-132.2	145.0	27	36	42							SS-33		NAVESINK FORMATION: Silty SAND (SM), very dark greenish gray (10GY 3/1), very dense, wet, fine to coarse sand, few shell fragments, weak HCl reaction, mostly glauconite
-137.2	150.0	18	21	23							SS-34		NAVESINK FORMATION: Clayey SAND (SC), very dark greenish gray (10Y 3/1), dense, moist, trace shells, strong HCl reaction, mostly glauconite
-142.2	155.0	18	28	37							SS-35		NAVESINK FORMATION: Silty SAND (SM), very dark greenish gray (10Y 3/1), very dense, wet, weak HCl reaction, mostly glauconite
-147.2	160.0	23	38	44							SS-36		
-152.2	165.0	22	33	45							SS-37		MOUNT LAUREL FORMATION: Clayey SAND (SC), dark olive gray (5Y 3/2), very dense, moist to wet, fine to medium sand, few subangular to subrounded coarse sand, strong HCl reaction, trace to few glauconite

PSEG ESP BORE PSEG ESP 7-07-09 GFI PSEG ESP.GDT 7/10/09



PERMIT NO.: P200900084		DRILLER: G. McAneny / R. Bartholomew				NJ LICENSE NO.: 0024058 / 0001383		GEOLOGIST: R. Clark / S. Johnson					
SITE DESCRIPTION: PSEG SITE ESP APPLICATION				COUNTY: Salem, NJ		MACTEC PROJECT NO.: 6468-08-2251			FLUID LEVEL (ft)				
BORING NO.: NB-1		DRILL METHOD: Mud Rotary			SAMPLE METHODS: SPT			0 HR. ND					
GROUND SURFACE ELEV.: 12.8 US ft (NAVD88)		NORTHING: 234567.6 US ft (NAD83)		EASTING: 198469.1 US ft (NAD83)			24 HR. 11.0						
TOTAL DEPTH: 600.9 ft		DRILL MACHINE: CME-75 Truck			CASING DEPTH: 13.5 ft			HAMMER (ID): 140 lb Auto. (CTB-2)					
DATE STARTED: 1/13/09		COMPLETED: 2/9/09		HOLE DIA.: 4"		ROD TYPE: NWJ		BITS USED: 3-7/8" Drag Bit					
ELEV. (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION	
		0.5ft	0.5ft	0.5ft	0	20	40	60	80	100			
-155.5					Continued from previous page								
-157.2	170.0	50/0.3								50/0.3	SS-38		MOUNT LAUREL FORMATION: Clayey SAND (SC), dark olive gray (5Y 3/2), very dense, moist to wet, fine to medium sand, few subangular to subrounded coarse sand, strong HCl reaction, trace to few glauconite (continued)
-162.2	175.0	50/0.3								50/0.3	SS-39		175.0ft: Trace shell fragments
-167.2	180.0	50/0.3								50/0.3	SS-40		
-172.2	185.0	12	20	44						64	SS-41		185.0ft: Trace coarse sand S. Johnson takes over as Rlg Geologist
-177.2	190.0	13	24	35						59	SS-42		190.0ft: Dark gray (5Y 4/1), weak HCl reaction
-182.2	195.0	8	23	28						51	SS-43		195.0ft: No HCl reaction, trace glauconite
-187.2	200.0	20	80/0.5							100/1.0	SS-44		-185.2 MOUNT LAUREL FORMATION: Silty SAND (SM), dark greenish gray (5GY 4/1), very dense, wet, fine to medium sand, no HCl reaction, trace to few glauconite 198.0
-197.2	210.0	48	52/0.2							100/0.7	SS-45		-192.2 MOUNT LAUREL FORMATION: Poorly graded SAND with silt (SP-SM), dark greenish gray (10GY 4/1), very dense, wet, fine to medium sand, no HCl reaction, trace glauconite 205.0
-207.2	220.0	55	45/0.2							100/0.7	SS-46		220.0ft: Weak HCl reaction

PSEG ESP BORE PSEG ESP 7-07-09 GFI PSEG ESP GDI 7/10/09



PERMIT NO.: P200900084		DRILLER: G. McAneny / R. Bartholomew			NJ LICENSE NO.: 0024058 / 0001383		GEOLOGIST: R. Clark / S. Johnson						
SITE DESCRIPTION: PSEG SITE ESP APPLICATION				COUNTY: Salem, NJ		MACTEC PROJECT NO.: 6468-08-2251		FLUID LEVEL (ft)					
BORING NO.: NB-1		DRILL METHOD: Mud Rotary			SAMPLE METHODS: SPT			0 HR. ND					
GROUND SURFACE ELEV.: 12.8 US ft (NAVD88)		NORTHING: 234567.6 US ft (NAD83)			EASTING: 198469.1 US ft (NAD83)			24 HR. 11.0					
TOTAL DEPTH: 600.9 ft		DRILL MACHINE: CME-75 Truck			CASING DEPTH: 13.5 ft			HAMMER (ID): 140 lb Auto. (CTB-2)					
DATE STARTED: 1/13/09		COMPLETED: 2/9/09		HOLE DIA.: 4"		ROD TYPE: NWJ		BITS USED: 3-7/8" Drag Bit					
ELEV. (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION	
		0.5ft	0.5ft	0.5ft	0	20	40	60	80	100			
-211.6					Continued from previous page								
-217.2	230.0	36	64/0.3							SS-47		MOUNT LAUREL FORMATION: Poorly graded SAND with silt (SP-SM), dark greenish gray (10GY 4/1), very dense, wet, fine to medium sand, no HCl reaction, trace glauconite (continued)	
												230.0ft: Trace friable layers, no HCl reaction	
-227.2	240.0	25	38	62/0.4						SS-48		MOUNT LAUREL FORMATION: Silty SAND (SM), very dark greenish gray (5GY 3/1), very dense, wet, fine to medium sand, weak HCl reaction, trace glauconite	
												235.0	
-237.2	250.0	8	9	14						SS-49		MOUNT LAUREL FORMATION: Clayey SAND (SC), very dark gray (2.5Y 3/1), medium dense, wet, fine to medium sand, weak HCl reaction	
												246.0	
-247.2	260.0	7	17	32						SS-50		MOUNT LAUREL FORMATION: Silty SAND (SM), dark gray (5Y 4/1), dense, wet, fine sand, weak HCl reaction	
												255.0	
-257.2	270.0	5	12	14						SS-51		WENONAH FORMATION: Sandy LEAN CLAY (CL), very dark gray (N 3/), very stiff, wet, fine sand, weak HCl reaction	
												265.0	
-267.2	280.0											267.2	
												280.0	

PSEG ESP BORE PSEG ESP 7-07-09.GPJ PSEG ESP.GDT 7/10/09



PERMIT NO.: P200900084		DRILLER: G. McAneny / R. Bartholomew		NJ LICENSE NO.: 0024058 / 0001383		GEOLOGIST: R. Clark / S. Johnson							
SITE DESCRIPTION: PSEG SITE ESP APPLICATION				COUNTY: Salem, NJ		MACTEC PROJECT NO.: 6468-08-2251		FLUID LEVEL (ft)					
BORING NO.: NB-1		DRILL METHOD: Mud Rotary		SAMPLE METHODS: SPT				0 HR.	ND				
GROUND SURFACE ELEV.: 12.8 US ft (NAVD88)		NORTHING: 234567.6 US ft (NAD83)		EASTING: 198469.1 US ft (NAD83)				24 HR.	11.0				
TOTAL DEPTH: 600.9 ft		DRILL MACHINE: CME-75 Truck		CASING DEPTH: 13.5 ft		HAMMER (ID): 140 lb Auto. (CTB-2)							
DATE STARTED: 1/13/09		COMPLETED: 2/9/09		HOLE DIA.: 4"		ROD TYPE: NWJ		BITS USED: 3-7/8" Drag Bit					
ELEV. (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	▼	LOG	SOIL AND ROCK DESCRIPTION
		0.5ft	0.5ft	0.5ft	0	20	40	60	80	100			
-267.7					Continued from previous page								
		8	20	42				62			SS-52		MARSHALLTOWN FORMATION: Clayey SAND (SC), very dark gray (N 3/), very dense, wet, fine sand, trace friable zones, strong HCl reaction, trace glauconite (continued)
													285.0ft: Bit chatter to 289.0ft
													285.0
													MARSHALLTOWN FORMATION: Silty SAND (SM), very dark gray (N 3/), dense, wet, fine to medium sand, strong HCl reaction, few glauconite
-277.2	290.0	9	17	17							SS-53		
-287.2	300.0	15	32	68/0.4							SS-54		300.0ft: Greenish black (10Y 2.5/1), very dense, weak HCl reaction, trace to few glauconite
											</		

PSEG ESP BORE PSEG ESP 7-07-09.GPJ PSEG ESP.GDT 7/10/09



SHEET 7 OF 11

PERMIT NO.: P200900084		DRILLER: G. McAneny / R. Bartholomew		NJ LICENSE NO.: 0024058 / 0001383		GEOLOGIST: R. Clark / S. Johnson							
SITE DESCRIPTION: PSEG SITE ESP APPLICATION			COUNTY: Salem, NJ		MACTEC PROJECT NO.: 6468-08-2251		FLUID LEVEL (ft)						
BORING NO.: NB-1		DRILL METHOD: Mud Rotary		SAMPLE METHODS: SPT				0 HR. ND					
GROUND SURFACE ELEV.: 12.8 US ft (NAVD88)		NORTHING: 234567.6 US ft (NAD83)		EASTING: 198469.1 US ft (NAD83)				24 HR. 11.0					
TOTAL DEPTH: 600.9 ft		DRILL MACHINE: CME-75 Truck		CASING DEPTH: 13.5 ft			HAMMER (ID): 140 lb Auto. (CTB-2)						
DATE STARTED: 1/13/09		COMPLETED: 2/9/09		HOLE DIA.: 4"		ROD TYPE: NWJ		BITS USED: 3-7/8" Drag Bit					
ELEV. (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	▼	L O G	SOIL AND ROCK DESCRIPTION
		0.5ft	0.5ft	0.5ft	0	20	40	60	80	100			
-323.8					Continued from previous page								
-327.2	340.0												
		5	16	30							SS-58		ENGLISHTOWN FORMATION: FAT CLAY (CH), black (N 2.5/), hard, moist, few fine sand, weak HCl reaction (continued)
													340.0ft: Hard
-337.2	350.0												
		19	23	26							SS-59		WOODBURY FORMATION: FAT CLAY (CH), greenish black (5GY 2.5/1), hard, moist, few fine sand, trace indurated layers, no HCl reaction, trace glauconite
-347.2	360.0												
		5	10	17							SS-60		360.0ft: Very dark gray (10Y 3/1), very stiff
-357.2	370.0												
		4	9	12							SS-61		370.0ft: Trace mica, PP=4.0 tsf
-367.2	380.0												
		5	5	14							SS-62		380.0ft: Trace shell fragments, PP=4.5 tsf
-377.2	390.0												
		20	23	25							SS-63		MERCHANTVILLE FORMATION: Sandy LEAN CLAY (CL), greenish black (10GY 2.5/1), hard, moist, fine sand, no HCl reaction, few glauconite
													390.0ft: PP=3.5 tsf

PSEG ESP BORE PSEG ESP 7-07-09.GPJ PSEG ESP.GDT 7/10/09



PERMIT NO.: P200900084			DRILLER: G. McAneny / R. Bartholomew			NJ LICENSE NO.: 0024058 / 0001383			GEOLOGIST: R. Clark / S. Johnson				
SITE DESCRIPTION: PSEG SITE ESP APPLICATION					COUNTY: Salem, NJ		MACTEC PROJECT NO.: 6468-08-2251			FLUID LEVEL (ft)			
BORING NO.: NB-1		DRILL METHOD: Mud Rotary			SAMPLE METHODS: SPT			0 HR.			ND		
GROUND SURFACE ELEV.: 12.8		US ft (NAVD88)		NORTHING: 234567.6		US ft (NAD83)		EASTING: 198469.1		US ft (NAD83)		24 HR.	11.0
TOTAL DEPTH: 600.9 ft		DRILL MACHINE: CME-75 Truck			CASING DEPTH: 13.5 ft			HAMMER (ID): 140 lb Auto. (CTB-2)					
DATE STARTED: 1/13/09		COMPLETED: 2/9/09		HOLE DIA.: 4"		ROD TYPE: NWJ		BITS USED: 3-7/8" Drag Bit					
ELEV.	DEPTH	BLOW COUNT			BLOWS PER FOOT					SAMP.	LOG	SOIL AND ROCK DESCRIPTION	
(ft)	(ft)	0.5ft	0.5ft	0.5ft	0	20	40	60	80	100			NO.
-379.9					Continued from previous page								
-387.2	400.0												MERCHANTVILLE FORMATION: Sandy LEAN CLAY (CL), greenish black (10GY 2.5/1), hard, moist, fine sand, no HCl reaction, few glauconite (continued)
		15	22	30							SS-64		400.0ft: PP=4.5 tsf
-397.2	410.0												410.0ft: Black (N 2.5/), very stiff, trace glauconite, PP=3.0 tsf
		8	14	17							SS-65		415.0ft: Bit chatter to 416.0ft
-407.2	420.0												MAGOTHY FORMATION: SILT with sand (ML), gray (7.5YR 5/1), very dense, wet, fine sand, no HCl reaction
		42	58/0.3								SS-66		428.0
-417.2	430.0												MAGOTHY FORMATION: Clayey SAND (SC), dark gray (2.5Y 4/1), very dense, moist, trace of lignite
		12	27	45							SS-67		430.0ft: PP=3.0 tsf
-427.2	440.0												440.0ft: No recovery-sample pulled out, catcher inverted; replaced with steel catcher
		40	60/0.3								SS-68		441.0ft: Hard drilling to 443.0ft
													445.0
													MAGOTHY FORMATION: Silty SAND (SM), very dark gray (2.5Y 3/1), very dense, moist, fine sand, trace lignite, no HCl reaction

PSEG ESP BORE PSEG ESP 7-07-09.GPJ PSEG ESP.GDT 7/10/09



PERMIT NO.: P200900084		DRILLER: G. McAneny / R. Bartholomew		NJ LICENSE NO.: 0024058 / 0001383		GEOLOGIST: R. Clark / S. Johnson	
SITE DESCRIPTION: PSEG SITE ESP APPLICATION				COUNTY: Salem, NJ		MACTEC PROJECT NO.: 6468-08-2251	
BORING NO.: NB-1		DRILL METHOD: Mud Rotary		SAMPLE METHODS: SPT		FLUID LEVEL (ft)	
GROUND SURFACE ELEV.: 12.8 US ft (NAVD88)		NORTHING: 234567.6 US ft (NAD83)		EASTING: 198469.1 US ft (NAD83)		0 HR. ND	
TOTAL DEPTH: 600.9 ft		DRILL MACHINE: CME-75 Truck		CASING DEPTH: 13.5 ft		HAMMER (ID): 140 lb Auto. (CTB-2)	
DATE STARTED: 1/13/09		COMPLETED: 2/9/09		HOLE DIA.: 4"		ROD TYPE: NWJ	
BITS USED: 3-7/8" Drag Bit							

ELEV. (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION	
		0.5ft	0.5ft	0.5ft	0	20	40	60	80				100
-436.0					Continued from previous page								
-437.2	450.0	75	25/0.5							100/1.0	SS-69		MAGOTHY FORMATION: Silty SAND (SM), very dark gray (2.5Y 3/1), very dense, moist, fine sand, trace lignite, no HCl reaction (continued)
-456.5	469.3	24	38	42						80	SS-70		POTOMAC FORMATION: LEAN CLAY (CL), dark gray (2.5Y 4/1), hard, moist, trace fine sand seams, no HCl reaction -Top of Potomac Formation interpreted from geophysical log. 469.3 ft: PP=4.0 tsf
-477.1	489.9	100/0.2								100/0.2	SS-71		POTOMAC FORMATION: Silty SAND (SM), dark gray (2.5Y 4/1), very dense, wet, fine sand, trace lignite, no HCl reaction

PSEG ESP BORE PSEG ESP 7-07-09 GFI PSEG ESP GDI 7/10/09



SHEET 10 OF 11

PERMIT NO.: P200900084		DRILLER: G. McAneny / R. Bartholomew		NJ LICENSE NO.: 0024058 / 0001383		GEOLOGIST: R. Clark / S. Johnson	
SITE DESCRIPTION: PSEG SITE ESP APPLICATION				COUNTY: Salem, NJ		MACTEC PROJECT NO.: 6468-08-2251	
BORING NO.: NB-1		DRILL METHOD: Mud Rotary		SAMPLE METHODS: SPT		FLUID LEVEL (ft)	
GROUND SURFACE ELEV.: 12.8 US ft (NAVD88)		NORTHING: 234567.6 US ft (NAD83)		EASTING: 198469.1 US ft (NAD83)		0 HR. ND	
TOTAL DEPTH: 600.9 ft		DRILL MACHINE: CME-75 Truck		CASING DEPTH: 13.5 ft		HAMMER (ID): 140 lb Auto. (CTB-2)	
DATE STARTED: 1/13/09		COMPLETED: 2/9/09		HOLE DIA.: 4"		ROD TYPE: NWJ	
BITS USED: 3-7/8" Drag Bit							

ELEV. (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION
		0.5ft	0.5ft	0.5ft	0	20	40	60	80			
-492.1					Continued from previous page							
-496.7	509.5	100/0.3								100/0.3	SS-72	POTOMAC FORMATION: Silty SAND (SM), dark gray (2.5Y 4/1), very dense, wet, fine sand, trace lignite, no HCl reaction (continued)
												509.5ft: Dark gray (10YR 4/1), fine to medium sand
-512.2												525.0
												POTOMAC FORMATION: SILT (ML), gray (7.5YR 5/1), hard, moist, few fine sand, no HCl reaction
-516.8	529.6	100/0.5								100/0.5	SS-73AB	529.9
												POTOMAC FORMATION: Poorly graded SAND with silt (SP-SM), gray (2.5Y 6/1), very dense, wet, fine sand, no HCl reaction
												-Drill without sampling from 530.1ft to 600.0ft for geophysical testing
-525.2												538.0
												POTOMAC FORMATION: LEAN CLAY (CL)-Interpreted from geophysical log

PSEG ESP BORE PSEG ESP 7-07-09.GPJ PSEG ESP.GDT 7/10/09



GEOTECHNICAL BORING LOG

Prepared By MM Date 7/10/09Checked By MS Date 7/10/09

SHEET 1 OF 5

PERMIT NO.: P200901783		DRILLER: G. McAneny / J. Schuster		NJ LICENSE NO.: 0024058 / 482821		GEOLOGIST: S. Johnson				
SITE DESCRIPTION: PSEG SITE ESP APPLICATION				COUNTY: Salem, NJ		MACTEC PROJECT NO.: 6468-08-2251				
BORING NO.: NB-1UD		DRILL METHOD: Mud Rotary		SAMPLE METHODS: Shelby Tube/Pitcher Barrel		FLUID LEVEL (ft)				
GROUND SURFACE ELEV.: 12.7 US ft (NAVD88)		NORTHING: 234556.0 US ft (NAD83)		EASTING: 198459.0 US ft (NAD83)		0 HR. ND				
TOTAL DEPTH: 232.3 ft		DRILL MACHINE: CME-75 Truck		CASING DEPTH: 13.5 ft		24 HR. 8.5				
DATE STARTED: 3/4/09		COMPLETED: 3/13/09		HOLE DIA.: 6"		ROD TYPE: NWJ				
						BITS USED: 5-7/8" Drag Bit				
ELEV. (ft)	DEPTH (ft)	BLOW COUNT 0.5ft 0.5ft 0.5ft			BLOWS PER FOOT 0 20 40 60 80 100			SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION
12.7					Ground Surface					12.7 0.0
9.5	3.2							UD-1		10.7 2.0
										Boring drilled for collection of undisturbed samples. See boring NB-1 for complete strata and soil descriptions.
										ARTIFICIAL FILL: Not sampled
										HYDRAULIC FILL
										3.2ft: Shelby tube UD-1 pushed to 5.2ft in Sandy LEAN CLAY (CL), very dark greenish gray (10Y 3/1), wet, little fine to coarse angular gravel, no HCl reaction; recovery=1.8ft
-2.4	15.0							UD-2		15.0ft: Shelby tube UD-2 pushed to 17.0ft in FAT CLAY (CH), very dark greenish gray (10Y 3/1), wet, little organics, trace fine sand, no HCl reaction; recovery=1.4ft; TV=0.4 tsf; PP=0.5 tsf
-7.0	19.6							UD-3		19.6ft: Shelby tube UD-3 pushed to 21.6ft in ELASTIC SILT (MH), very dark greenish gray (10Y 3/1), wet, trace fine gravel, few organics, no HCl reaction; recovery=1.9ft; TV=0.3 tsf; PP=0.25 tsf
-16.9	29.5							UD-4		29.5ft: Shelby tube UD-4 pushed to 31.5ft in FAT CLAY (CH), very dark greenish gray (10Y 3/1), wet, no HCl reaction; recovery=1.7ft; TV=0.35 tsf; PP=0.25 tsf
-22.1	34.7							UD-5		34.7ft: Shelby tube UD-5 pushed to 36.7ft in FAT CLAY (CH), dark greenish gray (10Y 4/1), wet, few thin sand seams, no HCl reaction; recovery=1.9ft; TV=0.2 tsf; PP=<0.25 tsf
-26.9	39.5							UD-6		39.5ft: Shelby tube UD-6 pushed to 41.5ft; recovery=0.0ft
-30.9	43.5							UD-7		43.5ft: Shelby tube UD-7 pushed to 45.5ft in FAT CLAY (CH), dark greenish gray (10Y 4/1), wet, few thin sand seams, no HCl reaction; recovery=1.7ft; TV=0.25-0.35 tsf; PP=<0.25-0.25 tsf
										ALLUVIUM: Not sampled
-43.2	55.8									-33.4 46.0
										-42.4 55.0
										KIRKWOOD FORMATION

PSEG ESP BORE PSEG ESP 7-07-09.GPJ PSEG ESP.GDT 7/10/09



PERMIT NO.: P200901783		DRILLER: G. McAneny / J. Schuster		NJ LICENSE NO.: 0024058 / 482821		GEOLOGIST: S. Johnson	
SITE DESCRIPTION: PSEG SITE ESP APPLICATION				COUNTY: Salem, NJ		MACTEC PROJECT NO.: 6468-08-2251	
BORING NO.: NB-1UD		DRILL METHOD: Mud Rotary		SAMPLE METHODS: Shelby Tube/Pitcher Barrel		FLUID LEVEL (ft)	
GROUND SURFACE ELEV.: 12.7 US ft (NAVD88)		NORTHING: 234556.0 US ft (NAD83)		EASTING: 198459.0 US ft (NAD83)		0 HR. ND	
TOTAL DEPTH: 232.3 ft		DRILL MACHINE: CME-75 Truck		CASING DEPTH: 13.5 ft		HAMMER (ID): 140 lb Auto. (CTB-2)	
DATE STARTED: 3/4/09		COMPLETED: 3/13/09		HOLE DIA.: 6"		ROD TYPE: NWJ	
BITS USED: 5-7/8" Drag Bit							

ELEV. (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT						SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION
		0.5ft	0.5ft	0.5ft	0	20	40	60	80	100			
-43.5					Continued from previous page								
-46.5	59.1										UD-8		55.8ft: Shelby tube UD-8 pushed to 57.8ft in Sandy LEAN CLAY (CL), very dark gray (5Y 3/1), wet, trace gravel, no HCl reaction; recovery=1.9ft; TV=0.6 tsf; PP=0.75 tsf
-49.4	62.0										UD-9		KIRKWOOD FORMATION (continued) 59.1ft: Shelby tube UD-9 pushed to 61.1ft; recovery=0.0ft-lost tube in hole
-55.5	68.1										UD-10		62.0ft: Shelby tube UD-10 pushed to 64.0ft in FAT CLAY (CH), very dark gray (5Y 3/1) wet, no HCl reaction to 63.0ft, then Silty SAND (SM), olive gray (5Y 5/2), wet, fine sand, no HCl reaction; recovery=1.8ft -Change sample method to Pitcher Barrel Sampler
-59.4	72.0										UD-11		68.1ft: Pitcher tube UD-11 advanced to 70.6ft; recovery=0.0ft
-62.4	75.0										UD-12		VINCENNTOWN FORMATION 72.0ft: Pitcher tube UD-12 advanced to 74.5ft in Silty SAND (SM), brown (7.5YR 4/3), wet, strong HCl reaction; recovery=1.0ft
-65.4	78.0										UD-13		75.0ft: Pitcher tube UD-13 advanced to 77.5ft in Silty SAND (SM), yellowish brown (10YR 5/6) wet, fine sand, strong HCl reaction; recovery=1.4ft
-68.4	81.0										UD-14		78.0ft: Pitcher tube UD-14 advanced to 80.5ft in Silty SAND (SM), light gray (2.5Y 7/2), wet, fine sand, strong HCl reaction; recovery=1.3ft
-71.9	84.5										UD-15		81.0ft: Pitcher tube UD-15 advanced to 83.5ft in Silty SAND (SM), yellowish brown (10YR 5/4), wet, fine sand, few indurated zones, strong HCl reaction; recovery=1.7ft
-76.0	88.6										UD-16		84.5ft: Pitcher tube UD-16 advanced to 86.8ft in Silty SAND (SM), yellowish brown (10YR 5/4), wet, fine sand, few indurated zones, strong HCl reaction; recovery=1.2ft
-80.0	92.6										UD-17		88.6ft: Pitcher tube UD-17 advanced to 91.1ft in Silty SAND (SM), greenish gray (10GY 5/1), wet, fine sand, few indurated zones, strong HCl reaction; recovery=1.7ft
-83.8	96.4										UD-18		92.6ft: Pitcher tube UD-18 advanced to 95.1ft in Silty SAND (SM), greenish gray (10GY 5/1), wet, fine sand, few indurated zones, strong HCl reaction; recovery=1.4ft
-88.0	100.6										UD-19		96.4ft: Pitcher tube UD-19 advanced to 98.9ft in Silty SAND (SM), greenish gray (10GY 5/1), wet, fine sand, strong HCl reaction; recovery=2.1ft
-91.7	104.3										UD-20		100.6ft: Pitcher tube UD-20 advanced to 103.1ft in Silty SAND (SM), greenish gray (10GY 5/1), wet, fine sand, mostly indurated, strong HCl reaction; recovery=0.5ft
-94.6	107.2										UD-21		104.3ft: Pitcher tube UD-21 advanced to 106.5ft in Silty SAND (SM), greenish gray (10GY 5/1), wet, fine sand, few indurated to friable zones, strong HCl reaction; recovery=2.0ft
											UD-22		107.2ft: Pitcher tube UD-22 advanced to 108.7ft in Silty SAND (SM), greenish gray (10GY 5/1), wet, fine sand, few indurated zones, strong HCl reaction, trace glauconite; recovery=1.0ft

PSEG ESP BORE PSEG ESP 7-07-09.GPJ PSEG ESP.GDT 7/10/09



PERMIT NO.: P200901783		DRILLER: G. McAneny / J. Schuster		NJ LICENSE NO.: 0024058 / 482821		GEOLOGIST: S. Johnson	
SITE DESCRIPTION: PSEG SITE ESP APPLICATION				COUNTY: Salem, NJ		MACTEC PROJECT NO.: 6468-08-2251	
BORING NO.: NB-1UD		DRILL METHOD: Mud Rotary		SAMPLE METHODS: Shelby Tube/Pitcher Barrel			
GROUND SURFACE ELEV.: 12.7 US ft (NAVD88)		NORTHING: 234556.0 US ft (NAD83)		EASTING: 198459.0 US ft (NAD83)		FLUID LEVEL (ft) 0 HR. ND 24 HR. 8.5	
TOTAL DEPTH: 232.3 ft		DRILL MACHINE: CME-75 Truck		CASING DEPTH: 13.5 ft		HAMMER (ID): 140 lb Auto. (CTB-2)	
DATE STARTED: 3/4/09		COMPLETED: 3/13/09		HOLE DIA.: 6"		ROD TYPE: NWJ	
BITS USED: 5-7/8" Drag Bit							

ELEV. (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT						SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION
		0.5ft	0.5ft	0.5ft	0	20	40	60	80	100			
-99.6					Continued from previous page								
-99.9	112.5										UD-23		VINCENTOWN FORMATION (continued) 112.5ft: Pitcher tube UD-23 advanced to 114.4ft in Silty SAND (SM), greenish gray (10GY 5/1), wet, fine sand, few indurated zones, strong HCl reaction; recovery=0.8ft
-108.9	121.5										UD-24		121.5ft: Pitcher tube UD-24 advanced to 124.0ft in Poorly graded SAND with silt (SP-SM), greenish gray (10GY 5/1), wet, fine sand, few indurated zones, strong HCl reaction, trace glauconite; recovery=2.4ft
-113.0	125.6										UD-25		125.6ft: Pitcher tube UD-25 advanced to 128.1ft in Silty SAND (SM), greenish gray (10GY 5/1), wet, fine sand, strong HCl reaction, trace glauconite; recovery=2.2ft
-117.1	129.7										UD-26		129.7ft: Pitcher tube UD-26 advanced to 132.2ft in Silty SAND (SM), greenish gray (10GY 5/1), wet, fine sand, few indurated zones, weak HCl reaction, trace glauconite; recovery=1.1ft
-127.4	140.0										UD-27		140.0ft: Pitcher tube UD-27 advanced to 142.5ft in Silty SAND (SM), very dark grayish green (5G 3/2), wet, fine sand, strong HCl reaction, mostly glauconite; recovery=2.3ft
-131.3	143.9										UD-28		143.9ft: Pitcher tube UD-28 advanced to 146.4ft in Silty SAND (SM), very dark grayish green (5G 3/2), wet, fine sand, strong HCl reaction, trace shell fragments, mostly glauconite; recovery=2.4ft
-135.0	147.6										UD-29		147.6ft: Pitcher tube UD-29 advanced to 150.1ft in Clayey SAND (SC), very dark grayish green (5G 3/2), wet, fine sand, strong HCl reaction, little shell fragments, mostly glauconite; recovery=0.8ft
-139.5	152.1										UD-30		152.1ft: Pitcher tube UD-30 advanced to 154.6ft in Clayey SAND (SC), greenish black (5G 2.5/1), wet, fine sand, weak HCl reaction, trace shell fragments, mostly glauconite; recovery=1.3ft
-143.3	155.9										UD-31		155.9ft: Pitcher tube UD-31 advanced to 158.4ft in Silty SAND (SM), very dark grayish green (5G 3/2), wet, fine sand, strong HCl reaction, mostly glauconite; recovery=1.9ft
-147.5	160.1										UD-32		160.1ft: Pitcher tube UD-32 advanced to 162.6ft in Clayey SAND (SM), very dark grayish green (5G 3/2), to black (5Y 2.5/1), wet, fine sand, strong HCl reaction, little shell fragments, mostly glauconite; recovery=2.3ft
-150.7	163.3										UD-33		163.3ft: Pitcher tube UD-33 advanced to 165.8ft in Clayey SAND (SC), very dark gray (5Y 3/1), moist, fine to coarse sand, trace gravel, strong HCl reaction; recovery=1.6ft
-154.9	167.5										UD-34		

PSEG ESP BORE PSEG ESP 7-07-09 GFI PSEG ESP GDT 7/10/09



PERMIT NO.: P200901783		DRILLER: G. McAneny / J. Schuster		NJ LICENSE NO.: 0024058 / 482821		GEOLOGIST: S. Johnson	
SITE DESCRIPTION: PSEG SITE ESP APPLICATION				COUNTY: Salem, NJ		MACTEC PROJECT NO.: 6468-08-2251	
BORING NO.: NB-1UD		DRILL METHOD: Mud Rotary		SAMPLE METHODS: Shelby Tube/Pitcher Barrel		FLUID LEVEL (ft)	
GROUND SURFACE ELEV.: 12.7 US ft (NAVD88)		NORTHING: 234556.0 US ft (NAD83)		EASTING: 198459.0 US ft (NAD83)		0 HR. ND	
TOTAL DEPTH: 232.3 ft		DRILL MACHINE: CME-75 Truck		CASING DEPTH: 13.5 ft		HAMMER (ID): 140 lb Auto. (CTB-2)	
DATE STARTED: 3/4/09		COMPLETED: 3/13/09		HOLE DIA.: 6"		ROD TYPE: NWJ	
BITS USED: 5-7/8" Drag Bit							

ELEV. (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT						SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION
		0.5ft	0.5ft	0.5ft	0	20	40	60	80	100			
-155.7					Continued from previous page								
-170.9	183.5										UD-35		167.5ft: Pitcher tube UD-34 advanced to 168.9ft in Clayey SAND (SC), dark olive gray (5Y 3/2), moist, fine to coarse sand, strong HCl reaction; recovery=1.1ft MOUNT LAUREL FORMATION (continued)
-175.6	188.2										UD-36		183.5ft: Pitcher tube UD-35 advanced to 186.0ft in Silty SAND (SM), dark olive gray (5Y 3/2), moist, fine to coarse sand, trace fine gravel, strong HCl reaction, trace glauconite; recovery=1.8ft
-204.2	216.8										UD-37		188.2ft: Pitcher tube UD-36 advanced to 190.7ft in Silty SAND (SM), dark olive gray (5Y 3/2), wet, fine to coarse sand, trace fine gravel, strong HCl reaction, trace glauconite; recovery=1.1ft
-209.2	221.8										UD-38		216.8ft: Pitcher tube UD-37 advanced to 219.3ft in Poorly graded SAND with silt (SP-SM), dark greenish gray (10GY 4/1), wet, fine to medium sand, no HCl reaction, trace glauconite; recovery=1.8ft
													221.8ft: Pitcher tube UD-38 advanced to 224.3ft in Poorly graded SAND with silt (SP-SM), dark greenish gray (10GY 4/1), wet, fine to coarse sand, no HCl

PSEG ESP BORE PSEG ESP 7-07-09 GPI PSEG ESP GDI 7/10/09



SHEET 5 OF 5

PERMIT NO.: P200901783		DRILLER: G. McAneny / J. Schuster		NJ LICENSE NO.: 0024058 / 482821		GEOLOGIST: S. Johnson									
SITE DESCRIPTION: PSEG SITE ESP APPLICATION				COUNTY: Salem, NJ		MACTEC PROJECT NO.: 6468-08-2251									
BORING NO.: NB-1UD		DRILL METHOD: Mud Rotary		SAMPLE METHODS: Shelby Tube/Pitcher Barrel		FLUID LEVEL (ft)									
GROUND SURFACE ELEV.: 12.7 US ft (NAVD88)		NORTHING: 234556.0 US ft (NAD83)		EASTING: 198459.0 US ft (NAD83)		0 HR. ND									
TOTAL DEPTH: 232.3 ft		DRILL MACHINE: CME-75 Truck		CASING DEPTH: 13.5 ft		HAMMER (ID): 140 lb Auto. (CTB-2)									
DATE STARTED: 3/4/09		COMPLETED: 3/13/09		HOLE DIA.: 6"		ROD TYPE: NWJ									
BITS USED: 5-7/8" Drag Bit															
ELEV. (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT						SAMP. NO.	▼	L O G	SOIL AND ROCK DESCRIPTION	
		0.5ft	0.5ft	0.5ft	0	20	40	60	80	100					
-211.8					Continued from previous page										
-217.2	229.8										UD-39			reaction, trace glauconite; recovery=2.0ft MOUNT LAUREL FORMATION (continued)	
														229.8ft: Pitcher tube UD-39 advanced to 232.3ft in Poorly graded SAND with silt (SP-SM), dark greenish gray (10GY 4/1), wet, fine sand, weak HCl reaction, trace glauconite; recovery=1.4ft Boring terminated at 232.3 feet.	
														Boring closed by tremie method with cement-bentonite grout on 3/13/09.	



GEOTECHNICAL BORING LOG

Prepared By MAN Date 7/10/09Checked By JAS Date 7/10/09

SHEET 1 OF 1

PERMIT NO.: P200905732		DRILLER: M. Adams		NJ LICENSE NO.: 0001350		GEOLOGIST: M. Lear							
SITE DESCRIPTION: PSEG SITE ESP APPLICATION				COUNTY: Salem, NJ		MACTEC PROJECT NO.: 6468-08-2251							
BORING NO.: CH NB-1A		DRILL METHOD: Mud Rotary		SAMPLE METHODS: NA		FLUID LEVEL (ft)							
GROUND SURFACE ELEV.: 12.8 US ft (NAVD88)		NORTHING: 234544.4 US ft (NAD83)		EASTING: 198483.1 US ft (NAD83)		0 HR. ND							
TOTAL DEPTH: 201.0 ft		DRILL MACHINE: IR-T2W		CASING DEPTH: NA		HAMMER (ID): NA							
DATE STARTED: 5/18/09		COMPLETED: 5/18/09		HOLE DIA.: 8"		ROD TYPE: 3.5" IR Rod							
						BITS USED: 7-7/8" Drag Bit							
ELEV. (ft)	DEPTH (ft)	BLOW COUNT 0.5ft 0.5ft 0.5ft			BLOWS PER FOOT 0 20 40 60 80 100					SAMP. NO.	▼	L O G	SOIL AND ROCK DESCRIPTION
12.8					Ground Surface								12.8 0.0
													Boring drilled for installation of crosshole seismic casing. See boring NB-1 for strata and soil descriptions. Installed flush-jointed 4" Schedule 40 PVC casing with end cap from ground surface to 200.1 feet. -Steel centralizers installed at approximately 195, 145, 95, 45, and 5 feet below ground surface. -PVC casing held down/in place with 200 feet of NWJ drill rod set inside casing during grouting. -Annulus grouted via tremie method to ground surface with cement-bentonite grout per NJDEP regulations. -Approximately 2 feet of PVC casing sticking up above ground surface at completion.
													-188.2 201.0
													Boring terminated at 201.0 feet and crosshole seismic casing installed. For strata and soil descriptions see geotechnical boring NB-1.

PSEG ESP BORE PSEG ESP 7-07-09 GPJ PSEG ESP GDI 7/10/09

GEOTECHNICAL BORING LOG

Prepared By M/M Date 7/10/09

Checked By ADL Date 7/10/09

SHEET 1 OF 1

PERMIT NO.: P200905733						DRILLER: M. Adams						NJ LICENSE NO.: 0001350						GEOLOGIST: M. Lear											
SITE DESCRIPTION: PSEG SITE ESP APPLICATION												COUNTY: Salem, NJ						MACTEC PROJECT NO.: 6468-08-2251						FLUID LEVEL (ft)					
BORING NO.: CH NB-1B						DRILL METHOD: Mud Rotary						SAMPLE METHODS: NA						0 HR. ND											
GROUND SURFACE ELEV.: 13.0 US ft (NAVD88)						NORTHING: 234537.1 US ft (NAD83)						EASTING: 198476.0 US ft (NAD83)						24 HR. ND											
TOTAL DEPTH: 201.0 ft						DRILL MACHINE: IR-T2W						CASING DEPTH: NA						HAMMER (ID): NA											
DATE STARTED: 5/19/09						COMPLETED: 5/19/09						HOLE DIA.: 8"						ROD TYPE: 3.5" IR Rod BITS USED: 7-7/8" Drag Bit											
ELEV.		DEPTH		BLOW COUNT			BLOWS PER FOOT						SAMP.				L		SOIL AND ROCK DESCRIPTION										
(ft)		(ft)		0.5ft 0.5ft 0.5ft			0 20 40 60 80 100						NO.		O G														
13.0							Ground Surface												13.0 0.0										
																			<p>Boring drilled for installation of crosshole seismic casing. See boring NB-1 for strata and soil descriptions.</p> <p>Installed flush-jointed 4" Schedule 40 PVC casing with end cap from ground surface to 200.0 feet.</p> <p>-Steel centralizers installed at approximately 195, 145, 95, 45, and 5 feet below ground surface.</p> <p>-PVC casing held down/in place with 200 feet of NWJ drill rod set inside casing during grouting.</p> <p>-Annulus grouted via tremie method to ground surface with cement-bentonite grout per NJDEP regulations.</p> <p>-Approximately 2 feet of PVC casing sticking up above ground surface at completion.</p>										
																			-188.0 201.0										
																			<p>Boring terminated at 201.0 feet and crosshole seismic casing installed.</p> <p>For strata and soil descriptions see geotechnical boring NB-1.</p>										



GEOTECHNICAL BORING LOG

Prepared By MM Date 7/10/09

Checked By JAS Date 7/10/09

SHEET 1 OF 6

PERMIT NO.: P200900085		DRILLER: T. Ward		NJ LICENSE NO.: 0001105		GEOLOGIST: J. Howard / S. Johnson							
SITE DESCRIPTION: PSEG SITE ESP APPLICATION			COUNTY: Salem, NJ		MACTEC PROJECT NO.: 6468-08-2251		FLUID LEVEL (ft)						
BORING NO.: NB-2		DRILL METHOD: Mud Rotary		SAMPLE METHODS: SPT/Shelby Tube		0 HR. ND							
GROUND SURFACE ELEV.: 8.2		US ft (NAVD88)		NORTHING: 235205.0 US ft (NAD83)		EASTING: 197764.7 US ft (NAD83)		24 HR. ND					
TOTAL DEPTH: 301.5 ft		DRILL MACHINE: CME-75 Truck		CASING DEPTH: 14.0 ft		HAMMER (ID): 140 lb Auto. (CBT-1)							
DATE STARTED: 2/20/09		COMPLETED: 3/4/09		HOLE DIA.: 4"		ROD TYPE: NWJ		BITS USED: 3-7/8" Drag Bit					
ELEV.	DEPTH	BLOW COUNT			BLOWS PER FOOT					SAMP.	LOG	SOIL AND ROCK DESCRIPTION	
(ft)	(ft)	0.5ft	0.5ft	0.5ft	0	20	40	60	80	100			NO.
8.2					Ground Surface								
8.2	0.0	6	7	8						SS-1		8.2	ARTIFICIAL FILL: Sandy CLAY (CL), very dark brown (10YR 2/2), stiff, moist, weak HCl reaction
5.7	2.5	6	6	9						SS-2		4.2	2.5ft: Very dark grayish brown (10YR 3/2), no HCl reaction
3.8	4.4									UD-1		4.2	HYDRAULIC FILL: Sandy CLAY (CL), very dark grayish brown (10YR 3/2), very soft, moist, no HCl reaction
1.2	7.0	1	WOH	1						SS-3		2.2	Pushed shelby tube UD-1 from 4.4ft to 6.4ft; recovery=0.2ft
-0.8	9.0									UD-2			HYDRAULIC FILL: FAT CLAY (CH), black (N 2.5/), very soft, moist, trace fine sand, no HCl reaction
-3.3	11.5									UD-3			9.0ft: Pushed shelby tube UD-2 to 11.0ft; recovery=0.0ft
-5.8	14.0	WOH	WOH	WOH						SS-4			11.5ft: Pushed shelby tube UD-3 to 13.5ft; recovery=0.0ft
		WOH	WOH	WOH									14.0ft: Trace mica, PP=0.0 tsf
-11.7	19.9	WOH	WOH	WOH						SS-5			
-16.8	25.0	WOH	WOH	2						SS-6			25.0ft: Soft
-21.8	30.0	2	2	2						SS-7			30.0ft: PP=0.0 tsf
-23.9	32.1									UD-4			32.1ft: Pushed shelby tube UD-4 to 34.1ft; recovery=1.9ft
-26.8	35.0	WOH	1	WOH						SS-8			35.0ft: Very soft, trace fine sand lenses
-31.8	40.0	1	2	1						SS-9			40.0ft: Very dark gray (N 3/), soft
-36.8	45.0	4	3	4						SS-10		-35.3	ALLUVIUM: Clayey SAND (SC), very dark gray (N 3/), loose, moist, no HCl reaction
-41.7	49.9	WOH	1	1						SS-11A/B		-39.8	ALLUVIUM: PEAT (PT), brown (10YR 4/3), very soft, moist
-46.8	55.0	5	5	9						SS-12		-42.3	ALLUVIUM: Silty SAND (SM), dark gray (N 4/), very loose, wet, fine to medium sand, no HCl reaction
													55.0ft: Medium dense

PSEG ESP BORE PSEG ESP 7-07-09 GFI PSEG ESP.GDT 7/10/09



SHEET 2 OF 6

PERMIT NO.: P200900085		DRILLER: T. Ward		NJ LICENSE NO.: 0001105		GEOLOGIST: J. Howard / S. Johnson							
SITE DESCRIPTION: PSEG SITE ESP APPLICATION			COUNTY: Salem, NJ		MACTEC PROJECT NO.: 6468-08-2251		FLUID LEVEL (ft)						
BORING NO.: NB-2		DRILL METHOD: Mud Rotary		SAMPLE METHODS: SPT/Shelby Tube			0 HR. ND						
GROUND SURFACE ELEV.: 8.2		US ft (NAVD88)		NORTHING: 235205.0 US ft (NAD83)		EASTING: 197764.7 US ft (NAD83)		24 HR. ND					
TOTAL DEPTH: 301.5 ft		DRILL MACHINE: CME-75 Truck		CASING DEPTH: 14.0 ft			HAMMER (ID): 140 lb Auto. (CBT-1)						
DATE STARTED: 2/20/09		COMPLETED: 3/4/09		HOLE DIA.: 4"		ROD TYPE: NWJ		BITS USED: 3-7/8" Drag Bit					
ELEV. (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION	
		0.5ft	0.5ft	0.5ft	0	20	40	60	80	100			
-47.9					Continued from previous page								
-51.7	59.9	5	9	12							SS-13		ALLUVIUM: Silty SAND (SM), dark gray (N 4/), very loose, wet, fine to medium sand, no HCl reaction (continued)
-56.9	65.1	12	12	7							SS-14AB	-57.8	59.9ft: Greenish gray (10Y 5/1), fine to coarse subrounded sand, trace gravel
-61.8	70.0	7	4	4							SS-15		KIRKWOOD FORMATION: Silty SAND (SM), dark greenish gray (10GY 4/1), medium dense, wet, fine to medium sand, no HCl reaction
-67.1	75.3	3	2	3							SS-16		70.0ft: Dark yellowish brown (10YR 4/4), loose
-71.8	80.0	13	19	10							SS-17		75.3ft: Greenish gray (10GY 5/1), loose, trace glauconite
-73.9	82.1										UD-5	-69.8	VINCENNTOWN FORMATION: Silty SAND (SM), light yellowish brown (2.5Y 6/3), medium dense, wet, fine to medium sand, few friable to indurated zones, strong HCl reaction, strongly oxidized
-76.8	85.0	15	5	6							SS-18		82.1ft: Pushed shelby tube UD-5 to 84.1ft; recovery=1.9 ft
-78.7	86.9										UD-6		85.0ft: Brown (10YR 5/3), moist, trace moderately indurated layers, moderately oxidized
-81.9	90.1	4	4	7							SS-19		86.9ft: Pushed shelby tube UD-6 to 87.1ft; recovery=0.1ft (Refused on indurated layer)
-83.8	92.0										UD-7		90.1ft: Grayish brown (10YR 5/2), wet, trace glauconite, weakly oxidized
-86.9	95.1	5	4	27							SS-20		92.0ft: Shelby tube UD-7 pushed to 93.4ft; recovery=1.4ft
-91.8	100.0	5	6	15							SS-21		95.1ft: Light grayish brown (10YR 6/2), dense, trace friable to moderately indurated layers
-96.8	105.0	8	8	17							SS-22		100.0ft: Dark greenish gray (10Y 4/1), medium dense, no oxidation
-101.8	110.0	16	11	14							SS-23		

PSEG ESP BORE PSEG ESP 7-07-09 GPI PSEG ESP GDI 7/10/09



PERMIT NO.: P200900085		DRILLER: T. Ward		NJ LICENSE NO.: 0001105		GEOLOGIST: J. Howard / S. Johnson							
SITE DESCRIPTION: PSEG SITE ESP APPLICATION			COUNTY: Salem, NJ		MACTEC PROJECT NO.: 6468-08-2251		FLUID LEVEL (ft)						
BORING NO.: NB-2		DRILL METHOD: Mud Rotary		SAMPLE METHODS: SPT/Shelby Tube		0 HR. ND							
GROUND SURFACE ELEV.: 8.2		US ft (NAVD88)		NORTHING: 235205.0 US ft (NAD83)		EASTING: 197764.7 US ft (NAD83)		24 HR. ND					
TOTAL DEPTH: 301.5 ft		DRILL MACHINE: CME-75 Truck		CASING DEPTH: 14.0 ft		HAMMER (ID): 140 lb Auto. (CBT-1)							
DATE STARTED: 2/20/09		COMPLETED: 3/4/09		HOLE DIA.: 4"		ROD TYPE: NWJ		BITS USED: 3-7/8" Drag Bit					
ELEV. (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION	
		0.5ft	0.5ft	0.5ft	0	20	40	60	80	100			
-104.0					Continued from previous page								
-106.8	115.0	21	14	19							SS-24		-104.8 HORNERSTOWN FORMATION: Silty SAND (SM), dark greenish gray (10Y 4/1), dense, wet, fine to medium sand, trace friable layers, strong HCl reaction, few to little glauconite 113.0
-111.8	120.0	7	9	15							SS-25	120.0ft: Medium dense	
-116.8	125.0	6	13	20							SS-26	125.0ft: Very dark greenish gray (10GY 3/1), dense, few shell fragments, some glauconite	
-121.7	129.9	18	24	25							SS-27	129.9ft: NAVESINK FORMATION: Silty SAND (SM), very dark grayish green (5G 2.5/2), dense, moist, fine sand, trace shell fragments, weak HCl reaction, mostly glauconite 129.0	
-126.7	134.9	23	30	45							SS-28	134.9ft: Greenish black (5G 2.5/1), very dense, wet, fine to medium sand, few shell fragments	
-131.8	140.0	19	25	31							SS-29	140.0ft: Trace shell fragments	
-136.8	145.0	19	29	36							SS-30		
-141.7	149.9	22	29	38							SS-31	149.9ft: No HCl reaction	
-146.8	155.0	100/0.5									SS-32	155.0ft: MOUNT LAUREL FORMATION: Silty, Clayey SAND (SC-SM), dark grayish brown (10YR 4/2), very dense, moist, fine to coarse subrounded sand, strong HCl reaction, little glauconite 153.0	
-151.7	159.9	100/0.2									SS-33	159.9ft: Greenish gray (10Y 5/1), dry, trace shell fragments	
-156.8	165.0	100/0.3									SS-34	165.0ft: Moist, few shell fragments, no HCl reaction	

PSEG ESP BORE PSEG ESP 7-07-09 GFI PSEG ESP GDI 7/10/09



PERMIT NO.: P200900085		DRILLER: T. Ward		NJ LICENSE NO.: 0001105		GEOLOGIST: J. Howard / S. Johnson									
SITE DESCRIPTION: PSEG SITE ESP APPLICATION				COUNTY: Salem, NJ		MACTEC PROJECT NO.: 6468-08-2251		FLUID LEVEL (ft)							
BORING NO.: NB-2		DRILL METHOD: Mud Rotary		SAMPLE METHODS: SPT/Shelby Tube		0 HR.		ND							
GROUND SURFACE ELEV.: 8.2		US ft (NAVD88)		NORTHING: 235205.0		US ft (NAD83)		EASTING: 197764.7		US ft (NAD83)		24 HR.		ND	
TOTAL DEPTH: 301.5 ft		DRILL MACHINE: CME-75 Truck		CASING DEPTH: 14.0 ft		HAMMER (ID): 140 lb Auto. (CBT-1)									
DATE STARTED: 2/20/09		COMPLETED: 3/4/09		HOLE DIA.: 4"		ROD TYPE: NWJ		BITS USED: 3-7/8" Drag Bit							
ELEV.	DEPTH	BLOW COUNT			BLOWS PER FOOT					SAMP.	▼	LOG	SOIL AND ROCK DESCRIPTION		
(ft)	(ft)	0.5ft	0.5ft	0.5ft	0	20	40	60	80	100					NO.
-160.1		Continued from previous page													
-161.8	170.0	100/0.3									100/0.3	SS-35		MOUNT LAUREL FORMATION: Silty, Clayey SAND (SC-SM), dark grayish brown (10YR 4/2), very dense, moist, fine to coarse subrounded sand, strong HCl reaction, little glauconite (continued)	
-166.8	175.0	19	33	60								SS-36		175.0ft: Strong HCl reaction, few glauconite	
-171.8	180.0	16	25	30								SS-37			
-176.8	185.0	15	24	35								SS-38		185.0ft: Greenish gray (10Y 6/1)	
-181.8	190.0	39	61/0.5									SS-39		MOUNT LAUREL FORMATION: Silty SAND (SM), greenish gray (5GY 5/1), very dense, dry, fine to medium sand, trace indurated layers, strong HCl reaction, trace glauconite	
-186.9	195.1	57	43/0.3									SS-40		195.1ft: Moist, no HCl reaction	
-191.8	200.0	80	20/0.1									SS-41		200.0ft: Weak HCl reaction	
-201.8	210.0	52	48/0.3									SS-42			
-211.7	219.9	40	60/0.5									SS-43		219.9ft: Strong HCl reaction	

PSEG ESP BORE PSEG ESP 7-07-09 GFI PSEG ESP GDI 7/10/09



PERMIT NO.: P200900085		DRILLER: T. Ward		NJ LICENSE NO.: 0001105		GEOLOGIST: J. Howard / S. Johnson							
SITE DESCRIPTION: PSEG SITE ESP APPLICATION				COUNTY: Salem, NJ		MACTEC PROJECT NO.: 6468-08-2251		FLUID LEVEL (ft)					
BORING NO.: NB-2		DRILL METHOD: Mud Rotary			SAMPLE METHODS: SPT/Shelby Tube			0 HR. ND					
GROUND SURFACE ELEV.: 8.2		US ft (NAVD88)		NORTHING: 235205.0		US ft (NAD83)		EASTING: 197764.7 US ft (NAD83)		24 HR. ND			
TOTAL DEPTH: 301.5 ft		DRILL MACHINE: CME-75 Truck			CASING DEPTH: 14.0 ft			HAMMER (ID): 140 lb Auto. (CBT-1)					
DATE STARTED: 2/20/09		COMPLETED: 3/4/09		HOLE DIA.: 4"		ROD TYPE: NWJ		BITS USED: 3-7/8" Drag Bit					
ELEV. (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	▼	L O G	SOIL AND ROCK DESCRIPTION
		0.5ft	0.5ft	0.5ft	0	20	40	60	80	100			
-216.2					Continued from previous page								
-221.8	230.0	8	20	35						SS-44			MOUNT LAUREL FORMATION: Silty SAND (SM), greenish gray (5GY 5/1), very dense, dry, fine to medium sand, trace indurated layers, strong HCl reaction, trace glauconite (continued)
-231.8	240.0	9	19	28						SS-45			230.0ft: Greenish black (10Y 2.5/1), trace mica
-241.8	250.0	10	14	26						SS-46			240.0ft: Dense
-251.8	260.0	11	16	21						SS-47			-249.8 WENONAH FORMATION: Sandy LEAN CLAY (CL), greenish black (10Y 2.5/1), hard, moist, strong HCl reaction, trace mica, trace to few glauconite
-261.8	270.0	7	16	24						SS-48			-259.8 WENONAH FORMATION: Silty, Clayey SAND (SC-SM), greenish black (10Y 2.5/1), dense, moist, fine to medium sand, strong HCl reaction, trace to few glauconite
-271.8	280.0												-264.8 MARSHALLTOWN FORMATION: Sandy LEAN CLAY (CL), black (N 2.5/), very stiff, moist, strong HCl reaction, trace glauconite

PSEG ESP BORE PSEG ESP 7-07-09.GPJ PSEG ESP.GDT 7/10/09



PERMIT NO.: P200900085		DRILLER: T. Ward		NJ LICENSE NO.: 0001105		GEOLOGIST: J. Howard / S. Johnson	
SITE DESCRIPTION: PSEG SITE ESP APPLICATION				COUNTY: Salem, NJ		MACTEC PROJECT NO.: 6468-08-2251	
BORING NO.: NB-2		DRILL METHOD: Mud Rotary		SAMPLE METHODS: SPT/Shelby Tube		FLUID LEVEL (ft)	
GROUND SURFACE ELEV.: 8.2		US ft (NAVD88)		NORTHING: 235205.0		US ft (NAD83)	
EASTING: 197764.7		US ft (NAD83)		24 HR.		ND	
TOTAL DEPTH: 301.5 ft		DRILL MACHINE: CME-75 Truck		CASING DEPTH: 14.0 ft		HAMMER (ID): 140 lb Auto. (CBT-1)	
DATE STARTED: 2/20/09		COMPLETED: 3/4/09		HOLE DIA.: 4"		ROD TYPE: NWJ	
BITS USED: 3-7/8" Drag Bit							

ELEV. (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT	SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION
		0.5ft	0.5ft	0.5ft				
-272.3								Continued from previous page
		9	11	15	26	SS-49		MARSHALLTOWN FORMATION: Sandy LEAN CLAY (CL), black (N 2.5/), very stiff, moist, strong HCl reaction, trace glauconite (continued)
-281.8	290.0	16	22	34	56	SS-50		MARSHALLTOWN FORMATION: Silty SAND (SM), black (N 2.5/), very dense, moist, fine to medium sand, strong HCl reaction, trace glauconite
-291.8	300.0	7	11	17	28	SS-51		ENGLISHTOWN FORMATION: Sandy LEAN CLAY (CL), black (N 2.5/), very stiff, moist, trace shell fragments, no HCl reaction
								Boring terminated at 301.5 feet.
								Boring closed by tremie method with cement-bentonite grout on 3/05/09.



GEOTECHNICAL BORING LOG

Prepared By nan Date 7/10/09Checked By Jon Date 7/10/09

SHEET 1 OF 4

PERMIT NO.: P200900086		DRILLER: R. Bartholomew			NJ LICENSE NO.: 0001383			GEOLOGIST: S. Johnson					
SITE DESCRIPTION: PSEG SITE ESP APPLICATION				COUNTY: Salem, NJ		MACTEC PROJECT NO.: 6468-08-2251			FLUID LEVEL (ft)				
BORING NO.: NB-3		DRILL METHOD: Mud Rotary			SAMPLE METHODS: SPT			0 HR. ND					
GROUND SURFACE ELEV.: 7.4		US ft (NAVD88)		NORTHING: 234554.7		US ft (NAD83)		EASTING: 197895.8		US ft (NAD83)		24 HR. 9.0	
TOTAL DEPTH: 200.3 ft		DRILL MACHINE: CME-75 Truck			CASING DEPTH: 13.7 ft			HAMMER (ID): 140 lb Auto. (CTB-2)					
DATE STARTED: 2/17/09		COMPLETED: 2/20/09		HOLE DIA.: 4"		ROD TYPE: NWJ		BITS USED: 3-7/8" Drag Bit					
ELEV.	DEPTH	BLOW COUNT			BLOWS PER FOOT					SAMP.	LOG	SOIL AND ROCK DESCRIPTION	
(ft)	(ft)	0.5ft	0.5ft	0.5ft	0	20	40	60	80	100			NO.
7.4					Ground Surface							7.4	0.0
7.4	0.0	8	14	25						SS-1		ARTIFICIAL FILL: Silty SAND (SM), light olive brown (2.5Y 5/3), dense, moist, fine to coarse sand, little angular gravel, weak HCl reaction	
4.9	2.5	2	6	5						SS-2			
												2.5ft: Black (N 2.5/), medium dense, fine to medium sand	
2.4	5.0	WOH	WOH	WOH						SS-3		2.4	5.0
		WOH	WOH	WOH								HYDRAULIC FILL: LEAN CLAY (CL), very dark gray (N 3/), very soft, wet, trace fine sand, no HCl reaction	
-0.1	7.5	WOH	WOH	WOH						SS-4			
-2.2	9.6	WOH	WOH	WOH						SS-5		-1.6	9.0
		WOH	WOH	WOH								HYDRAULIC FILL: SILT (ML), very dark gray (N 3/), very soft, wet, trace fine sand, trace organic matter, no HCl reaction	
-4.4	11.8	WOH	WOH	WOH						SS-6			
		WOH	WOH	WOH								-4.1	11.5
-7.6	15.0	WOH	WOH	WOH						SS-7		HYDRAULIC FILL: FAT CLAY with sand (CH), very dark gray (N 3/), very soft, wet, fine to medium sand, trace organics, no HCl reaction 11.8ft: PP=0.0 tsf	
		WOH	WOH	WOH									
		WOH	WOH	WOH						SS-8		-10.6	18.0
-12.8	20.2	WOH	WOH	WOH								HYDRAULIC FILL: SILT (ML), very dark gray (N 3/), very soft, wet, trace organics, no HCl reaction, trace fine sand	
		WOH	WOH	WOH						SS-9A/B			
		2	4	2								-18.2	25.6
												HYDRAULIC FILL: Silty SAND (SM), dark greenish gray (N 4/), loose, wet, fine sand	
-22.7	30.1	WOH	WOH	WOH						SS-10			
		WOH	WOH	WOH								-20.6	28.0
		WOH	WOH	WOH						SS-11		HYDRAULIC FILL: SILT with sand (ML), very dark gray (N 3/), very soft, wet, no HCl reaction, little fine sand partings	
-27.7	35.1	WOH	WOH	WOH									
		WOH	WOH	WOH								-30.6	38.0
-32.3	39.7	1	1	1						SS-12A/B		ALLUVIUM: Silty SAND (SM), dark gray (N 4/), very loose, wet, fine to coarse sand	
												-32.8	40.2
												ALLUVIUM: FAT CLAY (CH), very dark gray (N 3/), very soft, wet, trace organics, no HCl reaction	
-37.3	44.7	WOH	2	3						SS-13			
		WOH										-35.6	43.0
												ALLUVIUM: Sandy SILT (ML), dark gray (N 4/), medium stiff, wet, fine to medium subrounded to angular sand, trace organics	
-42.2	49.6	6	7	6						SS-14A/B			
												-40.6	48.0
												ALLUVIUM: Poorly graded SAND with silt (SP-SM), gray (N 6/), medium dense, wet, fine to medium sand, no HCl reaction	
-47.2	54.6	WOH	WOH	WOH						SS15			
		WOH	WOH	WOH								-43.2	50.6
												KIRKWOOD FORMATION: FAT CLAY (CH), greenish gray (5G 5/1), stiff, wet, few fine to medium sand, no HCl reaction, PP=1.5 tsf	
												54.6ft: PP=1.0 tsf	

PSEG ESP BORE PSEG ESP 7-07-09 GFI PSEG ESP GDT 7/10/09



PERMIT NO.: P200900086		DRILLER: R. Bartholomew		NJ LICENSE NO.: 0001383		GEOLOGIST: S. Johnson							
SITE DESCRIPTION: PSEG SITE ESP APPLICATION			COUNTY: Salem, NJ		MACTEC PROJECT NO.: 6468-08-2251		FLUID LEVEL (ft)						
BORING NO.: NB-3		DRILL METHOD: Mud Rotary		SAMPLE METHODS: SPT		0 HR. ND							
GROUND SURFACE ELEV.: 7.4 US ft (NAVD88)		NORTHING: 234554.7 US ft (NAD83)		EASTING: 197895.8 US ft (NAD83)		24 HR. 9.0							
TOTAL DEPTH: 200.3 ft		DRILL MACHINE: CME-75 Truck		CASING DEPTH: 13.7 ft		HAMMER (ID): 140 lb Auto. (CTB-2)							
DATE STARTED: 2/17/09		COMPLETED: 2/20/09		HOLE DIA.: 4"		ROD TYPE: NWJ		BITS USED: 3-7/8" Drag Bit					
ELEV. (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	▼	L O G	SOIL AND ROCK DESCRIPTION
		0.5ft	0.5ft	0.5ft	0	20	40	60	80	100			
-48.7					Continued from previous page								
-52.2	59.6												
		WOH	WOH	WOH									
-57.2	64.6												
		5	2	4									
-62.2	69.6												
		5	3	5									
-67.2	74.6												
		10	8	8									
-72.2	79.6												
		11	17	16									
-77.2	84.6												
		14	9	8									
-82.2	89.6												
		10	10	25									
-87.2	94.6												
		25	24	25									
-92.2	99.6												
		8	9	11									
-97.2	104.6												
		5	66	33									
-102.2	109.6												
		50/0.5											
-104.2	111.6												

PSEG ESP BORE PSEG ESP 7-07-09.GPJ PSEG ESP GDI 7/10/09



PERMIT NO.: P200900086		DRILLER: R. Bartholomew		NJ LICENSE NO.: 0001383		GEOLOGIST: S. Johnson						
SITE DESCRIPTION: PSEG SITE ESP APPLICATION				COUNTY: Salem, NJ		MACTEC PROJECT NO.: 6468-08-2251		FLUID LEVEL (ft)				
BORING NO.: NB-3		DRILL METHOD: Mud Rotary		SAMPLE METHODS: SPT				0 HR. ND				
GROUND SURFACE ELEV.: 7.4		US ft (NAVD88)		NORTHING: 234554.7		US ft (NAD83)		EASTING: 197895.8 US ft (NAD83)		24 HR. 9.0		
TOTAL DEPTH: 200.3 ft		DRILL MACHINE: CME-75 Truck		CASING DEPTH: 13.7 ft				HAMMER (ID): 140 lb Auto. (CTB-2)				
DATE STARTED: 2/17/09		COMPLETED: 2/20/09		HOLE DIA.: 4"		ROD TYPE: NWJ		BITS USED: 3-7/8" Drag Bit				
ELEV.	DEPTH	BLOW COUNT			BLOWS PER FOOT					SAMP.	LOG	SOIL AND ROCK DESCRIPTION
(ft)	(ft)	0.5ft	0.5ft	0.5ft	0	20	40	60	80	100		
-104.8					Continued from previous page							
-107.2	114.6	10	12	14							SS-28	-105.6 HORNERSTOWN FORMATION: Silty SAND (SM), dark greenish gray (5GY 4/1), medium dense, wet, fine to medium sand, strong HCl reaction, trace to few glauconite
-112.2	119.6	13	30	19							SS-29	119.6ft: Dense
-117.2	124.6	10	12	16							SS-30	124.6ft: Medium dense
-122.2	129.6	25	21	21							SS-31	129.6ft: Dense, trace friable layers
-127.2	134.6	18	28	33							SS-32	-124.6 NAVESINK FORMATION: Clayey SAND (SC), very dark greenish gray (5G 3/2), very dense, wet, fine sand, trace to few shell fragments, mostly glauconite
-132.2	139.6	30	40	40							SS-33	-129.6 NAVESINK FORMATION: Silty SAND (SM), very dark greenish gray (10BG 2.5/1), very dense, wet, fine sand, weak HCl reaction, little shell fragments, mostly glauconite
-137.2	144.6	11	20	18							SS-34	-135.6 NAVESINK FORMATION: Clayey SAND (SC), very dark greenish gray (10Y 3/1), dense, wet, fine to medium sand, weak HCl reaction, mostly glauconite
-142.2	149.6	20	37	52							SS-35	-140.6 NAVESINK FORMATION: Silty SAND (SM), very dark greenish gray (5G 3/2), very dense, wet, fine sand, weak HCl reaction, mostly glauconite
-147.2	154.6	37	38	45							SS-36	-150.6 MOUNT LAUREL FORMATION: Clayey SAND (SC), dark greenish gray (10Y 4/1), very dense, moist, fine to coarse subrounded sand, strong HCl reaction
-152.2	159.6	30	39	61/0.3							SS-37	-155.6 MOUNT LAUREL FORMATION: Silty SAND (SM), greenish gray (10Y 5/1), very dense, wet, fine to coarse subangular to subrounded sand, trace indurated layers, trace shell fragments, weak HCl reaction, little glauconite
-157.2	164.6										SS-38	

PSEG ESP BORE PSEG ESP 7-07-09 GPT PSEG ESP GDT 7/10/09



SHEET 4 OF 4

PERMIT NO.: P200900086		DRILLER: R. Bartholomew		NJ LICENSE NO.: 0001383		GEOLOGIST: S. Johnson				
SITE DESCRIPTION: PSEG SITE ESP APPLICATION				COUNTY: Salem, NJ		MACTEC PROJECT NO.: 6468-08-2251				
BORING NO.: NB-3		DRILL METHOD: Mud Rotary		SAMPLE METHODS: SPT		FLUID LEVEL (ft)				
GROUND SURFACE ELEV.: 7.4 US ft (NAVD88)		NORTHING: 234554.7 US ft (NAD83)		EASTING: 197895.8 US ft (NAD83)		0 HR. ND				
TOTAL DEPTH: 200.3 ft		DRILL MACHINE: CME-75 Truck		CASING DEPTH: 13.7 ft		24 HR. 9.0				
DATE STARTED: 2/17/09		COMPLETED: 2/20/09		HOLE DIA.: 4"		BITS USED: 3-7/8" Drag Bit				
ELEV. (ft)	DEPTH (ft)	BLOW COUNT 0.5ft 0.5ft 0.5ft			BLOWS PER FOOT 0 20 40 60 80 100			SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION
-160.9					Continued from previous page					
-162.2	169.6	100/0.2					100/0.2	SS-39		MOUNT LAUREL FORMATION: Silty SAND (SM), greenish gray (10Y 5/1), very dense, wet, fine to coarse subangular to subrounded sand, trace indurated layers, trace shell fragments, weak HCl reaction, little glauconite (continued) 169.6ft: Dark greenish gray (10Y 4/1)
-167.2	174.6	100/0.4					100/0.4	SS-40		
-172.2	179.6	18	48	52/0.4			100/0.9	SS-41		MOUNT LAUREL FORMATION: Clayey SAND (SC), dark greenish gray (5GY 4/1), very dense, wet, fine sand, trace indurated layers, strong HCl reaction, trace glauconite
-177.2	184.6	16	24	45				SS-42		184.6ft: Weak HCl reaction
-182.2	189.6	19	24	42				SS-43		
-187.2	194.6	43	57/0.3				100/0.8	SS-44		MOUNT LAUREL FORMATION: Silty SAND (SM), greenish gray (5GY 6/1), very dense, wet, fine to coarse subrounded sand, no HCl reaction, trace glauconite
-192.2	199.6	75	25/0.2				100/0.7	SS-45		MOUNT LAUREL FORMATION: Poorly graded SAND with silt (SP-SM), dark green gray (5GY 4/1), very dense, wet, fine to coarse sand, no HCl reaction, trace glauconite
										Boring terminated at 200.3 feet. Boring closed by tremie method with cement-bentonite grout on 2/20/09.



GEOTECHNICAL BORING LOG

Prepared By JSR Date 7/10/09Checked By JS Date 7/10/09

SHEET 1 OF 4

PERMIT NO.: P200900087			DRILLER: D. Osuch			NJ LICENSE NO.: 0024289			GEOLOGIST: M. Lear / S. Johnson					
SITE DESCRIPTION: PSEG SITE ESP APPLICATION						COUNTY: Salem, NJ			MACTEC PROJECT NO.: 6468-08-2251			FLUID LEVEL (ft)		
BORING NO.: NB-4			DRILL METHOD: Mud Rotary			SAMPLE METHODS: SPT/Shelby Tube			0 HR.			ND		
GROUND SURFACE ELEV.: 11.5 US ft (NAVD88)			NORTHING: 233960.4 US ft (NAD83)			EASTING: 198139.0 US ft (NAD83)			24 HR.			5.5		
TOTAL DEPTH: 201.3 ft			DRILL MACHINE: CME-75 Truck			CASING DEPTH: 13.5 ft			HAMMER (ID): 140 lb Auto. (CTB-3)					
DATE STARTED: 2/19/09			COMPLETED: 2/25/09			HOLE DIA.: 4"			ROD TYPE: NWJ			BITS USED: 3-7/8" Drag Bit		
ELEV.	DEPTH	BLOW COUNT			BLOWS PER FOOT					SAMP.	LOG	SOIL AND ROCK DESCRIPTION		
(ft)	(ft)	0.5ft	0.5ft	0.5ft	0	20	40	60	80	100				
11.5					Ground Surface									
11.5	0.0	25	47	52							SS-1	11.5	0.0	ARTIFICIAL FILL: Silty GRAVEL (GM), dark grayish brown (10YR 4/2), very dense, dry to moist, angular, trace organics
9.0	2.5	2	2	2							SS-2	9.5	2.0	HYDRAULIC FILL: FAT CLAY (CH), very dark gray (5Y 3/1), soft to very soft, moist, trace to little organics, trace to few fine sand, PP=0.25 tsf
6.5	5.0	WOH	WOH	WOH							SS-3			PP=0.0 tsf for samples SS-3 to SS-12
4.0	7.5	WOH	WOH	WOH							SS-4			
1.5	10.0	WOH	WOH	WOH							SS-5			
-1.0	12.5	WOH	WOH	WOH							SS-6			
-3.5	15.0	WOH	WOH	WOH							SS-7			
-6.0	17.5	WOH	WOH	WOH							SS-8			17.5ft: Dark gray (5Y 4/1)
-8.5	20.0	WOH	WOH	WOH							SS-9			
-11.0	22.5	WOH	WOH	WOH							SS-10			
-13.5	25.0	WOH	WOH	WOH							SS-11			25.0ft: Trace fine sand partings
-16.0	27.5	WOH	WOH	WOH							SS-12			
-18.5	30.0	2	4	4							SS-13	-18.0	29.5	HYDRAULIC FILL: Silty SAND (SM), very dark gray (5Y 3/1), loose, wet, fine sand, no HCl reaction
-21.0	32.5	WOH	WOH	WOH							SS-14	-20.5	32.0	HYDRAULIC FILL: FAT CLAY with sand (CH), very dark gray (5Y 3/1), very soft, wet, little fine sand, no HCl reaction
-23.5	35.0	WOH	WOH	WOH							SS-15			35.0ft: Few fine sand partings, PP=0.0 tsf
-26.0	37.5	2	2	3							SS-16	-25.5	37.0	ALLUVIUM: Clayey SAND (SC), very dark gray (5Y 3/1), loose, wet, fine to coarse sand, trace gravel, no HCl reaction
-28.5	40.0	2	2	2							SS-17	-28.0	39.5	ALLUVIUM: Sandy FAT CLAY (CH), very dark gray (5Y 3/1), soft, wet, fine to coarse sand, trace organics
-31.0	42.5	WOH	2	3							SS-18			42.5ft: Medium stiff
-33.5	45.0	4	9	11							SS-19	-33.0	44.5	ALLUVIUM: Poorly graded SAND (SP), greenish gray (10Y 5/1), medium dense, wet, fine to coarse sand, trace subrounded fine gravel
-36.0	47.5	14	11	9							SS-20	-35.5	47.0	ALLUVIUM: Clayey SAND (SC), light greenish gray (5GY 7/1), medium dense, moist, fine to medium sand, trace gravel
-38.5	50.0	5	11	12							SS-21	-38.0	49.5	ALLUVIUM: Clayey GRAVEL (GC), brown (7.5YR 5/2), medium dense, wet, fine to coarse subrounded to angular gravel, few fine sand
-41.0	52.5	5	6	6							SS-22			
-43.5	55.0	2	2	2							SS-23	-43.0	54.5	

PSEG ESP BORE PSEG ESP 7-07-09 GFI PSEG ESP GDI 7/10/09



PERMIT NO.: P200900087		DRILLER: D. Osuch		NJ LICENSE NO.: 0024289		GEOLOGIST: M. Lear / S. Johnson							
SITE DESCRIPTION: PSEG SITE ESP APPLICATION				COUNTY: Salem, NJ		MACTEC PROJECT NO.: 6468-08-2251		FLUID LEVEL (ft)					
BORING NO.: NB-4		DRILL METHOD: Mud Rotary		SAMPLE METHODS: SPT/Shelby Tube				0 HR. ND					
GROUND SURFACE ELEV.: 11.5 US ft (NAVD88)		NORTHING: 233960.4 US ft (NAD83)		EASTING: 198139.0 US ft (NAD83)				24 HR. 5.5					
TOTAL DEPTH: 201.3 ft		DRILL MACHINE: CME-75 Truck		CASING DEPTH: 13.5 ft				HAMMER (ID): 140 lb Auto. (CTB-3)					
DATE STARTED: 2/19/09		COMPLETED: 2/25/09		HOLE DIA.: 4"		ROD TYPE: NWJ		BITS USED: 3-7/8" Drag Bit					
ELEV. (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION	
		0.5ft	0.5ft	0.5ft	0	20	40	60	80	100			
-44.6					Continued from previous page								
-45.5	57.0										UD-1		KIRKWOOD FORMATION: FAT CLAY (CH), Olive Gray (5Y 5/2), soft, moist, trace organics, trace fine sand, PP=0.0 tsf (continued) 57.0ft: Pushed shelby tube UD-1 to 59.0ft; recovery=2.0ft, PP=1.75 tsf, TV=0.7 tsf 59.0ft: Pushed shelby tube UD-2 to 61.0ft; recovery=2.0ft, PP=0.75 tsf, TV=0.4 tsf 61.0ft: Medium stiff, PP=0.5 tsf
-47.5	59.0										UD-2		
-50.0	61.5										SS-24		
		WOH	WOH	6									
-53.5	65.0										SS-25		
		WOH	WOH	2									
-56.0	67.5										SS-26		65.0ft: Very soft, few to little organics, few fine sand, PP=0.25 tsf
		4	10	32									
-58.5	70.0										SS-27		KIRKWOOD FORMATION: Silty GRAVEL with sand (GM), dark gray (5Y 4/1), and brown (7.5YR 4/3), dense, moist, to wet, subangular gravel, fine to coarse sand, few organics, trace glauconite
		4	4	10									
-60.5	72.0										UD-3		VINCENTOWN FORMATION: Silty SAND (SM), greenish gray (10Y 5/1), medium dense, moist to wet, fine to medium sand, trace gravel, trace friable zones, weak HCl reaction, trace to few glauconite
		5	15	8									72.0ft: Pushed shelby tube UD-3 to 73.6ft; recovery=1.5ft
-63.5	75.0										SS-28		
		13	5	7							UD-4/SS-29		77.0ft: Attempted shelby tube UD-4, refused with no penetration; Few friable to moderately indurated layers
-65.5	77.0												
		11	15	11							SS-30		80.0ft: Trace friable layers, strong HCl reaction, trace glauconite
-68.5	80.0												
		5	8	12							SS-31		82.5ft: Weak HCl reaction
-71.0	82.5												
		6	6	30							SS-32		85.0ft: Dense
-73.5	85.0												
		8	9	28							SS-33		
-76.0	87.5												
		13	10	12							SS-34		90.0ft: Medium dense
-78.5	90.0												
		6	7	11							SS-35		
-81.0	92.5												
		19	78	22							SS-36		95.0ft: Very dense, few moderately indurated zones, strong HCl reaction
-83.5	95.0												
		6	8	13							SS-37		97.5ft: Medium dense, trace friable zones, weak HCl reaction
-86.0	97.5												
		7	7	9							SS-38		
-88.5	100.0												
		5	6	7							SS-39		102.5ft: Strong HCl reaction
-91.0	102.5												
											UD-5		104.5ft: Pushed shelby tube UD-5 to 105.5ft; recovery=0.0ft
-93.0	104.5												
		5	8	12							SS-40		
-96.0	107.5												
		13	12	86							SS-41		110.0ft: Very dense, trace to few moderately indurated layers
-98.5	110.0												

PSEG ESP BORE PSEG ESP 7-07-09 GFI PSEG ESP GDT 7/10/09



PERMIT NO.: P200900087		DRILLER: D. Osuch		NJ LICENSE NO.: 0024289		GEOLOGIST: M. Lear / S. Johnson									
SITE DESCRIPTION: PSEG SITE ESP APPLICATION				COUNTY: Salem, NJ		MACTEC PROJECT NO.: 6468-08-2251		FLUID LEVEL (ft)							
BORING NO.: NB-4		DRILL METHOD: Mud Rotary		SAMPLE METHODS: SPT/Shelby Tube		0 HR.		ND							
GROUND SURFACE ELEV.: 11.5		US ft (NAVD88)		NORTHING: 233960.4		US ft (NAD83)		EASTING: 198139.0		US ft (NAD83)		24 HR.		5.5	
TOTAL DEPTH: 201.3 ft		DRILL MACHINE: CME-75 Truck		CASING DEPTH: 13.5 ft		HAMMER (ID): 140 lb Auto. (CTB-3)									
DATE STARTED: 2/19/09		COMPLETED: 2/25/09		HOLE DIA.: 4"		ROD TYPE: NWJ		BITS USED: 3-7/8" Drag Bit							
ELEV.	DEPTH	BLOW COUNT			BLOWS PER FOOT					SAMP.	LOG	SOIL AND ROCK DESCRIPTION			
(ft)	(ft)	0.5ft	0.5ft	0.5ft	0	20	40	60	80	100	NO.				
-100.7					Continued from previous page										
-101.0	112.5	49	24	20							SS-42		VINCENTOWN FORMATION: Silty SAND (SM), greenish gray (10Y 5/1), medium dense, moist to wet, fine to medium sand, trace gravel, trace friable zones, weak HCl reaction, trace to few glauconite		
-103.5	115.0	6	10	15							SS-43		(continued)		
-106.0	117.5	100/0.4									SS-44		-105.5	117.0	112.5ft: Dense, trace to few friable layers
-108.5	120.0	6	9	10							SS-45		-107.5	119.0	VINCENTOWN FORMATION: Poorly graded SAND with silt (SP-SM), greenish gray (10Y 5/1), very dense, wet, mostly indurated, trace glauconite
-111.0	122.5	100/0.3									SS-46				VINCENTOWN FORMATION: Silty SAND (SM), greenish gray (10Y 5/1), medium dense, wet, fine sand, strong HCl reaction, trace glauconite
-113.5	125.0	8	10	13							SS-47		-113.0	124.5	122.5ft: Mostly indurated
-116.0	127.5	10	12	15							SS-48		-115.5	127.0	HORNERSTOWN FORMATION: Silty SAND (SM), dark greenish gray (10Y 4/1), medium dense, wet, fine sand, strong HCl reaction, trace glauconite
-118.5	130.0	10	12	17							SS-49				HORNERSTOWN FORMATION: Poorly graded SAND with silt (SP-SM), dark greenish gray (10Y 4/1), medium dense, wet, fine to medium sand, strong HCl reaction, trace to few glauconite
-121.0	132.5	65	35/0.1								SS-50		-120.5	132.0	HORNERSTOWN FORMATION: Silty SAND (SM), dark greenish gray (5GY 4/1), very dense, wet, fine sand, little friable layers, weak HCl reaction, few glauconite
-123.5	135.0	12	15	17							SS-51		-123.0	134.5	HORNERSTOWN FORMATION: Poorly graded SAND with silt (SP-SM), very dark greenish gray (5GY 3/1), dense, wet, fine to medium sand, weak to strong HCl reaction, few glauconite
-126.0	137.5	10	17	22							SS-52				140.0ft: Trace shell fragments
-128.5	140.0	12	17	22							SS-53		-130.5	142.0	NAVESINK FORMATION: Clayey SAND (SC), very dark greenish gray (10BG 3/1), very dense, wet, fine sand, trace shell fragments, weak HCl reaction, mostly glauconite
-131.0	142.5	17	22	32							SS-54		-133.0	144.5	NAVESINK FORMATION: Silty SAND (SM), very dark greenish gray (10BG 3/1), very dense, wet, fine sand, trace shell fragments, no to weak HCl reaction, mostly glauconite
-133.5	145.0	26	35	40							SS-55				147.5ft: Greenish black (10BG 2.5/1)
-136.0	147.5	22	33	37							SS-56		-140.5	152.0	NAVESINK FORMATION: Clayey SAND (SC), greenish black (10BG 2.5/1), dense, wet, fine sand, weak HCl reaction, mostly glauconite
-138.5	150.0	16	28	35							SS-57				155.0ft: Very dense, trace shell fragments
-141.0	152.5	14	20	28							SS-58		-145.5	157.0	NAVESINK FORMATION: Silty SAND (SM), very dark greenish gray (5G 3/2), very dense, wet, fine sand, weak HCl reaction, mostly glauconite
-143.5	155.0	20	27	37							SS-59		-148.0	159.5	NAVESINK FORMATION: Clayey SAND (SC), very dark grayish green (5G 3/2), very dense, wet, fine sand, no to weak HCl reaction, mostly glauconite
-146.0	157.5	25	37	46							SS-60				162.5ft: Trace shell fragments
-148.5	160.0	28	31	37							SS-61		-153.0	164.5	MOUNT LAUREL FORMATION: Clayey SAND (SC), very dark gray (5Y 3/1), very dense, moist, fine to coarse sand, strong HCl reaction, trace to few glauconite
-151.0	162.5	28	36	49							SS-62		-155.5	167.0	
-153.5	165.0	16	28	65							SS-63				
-156.0	167.5	70	30/0.3								SS-64				

PSEG ESP BORE PSEG ESP 7-07-09 GFI PSEG ESP GDI 7/10/09

PSEGE ESP BORE PSEGE ESP 7-07-09.GPJ PSEGE ESP.GDT 7/10/09



GEOTECHNICAL BORING LOG

Prepared By mm Date 7/10/09
Checked By JS Date 7/10/09
SHEET 1 OF 4

PERMIT NO.: P200900091		DRILLER: M. Adams		NJ LICENSE NO.: 0001350		GEOLOGIST: R. Clark								
SITE DESCRIPTION: PSEG SITE ESP APPLICATION			COUNTY: Salem, NJ		MACTEC PROJECT NO.: 6468-08-2251		FLUID LEVEL (ft)							
BORING NO.: NB-5		DRILL METHOD: Mud Rotary		SAMPLE METHODS: SPT		0 HR.		ND						
GROUND SURFACE ELEV.: 7.8		US ft (NAVD88)		NORTHING: 234891.0		US ft (NAD83)		EASTING: 198445.7 US ft (NAD83)	24 HR.	2.5				
TOTAL DEPTH: 200.0 ft		DRILL MACHINE: CME-850 ATV		CASING DEPTH: 69.5 ft		HAMMER (ID): 140 lb Auto. (CTB-4)								
DATE STARTED: 2/6/09		COMPLETED: 2/8/09		HOLE DIA.: 4"		ROD TYPE: NWJ		BITS USED: 3-7/8" Drag Bit						
ELEV. (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION		
		0.5ft	0.5ft	0.5ft	0	20	40	60	80	100				
7.8					Ground Surface									
7.8	0.0	22	25	19									7.8	0.0
5.2	2.6												5.8	2.0
		7	5	6										
2.8	5.0												3.3	4.5
		4	3	3										
0.3	7.5													
		WOH	WOH	WOH										
-2.2	10.0													
		WOH	WOH	WOH										
-4.7	12.5													
		WOH	WOH	WOH										
-7.2	15.0												-6.7	14.5
		WOH	WOH	WOH										
		WOH												
-12.2	20.0													
		WOR	WOH	WOH										
		WOH												
-16.7	24.5													
		WOH	1	1										
-21.7	29.5													
		WOH	WOH	WOH										
		WOH												
-26.7	34.5													
		WOH	3	5										
													-29.2	37.0
-31.7	39.5													
		9	29	36										
-36.7	44.5													
		6	4	2										
-41.7	49.5													
		3	3	4										
-46.7	54.5													
		4	4	5										

PSEG ESP BORE PSEG ESP 7-07-09 GFI PSEG ESP GDT 7/10/09



PERMIT NO.: P200900091		DRILLER: M. Adams		NJ LICENSE NO.: 0001350		GEOLOGIST: R. Clark						
SITE DESCRIPTION: PSEG SITE ESP APPLICATION				COUNTY: Salem, NJ		MACTEC PROJECT NO.: 6468-08-2251		FLUID LEVEL (ft)				
BORING NO.: NB-5		DRILL METHOD: Mud Rotary		SAMPLE METHODS: SPT		0 HR.		ND				
GROUND SURFACE ELEV.: 7.8		US ft (NAVD88)		NORTHING: 234891.0		US ft (NAD83)		EASTING: 198445.7 US ft (NAD83)				
24 HR.		2.5										
TOTAL DEPTH: 200.0 ft		DRILL MACHINE: CME-850 ATV		CASING DEPTH: 69.5 ft		HAMMER (ID): 140 lb Auto. (CTB-4)						
DATE STARTED: 2/6/09		COMPLETED: 2/8/09		HOLE DIA.: 4"		ROD TYPE: NWJ		BITS USED: 3-7/8" Drag Bit				
ELEV.	DEPTH	BLOW COUNT			BLOWS PER FOOT					SAMP.	LOG	SOIL AND ROCK DESCRIPTION
(ft)	(ft)	0.5ft	0.5ft	0.5ft	0	20	40	60	80	100		
-48.3					Continued from previous page							
-51.7	59.5	3	4	6							SS-16	KIRKWOOD FORMATION: FAT CLAY (CH), dark olive gray (5Y 3/2), medium stiff, moist, few fine sand, no HCl reaction, PP=0.5 tsf (continued)
-56.7	64.5	15	8	9							SS-17	59.5ft: FAT CLAY with sand (CH), few subrounded gravel, trace organics, PP=0.25 tsf
-61.7	69.5	36	49	16							SS-18	KIRKWOOD FORMATION: Silty SAND with gravel (SM), dark greenish gray (5GY 4/1), medium dense, wet, fine sand, little subrounded to rounded gravel, no HCl reaction, trace glauconite
-66.7	74.5	8	11	19							SS-19	62.0ft: VINCENTOWN FORMATION: Silty SAND (SM), reddish brown (5Y 4/3), very dense, moist to wet, fine to medium sand, no HCl reaction, strongly oxidized
-71.7	79.5	7	6	10							SS-20	68.0ft: 74.5ft: Reddish brown (5Y 4/3) and light yellowish brown (2.5Y 6/3), medium dense, wet, fine sand, trace cross-bedding, no to strong HCl reaction
-76.7	84.5	11	7	9							SS-21	79.5ft: Yellowish brown (10Y 5/4) to light yellowish brown (2.5Y 6/4), strong HCl reaction, weakly oxidized
-81.7	89.5	15	16	15							SS-22	84.5ft: Yellowish brown (10YR 5/6) and light brownish gray (2.5Y 6/2), weakly oxidized
-86.7	94.5	41	7	12							SS-23	89.5ft: Greenish gray (10Y 6/1), dense, few to little glauconite, no oxidation
-91.7	99.5	12	28	39							SS-24	92.0ft: VINCENTOWN FORMATION: Poorly graded SAND with clay (SP-SC), greenish gray (10Y 6/1), medium dense, moist, fine sand, trace moderately indurated layers, strong HCl reaction, few glauconite
-96.7	104.5	6	19	24							SS-25	98.0ft: VINCENTOWN FORMATION: Poorly graded SAND with silt (SP-SM), greenish gray (10Y 5/1), very dense, wet, fine sand, strong HCl reaction, few glauconite
-101.7	109.5	12	12	13							SS-26	104.5ft: Dense
												109.5ft: Medium dense

PSEG ESP BORE PSEG ESP 7-07-09 GFI PSEG ESP.GDT 7/10/09



PERMIT NO.: P200900091		DRILLER: M. Adams		NJ LICENSE NO.: 0001350		GEOLOGIST: R. Clark											
SITE DESCRIPTION: PSEG SITE ESP APPLICATION				COUNTY: Salem, NJ		MACTEC PROJECT NO.: 6468-08-2251		FLUID LEVEL (ft)									
BORING NO.: NB-5		DRILL METHOD: Mud Rotary		SAMPLE METHODS: SPT		0 HR.		ND									
GROUND SURFACE ELEV.: 7.8		US ft (NAVD88)		NORTHING: 234891.0		US ft (NAD83)		EASTING: 198445.7		US ft (NAD83)		24 HR.		2.5			
TOTAL DEPTH: 200.0 ft		DRILL MACHINE: CME-850 ATV		CASING DEPTH: 69.5 ft		HAMMER (ID): 140 lb Auto. (CTB-4)											
DATE STARTED: 2/6/09		COMPLETED: 2/8/09		HOLE DIA.: 4"		ROD TYPE: NWJ		BITS USED: 3-7/8" Drag Bit									
ELEV.	DEPTH	BLOW COUNT			BLOWS PER FOOT					SAMP.	LOG	SOIL AND ROCK DESCRIPTION					
(ft)	(ft)	0.5ft	0.5ft	0.5ft	0	20	40	60	80	100	NO.						
-104.4		Continued from previous page															
-106.7	114.5									SS-27		-105.2	HORNERSTOWN FORMATION: Silty SAND (SM), greenish gray (10Y 5/1), medium dense, wet, fine to medium sand, strong HCl reaction, few glauconite				
-111.7	119.5	9	11	13													
-116.7	124.5	12	11	15						SS-28		119.5ft:	Few to little glauconite				
-121.7	129.5	17	19	21						SS-29		124.5ft:	Dense, few to little glauconite				
-126.7	134.5	21	22	32						SS-30		129.5ft:	Medium dense, little to some glauconite				
-131.7	139.5	23	28	42						SS-31		-124.2	NAVESINK FORMATION: Poorly graded SAND with silt (SP-SM), very dark greenish gray (5GY 3/1), very dense, wet, fine sand, trace to little shell fragments, strong HCl reaction, mostly glauconite				
-136.7	144.5	17	19	27						SS-32							
-141.7	149.5	32	36	49						SS-33		-135.2	NAVESINK FORMATION: Clayey SAND (SC), very dark greenish gray (5GY 3/1), dense, moist, fine sand, strong HCl reaction, mostly glauconite				
-146.7	154.5	24	25	40						SS-34		-140.2	NAVESINK FORMATION: Poorly graded SAND with silt (SP-SM), very dark greenish gray (10GY 3/1), very dense, wet, fine sand, strong HCl reaction, mostly glauconite				
-151.7	159.5	36	40	50/0.2						SS-35		154.5ft:	Very dark greenish gray (5GY 3/1)				
-156.7	164.5	50/0.2								SS-36		-149.2	MOUNT LAUREL FORMATION: Clayey SAND (SC), very dark grayish brown (2.5Y 3/2), very dense, moist, fine to coarse subrounded sand, strong HCl reaction, little glauconite				
										SS-37		164.5ft:	Dark olive gray (5Y 3/2), some glauconite -Observed apparent artesian flow of drill fluids from boring, possibly tidal influenced, driller thickens drill mud. -Mud tub overflowing due to artesian added flow at				

PSEG ESP BORE PSEG ESP 7-07-09.GPJ PSEG ESP.GDT 7/10/09



PERMIT NO.: P200900091			DRILLER: M. Adams			NJ LICENSE NO.: 0001350			GEOLOGIST: R. Clark					
SITE DESCRIPTION: PSEG SITE ESP APPLICATION					COUNTY: Salem, NJ			MACTEC PROJECT NO.: 6468-08-2251			FLUID LEVEL (ft)			
BORING NO.: NB-5			DRILL METHOD: Mud Rotary			SAMPLE METHODS: SPT			0 HR. ND					
GROUND SURFACE ELEV.: 7.8 US ft (NAVD88)			NORTHING: 234891.0 US ft (NAD83)			EASTING: 198445.7 US ft (NAD83)			24 HR. 2.5					
TOTAL DEPTH: 200.0 ft			DRILL MACHINE: CME-850 ATV			CASING DEPTH: 69.5 ft			HAMMER (ID): 140 lb Auto. (CTB-4)					
DATE STARTED: 2/6/09			COMPLETED: 2/8/09			HOLE DIA.: 4"			ROD TYPE: NWJ			BITS USED: 3-7/8" Drag Bit		
ELEV. (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	▼	L O G	SOIL AND ROCK DESCRIPTION	
		0.5ft	0.5ft	0.5ft	0	20	40	60	80	100				
-160.5					Continued from previous page									
-161.7	169.5	50/0.2			50/0.2					SS-38			174.5 feet. MOUNT LAUREL FORMATION: Clayey SAND (SC), very dark grayish brown (2.5Y 3/2), very dense, moist, fine to coarse subrounded sand, strong HCl reaction, little glauconite (continued)	
-166.7	174.5	50/0.3			50/0.3					SS-39				
-171.7	179.5	17	32	47	79					SS-40			179.5ft: Wet, trace shell fragments, little glauconite	
-176.7	184.5	17	27	28	55					SS-41			184.5ft: Olive gray (5Y 4/2), fine to coarse sand, trace shell fragments, few glauconite	
-181.7	189.5	17	24	32	56					SS-42			189.5ft: Olive gray (5Y 5/2), little glauconite	
-186.7	194.5	38	50/0.4		50/0.4					SS-43				
-191.7	199.5	50/0.5			50/0.5					SS-44				
													-192.2	200.0
												Boring terminated at 200.0 feet.		
												Boring closed by tremie method with cement-bentonite grout on 2/09/09.		



GEOTECHNICAL BORING LOG

Prepared By MM Date 7/10/09Checked By JS Date 7/10/09

SHEET 1 OF 4

PERMIT NO.: P200900088		DRILLER: M. Adams		NJ LICENSE NO.: 0001350		GEOLOGIST: B. Deobald							
SITE DESCRIPTION: PSEG SITE ESP APPLICATION				COUNTY: Salem, NJ		MACTEC PROJECT NO.: 6468-08-2251							
BORING NO.: NB-6		DRILL METHOD: Mud Rotary		SAMPLE METHODS: SPT/Shelby Tube									
GROUND SURFACE ELEV.: 9.3		US ft (NAVD88)		NORTHING: 235251.5		US ft (NAD83)							
TOTAL DEPTH: 200.0 ft		DRILL MACHINE: CME-850 ATV		CASING DEPTH: 14.5 ft		HAMMER (ID): 140 lb Auto. (CTB-4)							
DATE STARTED: 2/19/09		COMPLETED: 2/22/09		HOLE DIA.: 4"		ROD TYPE: NWJ							
BITS USED: 3-7/8" Drag Bit													
ELEV. (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION	
		0.5ft	0.5ft	0.5ft	0	20	40	60	80	100			
9.3					Ground Surface							9.3	0.0
9.3	0.0	5	6	4						SS-1		ARTIFICIAL FILL: SILT (ML), very dark grayish brown (2.5Y 3/2), stiff, moist, trace organics, trace angular gravel, cobbles and boulders 2.1ft: Very dark gray (2.5Y 3/1), very soft, trace fine sand 4.7ft: Stiff, wet	
7.2	2.1	2	1	1						SS-2			
4.6	4.7	WOH	4	6						SS-3			
1.7	7.6	WOH	4	6								2.3	7.0
-0.4	9.7	2	2	1						SS-4		ARTIFICIAL FILL: Silty SAND (SM), very dark gray (2.5Y 3/1), loose, wet, fine to medium sand, few organics, trace angular to rounded gravel HYDRAULIC FILL: SILT (ML), very dark gray (2.5Y 3/1), soft, wet, few organics	
-3.7	13.0	WOH	WOH	WOH						SS-5			
-5.7	15.0	WOH	1	1						SS-6		-2.7	12.0
-10.7	20.0	WOH	2	1						SS-7		HYDRAULIC FILL: FAT CLAY (CH), black (2.5Y 2.5/1), very soft, wet, trace to few organics 15.0ft: Very dark gray (2.5Y 3/1), no HCl reaction, silt layers, no organics	
-12.7	22.0	WOH	1	WOH						SS-8			
-15.2	24.5	1	1	1						UD-1		-8.7	18.0
-20.3	29.6	WOH	WOH	WOH						SS-9		HYDRAULIC FILL: SILT with sand (ML), very dark gray (2.5Y 3/1), soft, wet, little fine sand, no HCl reaction 22.0ft: Pushed shelly tube UD-1 to 24.0ft; recovery=2.0ft, PP=0.25 tsf, TV=0.25 tsf	
-25.3	34.6	WOH	WOH	WOH						SS-10			
-30.3	39.6	1	2	7						SS-11		-28.7	38.0
-35.3	44.6	WOH	3	4						SS-12		ALLUVIUM: Well graded SAND (SW), dark gray (2.5Y 4/1), loose, wet, fine to coarse sand, trace rounded gravel, no HCl reaction KIRKWOOD FORMATION: FAT CLAY (CH), gray (2.5Y 5/1) and light olive brown (2.5Y 5/4), medium stiff, moist, trace fine sand, no HCl reaction	
-40.3	49.6	3	4	5						SS-13			
-42.3	51.6									SS-14		-33.7	43.0
-44.9	54.2									UD-2		49.6ft: Gray (2.5Y 5/1) 51.6ft: Pushed shelly tube UD-2 to 53.6ft; recovery=1.9ft, PP=2.0 tsf, TV=1.7 tsf; moist to wet 54.2ft: Pushed shelly tube UD-3 to 56.2ft; recovery=1.8ft, PP=1.5 tsf, TV=1.3 tsf; very dark gray	
										UD-3			

PSEG ESP BORE PSEG ESP 7-07-09.GPJ PSEG ESP.GDT 7/10/09



PERMIT NO.: P200900088		DRILLER: M. Adams		NJ LICENSE NO.: 0001350		GEOLOGIST: B. Deobald								
SITE DESCRIPTION: PSEG SITE ESP APPLICATION				COUNTY: Salem, NJ		MACTEC PROJECT NO.: 6468-08-2251		FLUID LEVEL (ft)						
BORING NO.: NB-6		DRILL METHOD: Mud Rotary		SAMPLE METHODS: SPT/Shelby Tube		0 HR.		ND						
GROUND SURFACE ELEV.: 9.3		US ft (NAVD88)		NORTHING: 235251.5 US ft (NAD83)		EASTING: 198315.4 US ft (NAD83)		24 HR. 13.0						
TOTAL DEPTH: 200.0 ft		DRILL MACHINE: CME-850 ATV		CASING DEPTH: 14.5 ft		HAMMER (ID): 140 lb Auto. (CTB-4)								
DATE STARTED: 2/19/09		COMPLETED: 2/22/09		HOLE DIA.: 4"		ROD TYPE: NWJ		BITS USED: 3-7/8" Drag Bit						
ELEV. (ft)	DEPTH (ft)	BLOW COUNT 0.5ft 0.5ft 0.5ft			BLOWS PER FOOT 0 20 40 60 80 100					SAMP. NO.	▼	L O G	SOIL AND ROCK DESCRIPTION	
-46.8		Continued from previous page												
-47.4	56.7	5	5	6						SS-15			(2.5Y 3/1) KIRKWOOD FORMATION: FAT CLAY (CH), gray (2.5Y 5/1) and light olive brown (2.5Y 5/4), medium stiff, moist, trace fine sand, no HCl reaction (continued) 56.7ft: Very dark gray (2.5Y 3/1), and dark olive brown (2.5Y 3/3), stiff, few to little organics	
-55.3	64.6	8	11	12						SS-16			-52.7 KIRKWOOD FORMATION: Well graded SAND with gravel (SW), gray (2.5Y 5/1), medium dense, moist to wet, little subangular gravel, no HCl reaction 62.0	
-60.3	69.6	10	8	6						SS-17			-58.7 KIRKWOOD FORMATION: Poorly graded SAND with silt (SP-SM), grayish green (5G 4/2), medium dense, wet, fine to medium sand, no HCl reaction 68.0	
-65.3	74.6	29	24	15						SS-18			-62.7 VINCENTOWN FORMATION: Poorly graded SAND with silt (SP-SM), dark yellowish brown (10YR 4/6), dense, wet, fine to medium grained, no HCl reaction, strongly oxidized 72.0	
-67.3	76.6									UD-4				
-68.6	77.9	22	9	10						SS-19			76.6ft: Pushed shelby tube UD-4 to 76.9ft; recovery=0.2ft 77.9ft: Dark yellowish brown (10YR 4/6), medium dense, trace friable layers, no to strong HCl reaction, moderately oxidized	
-70.9	80.2									UD-5			80.2ft: Pushed shelby tube UD-5 to 81.5; recovery=1.3ft; moist to wet	
-73.3	82.6	8	9	15						SS-20			82.6ft: Dark greenish gray (10Y 4/1), wet, trace shell fragments, no oxidation	
-80.3	89.6	7	10	12						SS-21			89.6ft: Weak HCl reaction	
-85.3	94.6	50/0.4								SS-22			-83.7 VINCENTOWN FORMATION: Silty SAND (SM), greenish gray (10Y 5/1), very dense, moist, fine sand, trace shell fragments, trace friable layers, weak to strong HCl reaction, trace glauconite 93.0	
-90.3	99.6	12	14	16						SS-23			99.6ft: Medium dense, strong HCl reaction	
-95.3	104.6	8	10	15						SS-34			104.6ft: Weak to strong HCl reaction	
-100.3	109.6	12	17	21						SS-25			109.6ft: Dark greenish gray (5G 4/1), dense, fine to medium sand, weak HCl reaction	

PSEG ESP BORE PSEG ESP 7-07-09.GPJ PSEG ESP.GDT 7/10/09



PERMIT NO.: P200900088		DRILLER: M. Adams		NJ LICENSE NO.: 0001350		GEOLOGIST: B. Deobald							
SITE DESCRIPTION: PSEG SITE ESP APPLICATION			COUNTY: Salem, NJ		MACTEC PROJECT NO.: 6468-08-2251		FLUID LEVEL (ft)						
BORING NO.: NB-6		DRILL METHOD: Mud Rotary		SAMPLE METHODS: SPT/Shelby Tube		0 HR.		ND					
GROUND SURFACE ELEV.: 9.3		US ft (NAVD88)		NORTHING: 235251.5		US ft (NAD83)		EASTING: 198315.4 US ft (NAD83)					
TOTAL DEPTH: 200.0 ft		DRILL MACHINE: CME-850 ATV		CASING DEPTH: 14.5 ft		HAMMER (ID): 140 lb Auto. (CTB-4)							
DATE STARTED: 2/19/09		COMPLETED: 2/22/09		HOLE DIA.: 4"		ROD TYPE: NWJ		BITS USED: 3-7/8" Drag Bit					
ELEV. (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION	
		0.5ft	0.5ft	0.5ft	0	20	40	60	80	100			
-102.9					Continued from previous page								
-105.3	114.6	50/0.3									SS-26		-103.7 VINCENTOWN FORMATION: Poorly graded SAND with silt (SP-SM), dark greenish gray (5G 4/1), very dense, moist, fine to medium sand, trace friable zones, weak to strong HCl reaction, little glauconite
-110.3	119.6	9	10	34							SS-27		-107.7 HORNERSTOWN FORMATION: Poorly graded SAND with silt (SP-SM), dark greenish gray (5G 4/1), dense, moist, fine to medium sand, trace friable zones, weak to strong HCl reaction, little glauconite
-115.3	124.6	12	14	42							SS-28		124.6ft: Dark greenish gray (5G 4/1), very dense, trace shell fragments, strong HCl reaction
-120.3	129.6	13	17	28							SS-29		129.6ft: Very dark greenish gray (5GY 3/1), dense, trace to few shell fragments, weak HCl reaction, some glauconite
-125.3	134.6	20	35	46							SS-30		-124.7 NAVESINK FORMATION: Silty SAND (SM), grayish green (5G 4/2), to greenish black (5G 2.5/1), very dense, moist, fine to medium sand, trace shell fragments, no HCl reaction, mostly glauconite
-130.3	139.6	22	24	32							SS-31		139.6ft: Greenish black (5G 2.5/1), fine sand, trace to few shell fragments
-135.3	144.6	17	21	29							SS-32		144.6ft: Dense
-140.3	149.6	24	31	36							SS-33		149.6ft: Very dense
-145.3	154.6	24	30	33							SS-34		-143.7 NAVESINK FORMATION: Clayey SAND (SC), grayish green (5G 5/1) to greenish black (5G 2.5/1), very dense, moist, fine to medium sand, trace shell fragments, no HCl reaction, mostly glauconite
-150.3	159.6	48	50/0.3								SS-35		-148.7 MOUNT LAUREL FORMATION: Clayey SAND (SC), dark greenish gray (5GY 4/1), very dense, dry to moist, fine to coarse subrounded sand, trace subangular gravel, strong HCl reaction, glauconite
-155.3	164.6	50/0.2									SS-36		164.6ft: Few shell fragments

PSEG ESP BORE PSEG ESP 7-07-09 GFI PSEG ESP GDI 7/10/09



SHEET 4 OF 4

PERMIT NO.: P200900088		DRILLER: M. Adams		NJ LICENSE NO.: 0001350		GEOLOGIST: B. Deobald						
SITE DESCRIPTION: PSEG SITE ESP APPLICATION				COUNTY: Salem, NJ		MACTEC PROJECT NO.: 6468-08-2251						
BORING NO.: NB-6		DRILL METHOD: Mud Rotary		SAMPLE METHODS: SPT/Shelby Tube		FLUID LEVEL (ft)						
GROUND SURFACE ELEV.: 9.3		US ft (NAVD88)		NORTHING: 235251.5		US ft (NAD83)						
EASTING: 198315.4		US ft (NAD83)		24 HR.		13.0						
TOTAL DEPTH: 200.0 ft		DRILL MACHINE: CME-850 ATV		CASING DEPTH: 14.5 ft		HAMMER (ID): 140 lb Auto. (CTB-4)						
DATE STARTED: 2/19/09		COMPLETED: 2/22/09		HOLE DIA.: 4"		ROD TYPE: NWJ						
BITS USED: 3-7/8" Drag Bit												
ELEV. (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION
		0.5ft	0.5ft	0.5ft	0	20	40	60	80	100		
-159.0					Continued from previous page							
-160.3	169.6	50/0.2								SS-37		MOUNT LAUREL FORMATION: Clayey SAND (SC), dark greenish gray (5GY 4/1), very dense, dry to moist, fine to coarse subrounded sand, trace subangular gravel, strong HCl reaction, glauconite (continued) 169.6ft: Weak HCl reaction, trace shell fragments
-165.3	174.6	33	45	50/0.3						SS-38		
-170.3	179.6	20	33	50						SS-39		MOUNT LAUREL FORMATION: Silty SAND (SM), dark greenish gray (5GY 4/1), very dense, dry to moist, fine to coarse sand, trace shell fragments, weak HCl reaction, trace glauconite
-175.3	184.6	20	30	35						SS-40		MOUNT LAUREL FORMATION: Clayey SAND (SC), dark greenish gray (5GY 4/1), very dense, moist, fine to coarse sand, trace shell fragments, weak HCl reaction, trace glauconite
-180.3	189.6	18	28	37						SS-41		MOUNT LAUREL FORMATION: Silty SAND (SM), dark greenish gray (5GY 4/1), very dense, moist, fine to coarse sand, trace shell fragments, no to weak HCl reaction, trace glauconite
-185.3	194.6	37	50/0.4							SS-42		194.6ft: Dark greenish gray (5GY 4/1) and greenish gray (10Y 6/1), dry to moist, no HCl reaction
-190.3	199.6	50/0.4								SS-43		Boring terminated at 200.0 feet. Boring closed by tremie method with cement-bentonite grout on 2/22/09.

PSEG ESP BORE PSEG ESP 7-07-09 GP1 PSEG ESP.GDI 7/10/09



GEOTECHNICAL BORING LOG

Prepared By MM Date 7/10/09Checked By JA 2 Date 7/10/09

SHEET 1 OF 4

PERMIT NO.: P200900089		DRILLER: T. Ward		NJ LICENSE NO.: 0001105		GEOLOGIST: J. Howard	
SITE DESCRIPTION: PSEG SITE ESP APPLICATION				COUNTY: Salem, NJ		MACTEC PROJECT NO.: 6468-08-2251	
BORING NO.: NB-7		DRILL METHOD: Mud Rotary		SAMPLE METHODS: SPT		FLUID LEVEL (ft)	
GROUND SURFACE ELEV.: 6.2 US ft (NAVD88)		NORTHING: 234965.7 US ft (NAD83)		EASTING: 199685.6 US ft (NAD83)		0 HR. ND	
TOTAL DEPTH: 201.2 ft		DRILL MACHINE: CME-75 Truck		CASING DEPTH: 44.0 ft		24 HR. ND	
DATE STARTED: 1/24/09		COMPLETED: 1/27/09		HOLE DIA.: 4"		HAMMER (ID): 140 lb Auto. (CBT-1)	
DATE STARTED: 1/24/09		COMPLETED: 1/27/09		HOLE DIA.: 4"		ROD TYPE: NWJ	
DATE STARTED: 1/24/09		COMPLETED: 1/27/09		HOLE DIA.: 4"		BITS USED: 3-7/8" Drag Bit	

ELEV. (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION	
		0.5ft	0.5ft	0.5ft	0	20	40	60	80				100
6.2													
6.2	0.0	27	17	9									0.0
3.7	2.5	2	3	3									0.8
1.5	4.7	WOH	WOH	WOH									4.0
-1.3	7.5	WOH	WOH	WOH									7.0
-4.1	10.3	WOH	1	1									
-6.6	12.8	WOH	WOH	WOH									
-9.1	15.3	WOH	WOH	WOH									
-14.0	20.2	2	3	3									18.0
-19.1	25.3	WOH	WOH	WOH									23.0
-24.0	30.2	5	6	6									28.0
-29.0	35.2	13	17	18									34.0
-33.8	40.0	WOH	3	2									39.0
-38.8	45.0	7	7	9									45.0ft: Medium dense, strong HCl reaction
-43.8	50.0	7	7	7									50.0ft: Dark yellowish brown (10YR 4/6), fine to coarse sand
-48.8	55.0	7	8	10									53.0

Ground Surface

ARTIFICIAL FILL: Poorly graded GRAVEL with sand (GP), yellow (10YR 8/8), medium dense, dry to wet, angular gravel, no HCl reaction

ARTIFICIAL FILL: Sandy LEAN CLAY (CL), black (10YR 2/1), very stiff, moist, no HCl reaction

2.5ft: Greenish Black (5GY 2.5/1), medium stiff

HYDRAULIC FILL: Sandy LEAN CLAY (CL), greenish black (5GY 2.5/1), very soft, moist, no HCl reaction

HYDRAULIC FILL: FAT CLAY (CH), very dark greenish gray (10Y 3/1), very soft, moist, few organics, no HCl reaction

HYDRAULIC FILL: Silty SAND (SM), black (N 2.5/), loose, wet, fine sand, no HCl reaction

HYDRAULIC FILL: ELASTIC SILT (MH), very dark gray (N 3/), very soft, moist, no HCl reaction

ALLUVIUM: Silty SAND with Gravel (SM), greenish gray (10Y 5/1), medium dense, wet, fine to medium sand, fine subrounded gravel, no HCl reaction

ALLUVIUM: Clayey GRAVEL with sand (GC), dark grayish brown (10YR 4/2), dense, moist, subrounded gravel, fine to medium sand, no HCl reaction

VINCETOWN FORMATION: Silty SAND (SM), yellowish brown (10YR 5/8), loose, wet, fine to medium sand, weak HCl reaction, trace glauconite, strongly oxidized

VINCETOWN FORMATION: Poorly Graded SAND with Silt (SP-SM), dark yellowish brown (10YR 4/6), medium dense, wet, fine to medium sand, strong HCl reaction, trace glauconite, strongly oxidized

PSEG ESP BORE PSEG ESP 7-07-09.GPJ PSEG ESP.GDT 7/10/09



PERMIT NO.: P200900089		DRILLER: T. Ward		NJ LICENSE NO.: 0001105		GEOLOGIST: J. Howard						
SITE DESCRIPTION: PSEG SITE ESP APPLICATION				COUNTY: Salem, NJ		MACTEC PROJECT NO.: 6468-08-2251		FLUID LEVEL (ft)				
BORING NO.: NB-7		DRILL METHOD: Mud Rotary			SAMPLE METHODS: SPT			0 HR. ND				
GROUND SURFACE ELEV.: 6.2		US ft (NAVD88)		NORTHING: 234965.7		US ft (NAD83)		EASTING: 199685.6 US ft (NAD83)		24 HR. ND		
TOTAL DEPTH: 201.2 ft		DRILL MACHINE: CME-75 Truck			CASING DEPTH: 44.0 ft			HAMMER (ID): 140 lb Auto. (CBT-1)				
DATE STARTED: 1/24/09		COMPLETED: 1/27/09		HOLE DIA.: 4"		ROD TYPE: NWJ		BITS USED: 3-7/8" Drag Bit				
ELEV.	DEPTH	BLOW COUNT			BLOWS PER FOOT					SAMP.	LOG	SOIL AND ROCK DESCRIPTION
(ft)	(ft)	0.5ft	0.5ft	0.5ft	0	20	40	60	80	100		
-49.9					Continued from previous page							
-53.8	60.0	13	8	13							SS-16	VINCENTOWN FORMATION: Poorly Graded SAND with Silt (SP-SM), dark yellowish brown (10YR 4/6), medium dense, wet, fine to medium sand, strong HCl reaction, trace glauconite, strongly oxidized (continued) 60.0ft: Yellowish red (5YR 5/8)
-58.9	65.1	7	7	9							SS-17	65.1ft: Brownish yellow (10YR 6/6), trace friable layers, weak to strong HCl reaction, moderately oxidized
-63.8	70.0	7	20	19							SS-18	VINCENTOWN FORMATION: Clayey SAND (SC), light yellowish brown (10YR 6/4), dense, moist, fine to medium sand, strong HCl reaction, trace glauconite, weakly oxidized
-68.8	75.0	14	11	34							SS-19	VINCENTOWN FORMATION: Silty SAND (SM), greenish gray (10Y 5/1), dense, wet, fine to medium sand, trace friable layers, strong HCl reaction, trace glauconite, no oxidation
-73.8	80.0	11	27	19							SS-20	
-79.0	85.2	19	13	15							SS-21	85.2ft: Medium dense
-84.0	90.2	8	92/0.3								SS-22	90.2ft: Dark greenish gray (10Y 4/1), very dense, trace shell fragments, trace moderately indurated layers
-89.0	95.2	7	12	30							SS-23	95.2ft: Dense
-93.8	100.0	13	13	14							SS-24	100.0ft: Medium dense
-98.9	105.1	9	16	29							SS-25	105.1ft: Greenish gray (10Y 5/1), very dense, trace friable cemented layers, weak HCl reaction
-103.9	110.1	6	26	16							SS-26	110.1ft: Dense, trace shell fragments, strong HCl reaction

PSEG ESP BORE PSEG ESP 7-07-09 GPI PSEG ESP GDI 7/10/09



PERMIT NO.: P200900089		DRILLER: T. Ward		NJ LICENSE NO.: 0001105		GEOLOGIST: J. Howard						
SITE DESCRIPTION: PSEG SITE ESP APPLICATION				COUNTY: Salem, NJ		MACTEC PROJECT NO.: 6468-08-2251		FLUID LEVEL (ft)				
BORING NO.: NB-7		DRILL METHOD: Mud Rotary		SAMPLE METHODS: SPT				0 HR.	ND			
GROUND SURFACE ELEV.: 6.2		US ft (NAVD88)		NORTHING: 234965.7		US ft (NAD83)		EASTING: 199685.6	US ft (NAD83)	24 HR.	ND	
TOTAL DEPTH: 201.2 ft		DRILL MACHINE: CME-75 Truck		CASING DEPTH: 44.0 ft		HAMMER (ID): 140 lb Auto. (CBT-1)						
DATE STARTED: 1/24/09		COMPLETED: 1/27/09		HOLE DIA.: 4"		ROD TYPE: NWJ		BITS USED: 3-7/8" Drag Bit				
ELEV.	DEPTH	BLOW COUNT			BLOWS PER FOOT					SAMP.	LOG	SOIL AND ROCK DESCRIPTION
(ft)	(ft)	0.5ft	0.5ft	0.5ft	0	20	40	60	80	100		
-106.0					Continued from previous page							
-108.8	115.0	12	12	16							SS-27	VINCENTOWN FORMATION: Silty SAND (SM), greenish gray (10Y 5/1), dense, wet, fine to medium sand, trace friable layers, strong HCl reaction, trace glauconite, no oxidation (continued) 115.1ft: Medium dense, few glauconite
-113.8	120.0	6	25	27							SS-28	-111.8 HORNERSTOWN FORMATION: Silty SAND (SM), Greenish Gray (10Y 5/1), very dense, wet, fine to medium sand, trace friable layers, strong HCl reaction, few to little glauconite
-118.8	125.0	7	9	15							SS-29	125.0ft: Medium dense, trace shell fragments, little glauconite
-123.8	130.0	7	12	13							SS-30	
-128.8	135.0	9	15	19							SS-31	
-133.8	140.0	21	60	40/0.4							SS-32	-131.8 NAVESINK FORMATION: Silty SAND (SM), very dark grayish green (5G 2.5/2), very dense, moist, fine to medium sand, few shell fragments, weak HCl reaction, mostly glauconite
-138.8	145.0	19	30	40							SS-33	145.0ft: Trace shell fragments
-143.8	150.0	27	29	42							SS-34	
-148.9	155.1	26	32	46							SS-35	
-153.8	160.0	33	49	51/0.3							SS-36	160.0ft: Very dark grayish green (5G 3/2), few shell fragments
-158.8	165.0	35	65/0.2								SS-37	-156.8 MOUNT LAUREL FORMATION: Clayey SAND (SC), very dark greenish gray (10Y 3/1), very dense, moist, fine to medium sand, trace coarse sand, trace fine gravel, trace shell fragments, weak HCl reaction, little glauconite

PSEG ESP BORE, PSEG ESP 7-07-09.GPJ, PSEG ESP.GDI 7/10/09



SHEET 4 OF 4

PERMIT NO.: P200900089		DRILLER: T. Ward		NJ LICENSE NO.: 0001105		GEOLOGIST: J. Howard	
SITE DESCRIPTION: PSEG SITE ESP APPLICATION				COUNTY: Salem, NJ		MACTEC PROJECT NO.: 6468-08-2251	
BORING NO.: NB-7		DRILL METHOD: Mud Rotary		SAMPLE METHODS: SPT		FLUID LEVEL (ft)	
GROUND SURFACE ELEV.: 6.2		US ft (NAVD88)		NORTHING: 234965.7		US ft (NAD83)	
TOTAL DEPTH: 201.2 ft		DRILL MACHINE: CME-75 Truck		CASING DEPTH: 44.0 ft		HAMMER (ID): 140 lb Auto. (CBT-1)	
DATE STARTED: 1/24/09		COMPLETED: 1/27/09		HOLE DIA.: 4"		ROD TYPE: NWJ	
BITS USED: 3-7/8" Drag Bit							

ELEV. (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT						SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION
		0.5ft	0.5ft	0.5ft	0	20	40	60	80	100			
-162.1					Continued from previous page								
-163.8	170.0	100/0.4			100/0.4						SS-38		MOUNT LAUREL FORMATION: Clayey SAND (SC), very dark greenish gray (10Y 3/1), very dense, moist, fine to medium sand, trace coarse sand, trace fine gravel, trace shell fragments, weak HCl reaction, little glauconite (continued)
-168.8	175.0	100/0.5			100/0.5						SS-39		175.0ft: Dark greenish gray (10Y 4/1)
-173.8	180.0	40	60/0.4		100/0.9						SS-40		180.0ft: Weak to strong HCl reaction, trace glauconite
-178.8	185.0	23	35	41	76						SS-41		185.0ft: Few shell fragments, strong HCl reaction
-183.8	190.0	15	26	46	72						SS-42		190.0ft: Weak HCl reaction
-188.8	195.0	34	42	58/0.3	100/0.8						SS-43		MOUNT LAUREL FORMATION: Silty SAND (SM), Greenish Gray (10Y 5/1), very dense, moist, fine to medium sand, weak HCl reaction
-193.8	200.0	38	53	47/0.2	100/0.7						SS-44		MOUNT LAUREL FORMATION: Poorly Sorted SAND with silt (SP-SM), greenish gray (10Y 5/1), very dense, moist, fine to medium sand, no HCl reaction
													Boring terminated at 201.2 feet.
													Boring closed by tremie method with cement-bentonite grout on 1/27/09.

PSEG ESP BORE PSEG ESP 7-07-09 GFI PSEG ESP.GDT 7/10/09



GEOTECHNICAL BORING LOG

Prepared By MR Date 7/10/09Checked By JSW Date 7/10/09

SHEET 1 OF 6

PERMIT NO.: P200900090			DRILLER: D. Osuch			NJ LICENSE NO.: 0024289			GEOLOGIST: S. Johnson / M. Lear					
SITE DESCRIPTION: PSEG SITE ESP APPLICATION					COUNTY: Salem, NJ			MACTEC PROJECT NO.: 6468-08-2251			FLUID LEVEL (ft)			
BORING NO.: NB-8			DRILL METHOD: Mud Rotary			SAMPLE METHODS: SPT			0 HR.			ND		
GROUND SURFACE ELEV.: 8.9			US ft (NAVD88)			NORTHING: 234140.4 US ft (NAD83)			EASTING: 199745.9 US ft (NAD83)			24 HR.	5.4	
TOTAL DEPTH: 315.3 ft			DRILL MACHINE: CME-75 Truck			CASING DEPTH: 8.5 ft			HAMMER (ID): 140 lb Auto. (CTB-3)					
DATE STARTED: 1/9/09			COMPLETED: 1/13/09			HOLE DIA.: 4"			ROD TYPE: NWJ		BITS USED: 3-7/8" Drag & Roller Cone Bits			
ELEV. (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION		
		0.5ft	0.5ft	0.5ft	0	20	40	60	80	100				
8.9					Ground Surface									
8.9	0.0	8	10	50								8.9	0.0	
6.4	2.5	3	4	4							SS-1	6.9	2.0	ARTIFICIAL FILL: Silty GRAVEL with sand (GM), very dark gray (5Y 3/1), very dense, moist, fine to coarse gravel, little fine sand
3.9	5.0	2	2	2							SS-2			HYDRAULIC FILL: LEAN CLAY with sand (CL), very dark gray (10Y 3/1), medium stiff, moist, little fine sand
1.4	7.5	7	9	5							SS-3			5.0ft: Soft, wet
-1.1	10.0	WOH	WOH	WOH							SS-4	1.9	7.0	HYDRAULIC FILL: Silty SAND (SM), gray (N 5/), medium dense, wet, few gravel
-3.3	12.2	3	5	4							SS-5	-0.6	9.5	HYDRAULIC FILL: FAT CLAY (CH), very dark gary (N 3/), very soft, wet, trace to few organics
-5.6	14.5	WOH	WOH	WOH							SS-6	-3.1	12.0	HYDRAULIC FILL: Silty, Clayey SAND (SC-SM), very dark gray (N 3/), loose, wet, fine to medium sand, trace fine gravel, trace organics
		WOH	WOH	WOH							SS-7	-5.1	14.0	HYDRAULIC FILL: FAT CLAY (CH), dark greenish gray (10Y 4/1), very soft, wet, few organics
-11.1	20.0	WOH	WOH	WOH							SS-8			20.0ft: Trace organics
-15.6	24.5	WOH	WOH	WOH							SS-9			24.5ft: Trace fine sand
-20.6	29.5	WOH	WOH	WOH							SS-10			
-25.6	34.5	1	1	1							SS-11A/B	-24.1	33.0	ALLUVIUM: Sandy SILT (ML), dark gray (N 4/), very soft, wet, fine sand
-30.6	39.5	1	3	7							SS-12	-26.6	35.5	ALLUVIUM: PEAT (PT), very dark brown (5Y4/2), very soft, wet
-35.6	44.5	10	11	4							SS-13A/B	-29.1	38.0	ALLUVIUM: Silty SAND (SM), olive gray (5Y 4/2), loose, wet, fine to medium sand
-40.6	49.5	WOH	2	3							SS-14	-35.1	44.0	ALLUVIUM: Silty GRAVEL with sand (GM), very dark gray (10YR 3/1), medium dense, wet, fine to coarse sand, fine to coarse gravel
-45.6	54.5	WOH	WOH	WOH							SS-15	-36.6	45.5	ALLUVIUM: Sandy LEAN CLAY (CL), very dark greenish gray (10G 3/1), stiff, wet, fine to medium sand, trace of gravel
												-39.1	48.0	KIRKWOOD FORMATION: Clayey SAND (SC), dark brown (7.5YR 3/2), loose, wet, fine to medium sand, trace gravel
														54.5ft: Reddish brown (5YR 4/4), very loose

PSEG ESP BORE PSEG ESP 7-07-09 GPT PSEG ESP GDT 7/10/09



SHEET 2 OF 6

PERMIT NO.: P200900090			DRILLER: D. Osuch			NJ LICENSE NO.: 0024289			GEOLOGIST: S. Johnson / M. Lear				
SITE DESCRIPTION: PSEG SITE ESP APPLICATION					COUNTY: Salem, NJ			MACTEC PROJECT NO.: 6468-08-2251			FLUID LEVEL (ft)		
BORING NO.: NB-8			DRILL METHOD: Mud Rotary			SAMPLE METHODS: SPT			0 HR. ND				
GROUND SURFACE ELEV.: 8.9 US ft (NAVD88)			NORTHING: 234140.4 US ft (NAD83)			EASTING: 199745.9 US ft (NAD83)			24 HR. 5.4				
TOTAL DEPTH: 315.3 ft			DRILL MACHINE: CME-75 Truck			CASING DEPTH: 8.5 ft			HAMMER (ID): 140 lb Auto. (CTB-3)				
DATE STARTED: 1/9/09		COMPLETED: 1/13/09		HOLE DIA.: 4"		ROD TYPE: NWJ		BITS USED: 3-7/8" Drag & Roller Cone Bits					
ELEV. (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	▼	L O G	SOIL AND ROCK DESCRIPTION
		0.5ft	0.5ft	0.5ft	0	20	40	60	80	100			
-47.2					Continued from previous page								
-50.6	59.5												KIRKWOOD FORMATION: Clayey SAND (SC), dark brown (7.5YR 3/2), loose, wet, fine to medium sand, trace gravel (continued)
		WOH	WOH	WOH									
-55.6	64.5												
		8	10	12									VINCETOWN FORMATION: Silty SAND (SM), reddish yellow (7.5YR 6/8), medium dense, wet, fine to medium sand, trace friable layers, strong HCl reaction, trace of glauconite, strongly oxidized
-60.6	69.5												
		8	8	7									
-65.6	74.5												
		19	9	9									74.5ft: Reddish yellow (7.5YR 6/6)
-70.6	79.5												
		7	20	15									VINCETOWN FORMATION: Clayey SAND (SC), light gray (2.5Y 7/2), dense, wet, fine to medium sand, trace indurated layers, strong HCl reaction, trace glauconite, weakly oxidized
-75.6	84.5												
		6	6	18									84.5ft: Medium dense
-80.6	89.5												
		100/0.5											89.5ft: Very dense, mostly indurated
-85.6	94.5												
		11	11	65									VINCETOWN FORMATION: Silty, Clayey SAND (SC-SM), light greenish gray (5GY 8/1), very dense, wet, fine to medium sand, trace indurated layers, strong HCl reaction, trace glauconite, no oxidation
-90.6	99.5												
		48	12	14									99.5ft: Medium dense, few friable layers
-95.6	104.5												
		7	12	50									104.5ft: Light greenish gray (5GY 7/1), very dense
-100.6	109.5												
		100/0.2											109.5ft: Mostly friable to indurated

PSEG ESP BORE PSEG ESP 7-07-09 GFI PSEG ESP GDI 7/10/09



PERMIT NO.: P200900090		DRILLER: D. Osuch		NJ LICENSE NO.: 0024289		GEOLOGIST: S. Johnson / M. Lear						
SITE DESCRIPTION: PSEG SITE ESP APPLICATION				COUNTY: Salem, NJ		MACTEC PROJECT NO.: 6468-08-2251		FLUID LEVEL (ft)				
BORING NO.: NB-8		DRILL METHOD: Mud Rotary			SAMPLE METHODS: SPT			0 HR. ND				
GROUND SURFACE ELEV.: 8.9		US ft (NAVD88)		NORTHING: 234140.4		US ft (NAD83)		EASTING: 199745.9 US ft (NAD83)		24 HR. 5.4		
TOTAL DEPTH: 315.3 ft		DRILL MACHINE: CME-75 Truck			CASING DEPTH: 8.5 ft			HAMMER (ID): 140 lb Auto. (CTB-3)				
DATE STARTED: 1/9/09		COMPLETED: 1/13/09		HOLE DIA.: 4"		ROD TYPE: NWJ		BITS USED: 3-7/8" Drag & Roller Cone Bits				
ELEV.	DEPTH	BLOW COUNT			BLOWS PER FOOT					SAMP.	LOG	SOIL AND ROCK DESCRIPTION
(ft)	(ft)	0.5ft	0.5ft	0.5ft	0	20	40	60	80	100		
-103.3					Continued from previous page							
-105.6	114.5	8	14	19							SS-27	VINCENTOWN FORMATION: Silty, Clayey SAND (SC-SM), light greenish gray (5GY 8/1), very dense, wet, fine to medium sand, trace indurated layers, strong HCl reaction, trace glauconite, no oxidation (continued)
-110.6	119.5	43	21	21							SS-28	114.5ft: Greenish gray (5GY 5/1), dense, trace to few glauconite
-115.6	124.5	8	12	17							SS-29	119.5ft: Greenish gray (5GY 5/1), dense, trace friable layers
-120.6	129.5	6	10	16							SS-30	123.0
-125.6	134.5	8	14	42							SS-31	HORNERSTOWN FORMATION: Silty SAND (SM), dark greenish gray (10Y 5/1), medium dense, wet, fine to medium sand, strong HCl reaction, trace of glauconite
-130.6	139.5	33	22	20							SS-32	129.5ft: Few to little glauconite
-135.6	144.5	13	16	31							SS-33	134.5ft: Very dense
-140.6	149.5	20	29	32							SS-34	139.5ft: Dark greenish gray (5GY 4/1), dense, trace friable layers, little glauconite
-145.6	154.5	28	40	40							SS-35	141.5
-150.6	159.5	23	39	36							SS-36	NAVESINK FORMATION: Silty SAND (SM), very dark greenish gray (5G 3/2), dense, wet, fine sand, trace shell fragments, weak HCl reaction, mostly glauconite
-155.6	164.5	27	36	43							SS-37	149.5ft: Very dense, little shell fragments
												153.0
												NAVESINK FORMATION: Silty, Clayey SAND (SC-SM), very dark greenish gray (5G 3/2), very dense, wet, fine to coarse sand, trace fine gravel, few to little shell fragments, weak HCl reaction, mostly glauconite
												157.1
												MOUNT LAUREL FORMATION: Sandy LEAN CLAY (CL), dark gray (2.5Y 4/1), hard, moist, fine to coarse sand, little glauconite, strong HCl reaction

PSEG ESP BORE PSEG ESP 7-07-09 GFI PSEG ESP GDT 7/10/09



SHEET 4 OF 6

PERMIT NO.: P200900090		DRILLER: D. Osuch		NJ LICENSE NO.: 0024289		GEOLOGIST: S. Johnson / M. Lear	
SITE DESCRIPTION: PSEG SITE ESP APPLICATION				COUNTY: Salem, NJ		MACTEC PROJECT NO.: 6468-08-2251	
BORING NO.: NB-8		DRILL METHOD: Mud Rotary		SAMPLE METHODS: SPT		FLUID LEVEL (ft)	
GROUND SURFACE ELEV.: 8.9		US ft (NAVD88)		NORTHING: 234140.4 US ft (NAD83)		EASTING: 199745.9 US ft (NAD83)	
TOTAL DEPTH: 315.3 ft		DRILL MACHINE: CME-75 Truck		CASING DEPTH: 8.5 ft		HAMMER (ID): 140 lb Auto. (CTB-3)	
DATE STARTED: 1/9/09		COMPLETED: 1/13/09		HOLE DIA.: 4"		ROD TYPE: NWJ	
BITS USED: 3-7/8" Drag & Roller Cone Bits							

ELEV. (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT						SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION
		0.5ft	0.5ft	0.5ft	0	20	40	60	80	100			
-159.4					Continued from previous page								
-160.6	169.5	30	40	60/0.2							SS-38		MOUNT LAUREL FORMATION: Sandy LEAN CLAY (CL), dark gray (2.5Y 4/1), hard, moist, fine to coarse sand, little glauconite, strong HCl reaction (continued)
-165.6	174.5	100/0.2									SS-39		MOUNT LAUREL FORMATION: Clayey SAND (SC), dark greenish gray (10Y 4/1), very dense, moist, fine to coarse sand, trace shell fragments, strong HCl reaction, little glauconite
-170.6	179.5	100/0.3									SS-40		
-175.6	184.5	60	40/0.2								SS-41		MOUNT LAUREL FORMATION: Silty SAND (SM), very dark greenish gray (5GY 3/1), very dense, wet, fine sand, strong HCl reaction, mostly glauconite
-180.6	189.5	25	33	53							SS-42		MOUNT LAUREL FORMATION: Clayey SAND (SC), very dark greenish gray (5GY 3/1), very dense, wet, fine to medium sand, trace shell fragments, strong HCl reaction, little glauconite
-185.6	194.5	23	33	41							SS-43		194.5ft: Trace glauconite
-190.6	199.5	19	35	57							SS-44		199.5ft: Greenish gray (5GY 5/1), weak HCl reaction
-200.6	209.5	50	50/0.2								SS-45		MOUNT LAUREL FORMATION: Poorly graded SAND with silt (SP-SM), greenish gray (10GY 5/1), very dense, wet, fine to coarse subangular sand, few friable layers, no HCl reaction, trace of glauconite
-210.6	219.5	75	25/0.1								SS-46		219.5ft: Very dark greenish gray (5GY 3/1), moist to wet, weak HCl reaction

PSEG ESP BORE, PSEG ESP, 7-07-09 GJP, PSEG ESP, GDT, 7/10/09



PERMIT NO.: P200900090		DRILLER: D. Osuch		NJ LICENSE NO.: 0024289		GEOLOGIST: S. Johnson / M. Lear							
SITE DESCRIPTION: PSEG SITE ESP APPLICATION			COUNTY: Salem, NJ		MACTEC PROJECT NO.: 6468-08-2251		FLUID LEVEL (ft)						
BORING NO.: NB-8		DRILL METHOD: Mud Rotary		SAMPLE METHODS: SPT		0 HR.		ND					
GROUND SURFACE ELEV.: 8.9		US ft (NAVD88)		NORTHING: 234140.4 US ft (NAD83)		EASTING: 199745.9 US ft (NAD83)		24 HR. 5.4					
TOTAL DEPTH: 315.3 ft		DRILL MACHINE: CME-75 Truck		CASING DEPTH: 8.5 ft		HAMMER (ID): 140 lb Auto. (CTB-3)							
DATE STARTED: 1/9/09		COMPLETED: 1/13/09		HOLE DIA.: 4"		ROD TYPE: NWJ		BITS USED: 3-7/8" Drag & Roller Cone Bits					
ELEV. (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	▼	L O G	SOIL AND ROCK DESCRIPTION
		0.5ft	0.5ft	0.5ft	0	20	40	60	80	100			
-215.5					Continued from previous page								
-220.6	229.5	55	45/0.3							100/0.8	SS-47		MOUNT LAUREL FORMATION: Poorly graded SAND with silt (SP-SM), greenish gray (10GY 5/1), very dense, wet, fine to coarse subangular sand, few friable layers, no HCl reaction, trace of glauconite (continued) 229.5ft: trace to few glauconite
-230.6	239.5	30	53	47/0.4						100/0.9	SS-48		
-240.6	249.5	39	44	48						92	SS-49		MOUNT LAUREL FORMATION: Silty, Clayey SAND (SC-SM), very dark greenish gray (5G 3/1), very dense, wet, fine to medium sand, weak HCl reaction, trace to few glauconite
-250.6	259.5	17	30	43						73	SS-50		MOUNT LAUREL FORMATION: Silty SAND (SM), very dark greenish gray (5GY 3/1), very dense, wet, fine to medium sand, weak HCl reaction, trace glauconite
-260.6	269.5	5	5	13						18	SS-51		WENONAH FORMATION: FAT CLAY with sand (CH), very dark gray (N 3/), very stiff, wet, little fine sand, strong HCl reaction
-270.6	279.5	2	3	4							SS-52		WENONAH FORMATION: Clayey SAND (SC), very dark gray (N 3/), loose, wet, fine to medium sand, strong HCl reaction

PSEG ESP BORE PSEG ESP 7-07-09 GFI PSEG ESP GDT 7/10/09

[illegible]

GEOTECHNICAL BORING LOG

Prepared By Man Date 7/10/09

Checked By 212 Date 7/10/09

SHEET 1 OF 1

[illegible]



GEOTECHNICAL BORING LOG

Prepared By NB Date 7/10/09Checked By JA Date 7/10/09

SHEET 1 OF 7

PERMIT NO.: P200900125		DRILLER: T. Ward		NJ LICENSE NO.: 0001105		GEOLOGIST: J. Howard							
SITE DESCRIPTION: PSEG SITE ESP APPLICATION				COUNTY: Salem, NJ		MACTEC PROJECT NO.: 6468-08-2251		FLUID LEVEL (ft)					
BORING NO.: EB-1		DRILL METHOD: Mud Rotary		SAMPLE METHODS: SPT		0 HR.		ND					
GROUND SURFACE ELEV.: 15.9 US ft (NAVD88)		NORTHING: 232316.7 US ft (NAD83)		EASTING: 202774.1 US ft (NAD83)		24 HR.		3.1					
TOTAL DEPTH: 351.5 ft		DRILL MACHINE: CME-75 Truck		CASING DEPTH: 4"=38.5' / 6"=18.5'		HAMMER (ID): 140 lb Auto. (CBT-1)							
DATE STARTED: 1/9/09		COMPLETED: 1/21/09		HOLE DIA.: 4"-6"		ROD TYPE: NWJ		BITS USED: 3-7/8" Drag Bit					
ELEV. (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION	
		0.5ft	0.5ft	0.5ft	0	20	40	60	80	100			
15.9					Ground Surface								
15.9	0.0	7	11	9						SS-1		15.9	0.0
13.4	2.5	3	5	5						SS-2		15.0	0.9
10.9	5.0	1	WOH	1						SS-3		10.9	5.0
8.4	7.5	WOH	WOH	WOH						SS-4			
5.9	10.0	WOH	WOH	1						SS-5			
3.4	12.5	1	WOH	1						SS-6			
0.9	15.0	WOH	1	WOH						SS-7			
-4.1	20.0	WOH	1	1						SS-8			
-9.1	25.0	WOH	WOH	WOH						SS-9			
-14.1	30.0	WOH	WOH	WOH						SS-10			
-19.1	35.0	WOH	WOH	WOH						SS-11			
-24.1	40.0	12	16	13						SS-12			
-29.1	45.0	6	8	9						SS-13			
-34.1	50.0	5	11	13						SS-14			
-39.1	55.0	7	8	13						SS-15			

PSEG ESP BORE PSEG ESP 7-07-09.GPJ PSEG ESP.GDT 7/10/09

PSEG ESP BORE PSEG ESP 7-07-09.GPJ PSEG ESP.GDT 7/10/09



SHEET 3 OF 7

PERMIT NO.: P200900125		DRILLER: T. Ward		NJ LICENSE NO.: 0001105		GEOLOGIST: J. Howard							
SITE DESCRIPTION: PSEG SITE ESP APPLICATION			COUNTY: Salem, NJ		MACTEC PROJECT NO.: 6468-08-2251		FLUID LEVEL (ft)						
BORING NO.: EB-1		DRILL METHOD: Mud Rotary		SAMPLE METHODS: SPT		0 HR. ND							
GROUND SURFACE ELEV.: 15.9 US ft (NAVD88)		NORTHING: 232316.7 US ft (NAD83)		EASTING: 202774.1 US ft (NAD83)		24 HR. 3.1							
TOTAL DEPTH: 351.5 ft		DRILL MACHINE: CME-75 Truck		CASING DEPTH: 4"=38.5' / 6"=18.5'		HAMMER (ID): 140 lb Auto. (CBT-1)							
DATE STARTED: 1/9/09		COMPLETED: 1/21/09		HOLE DIA.: 4"-6"		ROD TYPE: NWJ							
						BITS USED: 3-7/8" Drag Bit							
ELEV. (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION	
		0.5ft	0.5ft	0.5ft	0	20	40	60	80	100			
-96.3					Continued from previous page								
-99.0	114.9	17	14	16			30				SS-28		VINCENTOWN FORMATION: Silty SAND (SM), greenish gray (5GY 5/1), medium dense, wet, fine to medium sand, no HCl reaction, trace glauconite
-104.2	120.1	41	28	18			46				SS-29		120.1ft: Greenish gray (10Y 5/1), dense, moist, no to weak HCl reaction, few friable to moderately indurated layers
-109.3	125.2	9	24	15			39				SS-30		125.2ft: Weak to strong HCl reaction, trace shell fragments, few moderately indurated layers
-114.1	130.0	9	76	24						100/1.0	SS-31		130.0ft: Greenish gray (10Y 6/1), very dense, wet, few friable layers
-119.1	135.0	7	93/0.4							100/0.9	SS-32		135.0ft: Greenish gray (10Y 5/1), strong HCl reaction, few friable to moderately indurated layers
-124.1	140.0	9	12	13			25				SS-33		140.0ft: Greenish gray (10Y 6/1), medium dense, no to weak HCl reaction
-129.1	145.0	100/0.1								100/0.1	SS-34		HORNERSTOWN FORMATION: Silty SAND (SM), greenish gray (10Y 6/1), very dense, moist, fine to medium sand, weak HCl reaction, trace to few glauconite 145.0ft: Moderately indurated to friable
-134.1	150.0	6	11	16			27				SS-35		150.0ft: Medium dense, strong HCl reaction, few glauconite
-139.2	155.1	6	12	19			31				SS-36		155.1ft: Greenish gray (10Y 5/1), dense
-144.0	159.9	7	36	26						62	SS-37		159.9ft: Dark greenish gray (5GY 4/1), very dense, trace shell fragments, few to little glauconite
-149.1	165.0	41	28	32						60	SS-38		NAVESINK FORMATION: Silty, Clayey SAND (SC-SM), dark bluish gray (5B 4/1), very dense, moist, fine to medium sand, trace shell fragments, weak HCl reaction, mostly glauconite

PSEG ESP BORE PSEG ESP 7-07-09.GPJ PSEG ESP.GDT 7/10/09



PERMIT NO.: P200900125		DRILLER: T. Ward		NJ LICENSE NO.: 0001105		GEOLOGIST: J. Howard						
SITE DESCRIPTION: PSEG SITE ESP APPLICATION			COUNTY: Salem, NJ		MACTEC PROJECT NO.: 6468-08-2251		FLUID LEVEL (ft)					
BORING NO.: EB-1		DRILL METHOD: Mud Rotary		SAMPLE METHODS: SPT		0 HR. ND						
GROUND SURFACE ELEV.: 15.9		US ft (NAVD88)		NORTHING: 232316.7		US ft (NAD83)		24 HR. 3.1				
TOTAL DEPTH: 351.5 ft		DRILL MACHINE: CME-75 Truck		CASING DEPTH: 4"=38.5' / 6"=18.5'		HAMMER (ID): 140 lb Auto. (CBT-1)						
DATE STARTED: 1/9/09		COMPLETED: 1/21/09		HOLE DIA.: 4"-6"		ROD TYPE: NWJ		BITS USED: 3-7/8" Drag Bit				
ELEV.	DEPTH	BLOW COUNT			BLOWS PER FOOT					SAMP.	LOG	SOIL AND ROCK DESCRIPTION
(ft)	(ft)	0.5ft	0.5ft	0.5ft	0	20	40	60	80	100		
-152.4					Continued from previous page							
-154.0	169.9	19	30	34	64					SS-39		NAVESINK FORMATION: Silty, Clayey SAND (SC-SM), dark bluish gray (5B 4/1), very dense, moist, fine to medium sand, trace shell fragments, weak HCl reaction, mostly glauconite (continued) 169.9ft: Greenish black (5BG 2.5/1), no HCl reaction
-159.1	175.0	17	28	38	66					SS-40		175.0ft: Medium dense, weak HCl reaction
-164.1	180.0	26	39	57	96					SS-41		180.0ft: No HCl reaction
-169.0	184.9	20	30	38	68					SS-42A/B		184.9ft: Little coarse shell fragments
-174.0	189.9	35	65/0.1		100/0.6					SS-43		MOUNT LAUREL FORMATION: Silty, Clayey SAND (SC-SM), dark gray (10YR 4/1), very dense, moist, fine to coarse subrounded sand, little shell fragments, weak to strong HCl reaction, little glauconite
-179.1	195.0	100/0.3			100/0.3					SS-44		189.9ft: Dark greenish gray (10Y 4/1), strong HCl reaction
-184.0	199.9	100/0.4			100/0.4					SS-45		195.0ft: Fine to medium sand, weak HCl reaction
-194.1	210.0	21	36	42	78					SS-46		210.0ft: Trace shell fragments, few glauconite
-203.9	219.8	26	40	60	100/1.0					SS-47		MOUNT LAUREL FORMATION: Silty SAND (SM), greenish gray (10Y 5/1), very dense, moist, fine to medium sand, weak HCl reaction, trace glauconite

PSEG ESP BORE PSEG ESP 7-07-09.GPJ PSEG ESP.GDT 7/10/09



SHEET 5 OF 7

PERMIT NO.: P200900125		DRILLER: T. Ward		NJ LICENSE NO.: 0001105		GEOLOGIST: J. Howard	
SITE DESCRIPTION: PSEG SITE ESP APPLICATION				COUNTY: Salem, NJ		MACTEC PROJECT NO.: 6468-08-2251	
BORING NO.: EB-1		DRILL METHOD: Mud Rotary		SAMPLE METHODS: SPT		FLUID LEVEL (ft)	
GROUND SURFACE ELEV.: 15.9 US ft (NAVD88)		NORTHING: 232316.7 US ft (NAD83)		EASTING: 202774.1 US ft (NAD83)		0 HR. ND	
TOTAL DEPTH: 351.5 ft		DRILL MACHINE: CME-75 Truck		CASING DEPTH: 4"=38.5' / 6"=18.5'		HAMMER (ID): 140 lb Auto. (CBT-1)	
DATE STARTED: 1/9/09		COMPLETED: 1/21/09		HOLE DIA.: 4"-6"		ROD TYPE: NWJ	
BITS USED: 3-7/8" Drag Bit							

ELEV. (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT						SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION
		0.5ft	0.5ft	0.5ft	0	20	40	60	80	100			
-208.5					Continued from previous page								
-214.0	229.9	58	42/0.2								SS-48		MOUNT LAUREL FORMATION: Silty SAND (SM), greenish gray (10Y 5/1), very dense, moist, fine to medium sand, weak HCl reaction, trace glauconite (continued)
													229.9ft: No HCl reaction
-224.1	240.0	100/0.5									SS-49		
-234.0	249.9	60	40/0.2								SS-50		249.9ft: Weak HCl reaction
-244.1	260.0	63	37/0.2								SS-51		260.0ft: No HCl reaction
-254.1	270.0	100/0.5									SS-52		270.0ft: Dark greenish gray (10Y 4/1), weak HCl reaction
-259.1													MOUNT LAUREL FORMATION: Poorly graded SAND with silt (SP-SM), dark greenish gray (5GY 4/1), very dense, moist, fine to medium sand, no HCl reaction, trace glauconite
-264.0	279.9										SS-53		

PSEG ESP BORE PSEG ESP 7-07-09.GPJ PSEG ESP.GDT 7/10/09

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PSEGE ESP BORE PSEGE ESP 7-07-09.GPJ PSEGE ESP.GDT 7/10/09



GEOTECHNICAL BORING LOG

Prepared By NJB Date 7/10/09Checked By JOB Date 7/10/09

SHEET 1 OF 4

PERMIT NO.: P200804329		DRILLER: T. Ward		NJ LICENSE NO.: 0001105		GEOLOGIST: J. Howard						
SITE DESCRIPTION: PSEG SITE ESP APPLICATION				COUNTY: Salem, NJ		MACTEC PROJECT NO.: 6468-08-2251		FLUID LEVEL (ft)				
BORING NO.: EB-2		DRILL METHOD: Mud Rotary		SAMPLE METHODS: SPT				0 HR.	ND			
GROUND SURFACE ELEV.: 14.1 US ft (NAVD88)		NORTHING: 233264.7 US ft (NAD83)		EASTING: 202166.5 US ft (NAD83)				24 HR.	6.3			
TOTAL DEPTH: 200.7 ft		DRILL MACHINE: CME-75 Truck		CASING DEPTH: 14.0 ft		HAMMER (ID): 140 lb Auto. (CBT-1)						
DATE STARTED: 2/3/09		COMPLETED: 2/6/09		HOLE DIA.: 4"		ROD TYPE: NWJ		BITS USED: 3-7/8" Drag Bit				
ELEV.	DEPTH	BLOW COUNT			BLOWS PER FOOT					SAMP.	LOG	SOIL AND ROCK DESCRIPTION
(ft)	(ft)	0.5ft	0.5ft	0.5ft	0	20	40	60	80	100		
14.1					Ground Surface							
14.1	0.0	5	5	10						SS-1		14.1
11.6	2.5	5	5	4						SS-2		12.1
9.1	5.0	8	11	6						SS-3		9.6
6.6	7.5	4	1	2						SS-4		7.1
4.1	10.0	WOH	1	1						SS-5		10.0ft: No recovery, very soft
1.6	12.5	1	1	1						SS-6		2.1
-0.9	15.0	WOH	WOH	WOH						SS-7		HYDRAULIC FILL: ELASTIC SILT (MH), very dark greenish gray (10Y 3/1), very soft, moist, trace fine sand, trace organics, no HCl reaction, PP=0.0 tsf
-5.9	20.0	WOH	WOH	2						SS-8		
-11.2	25.3	WOH	WOH	WOH						SS-9		
-16.2	30.3	WOH	WOH	WOH						SS-10		
-21.1	35.2	WOH	WOH	WOH						SS-11		
-25.9	40.0	4	6	10						SS-12		-24.9
-31.7	45.8	1	3	4						SS-13		-29.9
-35.9	50.0	WOH	2	3						SS-14		-33.9
-40.9	55.0	WOH	1	2						SS-15		48.0
												ALLUVIUM: Silty SAND with gravel (SM), greenish gray (10Y 6/1), medium dense, wet, fine to coarse sand, little fine subrounded gravel, no HCl reaction
												44.0
												ALLUVIUM: Sandy SILT (ML), greenish gray (10Y 5/1), medium stiff, moist, some fine sand, no HCl reaction
												48.0
												ALLUVIUM: FAT CLAY (CH), greenish gray (10Y 5/1), medium stiff, moist, no HCl reaction
												50.0ft: PP=2.0 tsf
												55.0ft: Very dark greenish gray (10Y 3/1), soft, PP=0.75 tsf

PSEG ESP BORE PSEG ESP 7-07-09 GPJ PSEG ESP GDT 7/10/09



PERMIT NO.: P200804329			DRILLER: T. Ward			NJ LICENSE NO.: 0001105			GEOLOGIST: J. Howard				
SITE DESCRIPTION: PSEG SITE ESP APPLICATION					COUNTY: Salem, NJ		MACTEC PROJECT NO.: 6468-08-2251			FLUID LEVEL (ft)			
BORING NO.: EB-2			DRILL METHOD: Mud Rotary			SAMPLE METHODS: SPT			0 HR. ND				
GROUND SURFACE ELEV.: 14.1 US ft (NAVD88)			NORTHING: 233264.7 US ft (NAD83)			EASTING: 202166.5 US ft (NAD83)			24 HR. 6.3				
TOTAL DEPTH: 200.7 ft			DRILL MACHINE: CME-75 Truck			CASING DEPTH: 14.0 ft			HAMMER (ID): 140 lb Auto. (CBT-1)				
DATE STARTED: 2/3/09		COMPLETED: 2/6/09		HOLE DIA.: 4"		ROD TYPE: NWJ		BITS USED: 3-7/8" Drag Bit					
ELEV. (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION	
		0.5ft	0.5ft	0.5ft	0	20	40	60	80	100			
-42.0					Continued from previous page								
-45.9	60.0												ALLUVIUM: FAT CLAY (CH), greenish gray (10Y 5/1), medium stiff, moist, no HCl reaction (continued)
		WOH	2	3	5						SS-16		60.0ft: Medium stiff, PP=1.5 tsf
-51.2	65.3												KIRKWOOD FORMATION: Sandy LEAN CLAY (CL), very dark greenish gray (10Y 3/1), soft, moist, some fine to medium sand, trace shell fragments, no HCl reaction, PP=0.25 tsf
		WOH	1	2	3						SS-17		
-55.9	70.0												
		1	1	1	2						SS-18		70.0ft: Very soft, trace organics, PP=1.0 tsf
-61.0	75.1												
		WOH	WOH	1	1						SS-19		KIRKWOOD FORMATION: FAT CLAY (CH), dark greenish gray (10Y 4/1), very soft, moist, no HCl reaction, trace organics, PP=1.0 tsf
-65.9	80.0												
		WOH	1	1	2						SS-20		80.0ft: PP=0.25 tsf
-70.9	85.0												
		1	2	1	3						SS-21		85.0ft: Soft, few organics, PP=0.25 tsf
-76.2	90.3												
		WOH	WOH	WOH	0						SS-22		90.3ft: Very soft, trace organics, PP=0.5 tsf
-80.9	95.0												
		WOH	WOH	WOH	0						SS-23		95.0ft: PP=0.5 tsf
-85.9	100.0												
		10	15	14	29						SS-24		KIRKWOOD FORMATION: Poorly graded SAND with silt and gravel (SP-SM), greenish gray (10Y 5/1), medium dense, wet, fine to coarse sand, little fine to coarse gravel, no HCl reaction
-90.9	105.0												
		10	14	14	28						SS-25		VINCENTOWN FORMATION: Silty SAND (SM), greenish gray (5GY 5/1), medium dense, wet, fine to medium sand, few friable layers, strong HCl reaction, trace glauconite
-95.9	110.0												
		8	92/0.4								SS-26		110.0ft: Greenish gray (5GY 6/1), very dense, few moderately indurated layers

PSEG ESP BORE PSEG ESP 7-07-09 GFI PSEG ESP.GDI 7/10/09



PERMIT NO.: P200804329		DRILLER: T. Ward		NJ LICENSE NO.: 0001105		GEOLOGIST: J. Howard									
SITE DESCRIPTION: PSEG SITE ESP APPLICATION				COUNTY: Salem, NJ		MACTEC PROJECT NO.: 6468-08-2251		FLUID LEVEL (ft)							
BORING NO.: EB-2		DRILL METHOD: Mud Rotary		SAMPLE METHODS: SPT		0 HR.		ND							
GROUND SURFACE ELEV.: 14.1		US ft (NAVD88)		NORTHING: 233264.7		US ft (NAD83)		EASTING: 202166.5		US ft (NAD83)		24 HR.		6.3	
TOTAL DEPTH: 200.7 ft		DRILL MACHINE: CME-75 Truck		CASING DEPTH: 14.0 ft		HAMMER (ID): 140 lb Auto. (CBT-1)									
DATE STARTED: 2/3/09		COMPLETED: 2/6/09		HOLE DIA.: 4"		ROD TYPE: NWJ		BITS USED: 3-7/8" Drag Bit							
ELEV.	DEPTH	BLOW COUNT			BLOWS PER FOOT					SAMP.	▼	LOG	SOIL AND ROCK DESCRIPTION		
(ft)	(ft)	0.5ft	0.5ft	0.5ft	0	20	40	60	80	100					NO.
-98.1					Continued from previous page										
-100.8	114.9													VINCENTOWN FORMATION: Silty SAND (SM), greenish gray (5GY 5/1), medium dense, wet, fine to medium sand, few friable layers, strong HCl reaction, trace glauconite (continued)	
		6	12	26										114.9 ft: Greenish gray (10Y 5/1), dense, fine to medium sand, trace friable to moderately indurated layers	
-105.9	120.0													120.0ft: Greenish gray (10Y 6/1), very dense, moist, few friable layers	
		40	13	87/0.2											
-110.9	125.0													125.0ft: Mostly friable to moderately indurated	
		100/0.3													
-115.7	129.8													VINCENTOWN FORMATION: Clayey SAND (SC), greenish gray (5GY 6/1), very dense, moist, fine to medium sand, strong HCl reaction, trace glauconite	
		20	14	45											
-120.9	135.0													135.0ft: Mostly friable to moderately indurated	
		100/0.4													
-125.9	140.0													140.0ft: Few friable layers	
		9	91/0.5												
-130.9	145.0													HORNERSTOWN FORMATION: Silty SAND (SM), dark greenish gray (5GY 4/1), very dense, moist, fine to medium sand, trace friable layers, trace shell fragments, strong HCl reaction, trace glauconite	
		9	16	39											
-135.9	150.0													150.0ft: Dense, few to little glauconite	
		14	20	24											
-140.9	155.0														
		8	15	24											
-145.7	159.8													159.8ft: Greenish black (10GY 2.5/1), very dense, wet, trace shell fragments, little to some glauconite	
		11	25	33											
-150.9	165.0													NAVESINK FORMATION: Poorly graded SAND with silt (SP-SM), greenish black (10GY 2.5/1), very dense, wet, fine to medium sand, few shell fragments, weak HCl reaction, mostly glauconite	
		18	39	37											

PSEG ESP BORE PSEG ESP 7-07-09.GPJ PSEG ESP.GDT 7/10/09



PERMIT NO.: P200804329		DRILLER: T. Ward		NJ LICENSE NO.: 0001105		GEOLOGIST: J. Howard	
SITE DESCRIPTION: PSEG SITE ESP APPLICATION				COUNTY: Salem, NJ		MACTEC PROJECT NO.: 6468-08-2251	
BORING NO.: EB-2		DRILL METHOD: Mud Rotary		SAMPLE METHODS: SPT		FLUID LEVEL (ft)	
GROUND SURFACE ELEV.: 14.1 US ft (NAVD88)		NORTHING: 233264.7 US ft (NAD83)		EASTING: 202166.5 US ft (NAD83)		0 HR. ND	
TOTAL DEPTH: 200.7 ft		DRILL MACHINE: CME-75 Truck		CASING DEPTH: 14.0 ft		HAMMER (ID): 140 lb Auto. (CBT-1)	
DATE STARTED: 2/3/09		COMPLETED: 2/6/09		HOLE DIA.: 4"		ROD TYPE: NWJ	
BITS USED: 3-7/8" Drag Bit							

ELEV. (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT						SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION
		0.5ft	0.5ft	0.5ft	0	20	40	60	80	100			
-154.2					Continued from previous page								
-155.9	170.0	11	18	30							SS-38		NAVESINK FORMATION: Clayey SAND (SC), greenish black (10GY 2.5/1), dense, wet, fine to medium sand, weak HCl reaction, mostly glauconite (continued)
-161.1	175.2	16	30	47							SS-39		NAVESINK FORMATION: Poorly graded SAND with silt (SP-SM), greenish black (10GY 2.5/1), very dense, wet, fine to medium sand, weak HCl reaction, mostly glauconite
-165.7	179.8	36	45	55/0.3							SS-40		
-170.9	185.0	20	80/0.5								SS-41		
-175.8	189.9	100/0.3									SS-42		
-180.9	195.0	100/0.3									SS-43		195.0ft: Very dark greenish gray (10Y 3/1)
-185.9	200.0	70	30/0.2								SS-44		
													Boring terminated at 200.7 feet.
													Boring closed by tremie method with cement-bentonite grout on 2/07/09.

PSEG ESP BORE PSEG ESP 7-07-09.GPJ PSEG ESP.GDT 7/10/09



GEOTECHNICAL BORING LOG

Prepared By NBR Date 7/10/09

Checked By JS Date 7/10/09

SHEET 1 OF 12

PERMIT NO.: P200900124		DRILLER: D. Osuch / R. Bartholomew		NJ LICENSE NO.: 0024289 / 0001383		GEOLOGIST: M. Lear							
SITE DESCRIPTION: PSEG SITE ESP APPLICATION				COUNTY: Salem, NJ		MACTEC PROJECT NO.: 6468-08-2251		FLUID LEVEL (ft)					
BORING NO.: EB-3		DRILL METHOD: Mud Rotary		SAMPLE METHODS: SPT		0 HR.		ND					
GROUND SURFACE ELEV.: 16.5 US ft (NAVD88)		NORTHING: 232349.0 US ft (NAD83)		EASTING: 202473.9 US ft (NAD83)		24 HR.		13.8					
TOTAL DEPTH: 631.5 ft		DRILL MACHINE: CME-75 Truck		CASING DEPTH: 53.7 ft		HAMMER (ID): 140 lb Auto. (CTB-3)							
DATE STARTED: 1/24/09		COMPLETED: 2/17/09		HOLE DIA.: 4"		ROD TYPE: NWJ		BITS USED: 3-7/8" Drag & Roller Cone Bits					
ELEV.	DEPTH	BLOW COUNT			BLOWS PER FOOT					SAMP.	LOG	SOIL AND ROCK DESCRIPTION	
(ft)	(ft)	0.5ft	0.5ft	0.5ft	0	20	40	60	80	100			NO.
16.5					Ground Surface								
16.5	0.0	33	30	9						SS-1		16.5	ARTIFICIAL FILL: Silty GRAVEL with sand (GM), grayish brown (10YR 5/2), dense, dry to moist, fine to coarse gravel
14.0	2.5	5	5	4						SS-2		14.5	ARTIFICIAL FILL: Poorly graded SAND with gravel (SP), dark gray (10YR 4/1), loose, wet, fine to medium sand, little fine gravel
11.5	5.0	WOH	2	2						SS-3		12.0	HYDRAULIC FILL: SILT (ML), very dark gray (2.5Y 3/1), soft, moist to wet, trace fine sand, PP=0.5 tsf
9.0	7.5	2	1	2						SS-4			7.5ft: Wet
6.5	10.0	2	4	3						SS-5			10.0ft: Medium stiff
4.0	12.5	2	1	1						SS-6		3.7	
1.5	15.0	WOH	WOH	2						SS-7		2.0	HYDRAULIC FILL: Poorly graded SAND (SP), dark gray (2.5Y 4/1), very loose, wet, fine to coarse sand, trace organics
		WOH	WOH	2									HYDRAULIC FILL: Sandy SILT (ML), very dark gray (2.5Y 3/1), very soft, wet, some fine sand, trace organics, PP=0.0 tsf
-3.5	20.0	WOH	WOH	2						SS-8			
		WOH	WOH	WOH								-6.5	HYDRAULIC FILL: FAT CLAY with sand (CH), very dark gray (2.5Y 3/1), very soft, wet, few to little fine sand, trace organics, PP=0.0 tsf
-8.5	25.0	WOH	WOH	WOH						SS-9		-11.0	HYDRAULIC FILL: FAT CLAY (CH), very dark gray (2.5Y 3/1), very soft, wet, trace fine sand, trace organics, PP=0.5 tsf
-13.5	30.0	WOH	WOH	WOH						SS-10			
-18.5	35.0	WOH	WOH	WOH						SS-11		35.0ft: Moist to wet, trace fine sand partings, PP=0.0 tsf	
		WOH	WOH	WOH								-21.5	ALLUVIUM: Poorly graded SAND with silt and gravel (SP-SM), gray (5Y 5/1), medium dense, wet, fine to coarse sand, little fine to coarse subrounded to rounded gravel
-23.5	40.0	5	8	10						SS-12		-27.5	
-28.5	45.0	5	2	4						SS-13		44.0	ALLUVIUM: LEAN CLAY with sand (CL), dark greenish gray (10Y 4/1), medium stiff, moist to wet, little fine to medium sand, PP=0.75 tsf
-33.5	50.0	WOH	2	3						SS-14			50.0ft: Moist, PP=1.25 tsf
-38.5	55.0	WOH	2	5						SS-15		-36.5	KIRKWOOD FORMATION: FAT CLAY (CH), very dark greenish gray (10Y 3/1), medium stiff, wet, few fine sand, trace organics, PP=1.25 tsf

PSEG ESP BORE PSEG ESP 7-07-09 GP1 PSEG ESP GDT 7/10/09



PERMIT NO.: P200900124		DRILLER: D. Osuch / R. Bartholomew		NJ LICENSE NO.: 0024289 / 0001383		GEOLOGIST: M. Lear									
SITE DESCRIPTION: PSEG SITE ESP APPLICATION				COUNTY: Salem, NJ		MACTEC PROJECT NO.: 6468-08-2251		FLUID LEVEL (ft)							
BORING NO.: EB-3		DRILL METHOD: Mud Rotary				SAMPLE METHODS: SPT		0 HR. ND							
GROUND SURFACE ELEV.: 16.5		US ft (NAVD88)		NORTHING: 232349.0		US ft (NAD83)		EASTING: 202473.9 US ft (NAD83)		24 HR. 13.8					
TOTAL DEPTH: 631.5 ft		DRILL MACHINE: CME-75 Truck				CASING DEPTH: 53.7 ft		HAMMER (ID): 140 lb Auto. (CTB-3)							
DATE STARTED: 1/24/09		COMPLETED: 2/17/09		HOLE DIA.: 4"		ROD TYPE: NWJ		BITS USED: 3-7/8" Drag & Roller Cone Bits							
ELEV. (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	▼	L O G	SOIL AND ROCK DESCRIPTION		
		0.5ft	0.5ft	0.5ft	0	20	40	60	80	100					
-39.6					Continued from previous page										
-41.5	60.0	3	3	4	7						SS-16		KIRKWOOD FORMATION: Silty SAND (SM), very dark greenish gray (10Y 3/1), loose, wet, fine sand, few organics		
-46.5	65.0	WOH	WOH	2	2						SS-17		KIRKWOOD FORMATION: FAT CLAY (CH), very dark greenish gray (10Y 3/1), very soft, moist to wet, trace fine sand, trace organics, trace shell fragments, PP=0.0 tsf		
-53.5	70.0	WOH	3	4	7						SS-18		70.0ft: Medium stiff, moist, PP=1.25 tsf		
-58.5	75.0	WOH	WOH	2	2						SS-19		75.0ft: Very soft, PP=1.25 tsf		
-63.5	80.0	WOH	WOH	WOH	0						SS-20		80.0ft: Little fine to medium sand, PP=0.75 tsf		
-68.5	85.0	WOH	WOH	WOH	0						SS-21		85.0ft: PP=0.75 tsf		
-73.5	90.0	WOR	WOR	WOH	0						SS-22		90.0ft: Olive gray (5Y 4/2), PP=0.0 tsf		
-78.5	95.0	4	9	14	23						SS-23		93.5ft: Harder drilling		
-83.5	100.0	6	7	6	13						SS-24		KIRKWOOD FORMATION: Poorly graded SAND with silt (SP-SM), dark olive gray (5Y 3/2), medium dense, wet, fine to coarse sand, few fines, no HCl reaction		
-88.5	105.0	24	27	18	45						SS-25		KIRKWOOD FORMATION: Poorly graded GRAVEL with sand (GP), dark gray (5Y 4/1), dense, wet, little fine to coarse sand, fine to coarse subrounded to subangular gravel, trace fines		
-93.5	110.0	24	13	58	71						SS-26		VINCENTOWN FORMATION: Silty SAND (SM), greenish gray (5GY 5/1), very dense, moist to wet, fine to medium sand, few friable to moderately indurated layers, strong HCl reaction, few glauconite		

PSEG ESP BORE PSEG ESP 7-07-09.GP1 PSEG ESP GDI 7/10/09



PERMIT NO.: P200900124		DRILLER: D. Osuch / R. Bartholomew		NJ LICENSE NO.: 0024289 / 0001383		GEOLOGIST: M. Lear							
SITE DESCRIPTION: PSEG SITE ESP APPLICATION				COUNTY: Salem, NJ		MACTEC PROJECT NO.: 6468-08-2251		FLUID LEVEL (ft)					
BORING NO.: EB-3		DRILL METHOD: Mud Rotary		SAMPLE METHODS: SPT		0 HR.		ND					
GROUND SURFACE ELEV.: 16.5 US ft (NAVD88)		NORTHING: 232349.0 US ft (NAD83)		EASTING: 202473.9 US ft (NAD83)		24 HR.		13.8					
TOTAL DEPTH: 631.5 ft		DRILL MACHINE: CME-75 Truck		CASING DEPTH: 53.7 ft		HAMMER (ID): 140 lb Auto. (CTB-3)							
DATE STARTED: 1/24/09		COMPLETED: 2/17/09		HOLE DIA.: 4"		ROD TYPE: NWJ		BITS USED: 3-7/8" Drag & Roller Cone Bits					
ELEV. (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	▼	L O G	SOIL AND ROCK DESCRIPTION
		0.5ft	0.5ft	0.5ft	0	20	40	60	80	100			
-95.7					Continued from previous page								
-98.5	115.0												VINCENTOWN FORMATION: Silty SAND (SM), greenish gray (5GY 5/1), very dense, moist to wet, fine to medium sand, few friable to moderately indurated layers, strong HCl reaction, few glauconite (continued) 115.0ft: Dense, wet
		15	11	26							SS-27		
-103.5	120.0	9	10	21							SS-28		120.0ft: Few friable layers, weak HCl reaction
													122ft: Bit chatter to 124ft
-108.1	124.6	9	10	12							SS-29		124.6ft: Medium dense, trace glauconite
-113.1	129.6	12	13	19							SS-30		129.6ft: Greenish gray (10Y 5/1), dense, trace friable layers
													-Bit chatter drilling to 134.6ft
-118.1	134.6	50/0.5								50/0.5	SS-31		134.6ft: Very dense, moist, trace moderately indurated to indurated layers
													-Bit chatter from 135ft to 137ft and 138ft to 139ft
-123.1	139.6	7	8	92/0.2						100/0.7	SS-32		139.6ft: Trace moderately indurated layers
													-Bit chatter from 141ft to 143ft
-128.1	144.6	62	28	25							SS-33		-127.5 HORNERSTOWN FORMATION: Clayey SAND (SC), greenish gray (10Y 5/1), very dense, moist to wet, fine to medium sand, trace to few moderately indurated layers, weak to strong HCl reaction, trace glauconite
													-Slight bit chatter from 148ft to 149ft
-133.1	149.6	3	8	14							SS-34		149.6ft: Medium dense, weak HCl reaction, trace to few glauconite
-138.1	154.6	5	53	47/0.1						100/0.6	SS-35		154.6ft: Very dense, trace moderately indurated layers
-143.1	159.6	23	40	29							SS-36		159.6ft: Moist, trace friable layers, strong HCl reaction, few to little glauconite
-148.1	164.6	25	75/0.2							100/0.7	SS-37		-147.5 NAVESINK FORMATION: Silty SAND (SM), very dark greenish gray (5GY 3/1), very dense, moist, fine to medium sand, trace shell fragments, trace moderately indurated layers, weak HCl reaction, some to mostly glauconite
													164.0

PSEG ESP BORE PSEG ESP 7-07-09.GPJ PSEG ESP.GDT 7/10/09



PERMIT NO.: P200900124		DRILLER: D. Osuch / R. Bartholomew		NJ LICENSE NO.: 0024289 / 0001383		GEOLOGIST: M. Lear										
SITE DESCRIPTION: PSEG SITE ESP APPLICATION			COUNTY: Salem, NJ		MACTEC PROJECT NO.: 6468-08-2251		FLUID LEVEL (ft)									
BORING NO.: EB-3		DRILL METHOD: Mud Rotary		SAMPLE METHODS: SPT		0 HR. ND										
GROUND SURFACE ELEV.: 16.5 US ft (NAVD88)		NORTHING: 232349.0 US ft (NAD83)		EASTING: 202473.9 US ft (NAD83)		24 HR. 13.8										
TOTAL DEPTH: 631.5 ft		DRILL MACHINE: CME-75 Truck		CASING DEPTH: 53.7 ft		HAMMER (ID): 140 lb Auto. (CTB-3)										
DATE STARTED: 1/24/09		COMPLETED: 2/17/09		HOLE DIA.: 4"		ROD TYPE: NWJ		BITS USED: 3-7/8" Drag & Roller Cone Bits								
ELEV. (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	▼	L O G	SOIL AND ROCK DESCRIPTION			
		0.5ft	0.5ft	0.5ft	0	20	40	60	80	100						
-151.8					Continued from previous page											
-153.1	169.6													SS-38		NAVESINK FORMATION: Silty SAND (SM), very dark greenish gray (5GY 3/1), very dense, moist, fine to medium sand, trace shell fragments, trace moderately indurated layers, weak HCl reaction, some to mostly glauconite (continued) 169.6ft: Greenish black (10Y 2.5/1), moist to wet, trace to few shell fragments, no HCl reaction, mostly glauconite
-158.1	174.6	30	25	35												
-158.1	174.6	16	23	26										SS-39		-166.5 173.0 -160.5 177.0 NAVESINK FORMATION: Clayey SAND (SC), greenish black (10Y 2.5/1), dense, moist, fine to medium sand, trace shell fragments, weak HCl reaction, mostly glauconite
-163.1	179.6	20	38	48												
-168.1	184.6	13	30	33										SS-40		
-168.1	184.6	25	39	61/0.1												NAVESINK FORMATION: Silty SAND (SM), greenish black (10Y 2.5/1), very dense, moist, fine to medium sand, trace shell fragments, weak HCl reaction, mostly glauconite
-173.1	189.6	100/0.4												SS-41		-167.5 184.0 MOUNT LAUREL FORMATION: Clayey SAND (SC), dark olive gray (5Y 3/2), very dense, moist, fine to coarse subrounded sand, few to little shell fragments, weak HCl reaction, some glauconite
-178.1	194.6	100/0.4														189.6ft: Trace shell fragments, little glauconite
-183.1	199.6	100/0.4												SS-42		
-183.1	199.6	100/0.4														194.6ft: Trace to few shell fragments, trace glauconite
-193.1	209.6	17	27	39										SS-43		-181.5 198.0 MOUNT LAUREL FORMATION: Silty SAND (SM), olive gray (5Y 4/2), very dense, moist, fine to coarse subrounded to subangular sand, trace fine gravel, trace shell fragments, weak to no HCl reaction, trace glauconite
-203.1	219.6	25	40	60										SS-44		
-203.1	219.6													SS-45		
-203.1	219.6															
-203.1	219.6													SS-46		

PSEG ESP BORE PSEG ESP 7-07-09.GPJ PSEG ESP.GDT 7/10/09

PERMIT NO.: P200900124		DRILLER: D. Osuch / R. Bartholomew		NJ LICENSE NO.: 0024289 / 0001383		GEOLOGIST: M. Lear								
SITE DESCRIPTION: PSEG SITE ESP APPLICATION			COUNTY: Salem, NJ		MACTEC PROJECT NO.: 6468-08-2251		FLUID LEVEL (ft)							
BORING NO.: EB-3		DRILL METHOD: Mud Rotary		SAMPLE METHODS: SPT		0 HR. ND								
GROUND SURFACE ELEV.: 16.5 US ft (NAVD88)		NORTHING: 232349.0 US ft (NAD83)		EASTING: 202473.9 US ft (NAD83)		24 HR. 13.8								
TOTAL DEPTH: 631.5 ft		DRILL MACHINE: CME-75 Truck		CASING DEPTH: 53.7 ft		HAMMER (ID): 140 lb Auto. (CTB-3)								
DATE STARTED: 1/24/09		COMPLETED: 2/17/09		HOLE DIA.: 4"		ROD TYPE: NWJ								
BITS USED: 3-7/8" Drag & Roller Cone Bits														
ELEV. (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT						SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION	
		0.5ft	0.5ft	0.5ft	0	20	40	60	80	100				
-207.9					Continued from previous page									
-213.1	229.6													MOUNT LAUREL FORMATION: Silty SAND (SM), olive gray (5Y 4/2), very dense, moist, fine to coarse subrounded to subangular sand, trace fine gravel, trace shell fragments, weak to no HCl reaction, trace glauconite (<i>continued</i>)
		50	42/0.2											
-223.1	239.6													239.6ft: Fine to medium subrounded to subangular sand, trace fine gravel, no HCl reaction, few glauconite -Intermittent bit chatter from 239.6ft to 249.6ft
		56	44/0.2											
-233.1	249.6													
		45	55/0.4											
-243.1	259.6													
		39	55	45/0.3										
-253.1	269.6													269.6ft: Weak HCl reaction
		40	60/0.4											
-263.1	279.6													
		37	55	45/0.3										

PSEGE ESP BORE PSEGE ESP 7-07-09.GPJ PSEGE ESP.GDT 7/10/09



PERMIT NO.: P200900124		DRILLER: D. Osuch / R. Bartholomew		NJ LICENSE NO.: 0024289 / 0001383		GEOLOGIST: M. Lear							
SITE DESCRIPTION: PSEG SITE ESP APPLICATION			COUNTY: Salem, NJ		MACTEC PROJECT NO.: 6468-08-2251		FLUID LEVEL (ft)						
BORING NO.: EB-3		DRILL METHOD: Mud Rotary		SAMPLE METHODS: SPT		0 HR. ND							
GROUND SURFACE ELEV.: 16.5 US ft (NAVD88)		NORTHING: 232349.0 US ft (NAD83)		EASTING: 202473.9 US ft (NAD83)		24 HR. 13.8							
TOTAL DEPTH: 631.5 ft		DRILL MACHINE: CME-75 Truck		CASING DEPTH: 53.7 ft		HAMMER (ID): 140 lb Auto. (CTB-3)							
DATE STARTED: 1/24/09		COMPLETED: 2/17/09		HOLE DIA.: 4"		ROD TYPE: NWJ		BITS USED: 3-7/8" Drag & Roller Cone Bits					
ELEV. (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	▼	L O G	SOIL AND ROCK DESCRIPTION
		0.5ft	0.5ft	0.5ft	0	20	40	60	80	100			
-320.2					Continued from previous page								
-323.1	339.6												ENGLISHTOWN FORMATION: Sandy LEAN CLAY (CL), black (5Y 2.5/1), very stiff, moist, some fine sand, trace coarse sand, trace shell fragments, micaceous, weak HCl reaction, few to little glauconite, PP=3.25 tsf (continued)
		7	11	17						SS-58			
-333.1	349.6												349.6ft: Stiff, trace glauconite, PP=1.75 tsf
		2	4	6						SS-59			
-343.1	359.6												ENGLISHTOWN FORMATION: ELASTIC SILT (MH), black (5Y 2.5/1), very stiff, dry to moist, trace fine sand, trace shell fragments, weak to no HCl reaction, micaceous
		3	6	12						SS-60			
-353.1	369.6												369.6ft: PP=3.5 tsf
		WOR	6	16						SS-61			
-363.1	379.6												379.6ft: PP=3.5 tsf
		WOR	7	14						SS-62			
-373.1	389.6												WOODBURY FORMATION: FAT CLAY (CH), black (5Y 2.5/1), very stiff, dry to moist, trace shell fragments, weak HCl reaction, micaceous, PP=>4.5 tsf
		WOR	4	17						SS-63			

PSEG ESP BORE PSEG ESP 7-07-09.GPJ PSEG ESP.GDT 7/10/09



PERMIT NO.: P200900124		DRILLER: D. Osuch / R. Bartholomew		NJ LICENSE NO.: 0024289 / 0001383		GEOLOGIST: M. Lear						
SITE DESCRIPTION: PSEG SITE ESP APPLICATION				COUNTY: Salem, NJ		MACTEC PROJECT NO.: 6468-08-2251		FLUID LEVEL (ft)				
BORING NO.: EB-3		DRILL METHOD: Mud Rotary		SAMPLE METHODS: SPT		0 HR.		ND				
GROUND SURFACE ELEV.: 16.5		US ft (NAVD88)		NORTHING: 232349.0		US ft (NAD83)		EASTING: 202473.9 US ft (NAD83)				
TOTAL DEPTH: 631.5 ft		DRILL MACHINE: CME-75 Truck		CASING DEPTH: 53.7 ft		HAMMER (ID): 140 lb Auto. (CTB-3)		24 HR. 13.8				
DATE STARTED: 1/24/09		COMPLETED: 2/17/09		HOLE DIA.: 4"		ROD TYPE: NWJ		BITS USED: 3-7/8" Drag & Roller Cone Bits				
ELEV.	DEPTH	BLOW COUNT			BLOWS PER FOOT					SAMP.	LOG	SOIL AND ROCK DESCRIPTION
(ft)	(ft)	0.5ft	0.5ft	0.5ft	0	20	40	60	80	100		
-376.3					Continued from previous page							
-383.1	399.6	2	7	16	23					SS-64		WOODBURY FORMATION: FAT CLAY (CH), black (5Y 2.5/1), very stiff, dry to moist, trace shell fragments, weak HCl reaction, micaceous, PP=>4.5 tsf (continued)
-393.1	409.6	3	7	17	24					SS-65		
-403.1	419.6	13	23	23	46					SS-66		MERCHANTVILLE FORMATION: SILT (ML), greenish black (10Y 2.5/1), hard, moist, trace fine sand, trace friable layers, trace mica, weak HCl reaction, few to little glauconite, PP=3.5 tsf
-413.1	429.6	14	17	26	43					SS-67		429.6ft: PP=4.0 tsf
-423.1	439.6	7	11	71	82					SS-68		MERCHANTVILLE FORMATION: LEAN CLAY (CL), greenish black (10Y 2.5/1), hard, dry to moist, trace fine sand, trace friable to moderately indurated layers, no HCl reaction, few glauconite, PP=3.25 to 4.5 tsf
												MAGOTHY FORMATION: FAT CLAY (CH), gray (5YR 5/1) and very dark gray (2.5Y 3/1) mottled, hard, dry to moist, carbonaceous, trace lignite, no HCl reaction, PP=2.5 to >4.5 tsf

[illegible]

[illegible]



PERMIT NO.: P200900124		DRILLER: D. Osuch / R. Bartholomew		NJ LICENSE NO.: 0024289 / 0001383		GEOLOGIST: M. Lear							
SITE DESCRIPTION: PSEG SITE ESP APPLICATION				COUNTY: Salem, NJ		MACTEC PROJECT NO.: 6468-08-2251							
BORING NO.: EB-3		DRILL METHOD: Mud Rotary		SAMPLE METHODS: SPT		FLUID LEVEL (ft)							
GROUND SURFACE ELEV.: 16.5 US ft (NAVD88)		NORTHING: 232349.0 US ft (NAD83)		EASTING: 202473.9 US ft (NAD83)		0 HR. ND							
TOTAL DEPTH: 631.5 ft		DRILL MACHINE: CME-75 Truck		CASING DEPTH: 53.7 ft		HAMMER (ID): 140 lb Auto. (CTB-3)							
DATE STARTED: 1/24/09		COMPLETED: 2/17/09		HOLE DIA.: 4"		ROD TYPE: NWJ							
BITS USED: 3-7/8" Drag & Roller Cone Bits													
ELEV. (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION	
		0.5ft	0.5ft	0.5ft	0	20	40	60	80	100			
-544.6					Continued from previous page								
													POTOMAC FORMATION: SAND-Interpreted from geophysical log (continued)
													565.0ft: Driller indicates change in drill response drilling from 565ft to 575ft
													-551.5 POTOMAC FORMATION: LEAN CLAY (CL)-Interpreted from geophysical log 568.0
													-Change in drill fluid color from gray to reddish tint observed drilling from 575ft to 580ft

°SEÇ ESP BORE PSEG ESP 7-07-09.GPJ PSEG ESP.GDT 7/10/09



PERMIT NO.: P200901785		DRILLER: T. Ward		NJ LICENSE NO.: 0001105		GEOLOGIST: J. Howard							
SITE DESCRIPTION: PSEG SITE ESP APPLICATION				COUNTY: Salem, NJ		MACTEC PROJECT NO.: 6468-08-2251							
BORING NO.: EB-3UD		DRILL METHOD: Mud Rotary		SAMPLE METHODS: Shelby/Osterburg/Pitcher		FLUID LEVEL (ft)							
GROUND SURFACE ELEV.: 16.4 US ft (NAVD88)		NORTHING: 232350.2 US ft (NAD83)		EASTING: 202492.3 US ft (NAD83)		0 HR. ND							
TOTAL DEPTH: 226.2 ft		DRILL MACHINE: CME-75 Truck		CASING DEPTH: 24.0 ft		HAMMER (ID): 140 lb Auto. (CBT-1)							
DATE STARTED: 3/6/09		COMPLETED: 3/11/09		HOLE DIA.: 6"		ROD TYPE: NWJ							
BITS USED: 5-7/8" Drag Bit													
ELEV. (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION	
		0.5ft	0.5ft	0.5ft	0	20	40	60	80	100			
-39.7					Continued from previous page								
-47.6	64.0									UD-8		to 55.0ft then Silty SAND (SM), dark gray (N 4/), moist, fine to medium sand, no HCl reaction; recovery=0.8ft KIRKWOOD FORMATION (continued)	
-51.6	68.0									UD-9		64.0ft: Shelby tube UD-8 pushed to 66.0ft; recovery=0.0ft	
-55.9	72.3									UD-10		68.0ft: Shelby tube UD-9 pushed to 70.0ft; recovery=0.0ft -Change sample method to Osterburg Sampler	
-62.2	78.6									UD-11		72.3ft: Shelby tube UD-10 pushed to 74.3ft in LEAN CLAY (CL), very dark greenish gray (10Y 3/1), moist, no HCl reaction; recovery=1.9ft; TV=1.6 tsf; PP=2.5 tsf	
-65.7	82.1									UD-12		78.6ft: Shelby tube UD-11 pushed to 80.6ft in FAT CLAY (CH), dark greenish gray (10Y 4/1), moist, no HCl reaction; recovery=1.8ft; TV=1.5 tsf; PP=1.75 tsf	
-71.6	88.0									UD-13		82.1ft: Shelby tube UD-12 pushed to 84.1ft in FAT CLAY (CH), dark greenish gray (10Y 4/1), moist, no HCl reaction; recovery=1.8ft; TV=1.6 tsf; PP=1.75 tsf	
-90.6												88.0ft: Shelby tube UD-13 pushed to 90.0ft in FAT CLAY (CH), dark greenish gray (10Y 4/1), moist, no HCl reaction, trace mica; recovery=1.9ft; TV=1.7 tsf; PP=1.75 tsf	
-93.6	110.0									UD-14		90.6ft: Vincenttown Formation -Change sample method to Pitcher Barrel Sampler	
												110.0ft: Pitcher tube UD-14 advanced to 112.5ft in Silty SAND (SM), light gray (N 7/), wet, fine sand, strong HCl reaction, with indurated layers;	

PSEG ESP BORE PSEG ESP 7-07-09.GPJ PSEG ESP.GDT 7/10/09



PERMIT NO.: P200901785				DRILLER: T. Ward				NJ LICENSE NO.: 0001105				GEOLOGIST: J. Howard																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
SITE DESCRIPTION: PSEG SITE ESP APPLICATION								COUNTY: Salem, NJ				MACTEC PROJECT NO.: 6468-08-2251				FLUID LEVEL (ft)																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
BORING NO.: EB-3UD				DRILL METHOD: Mud Rotary				SAMPLE METHODS: Shelby/Osterburg/Pitcher								0 HR. ND																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
GROUND SURFACE ELEV.: 16.4				US ft (NAVD88)				NORTHING: 232350.2				US ft (NAD83)				EASTING: 202492.3				US ft (NAD83)				24 HR. 9.5																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								
TOTAL DEPTH: 226.2 ft				DRILL MACHINE: CME-75 Truck				CASING DEPTH: 24.0 ft				HAMMER (ID): 140 lb Auto. (CBT-1)																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
DATE STARTED: 3/6/09				COMPLETED: 3/11/09				HOLE DIA.: 6"				ROD TYPE: NWJ				BITS USED: 5-7/8" Drag Bit																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
ELEV. (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT						SAMP. NO.	▼	L O G	SOIL AND ROCK DESCRIPTION																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
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PSEG ESP BORE PSEG ESP 7-07-09 GP1 PSEG ESP GDI 7/10/09



PERMIT NO.: P200901785		DRILLER: T. Ward		NJ LICENSE NO.: 0001105		GEOLOGIST: J. Howard	
SITE DESCRIPTION: PSEG SITE ESP APPLICATION				COUNTY: Salem, NJ		MACTEC PROJECT NO.: 6468-08-2251	
BORING NO.: EB-3UD		DRILL METHOD: Mud Rotary		SAMPLE METHODS: Shelby/Osterburg/Pitcher		FLUID LEVEL (ft)	
GROUND SURFACE ELEV.: 16.4 US ft (NAVD88)		NORTHING: 232350.2 US ft (NAD83)		EASTING: 202492.3 US ft (NAD83)		0 HR. ND	
TOTAL DEPTH: 226.2 ft		DRILL MACHINE: CME-75 Truck		CASING DEPTH: 24.0 ft		HAMMER (ID): 140 lb Auto. (CBT-1)	
DATE STARTED: 3/6/09		COMPLETED: 3/11/09		HOLE DIA.: 6"		ROD TYPE: NWJ	
BITS USED: 5-7/8" Drag Bit							

ELEV. (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT						SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION
		0.5ft	0.5ft	0.5ft	0	20	40	60	80	100			
-151.9					Continued from previous page								
-155.3	171.7										UD-24		168.2ft: Pitcher tube UD-24 advanced to 170.7ft in Silty SAND (SM), greenish black (10GY 2.5/1), wet, fine to medium sand, strong HCl reaction, mostly glauconite; recovery=0.8ft
-159.6	176.0										UD-25		NAVESINK FORMATION (continued) 171.7ft: Pitcher tube UD-25 advanced to 174.2ft in Silty SAND (SM), dark greenish gray (5GY 4/1), moist, fine to medium sand, strong HCl reaction, mostly glauconite, few shell fragments; recovery=0.5ft
-163.6	180.0										UD-26		176.0ft: Pitcher tube UD-26 advanced to 178.5ft in Clayey SAND (SC), greenish black (5GY 2.5/1), moist, fine to medium sand, strong HCl reaction, mostly glauconite, few shell fragments; recovery=2.0ft
-167.6	184.0										UD-27		180.0ft: Pitcher tube UD-27 advanced to 182.5ft in Silty SAND (SM), very dark grayish green (5G 3/2), moist, fine to medium sand, weak HCl reaction, mostly glauconite; recovery=1.0ft
-171.9	188.3										UD-28		MOUNT LAUREL FORMATION 184.0ft: Pitcher tube UD-28 advanced to 186.5ft in Clayey SAND (SC), very dark grayish green (5G 2.5/2), to dark greenish gray (10Y 4/1), moist, fine to medium sand, no to strong HCl reaction; recovery=2.4ft
											UD-29		188.3ft: Pitcher tube UD-29 advanced to 189.8ft; recovery=0.0ft, tube damaged and discarded
-185.6	202.0										UD-30		202.0ft: Pitcher tube UD-30 advanced to 204.5ft in Silty SAND (SM), olive gray (5Y 4/2), moist, fine to medium sand, strong HCl reaction; recovery=1.2ft
-191.6	208.0										UD-31		208.0ft: Pitcher tube UD-31 advanced to 210.5ft in Clayey, Silty SAND (SC-SM), olive gray (5Y 4/2), moist, fine to medium sand, strong HCl reaction; recovery=2.5ft
-203.7	220.1										UD-32		220.1ft: Pitcher tube UD-32 advanced to 222.6ft in Silty SAND (SM), olive gray (5Y 4/2), moist, fine to medium sand, strong HCl reaction; recovery=1.2ft
-207.8	224.2												

PSEG ESP BORE PSEG ESP 7-07-09 GFI PSEG ESP GDI 7/10/09



GEOTECHNICAL BORING LOG

Prepared By MM Date 7/16/09Checked By Jbs Date 7/16/09

SHEET 1 OF 4

PERMIT NO.: P200804330		DRILLER: G. McAneny		NJ LICENSE NO.: 0024058		GEOLOGIST: R. Clark							
SITE DESCRIPTION: PSEG SITE ESP APPLICATION				COUNTY: Salem, NJ		MACTEC PROJECT NO.: 6468-08-2251		FLUID LEVEL (ft)					
BORING NO.: EB-4		DRILL METHOD: Mud Rotary		SAMPLE METHODS: SPT				0 HR.	ND				
GROUND SURFACE ELEV.: 20.3 US ft (NAVD88)		NORTHING: 231783.2 US ft (NAD83)		EASTING: 202017.5 US ft (NAD83)				24 HR.	3.5				
TOTAL DEPTH: 200.2 ft		DRILL MACHINE: CME-75 Truck		CASING DEPTH: 17.0 ft		HAMMER (ID): 140 lb Auto. (CTB-2)							
DATE STARTED: 1/8/09		COMPLETED: 1/13/09		HOLE DIA.: 4"		ROD TYPE: NWJ		BITS USED: 3-7/8" Drag Bit					
ELEV. (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION	
		0.5ft	0.5ft	0.5ft	0	20	40	60	80	100			
20.3					Ground Surface								
20.3	0.0	29	48	17									20.3
17.7	2.6	4	6	9									18.3
15.3	5.0	2	1	2									15.8
13.0	7.3	3	2	2									13.3
10.3	10.0	1	1	1									10.8
7.8	12.5	WOH	WOH	4									9.3
5.3	15.0	3	9	12									8.3
2.8	17.5	4	5	5									5.8
0.5	19.8	3	4	6									
-2.2	22.5	4	2	3									-2.7
-4.7	25.0	3	4	5									
-7.2	27.5	2	2	4									
-9.7	30.0	2	2	6									-9.2
-12.2	32.5	WOH	1	WOH									-11.7
-14.7	35.0	WOH	1	1									
-17.2	37.5	WOH	WOH	WOH									
-19.7	40.0	WOH	WOH	WOH									
-22.2	42.5	WOH	4	4									-23.2
-24.7	45.0	WOH	3	5									
-27.2	47.5	WOH	3	2									
-29.7	50.0	8	11	10									-29.2
-32.2	52.5	9	9	10									
-34.7	55.0	7	8	7									

PSEG ESP BORE PSEG ESP 7-07-09 GFI PSEG ESP GDT 7/10/09



SHEET 2 OF 4

PERMIT NO.: P200804330		DRILLER: G. McAneny		NJ LICENSE NO.: 0024058		GEOLOGIST: R. Clark											
SITE DESCRIPTION: PSEG SITE ESP APPLICATION				COUNTY: Salem, NJ		MACTEC PROJECT NO.: 6468-08-2251		FLUID LEVEL (ft)									
BORING NO.: EB-4		DRILL METHOD: Mud Rotary		SAMPLE METHODS: SPT		0 HR.		ND									
GROUND SURFACE ELEV.: 20.3		US ft (NAVD88)		NORTHING: 231783.2		US ft (NAD83)		EASTING: 202017.5		US ft (NAD83)		24 HR.		3.5			
TOTAL DEPTH: 200.2 ft		DRILL MACHINE: CME-75 Truck		CASING DEPTH: 17.0 ft		HAMMER (ID): 140 lb Auto. (CTB-2)											
DATE STARTED: 1/8/09		COMPLETED: 1/13/09		HOLE DIA.: 4"		ROD TYPE: NWJ		BITS USED: 3-7/8" Drag Bit									
ELEV.	DEPTH	BLOW COUNT			BLOWS PER FOOT					SAMP.	LOG	SOIL AND ROCK DESCRIPTION					
(ft)	(ft)	0.5ft	0.5ft	0.5ft	0	20	40	60	80	100	NO.						
-35.8					Continued from previous page												
-37.2	57.5	9	11	13							SS-24		ALLUVIUM: Poorly graded SAND with silt (SP-SM), greenish gray (10Y 5/1), medium dense, wet, fine to medium sand, trace mica, no HCl reaction (continued)				
-39.7	60.0	7	3	2							SS-25		-40.2 60.5				
-42.2	62.5	WOH	WOH	WOH							SS-26		ALLUVIUM: FAT CLAY (CH), dark greenish gray (10Y 4/1), medium stiff, moist, no HCl reaction				
-44.7	65.0	1	2	4							SS-27		62.5ft: Very soft, trace angular gravel				
-47.2	67.5	WOH	2	3							SS-28		-44.2 64.5				
-49.7	70.0	WOH	3	4							SS-29		KIRKWOOD FORMATION: FAT CLAY (CH), dark gray (5Y 4/1), medium stiff, moist, trace organics, no HCl reaction				
-52.2	72.5	7	9	13							SS-30		67.5ft: Greenish gray (10Y 5/1), trace fine sand				
-54.7	75.0	WOH	WOH	4							SS-31		-51.7 72.0				
-57.2	77.5	WOH	2	4							SS-32		KIRKWOOD FORMATION: Poorly graded SAND with silt (SP-SM), dark greenish gray (10Y 4/1), medium dense, wet, fine sand, no HCl reaction				
-59.7	80.0	WOH	1	3							SS-33		-54.2 74.5				
-62.2	82.5	1	1	1							SS-34		KIRKWOOD FORMATION: FAT CLAY (CH), dark greenish gray (10Y 4/1), soft, moist, trace fine sand, trace organics, weak HCl reaction				
-64.7	85.0	WOH	3	3							SS-35		77.5ft: Medium stiff, no HCl reaction				
-67.2	87.5	2	3	4							SS-36		-59.2 79.5				
-69.7	90.0	WOH	WOH	WOH							SS-37		KIRKWOOD FORMATION: LEAN CLAY (CL), dark greenish gray (10Y 4/1), soft, moist, trace to few fine sand, trace organics, no HCl reaction				
-72.2	92.5	WOH	2	4							SS-38		-61.7 82.0				
-74.7	95.0	WOH	WOH	WOH							SS-39		KIRKWOOD FORMATION: FAT CLAY (CH), dark gray (5Y 4/1), very soft, moist, trace organics, no HCl reaction				
-77.2	97.5	WOH	WOH	3							SS-40		85.0ft: Medium stiff				
-79.7	100.0	WOH	WOH	WOH							SS-41		87.5ft: Dark gray (10YR 4/1)				
-82.2	102.5	WOH	WOH	2							SS-42		90.0ft: Dark gray (5Y 4/1), very soft				
-84.7	105.0	WOR	WOH	3							SS-43		92.5ft: Dark gray (2.5Y 4/1), medium stiff				
-87.2	107.5	50/0.4									SS-44		95.0ft: Very soft				
-89.7	110.0	50/0.5									SS-45		97.5ft: Dark gray (2.5Y 4/1) mottled with olive yellow (2.5Y 6/6), soft				
													100.0ft: Dark gray (5Y 4/1), very soft				
													102.5ft: Trace laminations				
													105.0ft: Soft				
													-Bit chatter/ harder drilling at 107ft				
													-86.7 107.0				
													KIRKWOOD FORMATION: Poorly graded SAND with silt and gravel (SP-SM), olive gray (5Y 4/2), very dense, wet, angular to subrounded gravel, few glauconite				
													-88.7 109.0				

PSEG ESP BORE PSEG ESP 7-07-09.GPJ PSEG ESP.GDT 7/10/09

PSEG ESP BORE PSEG ESP 7-07-09.GPJ PSEG ESP.GDT 7/10/09



GEOTECHNICAL BORING LOG

Prepared By NAL Date 7/10/09Checked By JA2 Date 7/10/09

SHEET 1 OF 4

PERMIT NO.: P200804331		DRILLER: T. Samuelson / M. Adams		NJ LICENSE NO.: 0001238 / 0001350		GEOLOGIST: M. Lear							
SITE DESCRIPTION: PSEG SITE ESP APPLICATION				COUNTY: Salem, NJ		MACTEC PROJECT NO.: 6468-08-2251		FLUID LEVEL (ft)					
BORING NO.: EB-5		DRILL METHOD: Mud Rotary		SAMPLE METHODS: SPT				0 HR.	ND				
GROUND SURFACE ELEV.: 13.8 US ft (NAVD88)		NORTHING: 233048.3 US ft (NAD83)		EASTING: 203016.4 US ft (NAD83)				24 HR.	5.4				
TOTAL DEPTH: 199.3 ft		DRILL MACHINE: CME-850 ATV		CASING DEPTH: 18.5 ft		HAMMER (ID): 140 lb Auto. (CTB-4)							
DATE STARTED: 1/10/09		COMPLETED: 1/14/09		HOLE DIA.: 4"		ROD TYPE: NWJ		BITS USED: 3-7/8" Drag Bit					
ELEV. (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	▼	LOG	SOIL AND ROCK DESCRIPTION
		0.5ft	0.5ft	0.5ft	0	20	40	60	80	100			
13.8					Ground Surface								
13.8	0.0	2	4	6						SS-1			ARTIFICIAL FILL: LEAN CLAY (CL), dark brown (10YR 3/3), stiff, moist, few fine gravel, trace fine sand, trace organics
11.3	2.5	6	5	5						SS-2			2.5ft: Very dark grayish brown (10YR 3/2), trace fine gravel, trace to few organics
8.1	5.7	WOH	WOH	WOH						SS-3			HYDRAULIC FILL: FAT CLAY (CH), dark grayish brown (10YR 4/2), very soft, wet, trace fine sand, few organics
6.3	7.5	2	3	7						SS-4			HYDRAULIC FILL: Silty SAND (SM), very dark gray (10YR 3/1), loose, wet, fine to coarse sand, trace fine gravel, few organics
3.8	10.0	1	1	1						SS-5			HYDRAULIC FILL: Sandy SILT (ML), very dark gray (10YR 3/1), very soft, wet, some fine sand, trace organics
1.3	12.5	WOH	WOH	WOH						SS-6			HYDRAULIC FILL: FAT CLAY (CH), very dark gray (10YR 3/1), very soft, wet, trace fine sand, few organics
-1.2	15.0	WOH	WOH	WOH						SS-7			
-5.5	19.3	WOH	WOH	WOH						SS-8			19.3ft: Trace organics
-10.8	24.6	WOH	WOH	WOH						SS-9			
-15.5	29.3	WOH	WOH	WOH						SS-10			
-20.2	34.0	7	9	11						SS-11			ALLUVIUM: Poorly graded SAND with silt (SP-SM), olive gray (5Y 4/2), medium dense, wet, fine to coarse sand, trace fine gravel
-25.2	39.0	9	9	8						SS-12			ALLUVIUM: Poorly graded SAND with silt and gravel (SP-SM), olive gray (5Y 4/2), medium dense, wet, fine to coarse sand, little fine to coarse gravel
-30.2	44.0	7	6	7						SS-13			
-35.4	49.2	5	6	6						SS-14			49.2ft: Dark gray (5Y 4/1)
-40.2	54.0	3	4	5						SS-15			KIRKWOOD FORMATION: Silty SAND (SM), greenish gray (10Y 5/1), loose, wet, fine sand, trace fine gravel, no HCl reaction

PSEG ESP BORE PSEG ESP 7-07-09.GP1 PSEG ESP.GDT 7/10/09



PERMIT NO.: P200804331		DRILLER: T. Samuelson / M. Adams		NJ LICENSE NO.: 0001238 / 0001350		GEOLOGIST: M. Lear							
SITE DESCRIPTION: PSEG SITE ESP APPLICATION				COUNTY: Salem, NJ		MACTEC PROJECT NO.: 6468-08-2251		FLUID LEVEL (ft)					
BORING NO.: EB-5		DRILL METHOD: Mud Rotary		SAMPLE METHODS: SPT				0 HR.	ND				
GROUND SURFACE ELEV.: 13.8		US ft (NAVD88)		NORTHING: 233048.3		US ft (NAD83)		EASTING: 203016.4	US ft (NAD83)				
TOTAL DEPTH: 199.3 ft		DRILL MACHINE: CME-850 ATV		CASING DEPTH: 18.5 ft		HAMMER (ID): 140 lb Auto. (CTB-4)		24 HR.	5.4				
DATE STARTED: 1/10/09		COMPLETED: 1/14/09		HOLE DIA.: 4"		ROD TYPE: NWJ		BITS USED: 3-7/8" Drag Bit					
ELEV. (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	▼	LOG	SOIL AND ROCK DESCRIPTION
		0.5ft	0.5ft	0.5ft	0	20	40	60	80	100			
-42.3					Continued from previous page								
-45.2	59.0	3	4	6	●10					SS-16			KIRKWOOD FORMATION: Silty SAND (SM), greenish gray (10Y 5/1), loose, wet, fine sand, trace fine gravel, no HCl reaction (continued)
-50.2	64.0	6	6	8	●14					SS-17			64.0ft: Medium dense, moist to wet
-55.2	69.0	9	11	13	●24					SS-18			
-60.2	74.0	14	12	12	●24					SS-19			
-65.2	79.0	12	16	17	●33					SS-20			79.0ft: Dense, wet
-70.2	84.0	9	16	15	●31					SS-21			84.0ft: Weak HCl reaction, orange iron staining at very end of sample
-75.2	89.0	32	31	33	●64					SS-22			-73.2 -Bit chatter from 87ft to 89ft 87.0 KIRKWOOD FORMATION: Poorly graded GRAVEL with sand (GP), olive gray (5Y 4/2), very dense, moist to wet, fine to coarse subrounded gravel, fine to coarse subangular to subrounded sand -Bit chatter drilling to 94.0 feet
-80.2	94.0	41	35	31	●66					SS-23			94.0ft: No recovery-sample catcher inverted/mangled-same as above based on drill response
-85.2	99.0	22	24	24	●48					SS-24			-82.2 VINCENTOWN FORMATION: Silty SAND (SM), brown (10YR 5/3), dense to very dense, moist to wet, fine to coarse sand, trace friable layers, trace shell fragments, weak to strong HCl reaction, trace glauconite, moderately oxidized 96.0
-90.2	104.0	12	25	28	●53					SS-25			
-95.2	109.0	11	15	12	●27					SS-26			-Bit chatter drilling to 109ft (indurated layers) 109.0ft: Medium dense, strong HCl reaction -Bit chatter from 111ft to 112ft

PSEG ESP BORE PSEG ESP 7-07-09 GP1 PSEG ESP GDT 7/10/09



PERMIT NO.: P200804331		DRILLER: T. Samuelson / M. Adams		NJ LICENSE NO.: 0001238 / 0001350		GEOLOGIST: M. Lear							
SITE DESCRIPTION: PSEG SITE ESP APPLICATION				COUNTY: Salem, NJ		MACTEC PROJECT NO.: 6468-08-2251		FLUID LEVEL (ft)					
BORING NO.: EB-5		DRILL METHOD: Mud Rotary		SAMPLE METHODS: SPT		0 HR.		ND					
GROUND SURFACE ELEV.: 13.8 US ft (NAVD88)		NORTHING: 233048.3 US ft (NAD83)		EASTING: 203016.4 US ft (NAD83)		24 HR.		5.4					
TOTAL DEPTH: 199.3 ft		DRILL MACHINE: CME-850 ATV		CASING DEPTH: 18.5 ft		HAMMER (ID): 140 lb Auto. (CTB-4)							
DATE STARTED: 1/10/09		COMPLETED: 1/14/09		HOLE DIA.: 4"		ROD TYPE: NWJ		BITS USED: 3-7/8" Drag Bit					
ELEV. (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION	
		0.5ft	0.5ft	0.5ft	0	20	40	60	80	100			
-98.4					Continued from previous page								
-100.2	114.0	9	12	12							SS-27		VINCENTOWN FORMATION: Silty SAND (SM), brown (10YR 5/3), dense to very dense, moist to wet, fine to coarse sand, trace friable layers, trace shell fragments, weak to strong HCl reaction, trace glauconite, moderately oxidized (continued)
-105.2	119.0	17	12	14							SS-28		-Bit chatter from 116ft to 118ft
-110.2	124.0	50/0.0								50/0.0	SS-29		-Hard drilling/bit chatter to 124ft
-115.2	129.0	15	10	18							SS-30		124.0ft: Very dense, SPT refusal with no penetration at 124.0 feet; hard drilling/bit chatter to 123ft
-120.2	134.0	7	28	31							SS-31		129.0ft: Greenish gray (10Y 6/1), medium dense, trace friable to moderately indurated layers, no oxidation
-125.2	139.0	8	22	36							SS-32		134.0ft: Very dense, wet, trace friable layers
-130.2	144.0	WOH	9	91/0.4							SS-33		144.0ft: Greenish gray (10Y 5/1), moist to wet, few friable to moderately indurated layers
-135.2	149.0	9	58	42/0.4							SS-34		HORNERSTOWN FORMATION: Clayey SAND (SC), greenish gray (10Y 5/1), dense, moist to wet, fine to medium sand, trace shell fragments, few friable layers, strong HCl reaction, few glauconite
-140.2	154.0	6	8	17							SS-35		154.0ft: Medium dense, moist to wet, fine sand, trace glauconite
-145.2	159.0	5	14	21							SS-36		159.0ft: Dark grayish green (10Y 4/1), dense, fine to medium sand, few shell fragments, few to little glauconite
-150.2	164.0	23	27	50							SS-37		NAVESINK FORMATION: Silty SAND (SM), greenish black (5GY 2.5/1), very dense, moist to wet, fine to medium sand, few to little shell fragments, strong HCl reaction, some to mostly glauconite

PSEG ESP BORE PSEG ESP 7-07-09.GP! PSEG ESP.GDT 7/10/09



SHEET 4 OF 4

PERMIT NO.: P200804331		DRILLER: T. Samuelson / M. Adams		NJ LICENSE NO.: 0001238 / 0001350		GEOLOGIST: M. Lear							
SITE DESCRIPTION: PSEG SITE ESP APPLICATION				COUNTY: Salem, NJ		MACTEC PROJECT NO.: 6468-08-2251							
BORING NO.: EB-5		DRILL METHOD: Mud Rotary		SAMPLE METHODS: SPT		FLUID LEVEL (ft)							
GROUND SURFACE ELEV.: 13.8 US ft (NAVD88)		NORTHING: 233048.3 US ft (NAD83)		EASTING: 203016.4 US ft (NAD83)		0 HR. ND							
						24 HR. 5.4							
TOTAL DEPTH: 199.3 ft		DRILL MACHINE: CME-850 ATV		CASING DEPTH: 18.5 ft		HAMMER (ID): 140 lb Auto. (CTB-4)							
DATE STARTED: 1/10/09		COMPLETED: 1/14/09		HOLE DIA.: 4"		ROD TYPE: NWJ							
						BITS USED: 3-7/8" Drag Bit							
ELEV. (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION	
		0.5ft	0.5ft	0.5ft	0	20	40	60	80	100			
-154.5					Continued from previous page								
-155.2	169.0	23	32	48						SS-38		NAVESINK FORMATION: Silty SAND (SM), greenish black (5GY 2.5/1), very dense, moist to wet, fine to medium sand, few to little shell fragments, strong HCl reaction, some to mostly glauconite (continued)	
-160.2	174.0	21	28	38						SS-39		NAVESINK FORMATION: Clayey SAND (SC), greenish black (5GY 2.5/1), very dense, moist, fine to medium sand, trace shell fragments, no to weak HCl reaction, mostly glauconite	
-165.2	179.0	34	41	59						SS-40		NAVESINK FORMATION: Silty SAND (SM), greenish black (5GY 2.5/1), very dense, moist, fine to medium sand, trace shell fragments, trace friable to moderately indurated layers, weak to strong HCl reaction, mostly glauconite	
-170.2	184.0	34	43	57/0.4						SS-41		MOUNT LAUREL FORMATION: Clayey SAND (SC), very dark gray (5Y 3/1), very dense, moist, fine to coarse subrounded sand, trace fine gravel, trace shell fragments, strong HCl reaction, trace glauconite	
-175.2	189.0	100/0.4								SS-42			
-180.2	194.0	100/0.2								SS-43			
-185.2	199.0	100/0.3								SS-44			
												Boring terminated at 199.3 feet.	
												Boring closed by tremie method with cement-bentonite grout on 1/14/09.	



GEOTECHNICAL BORING LOG

Prepared By MM Date 7/10/09Checked By JS Date 7/10/09

SHEET 1 OF 4

PERMIT NO.: P200804332		DRILLER: M. Adams		NJ LICENSE NO.: 0001350		GEOLOGIST: B. Deobald / R. Clark									
SITE DESCRIPTION: PSEG SITE ESP APPLICATION				COUNTY: Salem, NJ		MACTEC PROJECT NO.: 6468-08-2251		FLUID LEVEL (ft)							
BORING NO.: EB-6		DRILL METHOD: Mud Rotary			SAMPLE METHODS: SPT			0 HR. ND							
GROUND SURFACE ELEV.: 13.7 US ft (NAVD88)		NORTHING: 232587.2 US ft (NAD83)		EASTING: 203262.4 US ft (NAD83)		24 HR. 0.0									
TOTAL DEPTH: 199.9 ft		DRILL MACHINE: CME-850 ATV			CASING DEPTH: 54.5 ft			HAMMER (ID): 140 lb Auto. (CTB-4)							
DATE STARTED: 1/26/09		COMPLETED: 2/4/09		HOLE DIA.: 4"		ROD TYPE: NWJ		BITS USED: 3-7/8" Drag Bit							
ELEV. (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION			
		0.5ft	0.5ft	0.5ft	0	20	40	60	80	100					
13.7					Ground Surface										
13.7	0.0	4	8	16								13.7	0.0	ARTIFICIAL FILL: Silty SAND with gravel (SM), very dark grayish brown (10YR 3/2), medium dense, moist to wet, fine to coarse sand, little angular gravel, trace organics 2.5ft: Few angular to rounded gravel	
11.2	2.5	11	7	7											
9.4	4.3	3	2	2									9.7	4.0	HYDRAULIC FILL: SILT (ML), very dark greenish gray (10Y 3/1), soft, wet, trace rounded gravel
6.1	7.6	9	5	12											7.6ft: Very stiff, few rounded gravel
3.7	10.0	2	3	1									4.2	9.5	HYDRAULIC FILL: Silty SAND (SM), very dark greenish gray (10Y 3/1), very loose, wet, fine sand
1.2	12.5	WOH	WOH	WOH									1.7	12.0	HYDRAULIC FILL: SILT (ML), very dark greenish gray (10Y 3/1), very soft, wet
-0.9	14.6	WOH	1	2									-0.8	14.5	HYDRAULIC FILL: SILT with sand (ML), very dark greenish gray (10Y 3/1), soft, wet, little fine sand
-5.8	19.5	WOH	1	1											19.5ft: Very dark grayish brown (10YR 3/1), very soft, moist
-10.8	24.5	WOH	WOH	WOH									-9.3	23.0	HYDRAULIC FILL: FAT CLAY (CH), very dark grayish brown (10YR 3/1), very soft, moist
-15.8	29.5	WOH	WOH	WOH											29.5ft: Black (10YR 2/1)
-20.8	34.5	5	16	22									-19.3	33.0	ALLUVIUM: Poorly graded SAND (SP), dark greenish gray (10Y 4/1), dense, wet, fine to medium sand, trace organics, no HCl reaction
-25.8	39.5	12	14	10											39.5ft: Medium dense
-30.8	44.5	15	14	17									-29.3	43.0	ALLUVIUM: Silty SAND (SM), greenish gray (10GY 5/1), dense, wet, trace rounded gravel, no HCl reaction
-35.8	49.5	10	8	9									-34.3	48.0	ALLUVIUM: Well graded SAND (SW), dark gray (10YR 4/1), medium dense, wet, little subangular gravel, no HCl reaction
-40.8	54.5	8	8	10									-39.3	53.0	KIRKWOOD FORMATION: Poorly graded SAND with silt (SP-SM), greenish gray (5GY 6/1), medium dense, wet, trace subrounded gravel, no HCl reaction

PSEG ESP BORE PSEG ESP 7-07-09 GPI PSEG ESP GDI 7/10/09



PERMIT NO.: P200804332		DRILLER: M. Adams		NJ LICENSE NO.: 0001350		GEOLOGIST: B. Deobald / R. Clark							
SITE DESCRIPTION: PSEG SITE ESP APPLICATION				COUNTY: Salem, NJ		MACTEC PROJECT NO.: 6468-08-2251		FLUID LEVEL (ft)					
BORING NO.: EB-6		DRILL METHOD: Mud Rotary		SAMPLE METHODS: SPT				0 HR.	ND				
GROUND SURFACE ELEV.: 13.7		US ft (NAVD88)		NORTHING: 232587.2		US ft (NAD83)		EASTING: 203262.4	US ft (NAD83)	24 HR.	0.0		
TOTAL DEPTH: 199.9 ft		DRILL MACHINE: CME-850 ATV		CASING DEPTH: 54.5 ft		HAMMER (ID): 140 lb Auto. (CTB-4)							
DATE STARTED: 1/26/09		COMPLETED: 2/4/09		HOLE DIA.: 4"		ROD TYPE: NWJ		BITS USED: 3-7/8" Drag Bit					
ELEV. (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	▼	LOG	SOIL AND ROCK DESCRIPTION
		0.5ft	0.5ft	0.5ft	0	20	40	60	80	100			
-42.4					Continued from previous page								
-45.8	59.5	8	7	8							SS-16		KIRKWOOD FORMATION: Poorly graded SAND with silt (SP-SM), greenish gray (5GY 6/1), medium dense, wet, trace subrounded gravel, no HCl reaction (continued)
-50.8	64.5	3	5	8							SS-17	-49.3	KIRKWOOD FORMATION: Sandy LEAN CLAY (CL), olive (5Y 5/3) and brownish yellow (10YR 6/8), stiff, moist, some fine sand, no HCl reaction 63.0
-55.8	69.5	19	18	15							SS-18	-54.3	VINCENTOWN FORMATION: Silty SAND (SM), light greenish gray (10Y 8/1) and brownish yellow (10YR 6/8), dense, moist, fine to coarse sand, few shell fragments, trace rounded gravel, weak HCl reaction 68.0
-60.8	74.5	73	14	14							SS-19		74.5ft: Very dense, weak to strong HCl reaction
-65.8	79.5	10	10	13							SS-20		79.5ft: Light greenish gray (10Y 7/1) and brownish yellow (10YR 6/8), medium dense, wet, little shell fragments, moderately oxidized
-70.8	84.5	18	13	15							SS-21		84.5ft: Dense, few shell fragments, weakly oxidized
-75.8	89.5	36	20	13							SS-22		89.5ft: Greenish gray (10GY 6/1) and light greenish gray (10GY 7/1), dense, moist, no oxidation
-80.8	94.5										SS-23		94.5ft: Very dense, with indurated layers
-85.8	99.5										SS-24		99.5ft: Greenish gray (5GY 6/1), very dense, wet, fine to medium sand, weak HCl reaction, trace subrounded gravel, trace shell fragments
-90.8	104.5										SS-25		104.5ft: Dense, moist, weak to strong HCl reaction, trace friable layers
-95.8	109.5										SS-26		109.5ft: Moist to wet, strong HCl reaction -Bit chatter drilling to 114.5 feet



PERMIT NO.: P200804332		DRILLER: M. Adams		NJ LICENSE NO.: 0001350		GEOLOGIST: B. Deobald / R. Clark							
SITE DESCRIPTION: PSEG SITE ESP APPLICATION				COUNTY: Salem, NJ		MACTEC PROJECT NO.: 6468-08-2251							
BORING NO.: EB-6		DRILL METHOD: Mud Rotary		SAMPLE METHODS: SPT		FLUID LEVEL (ft)							
GROUND SURFACE ELEV.: 13.7		US ft (NAVD88)		NORTHING: 232587.2		US ft (NAD83)							
EASTING: 203262.4		US ft (NAD83)		24 HR.		0.0							
TOTAL DEPTH: 199.9 ft		DRILL MACHINE: CME-850 ATV		CASING DEPTH: 54.5 ft		HAMMER (ID): 140 lb Auto. (CTB-4)							
DATE STARTED: 1/26/09		COMPLETED: 2/4/09		HOLE DIA.: 4"		ROD TYPE: NWJ							
BITS USED: 3-7/8" Drag Bit													
ELEV. (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION	
		0.5ft	0.5ft	0.5ft	0	20	40	60	80	100			
-98.5					Continued from previous page								
-100.8	114.5										SS-27		VINCENTOWN FORMATION: Silty SAND (SM), light greenish gray (10Y 8/1) and brownish yellow (10YR 6/8), dense, moist, fine to coarse sand, few shell fragments, trace rounded gravel, weak HCl reaction (continued) 114.5ft: Medium dense, wet, weak HCl reaction
-105.8	119.5										SS-28		119.5ft: Dense, moist -Bit chatter drilling to 124.5 feet
-110.8	124.5										SS-29		124.5ft: Medium dense
-115.8	129.5										SS-30		129.5ft: Very dense, indurated -Hard drilling/bit chatter to 133ft
-120.8	134.5										SS-31		VINCENTOWN FORMATION: Clayey SAND (SC), greenish gray (10Y 5/1), very dense, moist, fine sand, some moderately indurated layers, strong HCl reaction, few to little glauconite -Bit chatter 134.5ft to 135ft, 137ft to 139.5ft, and 139.5ft to 140ft
-125.8	139.5										SS-32		
-130.8	144.5										SS-33		HORNERSTOWN FORMATION: Silty SAND (SM), greenish gray (10Y 5/1), dense, moist to wet, fine sand, few moderately indurated layers, strong HCl reaction, little glauconite
-135.8	149.5										SS-34		149.5ft: Very dense
-140.8	154.5										SS-35		154.5ft: Dense, wet
-145.8	159.5										SS-36		159.5ft: Very dense, trace shell fragments, some glauconite
-150.8	164.5										SS-37		NAVESINK FORMATION: Silty SAND (SM), very dark greenish gray (5GY 3/1), very dense, wet, trace shell fragments, strong HCl reaction, mostly glauconite

PSEG ESP BORE PSEG ESP 7-07-09.GP1 PSEG ESP GDI 7/10/09



PERMIT NO.: P200804332		DRILLER: M. Adams		NJ LICENSE NO.: 0001350		GEOLOGIST: B. Deobald / R. Clark						
SITE DESCRIPTION: PSEG SITE ESP APPLICATION				COUNTY: Salem, NJ		MACTEC PROJECT NO.: 6468-08-2251						
BORING NO.: EB-6		DRILL METHOD: Mud Rotary		SAMPLE METHODS: SPT		FLUID LEVEL (ft)						
GROUND SURFACE ELEV.: 13.7 US ft (NAVD88)		NORTHING: 232587.2 US ft (NAD83)		EASTING: 203262.4 US ft (NAD83)		0 HR. ND						
TOTAL DEPTH: 199.9 ft		DRILL MACHINE: CME-850 ATV		CASING DEPTH: 54.5 ft		24 HR. 0.0						
DATE STARTED: 1/26/09		COMPLETED: 2/4/09		HOLE DIA.: 4"		BITS USED: 3-7/8" Drag Bit						
ELEV. (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION
		0.5ft	0.5ft	0.5ft	0	20	40	60	80	100		
-154.6					Continued from previous page							
-155.8	169.5									SS-38		NAVESINK FORMATION: Silty SAND (SM), very dark greenish gray (5GY 3/1), very dense, wet, trace shell fragments, strong HCl reaction, mostly glauconite (continued)
-160.8	174.5									SS-39		NAVESINK FORMATION: Clayey SAND (SC), very dark greenish gray (5GY 3/1), very dense, wet, weak HCl reaction, mostly glauconite
-165.8	179.5									SS-40		NAVESINK FORMATION: Silty SAND (SM), very dark greenish gray (5GY 3/1), very dense, wet, weak HCl reaction, mostly glauconite
-170.8	184.5									SS-41		MOUNT LAUREL FORMATION: Clayey SAND (SC), olive gray (5Y 4/2), very dense, moist, little coarse subrounded sand, strong HCL reaction, few to little glauconite
-175.8	189.5									SS-42		189.5ft: Dark greenish gray (10GY 4/1), trace glauconite
-180.8	194.5									SS-43		MOUNT LAUREL FORMATION: Silty SAND (SM), dark greenish gray (10GY 4/1), very dense, moist, fine to coarse subrounded sand, little shell fragments, strong HCl reaction, trace glauconite
-185.8	199.5									SS-44		199.5ft: Dark greenish gray (5GY 4/1), trace to little glauconite
												Boring terminated at 199.9 feet.
												Boring closed by tremie method with cement-bentonite grout on 2/04/09.
												NOTE: N-Values at 94.5ft and deeper not reported.

PSEG ESP BORE PSEG ESP 7-07-09.GPJ PSEG ESP GDT 7/10/09

°PSEG ESP BORE PSEG ESP 7-07-09.GPJ PSEG ESP.GDT 7/10/09



SHEET 2 OF 3

PERMIT NO.: P200804332		DRILLER: M. Adams / T. Ward		NJ LICENSE NO.: 0001350 / 0001105		GEOLOGIST: B. Deobald										
SITE DESCRIPTION: PSEG SITE ESP APPLICATION				COUNTY: Salem, NJ		MACTEC PROJECT NO.: 6468-08-2251										
BORING NO.: EB-6A		DRILL METHOD: Mud Rotary		SAMPLE METHODS: SPT		FLUID LEVEL (ft)										
GROUND SURFACE ELEV.: 14.1 US ft (NAVD88)		NORTHING: 232587.0 US ft (NAD83)		EASTING: 203251.3 US ft (NAD83)		0 HR. ND										
						24 HR. 15.0										
TOTAL DEPTH: 151.1 ft		DRILL MACHINE: CME-850 ATV		CASING DEPTH: 34.0 ft		HAMMER (ID): 140 lb Auto. (CTB-4)										
DATE STARTED: 2/22/09		COMPLETED: 2/24/09		HOLE DIA.: 4"		ROD TYPE: NWJ										
						BITS USED: 3-7/8" Drag Bit										
ELEV. (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	▼	LOG	SOIL AND ROCK DESCRIPTION			
		0.5ft	0.5ft	0.5ft	0	20	40	60	80	100						
-42.0					Continued from previous page											
-45.9	60.0														Driller advanced 4" casing to 34.0 ft and drilled without sampling to 94.6 feet. See EB-8 for information. (continued)	
-55.9	70.0															
-65.9	80.0															
-75.9	90.0															
-80.5	94.6	17	11	43												
-85.5	99.6	9	8	12											SS-1	VINCENTOWN FORMATION: Silty SAND (SM), dark greenish gray (10GY 4/1), very dense, wet, fine to medium sand, trace moderately indurated layers, strong HCl reaction, trace glauconite
-90.5	104.6	36	20	22											SS-2	99.6ft: Greenish gray (10Y 5/1), medium dense, fine to coarse sand, trace shell fragments, weak HCl reaction
-95.5	109.6	11	10	11											SS-3	104.6ft: Dense, moist, fine to medium sand, trace friable to moderately indurated layers, weak to strong HCl reaction
															SS-4	109.6ft: Medium dense, moist to wet, weak HCl reaction -Bit chatter 113ft to 114ft

PSEG ESP BORE PSEG ESP 7-07-09.GPJ PSEG ESP.GDT 7/10/09

PSEG ESP BORE PSEG ESP 7-07-09.GPJ PSEG ESP.GDT 7/10/09

GEOTECHNICAL BORING LOG

Prepared By NMR Date 7/10/09

Checked By Q.2 Date 7/10/09

SHEET 1 OF 4

PERMIT NO.: P200900126		DRILLER: T. Ward / G. McAneny		NJ LICENSE NO.: 0001105 / 0024058		GEOLOGIST: M. Lear							
SITE DESCRIPTION: PSEG SITE ESP APPLICATION				COUNTY: Salem, NJ		MACTEC PROJECT NO.: 6468-08-2251		FLUID LEVEL (ft)					
BORING NO.: EB-7		DRILL METHOD: Mud Rotary			SAMPLE METHODS: SPT			0 HR. ND					
GROUND SURFACE ELEV.: 17.0 US ft (NAVD88)		NORTHING: 232084.2 US ft (NAD83)			EASTING: 203023.1 US ft (NAD83)			24 HR. 4.2					
TOTAL DEPTH: 200.3 ft		DRILL MACHINE: CME-75 Truck			CASING DEPTH: 14.0 ft			HAMMER (ID): 140 lb Auto. (CBT-1)					
DATE STARTED: 12/19/08		COMPLETED: 1/6/09		HOLE DIA.: 4"		ROD TYPE: NWJ		BITS USED: 3-7/8" & 4-7/8" Drag Bits					
ELEV. (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION	
		0.5ft	0.5ft	0.5ft	0	20	40	60	80	100			
17.0					Ground Surface								
17.0	0.0	14	13	14							SS-1	17.0	0.0
14.5	2.5	6	3	3							SS-2A/B	15.0	2.0
12.0	5.0	WOH	WOH	WOH							SS-3	14.0	3.0
9.8	7.2	5	4	2							SS-4	12.5	4.5
7.6	9.4	7	7	8							SS-5	10.0	7.0
4.5	12.5	1	1	WOH							SS-6	8.0	9.0
1.6	15.4	WOH	1	1							SS-7	5.5	11.5
-3.0	20.0	1	1	1							SS-8	2.0	15.0
-8.0	25.0	WOH	WOH	WOH							SS-9		
-13.0	30.0	WOH	WOH	WOH							SS-10	-15.5	32.5
-18.0	35.0	WOH	1	1							SS-11	-21.0	38.0
-23.0	40.0	9	6	6							SS-12		
-28.0	45.0	5	4	5							SS-13		
-33.0	50.0	6	7	7							SS-14		
-38.0	55.0	3	3	4							SS-15	-37.0	54.0



PERMIT NO.: P200900126			DRILLER: T. Ward / G. McAneny			NJ LICENSE NO.: 0001105 / 0024058			GEOLOGIST: M. Lear						
SITE DESCRIPTION: PSEG SITE ESP APPLICATION					COUNTY: Salem, NJ		MACTEC PROJECT NO.: 6468-08-2251			FLUID LEVEL (ft) 0 HR. ND 24 HR. 4.2					
BORING NO.: EB-7		DRILL METHOD: Mud Rotary			SAMPLE METHODS: SPT										
GROUND SURFACE ELEV.: 17.0 US ft (NAVD88)		NORTHING: 232084.2 US ft (NAD83)		EASTING: 203023.1 US ft (NAD83)											
TOTAL DEPTH: 200.3 ft			DRILL MACHINE: CME-75 Truck			CASING DEPTH: 14.0 ft			HAMMER (ID): 140 lb Auto. (CBT-1)						
DATE STARTED: 12/19/08		COMPLETED: 1/6/09		HOLE DIA.: 4"		ROD TYPE: NWJ		BITS USED: 3-7/8" & 4-7/8" Drag Bits							
ELEV. (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION			
		0.5ft	0.5ft	0.5ft	0	20	40	60	80	100					
-39.1					Continued from previous page										
												KIRKWOOD FORMATION: Silty SAND (SM), greenish gray (5GY 5/1), loose, wet, fine sand, few to little mica (continued)			
-43.0	60.0	3	8	8						SS-16		60.0ft: Medium dense, few mica			
												-46.0	63.0	KIRKWOOD FORMATION: Sandy SILT (ML), greenish gray (5GY 5/1), medium stiff, wet, fine sand, trace to few mica	
-48.0	65.0	2	3	4						SS-17					
												-50.0	67.0	KIRKWOOD FORMATION: LEAN CLAY with sand (CL), dark brown (7.5YR 3/2), stiff, moist to wet, little fine sand, few mica, few organics	
-53.0	70.0	WOH	3	8						SS-18					
												-56.0	73.0	KIRKWOOD FORMATION: Silty, Clayey SAND (SC-SM), dark brown (7.5YR 3/2), loose, moist, fine to medium sand, trace shells, trace organics	
-58.0	75.0	WOH	WOH	WOH						SS-19					
												-63.0	80.0		
-63.0	80.0	2	3	8						SS-20A/B			-63.5	80.5	KIRKWOOD FORMATION: Silty SAND (SM), dark grayish brown (2.5Y 4/2), medium dense, wet, fine sand, trace shells, little mica
												-66.0	83.0		
-68.0	85.0	3	8	7						SS-21			-67.0	84.0	KIRKWOOD FORMATION: GRAVEL-Not sampled interpreted from bit chatter from 83.0ft to 84.0ft
														VINCETOWN FORMATION: Silty SAND (SM), greenish gray (10Y 6/1), medium dense, wet, fine to medium sand, few friable to moderately indurated layers, strong HCl reaction	
-73.0	90.0	48	23	15						SS-22					90.0ft: Brownish yellow (10YR 6/6), to greenish gray (10Y 6/1), dense, few shell fragments, little friable to moderately indurated layers, few glauconite, weakly oxidized
-78.0	95.0	18	14	16						SS-23					95.0ft: Medium dense, moist, fine to coarse sand, few friable to moderately indurated layers
												-81.0	98.0	VINCETOWN FORMATION: LEAN CLAY with sand (CL), light greenish gray (10Y 7/1), hard, moist to wet, little fine to medium sand, trace moderately indurated layers, trace shell fragments, strong HCl reaction, trace glauconite	
-83.0	100.0	11	89/0.2							SS-24			-86.0	103.0	VINCETOWN FORMATION: Silty SAND (SM), light greenish gray (10Y 7/1), medium dense, moist to wet, fine to medium sand, trace moderately indurated layers, few to little shell fragments, strong HCl reaction, trace glauconite
-88.0	105.0	11	11	12						SS-25					
-93.0	110.0	7	17	14						SS-26					110.0ft: Dense

PSEG ESP BORE PSEG ESP 7-07-09.GPJ PSEG ESP.GDT 7/10/09



PERMIT NO.: P200900126		DRILLER: T. Ward / G. McAneny		NJ LICENSE NO.: 0001105 / 0024058		GEOLOGIST: M. Lear									
SITE DESCRIPTION: PSEG SITE ESP APPLICATION				COUNTY: Salem, NJ		MACTEC PROJECT NO.: 6468-08-2251		FLUID LEVEL (ft)							
BORING NO.: EB-7		DRILL METHOD: Mud Rotary		SAMPLE METHODS: SPT		0 HR.		ND							
GROUND SURFACE ELEV.: 17.0		US ft (NAVD88)		NORTHING: 232084.2		US ft (NAD83)		EASTING: 203023.1		US ft (NAD83)		24 HR.		4.2	
TOTAL DEPTH: 200.3 ft		DRILL MACHINE: CME-75 Truck		CASING DEPTH: 14.0 ft		HAMMER (ID): 140 lb Auto. (CBT-1)									
DATE STARTED: 12/19/08		COMPLETED: 1/6/09		HOLE DIA.: 4"		ROD TYPE: NWJ		BITS USED: 3-7/8" & 4-7/8" Drag Bits							
ELEV.	DEPTH	BLOW COUNT			BLOWS PER FOOT					SAMP.	LOG	SOIL AND ROCK DESCRIPTION			
(ft)	(ft)	0.5ft	0.5ft	0.5ft	0	20	40	60	80	100			NO.		
-95.2		Continued from previous page													
-98.0	115.0	8	19	39						SS-27		VINCENTOWN FORMATION: Silty SAND (SM), light greenish gray (10Y 7/1), medium dense, moist to wet, fine to medium sand, trace moderately indurated layers, few to little shell fragments, strong HCl reaction, trace glauconite (continued) 115.0ft: Very dense, few shell fragments, few moderately indurated layers			
-103.0	120.0	13	11	15						SS-28		-Bit chatter from 116ft to 117ft 120.0ft: Medium dense, trace friable layers			
-108.0	125.0	9	91/0.2							SS-29		125.0ft: Very dense, few moderately indurated to indurated layers, trace shell fragments			
-113.0	130.0	31	13	17						SS-30		130.0ft: Greenish gray (10Y 5/1), medium dense, moist, few friable to moderately indurated layers			
-118.0	135.0	50/0.0								SS-31		135.0ft: No Recovery- SPT refusal with no penetration on indurated layers, very dense -Bit chatter from 138ft to 140ft			
-123.0	140.0	7	26	74/0.1						SS-32		VINCENTOWN FORMATION: Clayey SAND (SC), greenish gray (10Y 5/1), very dense, moist, fine to medium sand, few moderately indurated to indurated layers, trace shell fragments, strong HCl reaction, trace glauconite			
-128.0	145.0	6	9	14						SS-33		145.0ft: Medium dense			
-133.0	150.0	10	19	27						SS-34		-Bit chatter/hard drilling from 147ft to 148ft HORNERSTOWN FORMATION: Silty SAND (SM), greenish gray (10Y 5/1), dense, moist, fine sand, trace shell fragments, strong HCl reaction, few to little glauconite			
-138.0	155.0	6	11	46						SS-35		155.0ft: Very dense, trace moderate indurated layers			
-143.0	160.0	40	58	39						SS-36		160.0ft: Few to little friable to moderately indurated layers, few shell fragments, little glauconite			
-148.0	165.0	4	13	26						SS-37		165.0ft: Very dark greenish gray (10Y 3/1), dense, trace shell fragments, some glauconite			

00SEG ESP BORE PSEG ESP 7-07-09.GPJ PSEG ESP.GDT 7/10/09



GEOTECHNICAL BORING LOG

Prepared By MM Date 7/10/09Checked By JS Date 7/10/09

SHEET 1 OF 6

PERMIT NO.: P200900127		DRILLER: T. Ward		NJ LICENSE NO.: 0001105		GEOLOGIST: J. Howard						
SITE DESCRIPTION: PSEG SITE ESP APPLICATION				COUNTY: Salem, NJ		MACTEC PROJECT NO.: 6468-08-2251						
BORING NO.: EB-8		DRILL METHOD: Mud Rotary		SAMPLE METHODS: SPT/Shelby Tube		FLUID LEVEL (ft)						
GROUND SURFACE ELEV.: 15.3 US ft (NAVD88)		NORTHING: 231160.7 US ft (NAD83)		EASTING: 203499.7 US ft (NAD83)		0 HR. ND						
TOTAL DEPTH: 301.7 ft		DRILL MACHINE: CME-75 Truck		CASING DEPTH: 14.0 ft		HAMMER (ID): 140 lb Auto. (CBT-1)						
DATE STARTED: 2/7/09		COMPLETED: 2/19/09		HOLE DIA.: 4"		ROD TYPE: NWJ						
						BITS USED: 3-7/8" Drag Bit						
ELEV. (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION
		0.5ft	0.5ft	0.5ft	0	20	40	60	80			
15.3					Ground Surface							
15.3	0.0	3	6	8								15.3
12.8	2.5	5	2	2								13.3
10.3	5.0	WOH	WOH	WOH								ARTIFICIAL FILL: Clayey SAND with gravel (SC), dark grayish brown (10YR 4/2), medium dense, moist, fine to coarse sand, no HCl reaction, subrounded gravel
7.8	7.5	WOH	WOH	WOH								HYDRAULIC FILL: FAT CLAY (CH), black (N 2.5/), soft, moist, no HCl reaction, PP=0.0 tsf
5.3	10.0	WOH	1	WOH								5.0ft: Very soft, trace mica
3.0	12.3	WOH	WOH	WOH								7.5ft: Dark gray (N 4/)
0.5	14.8	WOH	3	2								10.0ft: Trace organics
		WOH	WOH	WOH								12.3ft: No recovery-Same as above
-4.8	20.1	WOH	WOH	WOH								14.0ft: Some fine to medium sand, PP=0.25 tsf
-9.9	25.2	WOH	WOH	WOH								HYDRAULIC FILL: Poorly graded SAND with silt (SP-SM), very dark gray (N 4/), wet, loose, fine to medium sand, no HCl reaction
-15.0	30.3	WOH	2	5								HYDRAULIC FILL: SILT (ML), very dark gray (N 3/), very soft, moist, no HCl reaction, trace mica, PP=0.0 tsf
-19.7	35.0	2	2	3								25.2ft: Few to little fine sand
-26.1	41.4	7	4	4								ALLUVIUM: Poorly graded SAND (SP), dark greenish gray (5GY 4/1), loose, wet, medium to coarse sand, no HCl reaction
-28.1	43.4											ALLUVIUM: PEAT (PT), dark brown (7.5YR 3/3), stiff, moist, no HCl reaction
-30.7	46.0	2	3	3								ALLUVIUM: LEAN CLAY (CL), dark greenish gray (5GY 4/1), stiff, moist, no HCl reaction
-32.7	48.0	4	3	1								ALLUVIUM: Clayey SAND (SC), greenish gray (10GY 6/1), to very dark greenish gray (5GY 3/1), loose, moist, fine to medium sand, no HCl reaction
-35.5	50.8	WOH	WOH	WOH								ALLUVIUM: FAT CLAY (CH), very dark greenish gray (5GY 3/1), moist
-39.7	55.0	WOH	WOH	WOH								43.4ft: Pushed shelby tube UD-1 to 45.4ft, recovery=1.8ft, PP=2.25 tsf
												KIRKWOOD FORMATION: Clayey SAND (SC), dark yellowish brown (10YR 4/4), to brown (10YR 4/3), loose, moist, fine to medium sand, no HCl reaction
												48.0ft: Pushed shelby tube UD-2 to 50.0ft, recovery=1.8ft
												50.8ft: Strong brown (7.5YR 4/6), very loose, wet, fine to coarse subrounded sand
												55.0ft: Yellowish red (5YR 4/6)

PSEG ESP BORE PSEG ESP 7-07-09.GPJ PSEG ESP GDI 7/10/09



PERMIT NO.: P200900127			DRILLER: T. Ward			NJ LICENSE NO.: 0001105			GEOLOGIST: J. Howard					
SITE DESCRIPTION: PSEG SITE ESP APPLICATION					COUNTY: Salem, NJ		MACTEC PROJECT NO.: 6468-08-2251			FLUID LEVEL (ft)				
BORING NO.: EB-8		DRILL METHOD: Mud Rotary			SAMPLE METHODS: SPT/Shelby Tube			0 HR.			ND			
GROUND SURFACE ELEV.: 15.3		US ft (NAVD88)		NORTHING: 231160.7		US ft (NAD83)		EASTING: 203499.7		US ft (NAD83)		24 HR.	4.2	
TOTAL DEPTH: 301.7 ft		DRILL MACHINE: CME-75 Truck			CASING DEPTH: 14.0 ft			HAMMER (ID): 140 lb Auto. (CBT-1)						
DATE STARTED: 2/7/09		COMPLETED: 2/19/09		HOLE DIA.: 4"		ROD TYPE: NWJ		BITS USED: 3-7/8" Drag Bit						
ELEV.	DEPTH	BLOW COUNT			BLOWS PER FOOT					SAMP.	LOG	SOIL AND ROCK DESCRIPTION		
(ft)	(ft)	0.5ft	0.5ft	0.5ft	0	20	40	60	80	100			NO.	
-40.8					Continued from previous page									
-42.3	57.6									UD-3		-41.7	57.0	KIRKWOOD FORMATION: Sandy SILT (ML), yellowish brown (10YR 5/6), wet, fine to medium sand, no HCl reaction
-44.7	60.0	3	4	6						SS-16		-44.7	60.0	57.6ft: Pushed shelby tube UD-3 to 59.6ft, recovery=1.7ft, PP=0.0 tsf
														VINCENTOWN FORMATION: Sandy SILT (ML), brownish yellow (10YR 6/8), stiff, wet, fine to medium sand, strong HCl reaction, trace friable layers, trace glauconite, strongly oxidized
-49.5	64.8	19	16	9						SS-17		-47.7	63.0	VINCENTOWN FORMATION: Silty SAND (SM), brownish yellow (10YR 6/8), medium dense, wet, fine to medium sand, strong HCl reaction, trace friable to moderately indurated layers, trace glauconite, strongly oxidized
-51.6	66.9									UD-4				66.9ft: Pushed shelby tube UD-4 to 68.9ft, recovery=1.9ft
-54.2	69.5	7	7	9						SS-18				69.5ft: Yellowish brown (10YR 5/6)
-59.5	74.8	9	8	13						SS-19				74.8ft: Very pale brown (10YR 7/4), trace friable layers, trace glauconite, moderately oxidized
-64.7	80.0	31	13	10						SS-20				80.0ft: Brownish yellow (10YR 6/6), weakly oxidized
-66.6	81.9									UD-5				81.9ft: Pushed shelby tube UD-5 to 82.4ft, recovery=0.4ft
-67.9	83.2	12	22	21						SS-21				83.2ft: Dense, trace friable to moderately indurated layers
-74.7	90.0	9	12	12						SS-22				90.0ft: Medium dense, trace friable layers
-76.6	91.9									UD-6				91.9ft: Pushed shelby tube UD-6 to 93.7ft, recovery=1.3ft
-78.6	93.9	8	46	13						SS-23				93.9ft: Very dense
-84.6	99.9	8	49	18						SS-24				99.9ft: Yellow (2.5Y 7/6), moist, trace moderately indurated layers
-89.7	105.0	9	7	9						SS-25				105.0ft: Pale yellow (2.5Y 7/3), medium dense, trace shell fragments, very weakly oxidized
-94.5	109.8	10	12	20						SS-26				109.8ft: Light brownish gray (2.5Y 6/2), dense, trace friable layers, no oxidation

PSEG ESP BORE PSEG ESP 7-07-09 GFI PSEG ESP GDI 7/10/09



PERMIT NO.: P200900127		DRILLER: T. Ward		NJ LICENSE NO.: 0001105		GEOLOGIST: J. Howard							
SITE DESCRIPTION: PSEG SITE ESP APPLICATION			COUNTY: Salem, NJ		MACTEC PROJECT NO.: 6468-08-2251		FLUID LEVEL (ft)						
BORING NO.: EB-8		DRILL METHOD: Mud Rotary		SAMPLE METHODS: SPT/Shelby Tube		0 HR. ND							
GROUND SURFACE ELEV.: 15.3 US ft (NAVD88)		NORTHING: 231160.7 US ft (NAD83)		EASTING: 203499.7 US ft (NAD83)		24 HR. 4.2							
TOTAL DEPTH: 301.7 ft		DRILL MACHINE: CME-75 Truck		CASING DEPTH: 14.0 ft		HAMMER (ID): 140 lb Auto. (CBT-1)							
DATE STARTED: 2/7/09		COMPLETED: 2/19/09		HOLE DIA.: 4"		ROD TYPE: NWJ		BITS USED: 3-7/8" Drag Bit					
ELEV. (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	▼	L O G	SOIL AND ROCK DESCRIPTION
		0.5ft	0.5ft	0.5ft	0	20	40	60	80	100			
-96.9					Continued from previous page								
-99.7	115.0	21	13	11							SS-27		VINCENTOWN FORMATION: Silty SAND (SM), brownish yellow (10YR 6/8), medium dense, wet, fine to medium sand, strong HCl reaction, trace friable to moderately indurated layers, trace glauconite, strongly oxidized (continued) 115.0ft: Greenish gray (10Y 5/1), medium dense, wet
-104.7	120.0	9	12	12							SS-28		120.0ft: Greenish gray (10Y 6/1)
-109.8	125.1	11	9	12							SS-29		125.1ft: Greenish gray (10Y 5/1), moist
-114.5	129.8	8	8	8							SS-30		129.8ft: Greenish gray (10Y 6/1), wet
-119.5	134.8	18	7	16							SS-31		
-124.7	140.0	100/0.4								100/0.4	SS-32		140ft: Very dense, indurated
-129.7	145.0	15	9	19							SS-33		145.0ft: Medium dense
-134.5	149.8	100/0.3								100/0.3	SS-34		149.8ft: Very dense, moderately indurated
-139.7	155.0	44	15	39							SS-35		HORNERSTOWN FORMATION: Clayey SAND (SC), greenish gray (10Y 5/1), very dense, moist, fine to medium sand, few friable layers, strong HCl reaction, trace to few glauconite
-144.7	160.0	9	26	36							SS-36		160ft: Greenish gray (10Y 6/1), trace friable layers
-149.9	165.2	8	92/0.4								SS-37		165.2ft: Trace moderately indurated layers, few to little glauconite

PSEG ESP BORE PSEG ESP 7-07-09.GPJ PSEG ESP.GDT 7/10/09



PERMIT NO.: P200900127		DRILLER: T. Ward		NJ LICENSE NO.: 0001105		GEOLOGIST: J. Howard							
SITE DESCRIPTION: PSEG SITE ESP APPLICATION			COUNTY: Salem, NJ		MACTEC PROJECT NO.: 6468-08-2251		FLUID LEVEL (ft)						
BORING NO.: EB-8		DRILL METHOD: Mud Rotary		SAMPLE METHODS: SPT/Shelby Tube		0 HR. ND							
GROUND SURFACE ELEV.: 15.3 US ft (NAVD88)		NORTHING: 231160.7 US ft (NAD83)		EASTING: 203499.7 US ft (NAD83)		24 HR. 4.2							
TOTAL DEPTH: 301.7 ft		DRILL MACHINE: CME-75 Truck		CASING DEPTH: 14.0 ft		HAMMER (ID): 140 lb Auto. (CBT-1)							
DATE STARTED: 2/7/09		COMPLETED: 2/19/09		HOLE DIA.: 4"		ROD TYPE: NWJ							
						BITS USED: 3-7/8" Drag Bit							
ELEV. (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	▼	L O G	SOIL AND ROCK DESCRIPTION
		0.5ft	0.5ft	0.5ft	0	20	40	60	80	100			
-153.0		Continued from previous page											
-154.6	169.9	9	17	48						SS-38			HORNERSTOWN FORMATION: Clayey SAND (SC), greenish gray (10Y 5/1), very dense, moist, fine to medium sand, few friable layers, strong HCl reaction, trace to few glauconite (continued) 169.9ft: Very dark greenish gray (5GY 3/1), weak HCl reaction, trace shell fragments, some glauconite NAVESINK FORMATION: Silty SAND (SM), black (N 2.5/), very dense, moist, fine to medium sand, few shell fragments, strong HCl reaction, mostly glauconite
-159.7	175.0	25	39	59						SS-39			
-164.7	180.0	27	33	36						SS-40			180.0ft: Weak HCl reaction, trace shell fragments
-169.7	185.0	41	38	51						SS-41			185.0ft: Very dark grayish green (5G 2.5/2)
-174.7	190.0	27	33	52						SS-42			190.0ft: Very dark grayish green (5G 2.5/2) to greenish black (10Y 2.5/1), few shell fragments
-179.9	195.2	40	60/0.3							SS-43			MOUNT LAUREL FORMATION: Clayey SAND (SC), very dark greenish gray (10Y 3/1), very dense, moist, fine to coarse subrounded sand, strong HCl reaction, little glauconite
-184.5	199.8	100/0.4								SS-44			199.8ft: Dry
-194.5	209.8	100/0.3								SS-45			209.8ft: Dark greenish gray (10Y 4/1), fine to medium sand, few glauconite
-204.7	220.0	18	50	50/0.3						SS-46			MOUNT LAUREL FORMATION: Silty SAND (SM), dark greenish gray (10Y 4/1), very dense, wet, fine to medium sand, weak to strong HCl reaction, few glauconite

PSEG ESP BORE PSEG ESP 7-07-09.GPJ PSEG ESP.GDT 7/10/09



PERMIT NO.: P200900127		DRILLER: T. Ward		NJ LICENSE NO.: 0001105		GEOLOGIST: J. Howard							
SITE DESCRIPTION: PSEG SITE ESP APPLICATION				COUNTY: Salem, NJ		MACTEC PROJECT NO.: 6468-08-2251							
BORING NO.: EB-8		DRILL METHOD: Mud Rotary		SAMPLE METHODS: SPT/Shelby Tube		FLUID LEVEL (ft)							
GROUND SURFACE ELEV.: 15.3 US ft (NAVD88)		NORTHING: 231160.7 US ft (NAD83)		EASTING: 203499.7 US ft (NAD83)		0 HR. ND							
						24 HR. 4.2							
TOTAL DEPTH: 301.7 ft		DRILL MACHINE: CME-75 Truck		CASING DEPTH: 14.0 ft		HAMMER (ID): 140 lb Auto. (CBT-1)							
DATE STARTED: 2/7/09		COMPLETED: 2/19/09		HOLE DIA.: 4"		ROD TYPE: NWJ							
						BITS USED: 3-7/8" Drag Bit							
ELEV. (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION	
		0.5ft	0.5ft	0.5ft	0	20	40	60	80	100			
-209.1					Continued from previous page								
-214.5	229.8	31	50	50/0.4						SS-47		MOUNT LAUREL FORMATION: Silty SAND (SM), dark greenish gray (10Y 4/1), very dense, wet, fine to medium sand, weak to strong HCl reaction, few glauconite (continued)	
-224.6	239.9	38	45	55/0.4						SS-48		229.8ft: Dark greenish gray (5GY 4/1), trace to few glauconite	
-234.7	250.0	63	37/0.3							SS-49		239.9ft: No HCl reaction, trace shell fragments, trace glauconite	
-244.7	260.0	58	42/0.3							SS-50			
-254.5	269.8	43	57/0.4							SS-51		269.8ft: Wet	
-264.7	280.0											280.0ft: Weak HCl reaction	

PSEG ESP BORE PSEG ESP 7-07-09 GPT PSEG ESP GDT 7/10/09

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GEOTECHNICAL BORING LOG

Prepared By MAN Date 7/10/09Checked By JAB Date 7/10/09
SHEET 1 OF 6

PERMIT NO.: P200900127		DRILLER: D. Osuch		NJ LICENSE NO.: 0024289		GEOLOGIST: M. Lear					
SITE DESCRIPTION: PSEG SITE ESP APPLICATION				COUNTY: Salem, NJ		MACTEC PROJECT NO.: 6468-08-2251					
BORING NO.: EB-8G		DRILL METHOD: Mud Rotary		SAMPLE METHODS: NA		FLUID LEVEL (ft)					
GROUND SURFACE ELEV.: 15.7 US ft (NAVD88)		NORTHING: 231153.3 US ft (NAD83)		EASTING: 203528.3 US ft (NAD83)		0 HR. ND					
TOTAL DEPTH: 315.0 ft		DRILL MACHINE: CME-75 Truck		CASING DEPTH: 9.0 ft		HAMMER (ID): 140 lb Auto. (CTB-3)					
DATE STARTED: 1/22/09		COMPLETED: 1/23/09		HOLE DIA.: 4"		ROD TYPE: NWJ					
BITS USED: 3-7/8" Drag & Roller Cone Bits											
ELEV. (ft)	DEPTH (ft)	BLOW COUNT 0.5ft 0.5ft 0.5ft			BLOWS PER FOOT 0 20 40 60 80 100			SAMP. NO.	▼	L O G	SOIL AND ROCK DESCRIPTION
15.7					Ground Surface						15.7
											0.0
											12.2
											3.5
											15.8
											31.5
											30.3
											46.0

Boring drilled without sampling to perform down-hole geophysical testing. Strata breaks inferred from geophysical log and boring EB-8. See geotechnical boring EB-8 for complete soil descriptions.

ARTIFICIAL FILL: GRAVEL-Not sampled

HYDRAULIC FILL: SILT-Not sampled, drill fluid changed color from brown to black at 3.5 feet.

ALLUVIUM: SAND-Not sampled, bit chatter/harder drilling at 36.0 feet, drilling fluid color change from black to brown.
-Change bit from drag bit to roller cone for gravelly zone.

KIRKWOOD FORMATION: Silty/Clayey SAND-Not sampled

[illegible]

[illegible]

PSEG ESP BORE PSEG ESP 7-07-09.GPJ PSEG ESP.GDT 7/10/09

[illegible]



PERMIT NO.: P200900127		DRILLER: D. Osuch		NJ LICENSE NO.: 0024289		GEOLOGIST: M. Lear								
SITE DESCRIPTION: PSEG SITE ESP APPLICATION				COUNTY: Salem, NJ		MACTEC PROJECT NO.: 6468-08-2251		FLUID LEVEL (ft)						
BORING NO.: EB-8G		DRILL METHOD: Mud Rotary		SAMPLE METHODS: NA				0 HR. ND						
GROUND SURFACE ELEV.: 15.7 US ft (NAVD88)		NORTHING: 231153.3 US ft (NAD83)		EASTING: 203528.3 US ft (NAD83)				24 HR. 3.2						
TOTAL DEPTH: 315.0 ft		DRILL MACHINE: CME-75 Truck		CASING DEPTH: 9.0 ft			HAMMER (ID): 140 lb Auto. (CTB-3)							
DATE STARTED: 1/22/09		COMPLETED: 1/23/09		HOLE DIA.: 4"		ROD TYPE: NWJ		BITS USED: 3-7/8" Drag & Roller Cone Bits						
ELEV. (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	▼	L O G	SOIL AND ROCK DESCRIPTION	
		0.5ft	0.5ft	0.5ft	0	20	40	60	80	100				
-208.7					Continued from previous page									
														MOUNT LAUREL FORMATION: SAND-Not sampled, hard drilling throughout, coarse sand, fine gravel, trace glauconite in drill fluid return. (continued)



PERMIT NO.: P200900127		DRILLER: D. Osuch		NJ LICENSE NO.: 0024289		GEOLOGIST: M. Lear							
SITE DESCRIPTION: PSEG SITE ESP APPLICATION				COUNTY: Salem, NJ		MACTEC PROJECT NO.: 6468-08-2251							
BORING NO.: EB-8G		DRILL METHOD: Mud Rotary		SAMPLE METHODS: NA		FLUID LEVEL (ft)							
GROUND SURFACE ELEV.: 15.7 US ft (NAVD88)		NORTHING: 231153.3 US ft (NAD83)		EASTING: 203528.3 US ft (NAD83)		0 HR. ND							
TOTAL DEPTH: 315.0 ft		DRILL MACHINE: CME-75 Truck		CASING DEPTH: 9.0 ft		HAMMER (ID): 140 lb Auto. (CTB-3)							
DATE STARTED: 1/22/09		COMPLETED: 1/23/09		HOLE DIA.: 4"		ROD TYPE: NWJ							
BITS USED: 3-7/8" Drag & Roller Cone Bits													
ELEV. (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION	
		0.5ft	0.5ft	0.5ft	0	20	40	60	80	100			
-264.8					Continued from previous page								
													MOUNT LAUREL FORMATION: SAND-Not sampled, hard drilling throughout, coarse sand, fine gravel, trace glauconite in drill fluid return. (continued)
													300.0ft: Driller mixes fresh mud
													288.3
													304.0
													WENONAH FORMATION: SAND-Not sampled (Interpreted from geophysical log)
													315.0ft: Driller mixes fresh mud and flushes hole, pulls rods for geophysical testing
													299.3
													315.0
													Boring terminated at 315.0 feet.
													Boring closed by tremie method with cement-bentonite grout on 1/24/09.

Observation Well Boring Logs

GEOTECHNICAL BORING LOG

Prepared By NRH Date 6/16/09

Checked By JA2 Date 6/17/09

SHEET 1 OF 2

PERMIT NO.: P200900115		DRILLER: R. Tabor		NJ LICENSE NO.: 0001335		GEOLOGIST: R. Clark							
SITE DESCRIPTION: PSEG SITE ESP APPLICATION			COUNTY: Salem, NJ		MACTEC PROJECT NO.: 6468-08-2251		FLUID LEVEL (ft)						
BORING NO.: NOW-2L		DRILL METHOD: Rotosonic		SAMPLE METHODS: Rotosonic disturbed soil core			0 HR. ND						
GROUND SURFACE ELEV.: 8.3 US ft (NAVD88)		NORTHING: 235227.7 US ft (NAD83)		EASTING: 197752.8 US ft (NAD83)			24 HR. ND						
TOTAL DEPTH: 115.0 ft		DRILL MACHINE: Minisonic Track		CASING DEPTH: 115			HAMMER (ID): NA						
DATE STARTED: 1/22/09		COMPLETED: 1/22/09		HOLE DIA.: 6"		ROD TYPE: Sonic		BITS USED: 4" Auger Core Bit					
ELEV. (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION	
		0.5ft	0.5ft	0.5ft	0	20	40	60	80	100			
8.3					Ground Surface								
8.3	0.0									RUN 1		8.3	0.0
										S-1		5.3	3.0
-1.7	10.0									RUN 2			
										S-2			
-11.7	20.0									RUN 3			
										S-3			
-21.7	30.0									RUN 4			
										S-4			
-31.7	40.0									RUN 5			
										S-5			
-41.7	50.0									RUN 6			
										S-6			
-51.7	60.0									RUN 7			
										S-7			
-61.7	70.0									RUN 8			
										S-8			
										S-9			



GEOTECHNICAL BORING LOG

Prepared By MAN Date 6/16/09Checked By JAS Date 6/17/09

SHEET 1 OF 2

PERMIT NO.: P200900117		DRILLER: R. Tabor		NJ LICENSE NO.: 0001335		GEOLOGIST: R. Clark								
SITE DESCRIPTION: PSEG SITE ESP APPLICATION				COUNTY: Salem, NJ		MACTEC PROJECT NO.: 6468-08-2251								
BORING NO.: NOW-3L		DRILL METHOD: Rotosonic		SAMPLE METHODS: Rotosonic disturbed soil core		FLUID LEVEL (ft)								
GROUND SURFACE ELEV.: 7.4 US ft (NAVD88)		NORTHING: 234565.5 US ft (NAD83)		EASTING: 197897.9 US ft (NAD83)		0 HR. ND								
TOTAL DEPTH: 102.5 ft		DRILL MACHINE: Minisonic Track		CASING DEPTH: 102.5		HAMMER (ID): NA								
DATE STARTED: 1/20/09		COMPLETED: 1/21/09		HOLE DIA.: 6"		ROD TYPE: Sonic								
						BITS USED: 4" Auger Core Bit								
ELEV. (ft)	DEPTH (ft)	BLOW COUNT 0.5ft 0.5ft 0.5ft			BLOWS PER FOOT 0 20 40 60 80 100					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION		
7.4					Ground Surface									
7.4	0.0									RUN 1		7.4	ARTIFICIAL FILL: Poorly graded SAND with silt and gravel (SP-SM), grayish brown (2.5Y 5/2), wet, angular to subrounded gravel, no HCl reaction	0.0
										S-1				
												2.4	HYDRAULIC FILL: LEAN CLAY with sand (CL), very dark greenish gray (5GY 3/1), wet, weak HCl reaction	5.0
-2.6	10.0									S-2		-2.6		10.0
										RUN 2				
										S-3				
-12.6	20.0													
										RUN 3				
										S-4				
-22.6	30.0											-22.6	ALLUVIUM: Poorly graded SAND with silt (SP-SM), greenish gray (10Y 5/1), wet, fine sand, no HCl reaction	30.0
										RUN 4				
										S-5				
										S-6		-27.6	ALLUVIUM: FAT CLAY (CH), dark greenish gray (10Y 4/1), moist, trace gravel, trace shell fragments, few fine sand lenses, weak HCl reaction	35.0
-32.6	40.0											-32.6		40.0
										RUN 5				
										S-7				
										S-8		-36.6	ALLUVIUM: Clayey SAND (SC), dark greenish gray (10Y 4/1), wet, no HCl reaction	44.0
										S-9		-38.6	ALLUVIUM: Poorly graded SAND with silt (SP-SM), greenish gray (10Y 5/1), wet, trace to little fines	46.0
-42.6	50.0													
										RUN 6				
										S-10		-44.6	KIRKWOOD FORMATION: FAT CLAY (CH), greenish gray (10Y 5/1), to grayish brown (2.5Y 5/2), mottled, moist to wet, trace subangular to subrounded gravel, trace iron staining, no HCl reaction	52.0
-52.6	60.0													
										RUN 7				
										S-11		-54.6	KIRKWOOD FORMATION: Clayey SAND (SC), dark olive gray (5Y 3/2), wet, few to little subrounded fine to coarse gravel	62.0
										S-12		-56.6	VINCENNTOWN FORMATION: Poorly graded SAND with silt (SP-SM), olive (5Y 5/3), wet, fine sand, strong HCl reaction, trace subrounded gravel, trace moderately indurated layers	64.0
-62.6	70.0													
										RUN 8		-63.6		71.0

PSEG ESP BORE PSEG ESP 6-15-09.GPJ PSEG ESP.GDT 6/16/09

[illegible]



GEOTECHNICAL BORING LOG

Prepared By MM Date 6/17/09Checked By JR Date 6/17/09

SHEET 1 OF 2

PERMIT NO.: P200900119		DRILLER: R. Bartholomew		NJ LICENSE NO.: 0001383		GEOLOGIST: S. Johnson/J. Howard				
SITE DESCRIPTION: PSEG SITE ESP APPLICATION				COUNTY: Salem, NJ		MACTEC PROJECT NO.: 6468-08-2251				
BORING NO.: NOW-4L		DRILL METHOD: Mud Rotary with Reverse Circulation				SAMPLE METHODS: SPT				
GROUND SURFACE ELEV.: 10.6 US ft (NAVD88)		NORTHING: 233972.7 US ft (NAD83)		EASTING: 198147.9 US ft (NAD83)		FLUID LEVEL (ft) 0 HR. ND 24 HR. ND				
TOTAL DEPTH: 85.0 ft		DRILL MACHINE: CME-75 Truck		CASING DEPTH: NA		HAMMER (ID): 140 lb. Auto (CTB-5)				
DATE STARTED: 1/22/09		COMPLETED: 1/24/09		HOLE DIA.: 6"		ROD TYPE: NWJ				
						BITS USED: 3-7/8" & 5-7/8" Drag Bit				
ELEV. (ft)	DEPTH (ft)	BLOW COUNT 0.5ft 0.5ft 0.5ft			BLOWS PER FOOT 0 20 40 60 80 100			SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION
10.6					Ground Surface					10.6
										0.0
										Drill without sampling to 18.0 feet. Boring advanced with a 4" drag bit during sampling, then reamed with a 6" drag bit for observation well installation.
-7.4	18.0	WOH	WOH	WOH	0			SS-1		-7.4
		WOH	WOH	WOH	0					18.0
-12.7	23.3	WOH	WOH	WOH	0			SS-2		
		WOH	WOH	WOH	0					
-17.4	28.0	5	4	4	8			SS-3		-18.4
										27.0
-22.4	33.0	WOH	2	1	3			SS-4		
-27.5	38.1	1	1	1	2			SS-5		-25.4
										36.0
-32.4	43.0	2	3	5	8			SS-6		-32.4
										43.0
-37.4	48.0	8	11	15	26			SS-7		-36.4
										47.0
-42.3	52.9	6	2	2	4			SS-8		-41.4
										52.0
-52.3	62.9	6	6	11	17			SS-9		-43.8
										54.4
-57.2	67.8	8	11	23	34			SS-10		-52.3
										62.9
-62.4	73.0	6	6	9	15			SS-11		-56.4
										67.0
										-62.4
										73.0

PSEG ESP BORE PSEG ESP 6-15-09 GPI PSEG ESP GDT 6/17/09



SHEET 2 OF 2

PERMIT NO.: P200900119		DRILLER: R. Bartholomew		NJ LICENSE NO.: 0001383		GEOLOGIST: S. Johnson/J. Howard							
SITE DESCRIPTION: PSEG SITE ESP APPLICATION				COUNTY: Salem, NJ		MACTEC PROJECT NO.: 6468-08-2251							
BORING NO.: NOW-4L		DRILL METHOD: Mud Rotary with Reverse Circulation		SAMPLE METHODS: SPT		FLUID LEVEL (ft)							
GROUND SURFACE ELEV.: 10.6 US ft (NAVD88)		NORTHING: 233972.7 US ft (NAD83)		EASTING: 198147.9 US ft (NAD83)		0 HR. ND							
						24 HR. ND							
TOTAL DEPTH: 85.0 ft		DRILL MACHINE: CME-75 Truck		CASING DEPTH: NA		HAMMER (ID): 140 lb. Auto (CTB-5)							
DATE STARTED: 1/22/09		COMPLETED: 1/24/09		HOLE DIA.: 6"		ROD TYPE: NWJ							
						BITS USED: 3-7/8" & 5-7/8" Drag Bit							
ELEV. (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION	
		0.5ft	0.5ft	0.5ft	0	20	40	60	80	100			
-64.2					Continued from previous page								
-67.4	78.0	15	12	14						SS-12		VINCENTOWN FORMATION: Silty SAND (SM), greenish gray (5GY 6/1), medium dense, moist, fine to medium sand, strong HCl reaction (<i>continued</i>) 78.0ft: Greenish gray (5GY 5/1), trace shell fragments	
-72.4	83.0	11	19	72						SS-13		83.0ft: Very dense, weak to strong HCl reaction	
													Boring terminated at 85.0 feet and observation well NOW-4L constructed. Boring logged to establish the general geologic conditions for the selection of observation well depths and well screen intervals. For complete strata and soil descriptions see geotechnical boring NB-4.



GEOTECHNICAL BORING LOG

Prepared By MM Date 6/17/09

Checked By JS Date 6/17/09

SHEET 1 OF 2

PERMIT NO.: P200900123		DRILLER: R. Tabor		NJ LICENSE NO.: 0001335		GEOLOGIST: R. Clark							
SITE DESCRIPTION: PSEG SITE ESP APPLICATION			COUNTY: Salem, NJ		MACTEC PROJECT NO.: 6468-08-2251		FLUID LEVEL (ft)						
BORING NO.: NOW-5L		DRILL METHOD: Rotasonic		SAMPLE METHODS: Rotasonic disturbed soil core			0 HR. ND						
GROUND SURFACE ELEV.: 7.6		US ft (NAVD88)		NORTHING: 234927.5 US ft (NAD83)		EASTING: 198438.4 US ft (NAD83)		24 HR. ND					
TOTAL DEPTH: 102.3 ft		DRILL MACHINE: Minisonic Track		CASING DEPTH: 102.3			HAMMER (ID): NA						
DATE STARTED: 1/26/09		COMPLETED: 1/26/09		HOLE DIA.: 6"		ROD TYPE: Sonic		BITS USED: 4" Auger Core Bit					
ELEV.	DEPTH	BLOW COUNT			BLOWS PER FOOT					SAMP.	LOG	SOIL AND ROCK DESCRIPTION	
(ft)	(ft)	0.5ft	0.5ft	0.5ft	0	20	40	60	80	100			NO.
7.6					Ground Surface							7.6	0.0
7.6	0.0										RUN 1		ARTIFICIAL FILL: LEAN CLAY with gravel (CL), very dark grayish brown (2.5Y 3/2), wet, trace organics, few sand, no HCL reaction
											S-1		2.6 5.0
											RUN 2		HYDRAULIC FILL: FAT CLAY with gravel (CH), greenish black (10Y 3/1), moist to wet, no HCL reaction
-2.5	10.0										S-2		10.0ft: FAT CLAY (CH), very dark greenish gray (5GY 3/1), moist to wet, little fine sand, no HCL reaction
											RUN 3		20.0ft: Very dark gray (5Y 3/1), moist
											S-3		
-12.5	20.0										RUN 4		
											S-4		
											RUN 5		
-22.5	30.0										S-5		29.5 37.0
											RUN 6		ALLUVIUM: Poorly graded SAND with clay (SP-SC), greenish gray (5GY 5/1), wet, no HCL reaction, trace glauconite
-32.5	40.0										S-6		31.5 39.0
											RUN 7		ALLUVIUM: Poorly graded SAND with silt (SP-SM), greenish gray (5GY 5/1), wet, trace subrounded gravel, trace glauconite, no HCL reaction
											S-7		33.5 41.0
											RUN 8		KIRKWOOD FORMATION: FAT CLAY (CH), dark olive gray (5Y 3/2), moist, no HCL reaction
-42.5	50.0										S-8		52.0 59.5
											RUN 9		KIRKWOOD FORMATION: Clayey SAND (SC), dark gray (5Y 4/1), wet, fine sand, no HCL reaction
-52.5	60.0										S-9		54.5 62.0
											RUN 10		KIRKWOOD FORMATION: Poorly graded GRAVEL with silt and sand (GP-GM), dark gray (5Y 4/1), wet, subrounded, no HCL reaction
-62.5	70.0										S-10		58.5 66.0
											RUN 11		VINCENTOWN FORMATION: Poorly graded SAND with silt (SP-SM), olive gray (5Y 4/2), to reddish brown (5Y 4/3), wet, no HCL reaction, strongly oxidized
											RUN 12		70.0ft: Yellowish brown (10YR 5/4), strong HCL reaction

PSEG ESP BORE PSEG ESP 6-15-09 GPT PSEG ESP GDT 6/17/09



PERMIT NO.: P200900123		DRILLER: R. Tabor		NJ LICENSE NO.: 0001335		GEOLOGIST: R. Clark							
SITE DESCRIPTION: PSEG SITE ESP APPLICATION				COUNTY: Salem, NJ		MACTEC PROJECT NO.: 6468-08-2251							
BORING NO.: NOW-5L		DRILL METHOD: Rotosonic		SAMPLE METHODS: Rotosonic disturbed soil core		FLUID LEVEL (ft)							
GROUND SURFACE ELEV.: 7.6		US ft (NAVD88)		NORTHING: 234927.5		US ft (NAD83)							
EASTING: 198438.4		US ft (NAD83)		24 HR.		ND							
TOTAL DEPTH: 102.3 ft		DRILL MACHINE: Minisonic Track		CASING DEPTH: 102.3		HAMMER (ID): NA							
DATE STARTED: 1/26/09		COMPLETED: 1/26/09		HOLE DIA.: 6"		ROD TYPE: Sonic							
BITS USED: 4" Auger Core Bit													
ELEV. (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION	
		0.5ft	0.5ft	0.5ft	0	20	40	60	80	100			
-67.3					Continued from previous page								
-72.5	80.0									S-10		VINCENTOWN FORMATION: Poorly graded SAND with silt (SP-SM), olive gray (5Y 4/2), to reddish brown (5Y 4/3), wet, no HCl reaction, strongly oxidized (continued)	
										RUN 9		80.0ft: Light yellowish brown (2.5Y6/4), moderately oxidized	
-82.5	90.0									S-11		86.0ft: Greenish gray (10Y 5/1), fine sand, glauconitic, no oxidation	
										RUN 10		VINCENTOWN FORMATION: Poorly graded SAND with clay (SP-SC), greenish gray (10Y 5/1), wet, fine sand, strong HCl reaction, glauconitic	
-92.5	100.0									S-12			
										RUN 11			
												-94.8	102.3
Boring terminated at 102.3 feet and observation well NOW-5L constructed.													
Boring logged to establish the general geologic conditions for the selection of observation well depths and well screen intervals. For complete strata and soil descriptions see geotechnical boring NB-5.													



GEOTECHNICAL BORING LOG

Prepared By WMC Date 6/16/09Checked By B.J. Date 6/17/09

SHEET 1 OF 2

PERMIT NO.: P200900121		DRILLER: R. Tabor		NJ LICENSE NO.: 0001335		GEOLOGIST: R. Clark							
SITE DESCRIPTION: PSEG SITE ESP APPLICATION				COUNTY: Salem, NJ		MACTEC PROJECT NO.: 6468-08-2251							
BORING NO.: NOW-6L		DRILL METHOD: Rotosonic		SAMPLE METHODS: Rotosonic disturbed soil core		FLUID LEVEL (ft)							
GROUND SURFACE ELEV.: 7.8 US ft (NAVD88)		NORTHING: 235287.9 US ft (NAD83)		EASTING: 198312.8 US ft (NAD83)		0 HR. ND							
TOTAL DEPTH: 92.3 ft		DRILL MACHINE: Minisonic Track		CASING DEPTH: 92.3		HAMMER (ID): NA							
DATE STARTED: 1/25/09		COMPLETED: 1/25/09		HOLE DIA.: 6"		ROD TYPE: Sonic							
						BITS USED: 4" Auger Core Bit							
ELEV. (ft)	DEPTH (ft)	BLOW COUNT 0.5ft 0.5ft 0.5ft			BLOWS PER FOOT 0 20 40 60 80 100					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION	
7.8					Ground Surface							7.8	0.0
7.8	0.0									RUN 1		ARTIFICIAL FILL: FAT CLAY with gravel (CH), very dark greenish gray (5GY 3/1), moist to wet, little angular gravel and sand	
										S-1		2.8	5.0
												HYDRAULIC FILL: FAT CLAY (CH), very dark greenish gray (5GY 3/1), moist to wet, few organics, no HCl reaction	
-2.2	10.0									RUN 2		10.0ft: Wet, little sand, trace gravel	
										S-2			
-12.2	20.0									RUN 3		20.0ft: Very dark greenish gray (10Y 3/1), trace sand, trace organics	
										S-3			
-22.2	30.0									RUN 4			
										S-4			
-32.2	40.0									RUN 5		31.2	39.0
										S-5		ALLUVIUM: poorly graded SAND with silt (SP-SM), greenish gray (10Y 5/1), wet, fine sand, little subangular to subrounded gravel, no HCl reaction	
-42.2	50.0									RUN 6		36.7	44.5
										S-6		KIRKWOOD FORMATION: FAT CLAY (CH), dark olive gray (5Y 3/2), moist, trace fine sand, no HCl reaction	
-52.2	60.0									RUN 7			
										S-7			
-62.2	70.0									RUN 8		-55.2	63.0
										S-8		-56.2	64.0
												KIRKWOOD FORMATION: Clayey SAND (SC), olive gray (5Y 5/2), wet	
												KIRKWOOD FORMATION: Silty SAND (SM), olive gray (5Y 5/2), wet, fine to coarse sand, trace subrounded gravel, no HCl reaction	
										S-9		-59.2	67.0
										RUN 9		VINCENTOWN FORMATION: Poorly graded SAND with clay (SP-SC), greenish gray (10Y 6/1), wet, fine sand, glauconitic, strong HCl reaction	
												-64.2	72.0

PSEG ESP BORE PSEG ESP 6-15-09.GPJ PSEG ESP.GDT 6/16/09



SHEET 2 OF 2

PERMIT NO.: P200900121		DRILLER: R. Tabor		NJ LICENSE NO.: 0001335		GEOLOGIST: R. Clark									
SITE DESCRIPTION: PSEG SITE ESP APPLICATION				COUNTY: Salem, NJ		MACTEC PROJECT NO.: 6468-08-2251									
BORING NO.: NOW-6L		DRILL METHOD: Rotosonic		SAMPLE METHODS: Rotosonic disturbed soil core		FLUID LEVEL (ft)									
GROUND SURFACE ELEV.: 7.8		US ft (NAVD88)		NORTHING: 235287.9 US ft (NAD83)		EASTING: 198312.8 US ft (NAD83)									
TOTAL DEPTH: 92.3 ft		DRILL MACHINE: Minisonic Track		CASING DEPTH: 92.3		HAMMER (ID): NA									
DATE STARTED: 1/25/09		COMPLETED: 1/25/09		HOLE DIA.: 6"		ROD TYPE: Sonic									
BITS USED: 4" Auger Core Bit															
ELEV. (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT						SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION		
		0.5ft	0.5ft	0.5ft	0	20	40	60	80	100					
-67.0					Continued from previous page										
-72.2	80.0										S-10		VINCENTOWN FORMATION: Poorly graded SAND with silt (SP-SM), strong brown (7.5YR 4/6), wet, fine to medium sand, strong HCl reaction, glauconitic, strongly oxidized (<i>continued</i>) 80.0ft: Greenish gray (10Y 6/1), no oxidation		
											RUN 9				
											S-11				
-82.2	90.0										RUN 10				
													-84.5	92.3	Boring terminated at 92.3 feet and observation well NOW-6L constructed. Boring logged to establish the general geologic conditions for the selection of observation well depths and well screen intervals. For complete strata and soil descriptions see geotechnical boring NB-6.



GEOTECHNICAL BORING LOG

Prepared By NR Date 6/16/09

Checked By JAG Date 6/1/09

SHEET 1 OF 2

PERMIT NO.: P200900095		DRILLER: R. Tabor		NJ LICENSE NO.: 0001335		GEOLOGIST: R. Clark	
SITE DESCRIPTION: PSEG SITE ESP APPLICATION				COUNTY: Salem, NJ		MACTEC PROJECT NO.: 6468-08-2251	
BORING NO.: NOW-7L		DRILL METHOD: Rotosonic		SAMPLE METHODS: Rotosonic disturbed soil core		FLUID LEVEL (ft)	
GROUND SURFACE ELEV.: 6.1 US ft (NAVD88)		NORTHING: 234973.4 US ft (NAD83)		EASTING: 199675.9 US ft (NAD83)		0 HR. ND	
TOTAL DEPTH: 97.0 ft		DRILL MACHINE: Minisonic Track		CASING DEPTH: 97.0		HAMMER (ID): NA	
DATE STARTED: 1/23/09		COMPLETED: 1/24/09		HOLE DIA.: 6"		ROD TYPE: Sonic	
BITS USED: 4" Auger Core Bit							

ELEV. (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT						SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION			
		0.5ft	0.5ft	0.5ft	0	20	40	60	80	100						
6.1					Ground Surface											
6.1	0.0													6.1	0.0	
														4.1	2.0	ARTIFICIAL FILL: FAT CLAY with gravel and sand (CH), very pale brown (10YR 7/3)
																HYDRAULIC FILL: FAT CLAY (CH), very dark greenish gray (10Y 3/1), wet, few organics, trace gravel and sand, no HCl reaction
-3.9	10.0															
-13.9	20.0													-13.9	20.0	ALLUVIUM: Clayey SAND (SC), dark greenish gray (10Y 4/1), wet, few shell fragments, little angular gravel
														-16.9	23.0	ALLUVIUM: FAT CLAY (CH), very dark greenish gray (10Y 3/1), wet, few fine sand, no HCl reaction
-23.9	30.0													-22.9	29.0	ALLUVIUM: Clayey SAND (SC), dark greenish gray (10Y 4/1), wet, trace angular gravel, no HCl reaction
														-26.4	32.5	KIRKWOOD FORMATION: LEAN CLAY with sand and gravel (CL), brown (10YR 5/3), moist, subangular to subrounded gravel and sand, no HCl reaction
-33.9	40.0													-33.9	40.0	VINCENTOWN FORMATION: Clayey SAND (SC), yellowish brown (10YR 5/6), wet, fine sand, strong HCl reaction, strongly oxidized
-43.9	50.0													-42.4	48.5	VINCENTOWN FORMATION: Poorly graded SAND with silt (SP-SM), yellowish brown (10YR 5/8), wet, fine sand, strong HCl reaction, strongly oxidized
-53.9	60.0													-57.4	63.5	VINCENTOWN FORMATION: Poorly graded SAND with clay (SP-SC), light yellowish brown (10YR 6/4), wet, fine sand, strong HCl reaction, moderately oxidized
-63.9	70.0													-65.4	71.5	

PSEG ESP BORE PSEG ESP 6-15-09 GFI PSEG ESP.GDT 6/16/09



PERMIT NO.: P200900095						DRILLER: R. Tabor						NJ LICENSE NO.: 0001335						GEOLOGIST: R. Clark											
SITE DESCRIPTION: PSEG SITE ESP APPLICATION												COUNTY: Salem, NJ						MACTEC PROJECT NO.: 6468-08-2251						FLUID LEVEL (ft)					
BORING NO.: NOW-7L						DRILL METHOD: Rotosonic						SAMPLE METHODS: Rotosonic disturbed soil core						0 HR. ND											
GROUND SURFACE ELEV.: 6.1 US ft (NAVD88)						NORTHING: 234973.4 US ft (NAD83)						EASTING: 199675.9 US ft (NAD83)						24 HR. ND											
TOTAL DEPTH: 97.0 ft						DRILL MACHINE: Minisonic Track						CASING DEPTH: 97.0						HAMMER (ID): NA											
DATE STARTED: 1/23/09						COMPLETED: 1/24/09						HOLE DIA.: 6"						ROD TYPE: Sonic						BITS USED: 4" Auger Core Bit					
ELEV. (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT						SAMP. NO.	▼	L O G	SOIL AND ROCK DESCRIPTION															
		0.5ft	0.5ft	0.5ft	0	20	40	60	80	100																			
-68.7					Continued from previous page																								
-73.9	80.0										S-10			VINCENTOWN FORMATION: Clayey SAND (SC), greenish gray (10Y 6/1), wet, trace moderately indurated layers, glauconitic, strong HCl reaction, no oxidation (<i>continued</i>)															
											RUN 9			-74.4	80.5														
											S-11																		
-83.9	90.0										RUN 10																		
														-90.9	97.0	Boring terminated at 97.0 feet and observation well NOW-7L constructed. Boring logged to establish the general geologic conditions for the selection of observation well depths and well screen intervals. For complete strata and soil descriptions see geotechnical boring NB-7.													



GEOTECHNICAL BORING LOG

Prepared By MM Date 6/16/09

Checked By JS Date 6/17/09

SHEET 1 OF 2

PERMIT NO.: P200900105		DRILLER: C. Marsh		NJ LICENSE NO.: 0001190		GEOLOGIST: T. Longley	
SITE DESCRIPTION: PSEG SITE ESP APPLICATION				COUNTY: Salem, NJ		MACTEC PROJECT NO.: 6468-08-2251	
BORING NO.: EOW-2L		DRILL METHOD: Rotosonic		SAMPLE METHODS: Rotosonic disturbed soil core		FLUID LEVEL (ft)	
GROUND SURFACE ELEV.: 13.9 US ft (NAVD88)		NORTHING: 233271.5 US ft (NAD83)		EASTING: 202177.7 US ft (NAD83)		0 HR. ND	
TOTAL DEPTH: 111.0 ft		DRILL MACHINE: Prosonic Truck		CASING DEPTH: 111.0		HAMMER (ID): NA	
DATE STARTED: 1/26/09		COMPLETED: 1/26/09		HOLE DIA.: 6"		ROD TYPE: Sonic	
BITS USED: 4" Auger Core Bit							

ELEV. (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT						SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION		
		0.5ft	0.5ft	0.5ft	0	20	40	60	80	100					
13.9					Ground Surface								13.9	0.0	
13.9	0.0										RUN 1		11.4	2.5	ARTIFICIAL FILL: SILT with sand (ML), very dark grayish brown (2.5Y 3/2), moist, trace rounded gravel
6.9	7.0										S-1				HYDRAULIC FILL: Silty SAND (SM), black (2.5Y 2.5/1), to greenish black (10GY 2.5/1), moist, trace fine to coarse rounded gravel; gravel and silt increase with depth
											RUN 2				
											S-2		1.6	12.3	HYDRAULIC FILL: FAT CLAY (CH), dark greenish gray (10Y 3/1), moist, no HCl reaction, trace to few organics, few fine sand partings
-3.1	17.0										RUN 3				
											S-3				
-13.1	27.0										RUN 4				27.0ft: Greenish black (5GY 2.5/1)
											S-4				
-23.1	37.0										RUN 5				
											S-5		-25.1	39.0	ALLUVIUM: Well graded SAND (SW), light brownish gray (10YR 6/2), wet, few fine gravel
											S-6				
-33.1	47.0										RUN 6		-33.1	47.0	ALLUVIUM: Silty SAND (SM), dark gray (10YR 4/1), wet, fine to medium sand
											S-7		-34.1	48.0	ALLUVIUM: FAT CLAY (CH), very dark gray (10YR 3/1), moist, no HCl reaction
											S-8				
-43.1	57.0										RUN 7		-41.1	55.0	KIRKWOOD FORMATION: FAT CLAY (CH), very dark grayish brown (2.5Y 3/2), moist, few to little shell fragments, no HCl reaction
											S-9				
-53.1	67.0										RUN 8				67.0ft: Very dark gray (2.5Y 3/1) mottled with light yellowish brown (10YR 6/4), trace shell fragments

PSEG ESP BORE PSEG ESP 6-15-09.GPJ PSEG ESP GDI 6/16/09



SHEET 2 OF 2

PERMIT NO.: P200900105		DRILLER: C. Marsh		NJ LICENSE NO.: 0001190		GEOLOGIST: T. Longley	
SITE DESCRIPTION: PSEG SITE ESP APPLICATION				COUNTY: Salem, NJ		MACTEC PROJECT NO.: 6468-08-2251	
BORING NO.: EOW-2L		DRILL METHOD: Rotosonic		SAMPLE METHODS: Rotosonic disturbed soil core		FLUID LEVEL (ft)	
GROUND SURFACE ELEV.: 13.9 US ft (NAVD88)		NORTHING: 233271.5 US ft (NAD83)		EASTING: 202177.7 US ft (NAD83)		0 HR. ND	
TOTAL DEPTH: 111.0 ft		DRILL MACHINE: Prosonic Truck		CASING DEPTH: 111.0		HAMMER (ID): NA	
DATE STARTED: 1/26/09		COMPLETED: 1/26/09		HOLE DIA.: 6"		ROD TYPE: Sonic	
BITS USED: 4" Auger Core Bit							

ELEV. (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT						SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION		
		0.5ft	0.5ft	0.5ft	0	20	40	60	80	100					
-60.9					Continued from previous page										
-63.1	77.0										RUN 9		KIRKWOOD FORMATION: FAT CLAY (CH), very dark grayish brown (2.5Y 3/2), moist, few to little shell fragments, no HCl reaction (<i>continued</i>) 77.0ft: Very dark gray (5Y 3/1) mottled with light yellowish brown (10YR 6/4) 87.0ft: Dark olive gray (5Y 3/2)		
-73.1	87.0										S-9				
											RUN 10				
											S-10				
-83.1	97.0										RUN 11				
											S-11		-85.1	99.0	KIRKWOOD FORMATION: Well graded SAND with gravel (SW), gray (5Y 6/1), wet, fine to coarse rounded gravel, no HCl reaction VINCENTOWN FORMATION: Poorly graded SAND (SP), greenish gray (10Y 5/1), wet, strong HCl reaction, few indurated layers, fine to medium sand, trace glauconite
											S-12		-87.6	101.5	
													-97.1	111.0	Boring terminated at 111.0 feet and observation well EOW-2L constructed. Boring logged to establish the general geologic conditions for the selection of observation well depths and well screen intervals. For complete strata and soil descriptions see geotechnical boring EB-2.



GEOTECHNICAL BORING LOG

Prepared By nan Date 6/17/09
 Checked By JAJ Date 6/17/09
 SHEET 1 OF 2

PERMIT NO.: P200900109		DRILLER: M. Adams		NJ LICENSE NO.: 0001350		GEOLOGIST: B. Deobald	
SITE DESCRIPTION: PSEG SITE ESP APPLICATION				COUNTY: Salem, NJ		MACTEC PROJECT NO.: 6468-08-2251	
BORING NO.: EOW-6L		DRILL METHOD: Mud Rotary with Reverse Circulation		SAMPLE METHODS: SPT		FLUID LEVEL (ft)	
GROUND SURFACE ELEV.: 13.3 US ft (NAVD88)		NORTHING: 232588.1 US ft (NAD83)		EASTING: 203300.7 US ft (NAD83)		0 HR. ND	
TOTAL DEPTH: 102.0 ft		DRILL MACHINE: CME-850 Track		CASING DEPTH: 9.3		HAMMER (ID): 140 lb. Auto (CTB-4)	
DATE STARTED: 1/22/09		COMPLETED: 1/23/09		HOLE DIA.: 6"		ROD TYPE: NWJ	
BITS USED: 3-7/8" & 5-7/8" Drag Bits							

ELEV. (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION		
		0.5ft	0.5ft	0.5ft	0	20	40	60	80				100	
13.3					Ground Surface							13.3	0.0	
-6.4	19.6	1	WOH	1									-6.4	19.6
-11.4	24.6	WOH	WOH	WOH									-11.4	24.6
-16.4	29.6	WOH	WOH	WOH									-16.4	29.6
-21.4	34.6	4	4	6									-21.4	34.6
-26.4	39.6	3	7	5									-26.4	39.6
-31.4	44.6	4	2	4									-31.4	44.6
-36.4	49.6	12	14	17									-36.4	49.6
-41.3	54.5	10	5	16									-41.3	54.5

SS-1	HYDRAULIC FILL: Sandy SILT (ML), very dark greenish gray (10Y 3/1), very soft, moist to wet, little sand, trace organics
SS-2	24.6ft: SILT (ML), soft, few sand
SS-3	HYDRAULIC FILL: FAT CLAY (CH), very dark greenish gray (10Y 3/1), very soft, moist, trace fine sand
SS-4	ALLUVIUM: Well graded SAND (SW), very dark gray (10YR 3/1), loose, wet, fine to coarse sand, trace angular gravel
SS-5	ALLUVIUM: LEAN CLAY (CL), light gray (10YR 7/1) mottled very pale brown (10YR 7/4), soft, moist
SS-6	ALLUVIUM: Silty SAND (SM), gray (10YR 6/1), loose, moist to wet, fine sand
SS-7	ALLUVIUM: Well graded SAND with gravel (SW), light olive gray (5Y 6/2), dense, wet, little sub-angular to rounded gravel
SS-8	ALLUVIUM: Poorly graded SAND (SP), light olive gray (5Y 6/2), medium dense, moist to wet, fine to medium sand, trace sub-angular to rounded gravel

Drill without sampling to 84.5 feet. Continue SPT's at 84.5 feet

PSEG ESP BORE PSEG ESP 6-15-09 GPI PSEG ESP GDI 6/17/09



SHEET 2 OF 2

PERMIT NO.: P200900109		DRILLER: M. Adams		NJ LICENSE NO.: 0001350		GEOLOGIST: B. Deobald	
SITE DESCRIPTION: PSEG SITE ESP APPLICATION				COUNTY: Salem, NJ		MACTEC PROJECT NO.: 6468-08-2251	
BORING NO.: EOW-6L		DRILL METHOD: Mud Rotary with Reverse Circulation		SAMPLE METHODS: SPT		FLUID LEVEL (ft)	
GROUND SURFACE ELEV.: 13.3 US ft (NAVD88)		NORTHING: 232588.1 US ft (NAD83)		EASTING: 203300.7 US ft (NAD83)		0 HR. ND	
TOTAL DEPTH: 102.0 ft		DRILL MACHINE: CME-850 Track		CASING DEPTH: 9.3		HAMMER (ID): 140 lb. Auto (CTB-4)	
DATE STARTED: 1/22/09		COMPLETED: 1/23/09		HOLE DIA.: 6"		ROD TYPE: NWJ	
BITS USED: 3-7/8" & 5-7/8" Drag Bits							

ELEV. (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT						SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION
		0.5ft	0.5ft	0.5ft	0	20	40	60	80	100			
-61.6					Continued from previous page								
													Drill without sampling to 84.5 feet. Continue SPT's at 84.5 feet (continued)
-71.3	84.5	18	13	15							SS-9		-71.3 84.5
-76.3	89.5	20	13	15							SS-10		-74.8 88.0
-81.3	94.5	14	8	11							SS-11		
-86.3	99.5	40	16	14							SS-12		
													94.5ft: Moist to wet, fine to medium sand, trace shell fragments, trace rounded gravel, weak HCl reaction
													99.5ft: Greenish gray (5GY 6/1), to dark greenish gray (5GY 4/1), very dense, glauconitic
													Boring terminated at 102.0 feet and observation well EOW-6L constructed.
													Boring logged to establish the general geologic conditions for the selection of observation well depths and well screen intervals. For complete strata and soil descriptions see geotechnical boring EB-6.



GEOTECHNICAL BORING LOG

Prepared By nan Date 6/16/09

Checked By JD Date 6/17/09

SHEET 1 OF 2

PERMIT NO.: P200900111		DRILLER: C. Marsh			NJ LICENSE NO.: 0001190			GEOLOGIST: T. Longley					
SITE DESCRIPTION: PSEG SITE ESP APPLICATION				COUNTY: Salem, NJ		MACTEC PROJECT NO.: 6468-08-2251			FLUID LEVEL (ft)				
BORING NO.: EOW-8L		DRILL METHOD: Rotosonic			SAMPLE METHODS: Rotosonic disturbed soil core				0 HR.	ND			
GROUND SURFACE ELEV.: 15.4		US ft (NAVD88)		NORTHING: 231163.5		US ft (NAD83)		EASTING: 203516.0		24 HR.	ND		
TOTAL DEPTH: 79.0 ft			DRILL MACHINE: Prosonic Truck			CASING DEPTH: 79.0			HAMMER (ID): NA				
DATE STARTED: 1/25/09		COMPLETED: 1/25/09		HOLE DIA.: 6"		ROD TYPE: Sonic		BITS USED: 4" Auger Core Bit					
ELEV.	DEPTH	BLOW COUNT			BLOWS PER FOOT					SAMP.	LOG	SOIL AND ROCK DESCRIPTION	
(ft)	(ft)	0.5ft	0.5ft	0.5ft	0	20	40	60	80	100			NO.
15.4					Ground Surface							15.4	0.0
15.4	0.0									RUN 1		ARTIFICIAL FILL: Poorly graded SAND with silt (SP-SM), brown (7.5YR 4/3), moist, trace gravel	
										S-1		11.9	3.5
8.4	7.0									RUN 2		HYDRAULIC FILL: FAT CLAY (CH), black (5Y 2.5/1), moist, trace organics, trace to few fine sand partings, no HCl reaction	
										S-2			
-1.6	17.0									RUN 3		HYDRAULIC FILL: Silty SAND (SM), black (5Y 2.5/1), wet, no HCl reaction	
										S-3		-4.6	20.0
										S-4		HYDRAULIC FILL: FAT CLAY (CH), black (5Y 2.5/1), moist, trace organics, few fine sand partings	
-11.6	27.0									RUN 4			
										S-5		-15.9	31.3
										S-6		ALLUVIUM: Poorly graded SAND (SP), gray (5Y 6/1), wet, no HCl reaction	
-21.6	37.0									S-7		-17.6	33.0
										RUN 5		ALLUVIUM: FAT CLAY (CH), black (5Y 2.5/1), moist, little organics, no HCl reaction	
										S-8		-19.9	35.3
										S-9		ALLUVIUM: PEAT (PT), dark reddish brown (5YR 3/2), moist, mostly organics, grades into SILT (ML), gray (N 5/), no HCl reaction	
-31.6	47.0									RUN 6		-21.6	37.0
										S-10		ALLUVIUM: Silty SAND (SM), greenish gray (10Y 5/1), moist, fine sand, trace to little gravel (increases with depth)	
										S-11		-26.6	42.0
										RUN 7		KIRKWOOD FORMATION: SILT (ML), brown (10YR 4/3), moist, no HCl reaction	
-41.6	57.0									S-12		47.0ft: Dark yellowish brown (10YR 4/4), moist to wet, few to little fine to coarse sand	
										RUN 8		-40.6	56.0
										S-13		VINCENTOWN FORMATION: Silty SAND (SM), reddish brown (5YR 4/4), wet, fine sand, no HCl reaction, strongly oxidized	
-51.6	67.0									S-14		57.0ft: Strong brown (7.5YR 5/6), no to strong HCl reaction, trace friable layers	
										S-15		-52.6	68.0
										S-16		VINCENTOWN FORMATION: Poorly graded SAND with silt (SP-SM), light yellowish brown (2.5Y 6/4), wet, strong HCl reaction, trace friable layers, moderately oxidized	

PSEG ESP BORE PSEG ESP 6-15-09 GRI PSEG ESP GDI 6/16/09

PERMIT NO.: P200900111						DRILLER: C. Marsh							NJ LICENSE NO.: 0001190								GEOLOGIST: T. Longley														
SITE DESCRIPTION: PSEG SITE ESP APPLICATION																		COUNTY: Salem, NJ						MACTEC PROJECT NO.: 6468-08-2251								FLUID LEVEL (ft) 0 HR. ND 24 HR. ND			
BORING NO.: EOW-8L						DRILL METHOD: Rotosonic							SAMPLE METHODS: Rotosonic disturbed soil core																						
GROUND SURFACE ELEV.: 15.4 US ft (NAVD88)						NORTHING: 231163.5 US ft (NAD83)							EASTING: 203516.0 US ft (NAD83)																						
TOTAL DEPTH: 79.0 ft						DRILL MACHINE: Prosonic Truck							CASING DEPTH: 79.0								HAMMER (ID): NA														
DATE STARTED: 1/25/09						COMPLETED: 1/25/09							HOLE DIA.: 6"						ROD TYPE: Sonic				BITS USED: 4" Auger Core Bit												
ELEV.	DEPTH	BLOW COUNT			BLOWS PER FOOT						SAMP.	▼	L O G	SOIL AND ROCK DESCRIPTION																					
(ft)	(ft)	0.5ft	0.5ft	0.5ft	0	20	40	60	80	100	NO.																								
-59.4					Continued from previous page																														
-61.6	77.0										RUN 9			VINCENTOWN FORMATION: Poorly graded SAND with silt (SP-SM), light yellowish brown (2.5Y 6/4), wet, strong HCl reaction, trace friable layers, moderately oxidized (<i>continued</i>) 76.0ft: Light gray (2.5Y 7/2), weakly oxidized Boring terminated at 79.0 feet and observation well EOW-8L constructed. Boring logged to establish the general geologic conditions for the selection of observation well depths and well screen intervals. For complete strata and soil descriptions see geotechnical boring EB-8.																					
														-63.6 79.0																					



GEOTECHNICAL BORING LOG

Prepared By Mac Date 6/16/09
 Checked By JS Date 6/17/09
 SHEET 1 OF 2

PERMIT NO.: P200900100		DRILLER: C. Marsh		NJ LICENSE NO.: 0001190		GEOLOGIST: T. Longley							
SITE DESCRIPTION: PSEG SITE ESP APPLICATION			COUNTY: Salem, NJ		MACTEC PROJECT NO.: 6468-08-2251		FLUID LEVEL (ft)						
BORING NO.: EOW-9L		DRILL METHOD: Rotasonic		SAMPLE METHODS: Rotasonic disturbed soil core			0 HR. ND						
GROUND SURFACE ELEV.: 17.9 US ft (NAVD88)		NORTHING: 230925.6 US ft (NAD83)		EASTING: 202844.6 US ft (NAD83)			24 HR. ND						
TOTAL DEPTH: 129.0 ft		DRILL MACHINE: Prosonic Truck		CASING DEPTH: 129			HAMMER (ID): NA						
DATE STARTED: 1/20/09		COMPLETED: 1/20/09		HOLE DIA.: 6"		ROD TYPE: Sonic							
BITS USED: 4" Auger Core Bit													
ELEV. (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION	
		0.5ft	0.5ft	0.5ft	0	20	40	60	80	100			
17.9					Ground Surface							17.9	0.0
17.9	0.0										RUN 1		

PSEG ESP BORE PSEG ESP 6-15-09.GPJ PSEG ESP.GDT 6/16/09



SHEET 2 OF 2

PERMIT NO.: P200900100		DRILLER: C. Marsh		NJ LICENSE NO.: 0001190		GEOLOGIST: T. Longley							
SITE DESCRIPTION: PSEG SITE ESP APPLICATION				COUNTY: Salem, NJ		MACTEC PROJECT NO.: 6468-08-2251							
BORING NO.: EOW-9L		DRILL METHOD: Rotosonic		SAMPLE METHODS: Rotosonic disturbed soil core		FLUID LEVEL (ft)							
GROUND SURFACE ELEV.: 17.9 US ft (NAVD88)		NORTHING: 230925.6 US ft (NAD83)		EASTING: 202844.6 US ft (NAD83)		0 HR. ND							
TOTAL DEPTH: 129.0 ft		DRILL MACHINE: Prosonic Truck		CASING DEPTH: 129		HAMMER (ID): NA							
DATE STARTED: 1/20/09		COMPLETED: 1/20/09		HOLE DIA.: 6"		ROD TYPE: Sonic							
BITS USED: 4" Auger Core Bit													
ELEV. (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION	
		0.5ft	0.5ft	0.5ft	0	20	40	60	80	100			
-56.9					Continued from previous page								
-59.1	77.0										S-12		KIRKWOOD FORMATION: FAT CLAY (CH), very dark greenish gray (10Y 3/1), moist, little shell fragments, no HCl reaction, trace fine sand, trace organics (continued) 77.0ft: Trace shell fragments
											RUN 9		
											S-13		
-69.1	87.0										RUN 10		87.0ft: Sand increasing
											S-14		89.5
-79.1	97.0										RUN 11		KIRKWOOD FORMATION: Poorly graded SAND (SP), greenish gray (10Y 5/1), to gray (5Y 5/1), wet, fine to coarse sand, no HCl reaction
											S-15		97.0ft: Light gray (5Y 7/1)
-89.1	107.0										RUN 12		102.0
											S-16		KIRKWOOD FORMATION: FAT CLAY (CH), very dark gray (5Y 3/1), moist, few organics
											S-17		105.0
-99.1	117.0										RUN 13		VINCENTOWN FORMATION: Poorly graded SAND (SP), dark greenish gray (10Y 4/1), to light greenish gray (10Y 7/1), and greenish gray (10Y 6/1), wet, fine to medium sand, glauconitic, weak to strong HCl reaction, trace indurated layers
											S-18		117.0
													111.1
													VINCENTOWN FORMATION: Silty SAND (SM), greenish gray (10Y 5/1), to olive gray (5Y 5/1), wet, weak HCl reaction, few indurated layers
													129.0
													Boring terminated at 129.0 feet and observation well EOW-9L constructed.
													Boring logged to establish the general geologic conditions for the selection of observation well depths and well screen intervals.

PSEG ESP BORE PSEG ESP 6-15-09.GPJ PSEG ESP GDT 6/16/09



GEOTECHNICAL BORING LOG

Prepared By MM Date 6/16/09

Checked By JD Date 6/17/09

SHEET 1 OF 2

PERMIT NO.: P200900102		DRILLER: C. Marsh		NJ LICENSE NO.: 0001190		GEOLOGIST: T. Longley	
SITE DESCRIPTION: PSEG SITE ESP APPLICATION				COUNTY: Salem, NJ		MACTEC PROJECT NO.: 6468-08-2251	
BORING NO.: EOW-10L		DRILL METHOD: Rotasonic		SAMPLE METHODS: Rotasonic disturbed soil core		FLUID LEVEL (ft)	
GROUND SURFACE ELEV.: 11.7 US ft (NAVD88)		NORTHING: 231706.7 US ft (NAD83)		EASTING: 203521.9 US ft (NAD83)		0 HR. ND	
TOTAL DEPTH: 97.0 ft		DRILL MACHINE: Prosonic Truck		CASING DEPTH: 97		HAMMER (ID): NA	
DATE STARTED: 1/22/09		COMPLETED: 1/22/09		HOLE DIA.: 6"		ROD TYPE: Sonic	
BITS USED: 4" Auger Core Bit							

ELEV. (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT						SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION			
		0.5ft	0.5ft	0.5ft	0	20	40	60	80	100						
11.7					Ground Surface								11.7	0.0		
11.7	0.0										RUN 1			ARTIFICIAL FILL: SILT with sand and gravel (ML), dark reddish brown (5YR 3/4), dry		
4.7	7.0										S-1			6.7	5.0	
											RUN 2			HYDRAULIC FILL: FAT CLAY (CH), black (5Y 2/5), wet, trace sand and gravel		
														7.0ft: Very dark gray (N 3/), moist to wet, few fine sand partings, trace organics		
-5.3	17.0										S-2					
											RUN 3			17.0ft: Black (5Y 2.5/1), moist, little organics		
											S-3					
-15.3	27.0										RUN 4			-17.3	29.0	
											S-4			ALLUVIUM: Poorly graded SAND (SP), yellowish brown (10YR 5/4), to grayish brown (2.5Y 5/2), wet, trace fines, trace rounded gravel		
														-22.3	34.0	
											S-5			-23.3	35.0	
-25.3	37.0										RUN 5			ALLUVIUM: Sandy SILT (SM), light olive brown (2.5Y 5/3), wet, trace gravel		
														-25.3	37.0	
											S-6			KIRKWOOD FORMATION: FAT CLAY (CH), black (2.5Y 2.5/1), moist, trace organics		
											RUN 6			KIRKWOOD FORMATION: SILT (ML), greenish black (10Y 2.5/1), moist, trace fine sand, trace organics, no HCl reaction		
-35.3	47.0										S-7			-36.8	48.5	
														-39.6	51.3	
											S-8			KIRKWOOD FORMATION: Poorly graded SAND (SP), very dark greenish gray (10Y 3/1), wet, trace fines, trace rounded gravel, no HCl reaction		
-45.3	57.0										RUN 7			VINCENTOWN FORMATION: Poorly graded SAND with silt (SP-SM), greenish gray (10Y 6/1), wet, trace gravel, strong HCl reaction, trace friable layers		
											S-9					
											RUN 8			57.0ft: Moist to wet, few moderately indurated layers		
-55.3	67.0										S-10					

PSEG ESP BORE PSEG ESP 6-15-09.GPJ PSEG ESP.GDT 6/16/09

