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 μCi/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

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 gaseous effluent doses also be considered. Liquid effluent dose contributions are listed in Table 11.2-7, while 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. 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.

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

	New Unit(s)			
Isotope[c]	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

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

	New Unit(s)			
Isotope[c]	Single Unit[a] (Ci/yr)	Dual Unit (Ci/yr)	Existing Site[b] (Ci/yr)	Total (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

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

	New Unit(s)			
Isotope[c]	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.

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 (μCi/ml)	ECL (μCi/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

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 (μCi/ml)	ECL (μCi/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

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 (μCi/ml)	ECL (μCi/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

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

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

	Annual Rate			
Consumption Factor[a]	**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.

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

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	Annual Dose: Limit
Total Body (mrem)	1.57E-02	3
Maximum Organ – GI-LLI-Adult (mrem)	1.77E-01	10

Table 11.2-7
Liquid Contributions to Maximally Exposed Individual Doses with Regards to 40 CFR 190 Criteria[a]

	New Unit(s)	
Dose Type	**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. Comparison to 40 CFR 190 limits including contributions from liquid and gaseous effluents, as well as contributions from SGS and HCGS is shown in Table 11.3-9.

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

	Dose (person-rem/yr)	
Pathway	**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

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

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

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 μCi/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 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.

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.

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.

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.

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.

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

	New Unit(s)			
Isotope[c,d]	Single Unit[a] (Ci/yr)	Dual Unit (Ci/yr)	Existing Site[b] (Ci/yr)	Total (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	2.60E-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

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

	New Unit(s)			
Isotope[c,d]	Single Unit[a] (Ci/yr)	Dual Unit (Ci/yr)	Existing Site[b] (Ci/yr)	Total (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

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

	New Unit(s)			
Isotope[c,d]	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	4.60E-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	1.60E-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.

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 (μCi/ml)	ECL (μCi/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

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 (μCi/ml)	ECL (μCi/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

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 (μCi/ml)	ECL (μCi/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

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

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

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.

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

Dose Type	New Unit(s)[g] Gaseous Single Unit	New Unit(s)[g] Gaseous Dual Unit	New Unit(s)[g] Liquid Dual Unit[e]	Existing Units[g]	Total[f]	Limit
Total Body (mrem/yr)	2.00E-01[a]	4.00E-01	3.14E-02	5.36E-03	4.36E-01	25
Thyroid (mrem/yr)	2.13E+00[b]	4.26E+00	8.30E-02	2.04E-02	4.36E+00	75
Other Organ – Bone (mrem/yr)	5.49E-01[c]	1.10E+00	3.54E-01	2.04E-02[d]	1.47E+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 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).

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

	Dose (person-rem)	
Pathway	**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

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

	Total Body Dose (person-rem)	
Group	**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
Total	2.03E+01	4.06E+01