

**PSEG Site  
ESP Application  
Part 3, Environmental Report**

CHAPTER 7  
ENVIRONMENTAL IMPACTS OF POSTULATED ACCIDENTS INVOLVING RADIOACTIVE  
MATERIALS

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**ACRONYMS AND ABBREVIATIONS**

<u>Acronyms</u>	<u>Definitions</u>
ABWR	Advanced Boiling Water Reactor
AP1000	Advanced Passive 1000
AST	Alternative Source Term
BWR	boiling water reactor
CDF	Core Damage Frequency
Ci	curie
Ci/yr	curies per year
COL	combined license
DBA	design basis accident
DCD	Design Certification Document
DOE	U. S. Department of Energy
ESP	early site permit
ESPA	early site permit application
ft.	feet
ft <sup>3</sup>	cubic feet
ft <sup>3</sup> /yr	cubic feet per year
gpd	gallons per day
HCGS	Hope Creek Generating Station
HIC	high integrity container
hr.	hour
HRCQ	highway route controlled quantity
km	kilometer
lb.	pound
LOCA	Loss of Coolant Accident
LPGS	Liquid Pathway Generic Study
LPZ	Low Population Zone
LWR	light water reactor
m	meter
m <sup>3</sup>	cubic meter
MBq	megabecquerel
mi.	Miles

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**ACRONYMS AND ABBREVIATIONS (CONTINUED)**

<u>Acronyms</u>	<u>Definitions</u>
MTU	metric ton of uranium
MW	megawatt
MWd/MTU	megawattdays per metric ton of uranium
MWe	megawatts electric
MWt	megawatts thermal
NRC	U.S. Nuclear Regulatory Commission
PPE	plant parameter envelope
PSEG	PSEG Power, LLC and PSEG Nuclear, LLC
PWR	pressurized water reactor
sec.	second(s)
SSAR	Site Safety Analysis Report
Sv	sievert
TEDE	Total Effective Dose Equivalent
U.S. EPR	U.S. Evolutionary Power Reactor
U-235	uranium-235
US-APWR	U.S. Advanced Pressurized Water Reactor
yr	year



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## **CHAPTER 7**

### **ENVIRONMENTAL IMPACTS OF POSTULATED ACCIDENTS INVOLVING RADIOACTIVE MATERIALS**

This chapter evaluates the environmental impacts of postulated accidents involving radioactive materials. Section 7.1 discusses design basis accidents (DBAs). Section 7.2 discusses the impacts of severe accidents. Section 7.3 discusses severe accident mitigation alternatives. Section 7.4 discusses transportation accidents.

#### **7.1 DESIGN BASIS ACCIDENTS**

PSEG is considering constructing a new plant at the PSEG Site. The designs under consideration include an Advanced Boiling Water Reactor (ABWR), an Advanced Passive 1000 Reactor (AP1000) (dual unit), a U.S. Evolutionary Power Reactor (U.S. EPR), or a U.S. Advanced Pressurized Water Reactor (US-APWR). All of these designs are light water reactors (LWR). This section evaluates the radiological consequences of DBAs for the four reactor technologies.

##### **7.1.1 SELECTION OF DESIGN BASIS ACCIDENTS**

NUREG-1555, *Standard Review Plans for Environmental Reviews for Nuclear Power Plants: Environmental Standard Review Plan*, Section 7.1 Appendix A states that all DBAs having the potential to release activity to the environment must be identified. Due to differences in reactor technologies, not all accidents identified in NUREG-1555 apply to each reactor design. Tables 7.1-1 through 7.1-4 provide lists of applicable accidents corresponding to the different reactor technologies.

##### **7.1.2 EVALUATION METHODOLOGY**

Doses for selected accidents involving possible fission product release 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 radioactivity release, the bounding Loss of Coolant Accident (LOCA) analysis presumes substantial core damage with fission product release. Other DBAs of lesser magnitude, but greater frequencies of occurrence, are not expected to approach the 10 CFR 50.34, *Contents of Applications; Technical Information*, or 10 CFR 100, *Reactor Site Criteria*, limits as closely as a LOCA. For these accidents, the more restrictive dose limits in Regulatory Guide (RG) 1.183, *Alternative Radiological Source Terms for Evaluating Design Basis Accidents at Nuclear Power Reactors*, Revision 0, 2000, and NUREG-0800, *Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR Edition*, are invoked to determine if 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 are evaluated as part of the combined license (COL) review.

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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 through multiple pathways, 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 ( $\chi/Q$ ) is the only site-specific parameter required for determining the dose to an individual. The Design Certification Documents (DCDs) have developed  $\chi/Q$  values 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 are calculated using the ratio of the site-specific and design certified  $\chi/Q$  values for each respective reactor technology and then compared to the acceptance criteria in RG 1.183 and NUREG-0800. Site-specific  $\chi/Q$  values are based on on-site meteorology and described in Site Safety Analysis Report (SSAR) Section 2.3. Site-specific short-term directional dependent 50<sup>th</sup> percentile  $\chi/Q$  values are calculated for the PSEG Site using on-site meteorological data and the RG 1.145, *Atmospheric Dispersion Models for Potential Accident Consequence Assessments at Nuclear Power Plants*, Revision 1, 1983, methodology.

The accident dose evaluations are performed using  $\chi/Q$ s and activity releases for the following intervals.

<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.

The zero to two hour  $\chi/Q$  value is used for the two hour release duration with the greatest dose consequence at the EAB. Accident doses for the ABWR are expressed as whole body and thyroid doses consistent with 10 CFR 100. Accident doses for the other reactor technologies evaluated are expressed in total effective dose equivalent (TEDE) consistent with 10 CFR 50.34.

Note that SSAR Chapter 15 uses conservative assumptions to perform bounding safety analyses. One such assumption is the use of the 95<sup>th</sup> percentile  $\chi/Q$  values. These analyses overstate the environmental impact of the DBAs. Consistent with NUREG-1555, this section uses 50<sup>th</sup> percentile  $\chi/Q$  values that better reflect probable accident conditions.

### 7.1.3 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 submitted with the DCD. Each reactor technology uses 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. US-APWR source terms are listed in Tables 7.1-5 through 7.1-13, and are obtained from the US-APWR DCD (Reference 7.1-3). LOCA activity releases are calculated for a reactor power level of 4555 megawatts thermal (MWt) (102 percent of rated NSSS power of 4466 MWt).

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Activity releases for other accidents are calculated for a reactor power level equal to or less than that of the LOCA.

The ABWR source terms are calculated using the guidance in 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; and 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 ABWR DCD (Reference 7.1-2) by a factor of 1.095 (4386/4005), because activity releases scale directly with power. This approach is used for accidents that involve postulated fuel damage (LOCA and fuel handling accidents). The source terms for the ABWR are listed in Tables 7.1-14 through 7.1-18, and are obtained from the ABWR DCD (Reference 7.1-2).

The AP1000 source terms and approaches to assessing accidents are based on the Alternative Source Term (AST) methods as described in NUREG-1465, *Accident Source Terms for Light-Water Nuclear Power Plants*, 1995, 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 7.1-19 through 7.1-27.

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 7.1-28 through 7.1-37.

#### 7.1.4 DOSE CONSEQUENCES

PSEG Site-specific radiation doses at EAB and LPZ are calculated for the applicable postulated DBAs for the four reactor technologies. These PSEG Site-specific doses are calculated by multiplying the reactor DCD dose by the ratio of the site 50<sup>th</sup> percentile  $\chi/Q$  value to the DCD  $\chi/Q$  value. All PSEG Site-specific 50<sup>th</sup> percentile  $\chi/Q$  values are bounded by the DCD  $\chi/Q$  values, therefore all site-specific doses are bounded by DCD doses. The site-specific analysis results demonstrate that all US-APWR, AP1000, and U.S. EPR accident doses meet the site acceptance criteria of 10 CFR 50.34. The results also demonstrate that all ABWR accident doses 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 of 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 1.095 (4386/4005), since activity releases and thus doses are proportional to power. Reactor technology data table locations are listed below:

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<b><u>Reactor Technology</u></b>	<b><u><math>\gamma</math>/Q Data Table</u></b>	<b><u>Dose Data Table</u></b>
US-APWR	Table 7.1-38	Table 7.1-39
ABWR	Table 7.1-40	Tables 7.1-41 through 45
AP1000	Table 7.1-46	Tables 7.1-47 through 7.1-54
U.S. EPR	Table 7.1-55	Table 7.1-56

7.1.5 REFERENCES

- 7.1-1 AREVA, Design Certification Document for the U.S. Evolutionary Power Reactor (U.S. EPR), Revision 0.
- 7.1-2 GE, Design Certification Document for the Advanced Boiling Water Reactor (ABWR), Revision 4.
- 7.1-3 Mitsubishi, Design Certification Document for the U.S. Advanced Pressurized Water Reactor (US-APWR), Revision 1.
- 7.1-4 Westinghouse, Design Certification Document (DCD) for the Advanced Passive 1000 (AP1000) Reactor, Revision 17.

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**Table 7.1-1  
US-APWR Design Basis Accident List**

<b>NUREG-1555 DBA Descriptions</b>	<b>Consequences Tabulated</b>	<b>Remarks</b>
15.1.5A - Main Steam Line Failures Outside Containment of a PWR	Yes	
15.2.8 - Feedwater System Pipe Breaks Inside and Outside Containment (PWR)	No	Bounded by the main steam line break accident, as discussed in US-APWR DCD Subsection 15.2.8.5 (Reference 7.1-3).
15.3.3 - Reactor Coolant Pump Rotor Seizure	Yes	
15.3.4 - Reactor Coolant Pump Shaft Break	No	Bounded by the RCP rotor seizure accident, as discussed in US-APWR DCD Subsection 15.3.4 (Reference 7.1-3).
15.4.9A - Control Rod Drop Accident (BWR)	No	N/A
15.6.2 - Failure of Small Lines Carrying Primary Coolant Outside Containment	Yes	
15.6.3 - Steam Generator Tube Failure (PWR)	Yes	
15.6.5A - Design Basis Loss of Coolant Accident Including Containment Leakage Contribution	Yes	Included in LOCA analysis
15.6.5B - Design Basis Loss of Coolant Accident: Leakage From Engineered Safety Feature Components Outside Containment	Yes	Included in LOCA analysis
15.6.5D - Design Basis Loss of Coolant Accident: Leakage From Main Steam Isolation Valve Leakage Control System (BWR)	No	N/A
15.7.4 - Fuel Handling Accidents	Yes	
<b>Other Accident Descriptions</b>	<b>Consequences Tabulated</b>	<b>Remarks</b>
Spectrum of Rod Ejection Accidents (PWR)	Yes	

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**Table 7.1-2  
ABWR Design Basis Accident List**

<b>NUREG-1555 DBA Descriptions</b>	<b>Consequences Tabulated</b>		<b>Remarks</b>
15.1.5A - Main Steam Line Failures Outside Containment of a PWR	No	N/A	
15.2.8 - Feedwater System Pipe Breaks Inside and Outside Containment (PWR)	No	N/A	
15.3.3 - Reactor Coolant Pump Rotor Seizure	No		Accident does not result in any fuel failures, thus has no radiological consequences as discussed in ABWR DCD Subsection 15.3.4.5 (Reference 7.1-2).
15.3.4 - Reactor Coolant Pump Shaft Break	No		Accident does not result in any fuel failures, thus has no radiological consequences as discussed in ABWR DCD Subsection 15.3.4.5 (Reference 7.1-2).
15.4.9A - Control Rod Drop Accident (BWR)	No		There is no basis for this accident to occur, as discussed in ABWR DCD 15.4.10.3 (Reference 7.1-2).
15.6.2 - Failure of Small Lines Carrying Primary Coolant Outside Containment	Yes		
15.6.3 - Steam Generator Tube Failure (PWR)	No	N/A	
15.6.5A - Design Basis Loss of Coolant Accident Including Containment Leakage Contribution	Yes		Included in LOCA analysis
15.6.5B - Design Basis Loss of Coolant Accident: Leakage From Engineered Safety Feature Components Outside Containment	Yes		Included in LOCA analysis
15.6.5D - Design Basis Loss of Coolant Accident: Leakage From Main Steam Isolation Valve Leakage Control System (BWR)	Yes		Included in LOCA analysis
15.7.4 - Fuel Handling Accidents	Yes		
<b>Other Accident Descriptions</b>	<b>Consequences Tabulated</b>		<b>Remarks</b>
Main Steam Line Break	Yes		

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**Table 7.1-3  
AP1000 Design Basis Accident List**

<b>NUREG-1555 DBA Descriptions</b>	<b>Consequences Tabulated</b>	<b>Remarks</b>
15.1.5A - Main Steam Line Failures Outside Containment of a PWR	Yes	
15.2.8 - Feedwater System Pipe Breaks Inside and Outside Containment (PWR)	No	Bounded by steam system piping failures, as discussed in AP1000 DCD Subsection 15.1.5 (Reference 7.1-4).
15.3.3 - Reactor Coolant Pump Rotor Seizure	Yes	
15.3.4 - Reactor Coolant Pump Shaft Break	No	Bounded by RCP rotor seizure accident, as discussed in AP1000 DCD Subsection 15.3.3 (Reference 7.1-4).
15.4.9A - Control Rod Drop Accident (BWR)	No	N/A
15.6.2 - Failure of Small Lines Carrying Primary Coolant Outside Containment	Yes	
15.6.3 - Steam Generator Tube Failure (PWR)	Yes	
15.6.5A - Design Basis Loss of Coolant Accident Including Containment Leakage Contribution	Yes	Included in LOCA analysis
15.6.5B - Design Basis Loss of Coolant Accident: Leakage From Engineered Safety Feature Components Outside Containment	Yes	Included in LOCA analysis
15.6.5D - Design Basis Loss of Coolant Accident: Leakage From Main Steam Isolation Valve Leakage Control System (BWR)	No	N/A
15.7.4 - Fuel Handling Accidents	Yes	
<b>Other Accident Descriptions</b>	<b>Consequences Tabulated</b>	<b>Remarks</b>
Spectrum of Rod Cluster Control Assembly Ejection Accidents	Yes	

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**Table 7.1-4  
U.S. EPR Design Basis Accident List**

<b>NUREG-1555 DBA Descriptions</b>	<b>Consequences Tabulated</b>	<b>Remarks</b>
15.1.5A - Main Steam Line Failures Outside Containment of a PWR	Yes	
15.2.8 - Feedwater System Pipe Breaks Inside and Outside Containment (PWR)	No	Bounded by steam system piping failures, as discussed in U.S. EPR DCD Subsection 15.1.5 (Reference 7.1-1).
15.3.3 - Reactor Coolant Pump Rotor Seizure	Yes	
15.3.4 - Reactor Coolant Pump Shaft Break	No	Bounded by RCP rotor seizure accident, as discussed in U.S. EPR DCD Subsection 15.3.4 (Reference 7.1-1).
15.4.9A - Control Rod Drop Accident (BWR)	No	N/A
15.6.2 - Failure of Small Lines Carrying Primary Coolant Outside Containment	Yes	
15.6.3 - Steam Generator Tube Failure (PWR)	Yes	
15.6.5A - Design Basis Loss of Coolant Accident Including Containment Leakage Contribution	Yes	Included in LOCA analysis
15.6.5B - Design Basis Loss of Coolant Accident: Leakage From Engineered Safety Feature Components Outside Containment	Yes	Included in LOCA analysis
15.6.5D - Design Basis Loss of Coolant Accident: Leakage From Main Steam Isolation Valve Leakage Control System (BWR)	No	N/A
15.7.4 - Fuel Handling Accidents	Yes	
<b>Other Accident Descriptions</b>	<b>Consequences Tabulated</b>	<b>Remarks</b>
Rod Ejection Accident	Yes	



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US-APWR Source Terms  
Time Dependent Released Activity during LOCA (Ci)<sup>(a)</sup>**

<b>Nuclide</b>	<b>0.5 to 2.5 hr.<sup>(b)</sup></b>	<b>0 to 8 hr.</b>	<b>8 to 24 hr.</b>	<b>24 to 96 hr.</b>	<b>96 to 720 hr.</b>	<b>Total 0 to 720 hr.</b>
<b>Noble Gases</b>						
Kr-85	1.97E+02	7.75E+0	1.74E+03	3.92E+03	3.35E+04	3.99E+04
Kr-85m	3.03E+03	9.16E+0	4.37E+03	1.99E+02	0.00E+00	1.37E+04
Kr-87	2.00E+03	3.54E+0	7.83E+01	0.00E+00	0.00E+00	3.62E+03
Kr-88	6.55E+03	1.68E+0	3.68E+03	3.70E+01	0.00E+00	2.05E+04
Xe-133	2.97E+04	1.26E+0	2.76E+05	4.93E+05	9.77E+05	1.87E+06
Xe-135	1.04E+04	3.79E+0	4.05E+04	9.60E+03	4.41E+01	8.80E+04
<b>Iodines</b>						
I-131	8.72E+02	1.42E+0	5.61E+02	1.85E+03	5.60E+03	9.43E+03
I-132	1.09E+03	1.50E+0	1.01E+02	2.22E+02	2.48E+02	2.07E+03
I-133	1.68E+03	2.67E+0	7.37E+02	8.09E+02	8.07E+01	4.30E+03
I-134	3.09E+02	4.22E+0	1.84E-01	0.00E+00	0.00E+00	4.22E+02
I-135	1.30E+03	1.95E+0	2.44E+02	4.67E+01	1.20E-01	2.24E+03
<b>Alkali Metals</b>						
Rb-86	1.13E+00	1.44E+0	1.60E-02	0.00E+00	0.00E+00	1.45E+00
Cs-134	1.13E+02	1.44E+0	1.62E+00	0.00E+00	0.00E+00	1.46E+02
Cs-136	3.07E+01	3.90E+0	4.31E-01	0.00E+00	0.00E+00	3.94E+01
Cs-137	6.44E+01	8.19E+0	9.21E-01	1.00E-03	0.00E+00	8.28E+01
<b>Tellurium Group</b>						
Sb-127	8.55E+00	1.04E+0	1.26E-01	1.00E-05	0.00E+00	1.05E+01
Sb-129	1.74E+01	1.99E+0	6.87E-02	0.00E+00	0.00E+00	2.00E+01
Te-127	8.56E+00	1.04E+0	1.30E-01	0.00E+00	0.00E+00	1.05E+01
Te-127m	1.14E+00	1.39E+0	1.80E-02	0.00E+00	0.00E+00	1.40E+00
Te-129	1.99E+01	2.30E+0	1.12E-01	0.00E+00	0.00E+00	2.31E+01
Te-129m	3.90E+00	4.75E+0	6.13E-02	0.00E+00	0.00E+00	4.81E+00
Te-131m	1.13E+01	1.36E+0	1.44E-01	0.00E+00	0.00E+00	1.37E+01
Te-132	1.17E+02	1.41E+0	1.71E+00	1.00E-04	0.00E+00	1.43E+02
<b>Strontium and Barium</b>						
Sr-89	3.89E+01	4.74E+0	6.12E-01	0.00E+00	0.00E+00	4.80E+01
Sr-90	3.23E+00	3.93E+0	5.10E-02	0.00E+00	0.00E+00	3.98E+00
Sr-91	4.25E+01	5.01E+0	3.54E-01	1.00E-03	0.00E+00	5.05E+01
Sr-92	2.79E+01	3.11E+0	4.95E-02	0.00E+00	0.00E+00	3.11E+01
Ba-139	1.83E+01	1.96E+0	5.04E-03	0.00E+00	0.00E+00	1.96E+01
Ba-140	6.16E+01	7.49E+0	9.53E-01	0.00E+00	0.00E+00	7.59E+1

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**Table 7.1-5 (Sheet 2 of 2)  
US-APWR Source Terms  
Time Dependent Released Activity during LOCA (Ci)<sup>(a)</sup>**

<b>Nuclide</b>	<b>0.5 to 2.5 hr.<sup>(b)</sup></b>	<b>0 to 8 hr.</b>	<b>8 to 24 hr.</b>	<b>24 to 96 hr.</b>	<b>96 to 720 hr.</b>	<b>Total 0 to 720 hr.</b>
<b>Noble Metals</b>						
Co-58	3.36E-03	3.36E-03	4.50E-08	0.00E+00	0.00E+00	3.36E-03
Co-60	1.32E-02	1.59E-02	2.00E-04	1.01E-06	0.00E+00	1.61E-02
Mo-99	7.94E+00	9.57E+00	1.11E-01	1.00E-04	0.00E+00	9.68E+00
Tc-99m	7.01E+00	8.50E+00	1.04E-01	1.00E-04	0.00E+00	8.60E+00
Ru-103	6.26E+00	7.62E+00	9.83E-02	1.01E-04	0.00E+00	7.72E+00
Ru-105	2.74E+00	3.14E+00	1.12E-02	0.00E+00	0.00E+00	3.15E+00
Ru-106	2.19E+00	2.67E+00	3.46E-02	0.00E+00	0.00E+00	2.70E+00
Rh-105	3.80E+00	4.61E+00	5.41E-02	0.00E+00	0.00E+00	4.67E+00
<b>Lanthanides</b>						
Y-90	4.79E-02	7.44E-02	5.12E-03	6.06E-06	0.00E+00	7.96E-02
Y-91	4.90E-01	6.00E-01	8.54E-03	0.00E+00	0.00E+00	6.09E-01
Y-92	2.57E+00	4.13E+00	1.04E-01	0.00E+00	0.00E+00	4.24E+00
Y-93	4.99E-01	5.90E-01	4.32E-03	0.00E+00	0.00E+00	5.94E-01
Zr-95	6.20E-01	7.55E-01	9.76E-03	0.00E+00	0.00E+00	7.65E-01
Zr-97	5.56E-01	6.65E-01	6.12E-03	0.00E+00	0.00E+00	6.71E-01
Nb-95	6.24E-01	7.60E-01	9.85E-03	1.01E-05	0.00E+00	7.69E-01
La-140	1.05E+00	1.76E+00	1.43E-01	2.02E-04	0.00E+00	1.90E+00
La-141	3.74E-01	4.25E-01	1.29E-03	0.00E+00	0.00E+00	4.27E-01
La-142	1.87E-01	2.01E-01	7.07E-05	0.00E+00	0.00E+00	2.01E-01
Pr-143	5.53E-01	6.74E-01	8.91E-03	1.00E-05	0.00E+00	6.83E-01
Nd-147	2.30E-01	2.80E-01	3.55E-03	0.00E+00	0.00E+00	2.83E-01
Am-241	6.17E-05	7.51E-05	9.77E-07	0.00E+00	0.00E+00	7.60E-05
Cm-242	1.52E-02	1.86E-02	2.41E-04	0.00E+00	0.00E+00	1.88E-02
Cm-244	1.85E-03	2.26E-03	2.93E-05	0.00E+00	0.00E+00	2.29E-03
<b>Cerium Group</b>						
Ce-141	1.46E+00	1.78E+00	2.29E-02	0.00E+00	0.00E+00	1.80E+00
Ce-143	1.35E+00	1.63E+00	1.78E-02	0.00E+00	0.00E+00	1.65E+00
Ce-144	1.11E+00	1.35E+00	1.75E-02	0.00E+00	0.00E+00	1.36E+00
Np-239	1.53E+01	1.85E+01	2.16E-01	1.00E-05	0.00E+00	1.87E+01
Pu-238	4.35E-03	5.30E-03	6.88E-05	0.00E+00	0.00E+00	5.37E-03
Pu-239	3.29E-04	4.00E-04	5.19E-06	0.00E+00	0.00E+00	4.05E-04
Pu-240	5.15E-04	6.28E-04	8.14E-06	1.01E-08	0.00E+00	6.36E-04
Pu-241	1.14E-01	1.39E-01	1.81E-03	0.00E+00	0.00E+00	1.41E-01
<b>Total</b>	<b>5.78E+04</b>	<b>2.03E+05</b>	<b>3.28E+05</b>	<b>5.09E+05</b>	<b>1.02E+06</b>	<b>2.06E+06</b>

a) LOCA is calculated at a reactor power level of 4555 MWt (102% of 4466 MWt NSSS)

b) This release corresponds to the 2-hour period that yields the maximum dose at the EAB for this accident scenario.

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**Table 7.1-6  
US-APWR Source Terms  
Time Dependent Released Activity during Steam System Piping Failure (Ci)  
(Transient-Initiated Iodine Spike)<sup>(a)</sup>**

<b>Nuclide</b>	<b>0 to 2 hr.<sup>(b)</sup></b>	<b>0 to 8 hr.</b>	<b>8 to 24 hr.</b>	<b>24 to 96 hr.</b>	<b>96 to 720 hr.</b>	<b>Total 0 to 720 hr.</b>
<b>Noble Gases</b>						
Kr-85	8.04E+00	3.21E+01	2.40E+01	0.00E+00	0.00E+00	5.61E+01
Kr-85m	1.33E-01	3.56E-01	8.77E-02	0.00E+00	0.00E+00	4.43E-01
Kr-87	6.14E-02	9.12E-02	1.13E-03	0.00E+00	0.00E+00	9.23E-02
Kr-88	2.30E-01	5.10E-01	6.46E-02	0.00E+00	0.00E+00	5.74E-01
Xe-133	2.78E+01	1.08E+02	8.03E+01	0.00E+00	0.00E+00	1.88E+02
Xe-135	3.57E+00	7.61E+00	1.33E+01	0.00E+00	0.00E+00	2.09E+01
<b>Iodines</b>						
I-131	2.76E+01	5.05E+01	6.50E+01	0.00E+00	0.00E+00	1.16E+02
I-132	5.61E+00	9.89E+00	1.49E+00	0.00E+00	0.00E+00	1.14E+01
I-133	4.10E+01	7.65E+01	8.09E+01	0.00E+00	0.00E+00	1.57E+02
I-134	3.03E+00	3.77E+00	9.11E-03	0.00E+00	0.00E+00	3.78E+00
I-135	1.97E+01	3.77E+01	2.45E+01	0.00E+00	0.00E+00	6.21E+01
<b>Alkali Metals</b>						
Rb-86	8.49E-02	8.64E-02	1.62E-03	0.00E+00	0.00E+00	8.80E-02
Cs-134	8.65E+00	8.80E+00	1.68E-01	0.00E+00	0.00E+00	8.97E+00
Cs-136	2.28E+00	2.32E+00	4.33E-02	0.00E+00	0.00E+00	2.37E+00
Cs-137	4.92E+00	5.01E+00	9.56E-02	0.00E+00	0.00E+00	5.11E+00
<b>Total</b>	<b>1.53E+02</b>	<b>3.43E+02</b>	<b>2.90E+02</b>	<b>0.00E+00</b>	<b>0.00E+00</b>	<b>6.33E+02</b>

a) Steam system piping failure is calculated at a reactor power level of 4540 MWt (102 percent of 4451 MWt core thermal power).

b) This release corresponds to the 2-hour period that yields the maximum dose at the EAB for this accident scenario.

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**Table 7.1-7  
US-APWR Source Terms  
Time Dependent Released Activity during Steam System Piping Failure (Ci)  
(Pre-Transient Iodine Spike)<sup>(a)</sup>**

<b>Nuclide</b>	<b>0 to 2 hr.<sup>(b)</sup></b>	<b>0 to 8 hr.</b>	<b>8 to 24 hr.</b>	<b>24 to 96 hr.</b>	<b>96 to 720 hr.</b>	<b>Total 0 to 720 hr.</b>
<b>Noble Gases</b>						
Kr-85	8.04E+00	3.21E+01	2.40E+01	0.00E+00	0.00E+00	5.61E+01
Kr-85m	1.33E-01	3.56E-01	8.77E-02	0.00E+00	0.00E+00	4.43E-01
Kr-87	6.14E-02	9.12E-02	1.13E-03	0.00E+00	0.00E+00	9.23E-02
Kr-88	2.30E-01	5.10E-01	6.46E-02	0.00E+00	0.00E+00	5.74E-01
Xe-133	2.72E+01	1.07E+02	7.75E+01	0.00E+00	0.00E+00	1.85E+02
Xe-135	1.05E+00	4.38E+00	3.39E+00	0.00E+00	0.00E+00	7.78E+00
<b>Iodines</b>						
I-131	1.06E+01	1.72E+01	7.25E+00	0.00E+00	0.00E+00	2.44E+01
I-132	5.24E+00	6.18E+00	1.66E-01	0.00E+00	0.00E+00	6.35E+00
I-133	1.80E+01	2.79E+01	9.03E+00	0.00E+00	0.00E+00	3.69E+01
I-134	3.38E+00	3.49E+00	1.01E-03	0.00E+00	0.00E+00	3.49E+00
I-135	1.15E+01	1.62E+01	2.73E+00	0.00E+00	0.00E+00	1.89E+01
<b>Alkali Metals</b>						
Rb-86	8.49E-02	8.64E-02	1.62E-03	0.00E+00	0.00E+00	8.80E-02
Cs-134	8.65E+00	8.80E+00	1.68E-01	0.00E+00	0.00E+00	8.97E+00
Cs-136	2.28E+00	2.32E+00	4.33E-02	0.00E+00	0.00E+00	2.37E+00
Cs-137	4.92E+00	5.01E+00	9.56E-02	0.00E+00	0.00E+00	5.11E+00
Total	1.01E+02	2.32E+02	1.25E+02	0.00E+00	0.00E+00	3.56E+02

a) Steam system piping failure is calculated at a reactor power level of 4540 MWt (102 percent of 4451 MWt core thermal power).

b) This release corresponds to the 2-hour period that yields the maximum dose at the EAB for this accident scenario.

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**Table 7.1-8  
US-APWR Source Terms  
Time Dependent Released Activity during Steam Generator Tube Rupture (Ci)  
(Transient-Initiated Iodine Spike)<sup>(a)</sup>**

<b>Nuclide</b>	<b>0 to 2 hr.<sup>(b)</sup></b>	<b>0 to 8 hr.</b>	<b>8 to 24 hr.</b>	<b>24 to 96 hr.</b>	<b>96 to 720 hr.</b>	<b>Total 0 to 720 hr.</b>
<b>Noble Gases</b>						
Kr-85	3.41E+03	3.43E+03	4.64E+01	2.06E+02	1.59E+03	5.27E+03
Kr-85m	6.16E+01	6.17E+01	9.70E-02	8.00E-03	0.00E+00	6.18E+01
Kr-87	3.40E+01	3.40E+01	0.00E+00	0.00E+00	0.00E+00	3.40E+01
Kr-88	1.11E+02	1.11E+02	6.00E-02	1.00E-02	0.00E+00	1.11E+02
Xe-133	1.16E+04	1.16E+04	1.45E+02	5.06E+02	9.44E+02	1.32E+04
Xe-135	3.68E+02	3.70E+02	3.82E+00	6.70E-01	0.00E+00	3.74E+02
<b>Iodines</b>						
I-131	1.07E+02	1.10E+02	1.03E+01	0.00E+00	0.00E+00	1.20E+02
I-132	5.21E+01	5.24E+01	2.12E-01	0.00E+00	0.00E+00	5.26E+01
I-133	1.83E+02	1.87E+02	1.27E+01	0.00E+00	0.00E+00	2.00E+02
I-134	3.05E+01	3.05E+01	1.06E-03	0.00E+00	0.00E+00	3.05E+01
I-135	1.17E+02	1.19E+02	3.74E+00	0.00E+00	0.00E+00	1.23E+02
<b>Alkali Metals</b>						
Rb-86	4.07E-03	4.54E-03	5.44E-04	0.00E+00	0.00E+00	5.09E-03
Cs-134	4.15E-01	4.63E-01	5.63E-02	0.00E+00	0.00E+00	5.19E-01
Cs-136	1.09E-01	1.22E-01	1.45E-02	0.00E+00	0.00E+00	1.37E-01
Cs-137	2.36E-01	2.64E-01	3.21E-02	0.00E+00	0.00E+00	2.96E-01
Total	1.60E+04	1.61E+04	2.22E+02	7.12 E+02	2.53E+03	1.96E+04

a) SGTR is calculated at a reactor power level of 4555 MWt (102 percent of 4466 MWt NSSS)

b) This release corresponds to the 2-hour period that yields the maximum does at the EAB for this accident scenario.

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**Table 7.1-9  
US-APWR Source Terms  
Time Dependent Released Activity during Steam Generator Tube Rupture (Ci)  
(Pre-Transient Iodine Spike)<sup>(a)</sup>**

<b>Nuclide</b>	<b>0 to 2 hr.<sup>(b)</sup></b>	<b>0 to 8 hr.</b>	<b>8 to 24 hr.</b>	<b>24 to 96 hr.</b>	<b>96 to 720 hr.</b>	<b>Total 0 to 720 hr.</b>
<b>Noble Gases</b>						
Kr-85	3.41E+03	3.43E+03	4.64E+01	2.06E+02	1.59E+03	5.27E+03
Kr-85m	6.16E+01	6.17E+01	9.70E-02	8.00E-03	0.00E+00	6.18E+01
Kr-87	3.40E+01	3.40E+01	0.00E+00	0.00E+00	0.00E+00	3.40E+01
Kr-88	1.11E+02	1.11E+02	6.00E-02	1.00E-02	0.00E+00	1.11E+02
Xe-133	1.16E+04	1.16E+04	1.44E+02	5.06E+02	9.44E+02	1.32E+04
Xe-135	3.74E+02	3.75E+02	2.18E+00	6.70E-01	0.00E+00	3.78E+02
<b>Iodines</b>						
I-131	4.17E+02	4.18E+02	1.81E+00	0.00E+00	0.00E+00	4.20E+02
I-132	2.08E+02	2.09E+02	3.92E-02	0.00E+00	0.00E+00	2.09E+02
I-133	7.14E+02	7.16E+02	2.24E+00	0.00E+00	0.00E+00	7.18E+02
I-134	1.28E+02	1.28E+02	6.00E-05	0.00E+00	0.00E+00	1.28E+02
I-135	4.60E+02	4.61E+02	6.70E-01	0.00E+00	0.00E+00	4.62E+02
<b>Alkali Metals</b>						
Rb-86	4.07E-03	4.54E-03	5.44E-04	0.00E+00	0.00E+00	5.09E-03
Cs-134	4.15E-01	4.63E-01	5.63E-02	0.00E+00	0.00E+00	5.19E-01
Cs-136	1.09E-01	1.22E-01	1.45E-02	0.00E+00	0.00E+00	1.37E-01
Cs-137	2.36E-01	2.64E-01	3.21E-02	0.00E+00	0.00E+00	2.96E-01
Total	1.75E+04	1.76E+04	1.98E+02	7.12E+02	2.53E+03	2.10E+04

a) SGTR is calculated at a reactor power level of 4555 MWt (102 percent of 4466 MWt NSSS)

b) This release corresponds to the 2-hour period that yields the maximum dose at the EAB for this accident scenario.

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**Table 7.1-10  
US-APWR Source Terms  
Time Dependent Released Activity during RCP Rotor Seizure (Ci)<sup>(a)</sup>**

<b>Nuclide</b>	<b>10 to 12 hr.<sup>(b)</sup></b>	<b>0 to 8 hr.</b>	<b>8 to 24 hr.</b>	<b>24 to 96 hr.</b>	<b>96 to 720 hr.</b>	<b>Total 0 to 720 hr.</b>
<b>Noble Gases</b>						
Kr-85	2.81E+01	1.12E+02	8.40E+01	0.00E+00	0.00E+00	1.96E+02
Kr-85m	2.40E+02	6.40E+02	1.58E+02	0.00E+00	0.00E+00	7.98E+02
Kr-87	3.38E+02	5.02E+02	6.21E+00	0.00E+00	0.00E+00	5.08E+02
Kr-88	6.19E+02	1.37E+03	1.74E+02	0.00E+00	0.00E+00	1.55E+03
Xe-133	1.75E+03	6.87E+03	4.96E+03	0.00E+00	0.00E+00	1.18E+04
Xe-135	5.18E+02	1.61E+03	7.67E+02	0.00E+00	0.00E+00	2.37E+03
<b>Iodines</b>						
I-131	7.93E+01	8.81E+01	2.32E+02	0.00E+00	0.00E+00	3.20E+02
I-132	2.54E+00	1.94E+01	8.35E+00	0.00E+00	0.00E+00	2.77E+01
I-133	7.40E+01	9.85E+01	2.17E+02	0.00E+00	0.00E+00	3.15E+02
I-134	4.08E-02	6.46E+00	1.10E-01	0.00E+00	0.00E+00	6.57E+00
I-135	3.08E+01	6.38E+01	9.16E+01	0.00E+00	0.00E+00	1.55E+02
<b>Alkali Metals</b>						
Rb-86	2.96E-02	3.23E-02	8.66E-02	0.00E+00	0.00E+00	1.19E-01
Cs-134	3.00E+00	3.24E+00	8.78E+00	0.00E+00	0.00E+00	1.20E+01
Cs-136	7.98E-01	8.72E-01	2.33E+00	0.00E+00	0.00E+00	3.21E+00
Cs-137	1.71E+00	1.84E+00	5.00E+00	0.00E+00	0.00E+00	6.84E+00
Total	3.69E+03	1.14E+04	6.71E+03	0.00E+00	0.00E+00	1.81E+04

a) RCP rotor seizure is calculated at a reactor power level of 4555 MWt (102 percent of 4466 MWt NSSS).

b) This release corresponds to the 2-hour period that yields the maximum dose at the EAB for this accident scenario.

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**Table 7.1-11  
US-APWR Source Terms  
Time Dependent Released Activity during Rod Ejection Accident (Ci)<sup>(a)</sup>**

<b>Nuclide</b>	<b>0 to 2 hr.<sup>(b)</sup></b>	<b>0 to 8 hr.</b>	<b>8 to 24 hr.</b>	<b>24 to 96 hr.</b>	<b>96 to 720 hr.</b>	<b>Total 0 to 720 hr.</b>
<b>Noble Gases</b>						
Kr-85	6.73E+01	2.63E+02	2.50E+02	1.90E+02	1.63E+03	2.33E+03
Kr-85m	1.37E+03	3.59E+03	9.58E+02	9.86E+00	0.00E+00	4.56E+03
Kr-87	1.91E+03	2.81E+03	3.50E+01	0.00E+00	0.00E+00	2.85E+03
Kr-88	3.52E+03	7.70E+03	1.02E+03	2.05E+00	0.00E+00	8.72E+03
Xe-133	9.92E+03	3.81E+04	3.46E+04	2.11E+04	4.22E+04	1.36E+05
Xe-135	3.02E+03	9.31E+03	5.32E+03	5.40E+02	2.81E+00	1.52E+04
<b>Iodines</b>						
I-131	5.36E+02	5.82E+02	7.17E+02	2.58E+02	7.79E+02	2.34E+03
I-132	3.62E+02	4.62E+02	3.93E+01	1.40E-02	0.00E+00	5.01E+02
I-133	9.42E+02	1.12E+03	1.06E+03	1.13E+02	1.13E+01	2.30E+03
I-134	4.59E+02	4.95E+02	5.15E-01	0.00E+00	0.00E+00	4.95E+02
I-135	6.57E+02	8.75E+02	4.39E+02	6.60E+00	4.00E-03	1.32E+03
<b>Alkali Metals</b>						
Rb-86	4.02E-01	4.16E-01	9.65E-02	0.00E+00	0.00E+00	5.13E-01
Cs-134	4.02E+01	4.15E+01	9.79E+00	1.01E-03	0.00E+00	5.13E+01
Cs-136	1.09E+01	1.13E+01	2.60E+00	1.00E-06	0.00E+00	1.39E+01
Cs-137	2.29E+01	2.36E+01	5.57E+00	0.00E+00	0.00E+00	2.92E+01
<b>Total</b>	<b>2.28E+04</b>	<b>6.53E+04</b>	<b>4.45E+04</b>	<b>2.22E+04</b>	<b>4.46E+04</b>	<b>1.77E+05</b>

- a) Rod ejection accident is calculated at a reactor power level of 4540 MWt (102 percent of 4451 MWt core thermal power).
- b) This release corresponds to the 2-hour period that yields the maximum dose at the EAB for this accident scenario.



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**Table 7.1-12  
US-APWR Source Terms  
Time Dependent Released Activity during Fuel Handling Accident (Ci)**

<b>Nuclide</b>	<b>0 to 2 hr.<sup>(a)</sup></b>	<b>0 to 8 hr.</b>	<b>8 to 24 hr.</b>	<b>24 to 96 hr.</b>	<b>96 to 720 hr.</b>	<b>Total 0 to 720 hr.</b>
<b>Noble Gases</b>						
Kr-85	1.20E+03	1.20E+03	0.00E+00	0.00E+00	0.00E+00	1.20E+03
Kr-85m	3.90E+02	3.90E+02	0.00E+00	0.00E+00	0.00E+00	3.90E+02
Kr-87	5.98E-02	5.98E-02	0.00E+00	0.00E+00	0.00E+00	5.98E-02
Kr-88	1.25E+02	1.25E+02	0.00E+00	0.00E+00	0.00E+00	1.25E+02
Xe-133	9.90E+04	9.90E+04	0.00E+00	0.00E+00	0.00E+00	9.90E+04
Xe-135	2.21E+04	2.21E+04	0.00E+00	0.00E+00	0.00E+00	2.21E+04
<b>Iodines</b>						
I-131	3.67E+02	3.67E+02	0.00E+00	0.00E+00	0.00E+00	3.67E+02
I-132	2.75E+02	2.75E+02	0.00E+00	0.00E+00	0.00E+00	2.75E+02
I-133	2.31E+02	2.31E+02	0.00E+00	0.00E+00	0.00E+00	2.31E+02
I-134	2.71E-06	2.71E-06	0.00E+00	0.00E+00	0.00E+00	2.71E-06
I-135	3.80E+01	3.80E+01	0.00E+00	0.00E+00	0.00E+00	3.80E+01
Total	1.24E+05	1.24E+05	0.00E+00	0.00E+00	0.00E+00	1.24E+05

a) This release corresponds to the 2-hour period that yields the maximum dose at the EAB for this accident scenario.

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**Table 7.1-13  
US-APWR Source Terms  
Time Dependent Released Activity during Failure of Small Lines Carrying Primary  
Coolant Outside Containment (Ci)<sup>(a)</sup>**

<b>Nuclide</b>	<b>0 to 2 hr.<sup>(b)</sup></b>	<b>0 to 8 hr.</b>	<b>8 to 24 hr.</b>	<b>24 to 96 hr.</b>	<b>96 to 720 hr.</b>	<b>Total 0 to 720 hr.</b>
<b>Noble Gases</b>						
Kr-85	6.84E+02	6.84E+02	0.00E+00	0.00E+00	0.00E+00	6.84E+02
Kr-85m	1.25E+01	1.25E+01	0.00E+00	0.00E+00	0.00E+00	1.25E+01
Kr-87	7.05E+00	7.05E+00	0.00E+00	0.00E+00	0.00E+00	7.05E+00
Kr-88	2.26E+01	2.26E+01	0.00E+00	0.00E+00	0.00E+00	2.26E+01
Xe-133	2.32E+03	2.32E+03	0.00E+00	0.00E+00	0.00E+00	2.32E+03
Xe-135	7.70E+01	7.70E+01	0.00E+00	0.00E+00	0.00E+00	7.70E+01
<b>Iodines</b>						
I-131	1.72E+02	1.72E+02	0.00E+00	0.00E+00	0.00E+00	1.72E+02
I-132	7.98E+01	7.98E+01	0.00E+00	0.00E+00	0.00E+00	7.98E+01
I-133	2.93E+02	2.93E+02	0.00E+00	0.00E+00	0.00E+00	2.93E+02
I-134	4.33E+01	4.33E+01	0.00E+00	0.00E+00	0.00E+00	4.33E+01
I-135	1.85E+02	1.85E+02	0.00E+00	0.00E+00	0.00E+00	1.85E+02
Total	3.90E+03	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).

b) This release corresponds to the 2-hour period that yields the maximum dose at the EAB for this accident scenario.

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**Table 7.1-14 (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.
<b>A. Release from Reactor Building to Environment (MBq)</b>					
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>B.1 MSIV Pathway Release to Environment—Elemental (MBq)</b>					
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>B.2 MSIV Pathway Release to Environment—Organic (MBq)</b>					
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>B.3 MSIV Pathway Release to Environment—Resuspended Organic (MBq)</b>					
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>B.4 Release from Condenser to Environment—Sum of B.1+B.2+B.3 (MBq)</b>					
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 7.1-14 (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
<b>A. Release from Reactor Building to Environment (MBq)</b>					
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>B.1 MSIV Pathway Release to Environment—Elemental (MBq)</b>					
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>B.2 MSIV Pathway Release to Environment—Organic (MBq)</b>					
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>B.3 MSIV Pathway Release to Environment—Resuspended Organic (MBq)</b>					
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>B.4 Release from Condenser to Environment—Sum of B.1+B.2+B.3 (MBq)</b>					
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 7.1-15 (Sheet 1 of 2)  
ABWR Source Terms  
Noble Gas Activity Release to the Environment during a LOCA**

<b>Isotope</b>	<b>1 min</b>	<b>10 min</b>	<b>1 hr.</b>	<b>2 hr.</b>	<b>4 hr.</b>
<b>A. Reactor Building Release to Environment (MBq)</b>					
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>B. Condenser Release to Environment (MBq)</b>					
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 7.1-15 (Sheet 2 of 2)  
ABWR Source Terms  
Noble Gas Activity Release to the Environment during a LOCA**

<b>Isotope</b>	<b>8 hr.</b>	<b>12 hr.</b>	<b>1 day</b>	<b>4 days</b>	<b>30 days</b>
<b>A. Reactor Building Release to Environment (MBq)</b>					
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>B. Condenser Release to Environment (MBq)</b>					
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 7.1-16  
ABWR Source Terms  
Activity Released to Environment during a Main Steamline Break Accident (MBq)**

<b>Isotope</b>	<b>Case 1<sup>(a)</sup></b>	<b>Case 2<sup>(a)</sup></b>
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.

<b>Isotope</b>	<b>MBq/g</b>	
	<b>Case 1</b>	<b>Case 2</b>
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 7.1-17  
ABWR Source Terms  
Isotopic Releases during an Instrument Line Break Accident (MBq)**

<b>Isotope</b>	<b>1 min</b>	<b>10 min</b>	<b>1 hr.</b>	<b>2 hr.</b>	<b>4 hr.</b>	<b>8 hr.</b>
<b>Reactor Building Inventory</b>						
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
<b>Isotopic Releases to Environment</b>						
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 7.1-18  
ABWR Source Terms  
Isotopic Release to Environment during a Fuel Handling Accident (MBq)**

<b>Isotope</b>	<b>1 min</b>	<b>10 min</b>	<b>1 hr.</b>	<b>2 hr.</b>
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 7.1-19  
AP1000 Source Terms  
Activity Releases for Steam System Piping Failure with Pre-Existing Iodine Spike (Ci)**

<b>Isotope</b>	<b>0 to 2 hr.</b>	<b>2 to 8 hr.</b>	<b>8 to 24 hr.</b>	<b>24 to 72 hr.</b>	<b>Total</b>
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 7.1-20  
AP1000 Source Terms  
Activity Releases for Steam System Piping Failure with Accident-Initiated  
Iodine Spike (Ci)**

<b>Isotope</b>	<b>0 to 2 hr.</b>	<b>2 to 8 hr.</b>	<b>8 to 24 hr.</b>	<b>24 to 72 hr.</b>	<b>Total</b>
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 7.1-21  
AP1000 Source Terms  
Activity Releases for Reactor Coolant Pump Shaft Seizure (Ci)**

<b>Isotope</b>	<b>No</b>	<b>Feedwater Available</b>			
	<b>Feedwater</b>				
	<b>0 to 1.5 hr.</b>	<b>0 to 2 hr.</b>	<b>2 to 8 hr.</b>	<b>6 to 8 hr.</b>	<b>Total</b>
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 7.1-22  
AP1000 Source Terms  
Activity Releases for Spectrum of Rod Cluster Control Assembly Ejection Accidents (Ci)**

<b>Isotope</b>	<b>0 to 2 hr.</b>	<b>2 to 8 hr.</b>	<b>8 to 24 hr.</b>	<b>24 to 96 hr.</b>	<b>96 to 720 hr.</b>	<b>Total</b>
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
<b>Total</b>	<b>3.23E+03</b>	<b>2.62E+03</b>	<b>3.58E+03</b>	<b>4.53E+03</b>	<b>8.93E+03</b>	<b>2.29E+04</b>

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**Table 7.1-23  
AP1000 Source Terms  
Activity Releases for Failure of Small Lines Carrying Primary Coolant Outside  
Containment (Ci)**

<b>Isotope</b>	<b>0-2 hr.</b>
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 7.1-24  
AP1000 Source Terms  
Activity Releases for Steam Generator Tube Rupture with Pre-Existing Iodine Spike (Ci)**

<b>Isotope</b>	<b>0 to 2 hr.</b>	<b>2 to 8 hr.</b>	<b>8 to 24 hr.</b>	<b>Total</b>
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 7.1-25  
AP1000 Source Terms  
Activity Releases for Steam Generator Tube Rupture with Accident-Initiated  
Iodine Spike (Ci)**

<b>Isotope</b>	<b>0 to 2 hr.</b>	<b>2 to 8 hr.</b>	<b>8 to 24 hr.</b>	<b>Total</b>
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 7.1-26 (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)**

<b>Isotope</b>	<b>1.4 to 3.4 hr.</b>	<b>0 to 8 hr.</b>	<b>8 to 24 hr.</b>	<b>24 to 96 hr.</b>	<b>96 to 720 hr.</b>	<b>Total</b>
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

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**Table 7.1-26 (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)**

<b>Isotope</b>	<b>1.4 to 3.4 hr.</b>	<b>0 to 8 hr.</b>	<b>8 to 24 hr.</b>	<b>24 to 96 hr.</b>	<b>96 to 720 hr.</b>	<b>Total</b>
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
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 7.1-27  
AP1000 Source Terms  
Activity Releases for Fuel Handling Accident (Ci)**

<b>Isotope</b>	<b>0 to 2 hr.</b>
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 7.1-28  
U.S. EPR Source Terms  
Radionuclide Releases to Atmosphere for Main Steamline Break with Pre-Accident Iodine  
Spike (Ci)**

<b>Isotope</b>	<b>0 to 2 hr.</b>	<b>2 to 8 hr.</b>	<b>8 to 24 hr.</b>	<b>Total</b>
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 7.1-29  
U.S. EPR Source Terms  
Radionuclide Releases to Atmosphere for Main Steamline Break with Accident-Induced  
(Coincident) Iodine Spike (Ci)**

<b>Isotope</b>	<b>0 to 2 hr.</b>	<b>2 to 8 hr.</b>	<b>8 to 24 hr.</b>	<b>Total</b>
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 7.1-30A  
U.S. EPR Source Terms  
Radionuclide Releases to Atmosphere for Main Steamline Break with Accident-Induced  
3.3% Clad Failure (Ci)**

<b>Isotope</b>	<b>0 to 2 hr.</b>	<b>2 to 8 hr.</b>	<b>8 to 24 hr.</b>	<b>Total</b>
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 7.1-30B  
U.S. EPR Source Terms  
Radionuclide Releases to Atmosphere for Main Steam Line Break with  
Accident-Induced 0.58% Fuel Overheat (Ci)**

<b>Isotope</b>	<b>0 to 2 hr</b>	<b>2 to 8 hr</b>	<b>8 to 24 hr</b>	<b>Total</b>
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 7.1-31  
U.S. EPR Source Terms  
Radionuclide Releases to Atmosphere for Pump Locked Rotor Accident (LRA) with  
Accident-Induced 9.5% Clad Failure (Ci)**

<b>Isotope</b>	<b>0 to 2 hr.</b>	<b>2 to 8 hr.</b>	<b>Total</b>
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 7.1-32  
U.S. EPR Source Terms  
Radionuclide Releases to Atmosphere for Design Basis Small Line Break (Ci)**

<b>Isotope</b>	<b>0 to 2 hr.</b>
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 7.1-33  
U.S. EPR Source Terms  
Radionuclide Releases to Atmosphere for Steam Generator Tube Rupture  
with Pre-Accident Spike (Ci)**

<b>Isotope</b>	<b>0 to 2 hr.</b>	<b>2 to 8 hr.</b>	<b>8 to 24 hr.</b>	<b>24 to 96 hr.</b>	<b>96 to 720 hr.</b>	<b>Total</b>
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 7.1-34  
U.S. EPR Source Terms  
Radionuclide Releases to Atmosphere for Steam Generator Tube Rupture with Accident-  
Induced (Coincident) Iodine Spike (Ci)**

<b>Isotope</b>	<b>0 to 2 hr.</b>	<b>2 to 8 hr.</b>	<b>8 to 24 hr.</b>	<b>24 to 96 hr.</b>	<b>96 to 720 hr.</b>	<b>Total</b>
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 7.1-35 (Sheet 1 of 6)  
U.S. EPR Source Terms  
Radionuclide Releases to Atmosphere for Design Basis LOCA (Ci)**

<b>Isotope</b>	<b>0 to 1.5 hr.</b>	<b>1.5 to 3.5 hr.</b>	<b>3.5 to 8 hr.</b>
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 7.1-35 (Sheet 2 of 6)  
U.S. EPR Source Terms  
Radionuclide Releases to Atmosphere for Design Basis LOCA (Ci)**

<b>Isotope</b>	<b>8 to 24 hr.</b>	<b>24 to 96 hr.</b>	<b>96 to 720 hr.</b>	<b>Total</b>
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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Radionuclide Releases to Atmosphere for Design Basis LOCA (Ci)**

<b>Isotope</b>	<b>0 to 1.5 hr.</b>	<b>1.5 to 3.5 hr.</b>	<b>3.5 to 8 hr.</b>
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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Radionuclide Releases to Atmosphere for Design Basis LOCA (Ci)**

<b>Isotope</b>	<b>8 to 24 hr.</b>	<b>24 to 96 hr.</b>	<b>96 to 720 hr.</b>	<b>Total</b>
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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U.S. EPR Source Terms  
Radionuclide Releases to Atmosphere for Design Basis LOCA (Ci)**

<b>Isotope</b>	<b>0 to 1.5 hr.</b>	<b>1.5 to 3.5 hr.</b>	<b>3.5 to 8 hr.</b>
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)**

<b>Isotope</b>	<b>8 to 24 hr.</b>	<b>24 to 96 hr.</b>	<b>96 to 720 hr.</b>	<b>Total</b>
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 7.1-36  
U.S. EPR Source Terms  
Radionuclide Releases to Atmosphere for Fuel Handling Accident (Ci)**

<b>Isotope</b>	<b>0 to 2 hr.</b>	<b>2 to 8 hr.</b>	<b>8 to 24 hr.</b>	<b>24 to 96 hr.</b>	<b>96 to 720 hr.</b>	<b>Total</b>
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
<b>Total</b>	<b>1.148E+05</b>	<b>4.388E+03</b>	<b>4.307E+03</b>	<b>3.005E+03</b>	<b>5.610E+02</b>	<b>1.271E+05</b>

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**Table 7.1-37  
U.S. EPR Source Terms  
Radionuclide Releases to Atmosphere for Rod Ejection Accident (REA) with Accident-  
Induced 36.7% Clad Failure (Ci)**

<b>Isotope</b>	<b>0 to 2 hr.</b>	<b>2 to 8 hr.</b>	<b>Total</b>
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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**Table 7.1-38  
US-APWR Radiological Consequences  
Atmospheric Dispersion Factors**

<b>Location</b>	<b>Time (hr.)</b>	<b>DCD <math>\chi/Q</math> (sec/m<sup>3</sup>)</b>	<b>Site <math>\chi/Q</math> (sec/m<sup>3</sup>)</b>	<b><math>\chi/Q</math> Ratio (Site/DCD)</b>
EAB	0 to 2	5.00E-04	1.41E-04	0.282
LPZ	0 to 8	2.10E-04	2.30E-06	0.011
	8 to 24	1.30E-04	1.61E-06	0.012
	24 to 96	6.90E-05	7.51E-07	0.011
	96 to 720	2.80E-05	3.05E-07	0.011

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**Table 7.1-39  
US-APWR Radiological Consequences  
Dose Summary**

<b>Accident</b>	<b>DCD Dose (rem TEDE)</b>		<b><math>\chi/Q</math> ratio (Site/DCD)</b>		<b>Site Dose (rem TEDE)</b>		<b>Limit</b>
	<b>EAB</b>	<b>LPZ</b>	<b>EAB</b>	<b>LPZ<sup>(a)</sup></b>	<b>EAB</b>	<b>LPZ</b>	
Steam System Piping Failure - Pre-Existing Iodine Spike	0.19	0.11	0.282	0.012	5.36E-02	1.32E-03	25
Steam System Piping Failure - Accident-Initiated Iodine Spike	0.32	0.28	0.282	0.012	9.02E-02	3.36E-03	2.5
Reactor Coolant Pump Rotor Seizure	0.49	0.7	0.282	0.012	1.38E-01	8.40E-03	2.5
Spectrum of Rod Cluster Control Assembly Ejection Accidents	5.1	4.5	0.282	0.012	1.44E+00	5.40E-02	6.3
Failure of Small Lines Carrying Primary Coolant Outside Containment	1.5	0.6	0.282	0.012	4.23E-01	7.20E-03	2.5
Steam Generator Tube Rupture - Pre-Existing Iodine Spike	3.6	1.5	0.282	0.012	1.02E+00	1.80E-02	25
Steam Generator Tube Rupture - Accident-Initiated Iodine Spike	0.96	0.43	0.282	0.012	2.71E-01	5.16E-03	2.5
LOCA	13	13	0.282	0.012	3.67E+00	1.56E-01	25
Fuel Handling Accident	3.3	1.4	0.282	0.012	9.31E-01	1.68E-02	6.3

a) LPZ doses are not given in time-dependent form; therefore, the most conservative Site/DCD  $\chi/Q$  ratio (from the 8 to 24 hour interval) is used.

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**Table 7.1-40  
ABWR Radiological Consequences  
Atmospheric Dispersion Factors**

<b>Accident</b>	<b>Location</b>	<b>Time (hr.)</b>	<b>DCD <math>\chi/Q</math> (sec/m<sup>3</sup>)</b>	<b>Site <math>\chi/Q</math> (sec/m<sup>3</sup>)</b>	<b><math>\chi/Q</math> Ratio (Site/DCD)</b>
All Accidents	EAB	0 to 2	1.37E-03	1.41E-04	0.103
	LPZ	0 to 2	4.11E-04	4.72E-06	0.011
LOCA Only		0 to 8	1.56E-04	2.30E-06	0.015
		8 to 24	9.61E-05	1.61E-06	0.017
		24 to 96	3.36E-05	7.51E-07	0.022
		96 to 720	7.42E-06	3.05E-07	0.041

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**Table 7.1-41  
ABWR Radiological Consequences  
PSEG Site-Specific Dose Summary**

<b>Accident</b>	<b>Thyroid Dose (Sv)</b>	<b>Whole Body Dose (Sv)</b>	<b>Thyroid Limit (Sv)</b>	<b>Whole Body Limit (Sv)</b>
Failure of Small Lines Carrying Primary Coolant Outside Containment <sup>(a)</sup>	4.94E-03	9.68E-05	3.00E-01	2.50E-02
LOCA - EAB	2.14E-01	4.62E-03	3.00E+00	2.50E-01
LOCA - LPZ	7.72E-02	9.82E-04	3.00E+00	2.50E-01
Fuel Handling Accident <sup>(a)</sup>	8.46E-02	1.35E-03	7.50E-01	6.25E-02
Main Steamline Break Case 1 <sup>(a)(b)</sup>	2.68E-03	6.39E-05	3.00E-01	2.50E-02
Main Steamline Break Case 2 <sup>(a)(b)</sup>	5.25E-02	1.34E-03	3.00E+00	2.50E-01

- a) The dose is calculated for the maximum two 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.

<b>Isotope</b>	<b>MBq/g</b>	
	<b>Case 1</b>	<b>Case 2</b>
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 7.1-42  
ABWR Radiological Consequences  
Doses for an Instrument Line Break Accident**

DCD			Site	
Thyroid Dose (Sv)	Whole Body Dose (Sv)	$\chi/Q$ Ratio (Site/DCD)	Thyroid Dose (Sv)	Whole Body Dose (Sv)
4.80E-02	9.40E-04	0.103	4.94E-03	9.68E-05



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**Table 7.1-43  
ABWR Radiological Consequences  
Doses for a Fuel Handling Accident**

<b>DCD</b>		$\chi/Q$ Ratio (Site/DCD)	<b>Uprate Ratio</b>	<b>Site</b>	
<b>Thyroid Dose (Sv)</b>	<b>Whole Body Dose (Sv)</b>			<b>Thyroid Dose (Sv)</b>	<b>Whole Body Dose (Sv)</b>
7.50E-01	1.20E-02	0.103	1.095	8.46E-02	1.35E-03

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**Table 7.1-44  
ABWR Radiological Consequences  
Doses for a LOCA**

Location	Time (hr.)	DCD			Uprate Ratio	Site	
		Thyroid Dose (Sv)	Whole Body Dose (Sv)	$\chi/Q$ Ratio (Site/DCD)		Thyroid Dose (Sv)	Whole Body Dose (Sv)
EAB	0 to 2	1.90E+00	4.10E-02	0.103	1.095	2.14E-01	4.62E-03
LPZ	0 to 8	3.10E-01	1.00E-02	0.015	1.095	5.09E-03	1.64E-04
	0 to 24	5.10E-01	1.80E-02	0.017	1.095	8.81E-03	3.13E-04
	0 to 96	1.30E+00	2.90E-02	0.022	1.095	2.78E-02	5.78E-04
	0 to 720	2.40E+00	3.80E-02	0.041	1.095	7.72E-02	9.82E-04

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**Table 7.1-45  
ABWR Radiological Consequences  
Doses for a Main Steamline Break**

	<b>DCD</b>			<b>Site</b>	
	<b>Thyroid Dose (Sv)</b>	<b>Whole Body Dose (Sv)</b>	<b><math>\chi</math>/Q Ratio (Site/DCD)</b>	<b>Thyroid Dose (Sv)</b>	<b>Whole Body Dose (Sv)</b>
Case 1	2.60E-02	6.20E-04	0.103	2.68E-03	6.39E-05
Case 2	5.10E-01	1.30E-02	0.103	5.25E-02	1.34E-03

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**Table 7.1-46  
AP1000 Radiological Consequences  
Atmospheric Dispersion Factors**

<b>Accident</b>	<b>Location</b>	<b>Time (hr.)</b>	<b>DCD <math>\chi/Q</math> (sec/m<sup>3</sup>)</b>	<b>Site <math>\chi/Q</math> (sec/m<sup>3</sup>)</b>	<b><math>\chi/Q</math> Ratio (Site/DCD)</b>
LOCA	EAB	0 to 2	5.10E-04	1.41E-04	0.276
	LPZ	0 to 8	2.20E-04	2.30E-06	0.010
		8 to 24	1.60E-04	1.61E-06	0.010
		24 to 96	1.00E-04	7.51E-07	0.008
		96 to 720	8.00E-05	3.05E-07	0.004
Other Accidents	EAB	0 to 2	8.00E-04	1.41E-04	0.176
	LPZ	0 to 8	5.00E-04	2.30E-06	0.005
		8 to 24	3.00E-04	1.61E-06	0.005
		24 to 96	1.50E-04	7.51E-07	0.005
		96 to 720	8.00E-05	3.05E-07	0.004

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**Table 7.1-47  
AP1000 Radiological Consequences  
PSEG Site-Specific Dose Summary**

<b>Accident</b>	<b>Site Dose (rem TEDE)</b>		
	<b>EAB</b>	<b>LPZ</b>	<b>Limit</b>
Steam System Piping Failure – Pre-Existing Iodine Spike	1.76E-01	3.81E-03	25
Steam System Piping Failure – Accident-Initiated Iodine Spike	1.94E-01	9.67E-03	2.5
Reactor Coolant Pump Shaft Seizure – No Feedwater	1.41E-01	1.95E-03	2.5
Reactor Coolant Pump Shaft Seizure – Feedwater Available	1.06E-01	3.97E-03	2.5
Spectrum of Rod Cluster Control Assembly Ejection Accidents	6.34E-01	2.72E-02	6.3
Failure of Small Lines Carrying Primary Coolant Outside Containment	3.70E-01	5.10E-03	2.5
Steam Generator Tube Rupture – Pre-Existing Iodine Spike	3.87E-01	6.16E-03	25
Steam Generator Tube Rupture – Accident-Initiated Iodine Spike	1.94E-01	3.99E-03	2.5
LOCA	6.71E+00	2.31E-01	25
Fuel Handling Accident	9.15E-01	1.72E-02	6.3

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**Table 7.1-48  
AP1000 Radiological Consequences  
Doses for a Steam System Piping Failure**

<b>Doses for Steam System Piping Failure with Pre-Existing Iodine Spike</b>					
<b>Time (hr.)</b>	<b>DCD Dose (rem TEDE)</b>		<b><math>\chi/Q</math> Ratio (Site/DCD)</b>	<b>Site Dose (rem TEDE)</b>	
	<b>EAB</b>	<b>LPZ</b>		<b>EAB</b>	<b>LPZ</b>
0 to 2	1.00E+00		0.176	1.76E-01	
0 to 8		5.81E-01	0.005		2.91E-03
8 to 24		7.18E-02	0.005		3.59E-04
24 to 96		1.08E-01	0.005		5.40E-04
96 to 720		0.00E+00	0.004		0.00E+00
Total	1.00E+00	7.61E-01		1.76E-01	3.81E-03
Limit				25	25

<b>Doses for Steam System Piping Failure with Accident-Initiated Iodine Spike</b>					
<b>Time (hr.)</b>	<b>DCD Dose (rem TEDE)</b>		<b><math>\chi/Q</math> Ratio (Site/DCD)</b>	<b>Site Dose (rem TEDE)</b>	
	<b>EAB</b>	<b>LPZ</b>		<b>EAB</b>	<b>LPZ</b>
0 to 2	1.10E+00		0.176	1.94E-01	
0 to 8		1.02E+00	0.005		5.10E-03
8 to 24		3.77E-01	0.005		1.89E-03
24 to 96		5.36E-01	0.005		2.68E-03
96 to 720		0.00E+00	0.004		0.00E+00
Total	1.10E+00	1.93E+00		1.94E-01	9.67E-03
Limit				2.5	2.5

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**Table 7.1-49  
AP1000 Radiological Consequences  
Doses for a Reactor Coolant Pump Shaft Seizure Accident**

<b>Doses for Reactor Coolant Pump Shaft Seizure with No Feedwater</b>					
<b>Time (hr.)</b>	<b>DCD Dose (rem TEDE)</b>		<b><math>\chi/Q</math> Ratio (Site/DCD)</b>	<b>Site Dose (rem TEDE)</b>	
	<b>EAB</b>	<b>LPZ</b>		<b>EAB</b>	<b>LPZ</b>
0 to 2	8.00E-01		0.176	1.41E-01	
0 to 8		3.89E-01	0.005		1.95E-03
8 to 24		0.00E+00	0.005		0.00E+00
24 to 96		0.00E+00	0.005		0.00E+00
96 to 720		0.00E+00	0.004		0.00E+00
Total	8.00E-01	3.89E-01		1.41E-01	1.95E-03
Limit				2.5	2.5

<b>Doses for Reactor Coolant Pump Shaft Seizure with Feedwater Available</b>					
<b>Time (hr.)</b>	<b>DCD Dose (rem TEDE)</b>		<b><math>\chi/Q</math> Ratio (Site/DCD)</b>	<b>Site Dose (rem TEDE)</b>	
	<b>EAB</b>	<b>LPZ</b>		<b>EAB</b>	<b>LPZ</b>
0 to 2	6.00E-01		0.176	1.06E-01	
0 to 8		7.94E-01	0.005		3.97E-03
8 to 24		0.00E+00	0.005		0.00E+00
24 to 96		0.00E+00	0.005		0.00E+00
96 to 720		0.00E+00	0.004		0.00E+00
Total	6.00E-01	7.94E-01		1.06E-01	3.97E-03
Limit				2.5	2.5

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**Table 7.1-50  
AP1000 Radiological Consequences  
Doses for Spectrum of Rod Cluster Control Assembly Ejection Accidents**

Time (hr.)	<u>DCD Dose (rem TEDE)</u>		$\chi/Q$ Ratio (Site/DCD)	<u>Site Dose (rem TEDE)</u>	
	EAB	LPZ		EAB	LPZ
0 to 2	3.60E+00		0.176	6.34E-01	
0 to 8		4.58E+00	0.005		2.29E-02
8 to 24		7.84E-01	0.005		3.92E-03
24 to 96		6.32E-02	0.005		3.16E-04
96 to 720		2.06E-02	0.004		8.24E-05
Total	3.60E+00	5.45E+00		6.34E-01	2.72E-02
Limit				6.3	6.3



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**Table 7.1-51  
AP1000 Radiological Consequences  
Doses for Failure of Small Lines Carrying Primary Coolant Outside Containment**

<b>Time (hr.)</b>	<b><u>DCD Dose (rem TEDE)</u></b>		<b><math>\chi/Q</math> Ratio (Site/DCD)</b>	<b><u>Site Dose (rem TEDE)</u></b>	
	<b>EAB</b>	<b>LPZ</b>		<b>EAB</b>	<b>LPZ</b>
0 to 2	2.10E+00		0.176	3.70E-01	
0 to 8		1.02E+00	0.005		5.10E-03
8 to 24		0.00E+00	0.005		0.00E+00
24 to 96		0.00E+00	0.005		0.00E+00
96 to 720		0.00E+00	0.004		0.00E+00
Total	2.10E+00	1.02E+00		3.70E-01	5.10E-03
Limit				2.5	2.5

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**Table 7.1-52  
AP1000 Radiological Consequences  
Doses for Steam Generator Tube Rupture**

<b>Doses for Steam Generator Tube Rupture with Pre-Existing Iodine Spike</b>					
<b>Time (hr.)</b>	<b>DCD Dose (rem TEDE)</b>		<b><math>\chi/Q</math> Ratio (Site/DCD)</b>	<b>Site Dose (rem TEDE)</b>	
	<b>EAB</b>	<b>LPZ</b>		<b>EAB</b>	<b>LPZ</b>
0 to 2	2.20E+00		0.176	3.87E-01	
0 to 8		1.16E+00	0.005		5.80E-03
8 to 24		7.24E-02	0.005		3.62E-04
24 to 96		0.00E+00	0.005		0.00E+00
96 to 720		0.00E+00	0.004		0.00E+00
Total	2.20E+00	1.23E+00		3.87E-01	6.16E-03
Limit				25	25

<b>Doses for Steam Generator Tube Rupture with Accident-Initiated Iodine Spike</b>					
<b>Time (hr.)</b>	<b>DCD Dose (rem TEDE)</b>		<b><math>\chi/Q</math> Ratio (Site/DCD)</b>	<b>Site Dose (rem TEDE)</b>	
	<b>EAB</b>	<b>LPZ</b>		<b>EAB</b>	<b>LPZ</b>
0 to 2	1.10E+00		0.176	1.94E-01	
0 to 8		6.27E-01	0.005		3.14E-03
8 to 24		1.69E-01	0.005		8.45E-04
24 to 96		0.00E+00	0.005		0.00E+00
96 to 720		0.00E+00	0.004		0.00E+00
Total	1.10E+00	7.96E-01		1.94E-01	3.99E-03
Limit				2.5	2.5

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**Table 7.1-53  
AP1000 Radiological Consequences  
Doses for LOCA**

<b>Time (hr.)</b>	<b><u>DCD Dose (rem TEDE)</u></b>		<b><math>\chi/Q</math> Ratio (Site/DCD)</b>	<b><u>Site Dose (rem TEDE)</u></b>	
	<b>EAB</b>	<b>LPZ</b>		<b>EAB</b>	<b>LPZ</b>
0 to 2	2.43E+01		0.276	6.71E+00	
0 to 8		2.17E+01	0.010		2.17E-01
8 to 24		7.69E-01	0.010		7.69E-03
24 to 96		3.71E-01	0.008		2.97E-03
96 to 720		8.70E-01	0.004		3.48E-03
Total	2.43E+01	2.37E+01		6.71E+00	2.31E-01
Limit				25	25

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**Table 7.1-54  
AP1000 Radiological Consequences  
Doses for a Fuel Handling Accident**

<b>Time (hr.)</b>	<b><u>DCD Dose (rem TEDE)</u></b>		<b><math>\chi/Q</math> Ratio (Site/DCD)</b>	<b><u>Site Dose (rem TEDE)</u></b>	
	<b>EAB</b>	<b>LPZ</b>		<b>EAB</b>	<b>LPZ</b>
0 to 2	5.20E+00		0.176	9.15E-01	
0 to 8		3.44E+00	0.005		1.72E-02
8 to 24		0.00E+00	0.005		0.00E+00
24 to 96		0.00E+00	0.005		0.00E+00
96 to 720		0.00E+00	0.004		0.00E+00
Total	5.20E+00	3.44E+00		9.15E-01	1.72E-02
Limit				6.3	6.3

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**Table 7.1-55  
U.S. EPR Radiological Consequences  
Atmospheric Dispersion Factors**

<b>Location</b>	<b>Time (hr.)</b>	<b>DCD <math>\chi/Q</math> (sec/m<sup>3</sup>)</b>	<b>Site <math>\chi/Q</math> (sec/m<sup>3</sup>)</b>	<b><math>\chi/Q</math> Ratio (Site/DCD)</b>
EAB	0 to 2	1.00E-03	1.41E-04	0.141
LPZ	0 to 8	1.35E-04	2.30E-06	0.017
	8 to 24	1.00E-04	1.61E-06	0.016
	24 to 96	5.40E-05	7.51E-07	0.014
	96 to 720	2.20E-05	3.05E-07	0.014

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**Table 7.1-56  
U.S. EPR Radiological Consequences  
Dose Summary**

<b>Accident</b>	<b>DCD Dose (rem TEDE)</b>		<b><math>\chi/Q</math> ratio (Site/DCD)</b>		<b>Site Dose (rem TEDE)</b>		<b>Max</b>
	<b>EAB</b>	<b>LPZ</b>	<b>EAB</b>	<b>LPZ<sup>(a)</sup></b>	<b>EAB</b>	<b>LPZ</b>	
Main Steam Line Break - Pre-Existing Iodine Spike	0.2	0.1	0.141	0.017	2.82E-02	1.70E-03	25
Main Steam Line Break - Accident-Initiated Iodine Spike	0.3	0.2	0.141	0.017	4.23E-02	3.40E-03	2.5
Main Steam Line Break - Fuel Rod Clad Failure	5.3	2.6	0.141	0.017	7.47E-01	4.42E-02	25
Main Steam Line Break - Fuel Overheat	5.8	2.8	0.141	0.017	8.18E-01	4.76E-02	25
Reactor Coolant Pump Shaft Seizure	2.3	0.9	0.141	0.017	3.24E-01	1.53E-02	2.5
Spectrum of Rod Cluster Control Assembly Ejection Accidents	5.7	3.5	0.141	0.017	8.04E-01	5.95E-02	6.3
Failure of Small Lines Carrying Primary Coolant Outside Containment	1.8	0.3	0.141	0.017	2.54E-01	5.10E-03	2.5
Steam Generator Tube Rupture - Pre-Existing Iodine Spike	1.1	0.3	0.141	0.017	1.55E-01	5.10E-03	25
Steam Generator Tube Rupture - Accident-Initiated Iodine Spike	0.7	0.5	0.141	0.017	9.87E-02	8.50E-03	2.5
LOCA	12.2	11.1	0.141	0.017	1.72E+00	1.89E-01	25
Fuel Handling Accident	5.6	1	0.141	0.017	7.90E-01	1.70E-02	6.3

a) LPZ doses are not given in time-dependent form, therefore, the most conservative Site/DCD  $\chi/Q$  ratio (from the 0 to 8 hour interval) was used.

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## 7.2 SEVERE ACCIDENTS

This section evaluates the potential environmental impacts of severe accidents at the PSEG Site from four different reactor technologies. The four reactor technologies are: ABWR (4300 MWt), AP1000, US-APWR, and U.S. EPR. These reactor technologies are for a single-unit plant except for the AP1000 case, which is based on two units. The environmental impacts from postulated severe accidents are calculated using site-specific data to demonstrate acceptability.

Severe accidents are defined as accidents with substantial reactor core damage and degradation of containment systems. Because the severe accident probability is low for the considered reactor technologies, these accidents are not part of the new plant design basis. However, the U. S. Nuclear Regulatory Commission (NRC) requires, in *Severe Reactor Accidents Regarding Future Designs and Existing Plants* (Reference 7.2-1), the completion of a probabilistic risk assessment (PRA) for severe accidents for the new reactor designs. This requirement is specified in regulation 10 CFR 52.47, *Contents of Applications; Technical Information*.

A PRA is completed for each of the four reactor technologies as part of the associated application for design certification. This section uses the applicable results of the PRA for severe accidents, along with site-specific characteristics, to determine impacts of severe accidents over an entire new plant life cycle. The purpose of this analysis is to identify potential off-site radiological impacts of severe accidents and demonstrate that the impacts are acceptable.

### 7.2.1 METHODOLOGY

#### 7.2.1.1 Off-Site Consequences

The NRC computer code MACCS2 (Reference 7.2-2) is used to model the environmental consequences of the severe accidents. Each of the four reactor technologies has a reactor-specific set of severe accidents that correspond to unique accident sequences. The PRA for the four reactor technologies established event trees that define the end states of each accident sequence. Each end state has a corresponding release category source term. The source terms are based on core inventory data and release fractions for specific chemical groups. This data is used as input to the MACCS2 code. Table 7.2-1 contains the list of release categories and their brief descriptions. Table 7.2-4 contains the list of chemical groups and the associated nuclides. Table 7.2-5 contains the release fractions for all chemical groups.

The exposure pathways modeled include external exposure from the passing plume, external exposure from material deposited on the ground, inhalation of material in the passing plume or resuspended from the ground, and ingestion of contaminated food and surface water.

The MACCS2 code primarily addresses dose from the air pathway, but also calculates dose from surface runoff and deposition on surface water. The code evaluates the extent of contamination. The meteorology data used in the analysis is hourly data for one year that includes wind velocity (speed and direction), stability class, and rainfall.

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To assess human health impacts, the analysis determined the risk of early fatalities, the risk of latent cancer fatalities, and collective whole body dose-risk from a severe accident for the year 2081 estimated population within a 50-mile (mi.) radius of the new plant. The population data for the year 2081 is selected considering a new plant operating life (40 yr) and the potential license extension (20 yr). If the new plant has a start-up date within the next decade (2010 to 2020), the population data corresponds to the end-point of the plant operating period. This is the most conservative estimate for population because it increases with time.

The economic risk associated with severe accidents is determined. The economic risk is based on costs associated with short-term relocation of people, decontamination of property and equipment, and interdiction of food supplies. Risk calculation is further discussed in Subsection 7.2.1.2.

MACCS2 requires five input files: ATMOS, EARLY, CHRONC, METEOROLOGICAL, and SITE. ATMOS provides data to calculate the amount of material released to the atmosphere that is dispersed and deposited. The calculation uses a Gaussian plume model. Important reactor-specific inputs in this file include the core inventory, release fractions, and geometry of the reactor and associated buildings. EARLY provides inputs to calculations regarding exposure in the time period immediately following the release. Important site-specific information includes emergency response information such as evacuation time. CHRONC provides data for calculating long-term impacts and economic costs and includes region-specific data on agriculture and economic factors. These files access a meteorological file, (METEOROLOGICAL) which uses actual PSEG Site meteorological monitoring data for the year 2004, and a site characteristics file (SITE) which uses site-specific population data, land usage, watershed index, and regions. The meteorological data for year 2004 was selected due to its completeness (hourly data for each day of the year) and it is representative of the overall long-term regional climate (i.e., there are no outliers in the data set compared to the long-term regional climate).

#### 7.2.1.2 Risk Calculation

The results of the MACCS2 calculations and the accident frequency information are used to determine risk. The accident frequencies (the same as the release category frequencies) are listed in Table 7.2-2. Risk is the product of accident frequency and the consequences of the accident. The consequence is either a radiation dose, economic cost, or the area of land contaminated due to the accident. The total risk is determined by summing all the corresponding accident risks.

#### 7.2.2 CONSEQUENCES TO POPULATION GROUPS

This section evaluates impacts of severe accidents from air, surface water, and groundwater pathways. The MACCS2 code is used to evaluate the doses from the air pathway and from water ingestion with PSEG Site-specific data. MACCS2 does not model other surface water and groundwater dose pathways. These are analyzed qualitatively based on a comparison of the new plant atmospheric doses to those of the existing U.S. nuclear fleet.

The four reactor technologies considered here belong to a new generation of reactors that are based on improved design parameters with respect to the associated core damage frequencies (CDFs). The CDF is a measure of the impacts of potential accidents. A CDF is calculated using



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PRA modeling to evaluate how changes to the reactor or auxiliary systems change the severity of the accident. The CDFs for the ABWR, AP1000, US-APWR, and U.S. EPR are typically one to three orders of magnitude lower than the CDFs for the current nuclear fleet.

#### 7.2.2.1 Air Pathways

For each reactor technology, the potential severe accidents are grouped into release categories based on their similarity. The number of release categories is reactor-specific. Each release category has a set of characteristics representative of that categories chemical elements. Radionuclides that may be released are organized into groups having similar chemical characteristics. Table 7.2-4 provides the groupings. Release categories for each reactor technology are analyzed with MACCS2 to calculate population dose, number of early and latent fatalities, cost, and farm land requiring decontamination. The analysis assumes that 95 percent of the population is evacuated following declaration of a general emergency.

For each release category, risk is calculated by multiplying each consequence (population dose, fatalities, cost, and area of contaminated land) with its corresponding frequency. A summary of the results is provided in Table 7.2-3. The total cost calculation considers other consequences, such as evacuation costs, value of crops contaminated and condemned, value of milk contaminated and condemned, cost of property decontamination, and indirect costs resulting from loss of property use and incomes as a result of the accident.

#### 7.2.2.2 Surface Water Pathways

A population is exposed to radiation when airborne radioactivity is deposited onto surface water. The exposure pathway is from drinking the water, external radiation from submersion in the water, external radiation from activities near the shoreline, or ingestion of fish or shellfish. MACCS2 only calculates the dose from drinking water. The MACCS2 severe accident dose risk to the 50-mi. population from drinking water is  $8.74\text{E-}03$  person-rem/reactor-year ( $8.74\text{E-}05$  person-Sv/reactor-year) (Table 7.2-3) for the US-APWR, which is bounding for the four reactor technologies. This value is the sum of all water ingestion doses for the associated US-APWR release categories.

Surface water pathways involving swimming, fishing, and boating are not modeled by MACCS2. Surface water bodies within the 50-mi. region of PSEG Site include the Laurel Lake, Elkinton Millpond, Chesapeake Bay, Delaware Bay, Delaware River, Susquehanna River, Smyrna River, Schuylkill River, Cooper River and the reservoirs listed on Table 2.3-3. The tributary streams in the vicinity of the PSEG Site are listed in Table 2.3-4. The NRC evaluated doses from the aquatic food pathway (fishing) for the current nuclear fleet discharging to various bodies of water in NUREG-1437, *Generic Environmental Impact Statement for License Renewal of Nuclear Plants*. The NRC evaluation concluded that with interdiction, the risk associated with the aquatic food pathway is SMALL relative to the atmospheric pathway for most sites and essentially the same as the atmospheric pathway for the few sites with large annual aquatic food harvests. The new plant atmospheric pathway doses are lower than those of the current U.S. nuclear fleet, therefore, the doses from surface water sources are consistently lower for the new plant as well.

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**7.2.2.3 Groundwater Pathways**

People also receive a dose from groundwater pathways. Radioactivity released during an accident enters groundwater or moves through an aquifer that eventually discharges to surface water. The consequences of a radioactive spill not associated with an accident are evaluated in SSAR Subsection 2.4.13, which determined that if the radioactive liquids are released directly to the groundwater, all radionuclides are below the environmental concentration limits before they reach any local aquifers containing drinking water. NUREG-1437 also evaluated the groundwater pathway dose, based on the analysis in NUREG-0440, *Liquid Pathway Generic Study* (LPGS). NUREG-0440 analyzed a core meltdown that contaminated groundwater and subsequently contaminated surface water. However, NUREG-0440 did not analyze direct groundwater drinking because of the limited number of potable groundwater wells.

The LPGS results provide conservative, uninterdicted population dose estimates for six generic categories of plants. These dose estimates are one or more orders of magnitude less than those attributed to the atmospheric pathway. NUREG-1437 compared potential contamination at the existing Hope Creek Generating Station (HCGS) and found that its estimated uninterdicted total population dose is less than one percent of the LPGS generic dose for estuaries. The new plant proposed location has the same groundwater characteristics as the existing HCGS and the CDFs for the new reactor technologies are lower than that for the HCGS reactor. Therefore, the dose risk from the new reactor technologies via groundwater pathway is smaller than the dose risk from the existing HCGS reactor.

**7.2.3 CONCLUSIONS**

The total calculated dose risk to the 50-mi., year 2081 population from US-APWR airborne releases at the PSEG Site is  $1.15\text{E}+00$  person-rem/reactor-year ( $1.15\text{E}-02$  person-Sv/reactor-year) (Table 7.2-3). The US-APWR bounds the ABWR, AP1000 and U.S.EPR with respect to airborne releases. Similarly, the risks of persons exposed to doses greater than 25 rem (0.25 Sv) and 200 rem (2 Sv) for US-APWR are  $3.07\text{E}-03$  and  $9.23\text{E}-05$  person/reactor-year, respectively (Table 7.2-3).

The US-APWR population dose risk at the PSEG Site is less than that for all five reactors analyzed in NUREG-1150, *Severe Accident Risks; An Assessment for Five U.S. Nuclear Power Plants*. It is however greater than the minimum population risk of the current reactors that have undergone license renewal. Per NUREG-1811, *Environmental Impact Statement for an Early Site Permit (ESP) at the North Anna ESP Site*, and NUREG-1437, the lowest dose risk reported for reactors currently undergoing license renewal (e.g., Arkansas Nuclear One) is  $5.5\text{E}-01$  person-rem/reactor-year ( $5.5\text{E}-03$  person-Sv/reactor-year). The reason the US-APWR population dose risk is greater than the minimum dose risk in NUREG-1437 (Arkansas Nuclear One) is due to the significantly larger population within the 50-mi. radius of the PSEG Site (approximately three orders of magnitude).

As discussed in Subsection 7.2.2.2, the risk from surface water contamination resulting from an accident at the PSEG Site is less than the risk from the atmospheric pathway. The risk from the atmospheric pathway for a US-APWR severe accident is bounding. Therefore, the risk from surface water contamination is minor compared to the surface water pathway of the current U.S. nuclear fleet.

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As discussed in Subsection 7.2.2.3, the risk of groundwater contamination from a US-APWR severe accident is negligible, and is smaller than the associated risk from the currently licensed reactors.

To gauge the relative magnitude of the severe accident dose risk, the bounding severe accident population dose risk is compared to the population dose risk associated with normal operation of the new plant. As reported in Section 5.4, the total collective doses for the bounding reactor technology at the PSEG Site from normal operation due to liquid and gaseous effluents are  $4.55\text{E}+01$  person-rem/year ( $4.55\text{E}-01$  person-Sv/year) and  $2.04\text{E}+01$  person-rem/year ( $2.04\text{E}-01$  person-Sv/year), respectively. The sum of these two components is the total collective dose and is equal to  $6.59\text{E}+01$  person-rem/year ( $6.59\text{E}-01$  person-Sv/year). As previously described, dose risk is dose times frequency. Normal operation has a frequency of one. Therefore, the dose risk for normal operation is  $6.59\text{E}+01$  person-rem/year ( $6.59\text{E}-01$  person-Sv/year). Comparing this value to the bounding severe accident dose risk of  $1.15\text{E}+00$  person-rem/reactor-year ( $1.15\text{E}-02$  person-Sv/reactor-year) indicates that the bounding dose risk from severe accidents is 1.7 percent of dose risk from normal operation.

Per Table 7.2-3, the US-APWR severe accident produces a bounding economic risk of  $5.03\text{E}+03$  dollars/reactor-year for the new plant. Similarly, the bounding value for risk of farm land requiring decontamination is for the US-APWR severe reactor accident and is calculated to be  $7.34\text{E}-03$  hectares/reactor-year. The probability-weighted risks of early and latent cancer fatalities from a US-APWR severe accident at the PSEG Site are indicated in Table 7.2-3 as  $1.24\text{E}-09$  persons/reactor-year and  $7.36\text{E}-04$  persons/reactor-year, respectively. Note that because no member of the public resides within a mile of the PSEG Site, the prompt fatality risk for this area is zero and complies with the guideline established in Reference 7.2-3.

#### 7.2.4 REFERENCES

- 7.2-1. 50 FR 32138, Severe Reactor Accidents Regarding Future Designs and Existing Plants, Nuclear Regulatory Commission, August 8, 1985.
- 7.2-2. Chanin, D. I. and M. L. Young. Code Manual for MACCS2: Volume 1, User's Guide, SAND97-0594, Sandia National Laboratories, Albuquerque, New Mexico, March 1997.
- 7.2-3. Nuclear Regulatory Commission (NRC), "Safety Goals for the Operations of Nuclear Power Plants; Policy Statement; Republication", 51 FR 30028, August 1986.

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**Table 7.2-1 (Sheet 1 of 2)  
Severe Accident Release Categories for ABWR, AP1000, US-APWR, and U.S. EPR**

<b>Release Category</b>	<b>Accident Scenario Description</b>
<b>ABWR</b>	
NCL	No loss of containment.
Case 1	Transients followed by failure of high pressure coolant makeup and failure to depressurize in timely fashion.
Case 2	Short-term station blackout with reactor core isolation cooling (RCIC) failure, onsite power recovery in 8 hr.
Case 3	Station blackout with RCIC available for about 8 hr.
Case 4	Station blackout (more than 8 hr) with RCIC failure.
Case 5	Transients followed by failure of high pressure coolant makeup, successful depressurization of reactor, failure of low-pressure coolant makeup.
Case 6	Transient, loss-of-coolant accident (LOCA), and anticipated transient without scram (ATWS) events with successful coolant makeup, but potential prior failure of containment.
Case 7	Small/medium LOCA followed by failure of high-pressure coolant makeup and failure to depressurize.
Case 8	LOCA followed by failure of high pressure coolant makeup.
Case 9	ATWS followed by boron injection failure and successful high-pressure coolant makeup.
<b>AP1000</b>	
IC	Intact containment.
CFE	Early containment failure.
CFI	Intermediate containment failure.
CFL	Late containment failure.
CI	Containment isolation failure.
BP	Containment bypass.
<b>US-APWR</b>	
RC1	Containment bypass.
RC2	Containment isolation failure.
RC3	Containment failure before core damage.
RC4	Early containment failure.
RC5	Late containment failure.
RC6	Intact containment.
<b>U.S. EPR</b>	
RC101	No containment failure.
RC201	Containment fails before vessel breach due to isolation failure, melt retained in vessel.
RC202	Containment fails before vessel breach due to isolation failure, melt released from vessel, with MCCI, melt not flooded ex-vessel, with containment sprays.
RC203	Containment fails before vessel breach due to isolation failure, melt released from vessel, with MCCI, melt not flooded ex-vessel, without containment sprays.

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**Table 7.2-1 (Sheet 2 of 2)  
Severe Accident Release Categories for ABWR, AP1000, US-APWR, and U.S. EPR**

<b>Release Category</b>	<b>Accident Scenario Description</b>
RC204	Containment fails before vessel breach due to isolation failure, melt released from vessel, without MCCI, melt flooded ex-vessel with containment sprays.
RC205	Containment failures before vessel breach due to isolation failure, melt released from vessel, without MCCI, melt flooded ex-vessel without containment sprays.
RC206	Small containment failure due to failure to isolate 2" or smaller lines.
RC301	Containment fails before vessel breach due to containment rupture, with MCCI, melt not flooded ex-vessel, with containment sprays.
RC302	Containment fails before vessel breach due to containment rupture, with MCCI, melt not flooded ex-vessel, without containment sprays.
RC303	Containment fails before vessel breach due to containment rupture, without MCCI, melt flooded ex-vessel, with containment sprays.
RC304	Containment fails before vessel breach due to containment rupture, without MCCI, melt flooded ex-vessel, without containment sprays.
RC401	Containment failures after breach and up to melt transfer to the spreading area, with MCCI, without debris flooding, with containment spray.
RC402	Containment failures after breach and up to melt transfer to the spreading area, with MCCI, without debris flooding, without containment spray.
RC403	Containment failures after breach and up to melt transfer to the spreading area, without MCCI, with debris flooding, with containment spray.
RC404	Containment failures after breach and up to melt transfer to the spreading area, without MCCI, with debris flooding, without containment spray.
RC501	Long term containment failure during and after debris quench, due to rupture, with MCCI, without debris flooding, with containment sprays.
RC502	Long term containment failure during and after debris quench, due to rupture, with MCCI, without debris flooding, without containment sprays.
RC503	Long term containment failure during and after debris quench, due to rupture, without MCCI, with debris flooding, with containment sprays.
RC504	Long term containment failure during and after debris quench, due to rupture, without MCCI, with debris flooding, without containment sprays.
RC602	Long term containment failure due to basemat failure, without debris flooding, without containment sprays.
RC701	Steam Generator Tube Rupture with fission product scrubbing.
RC702	Steam Generator Tube Rupture without fission product scrubbing.
RC802	Interfacing System LOCA without fission product scrubbing.

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Table 7.2-2  
Severe Accident Release Categories and Frequencies for ABWR, AP1000, US-APWR, and U.S. EPR

Release Category	ABWR			AP1000			US-APWR			U.S. EPR		
	Frequency (Reactor Year)	Release Category	Frequency (Reactor Year)	Release Category	Frequency (Reactor Year)	Release Category	Frequency (Reactor Year)	Release Category	Frequency (Reactor Year)	Release Category	Frequency (Reactor Year)	Frequency (Reactor Year)
NCL	1.34E-07	IC	2.21E-07		RC1		7.5E-09	RC101			3.43E-07	
Case 1	2.08E-08	CFE	7.47E-09		RC2		2.1E-09	RC201			4.98E-10	
Case 2	1.00E-10	CFI	1.89E-10		RC3		2.0E-08	RC202			3.97E-14	
Case 3	1.00E-10	CFL	3.45E-13		RC4		1.1E-08	RC203			1.92E-12	
Case 4	1.00E-10	CI	1.33E-09		RC5		6.5E-08	RC204			2.78E-11	
Case 5	1.00E-10	BP	1.05E-08		RC6		1.1E-06	RC205			4.08E-10	
Case 6	1.00E-10							RC206			1.65E-08	
Case 7	3.91E-10							RC301			1.67E-12	
Case 8	4.05E-10							RC302			2.18E-11	
Case 9	1.70E-10							RC303			2.30E-09	
								RC304			1.75E-08	
								RC401			1.38E-11	
								RC402			2.75E-10	
								RC403			6.82E-10	
								RC404			1.34E-08	
								RC501			5.92E-13	
								RC502			2.87E-10	
								RC503			6.01E-10	
								RC504			1.19E-07	
								RC602			6.50E-10	
								RC701			1.02E-08	
								RC702			5.38E-09	
								RC802			2.64E-10	

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**Table 7.2-3 (Sheet 1 of 3)  
Environmental Consequence Risk Results**

Release Category	Population Dose Risk		Risk of Fatalities		Risk of Exceeding Threshold Doses		Economic Risk	Risk of Farm Land Requiring Decontamination
	Water Ingestion (Person-Sv)/(Reactor-Year)	Total	Early (Person)/(Reactor-Year)	Late (Person)/(Reactor-Year)	25 (rem) (Person)/(Reactor-Year)	200 (rem) (Person)/(Reactor-Year)	(Dollars)/(Reactor-Year)	Hectares/(Reactor-Year)
	ABWR							
NCL	1.37E-08	2.16E-05	0.00E+00	9.63E-07	0.00E+00	0.00E+00	3.43E-01	1.04E-06
Case 1	1.37E-11	1.78E-06	0.00E+00	7.40E-08	0.00E+00	0.00E+00	1.52E-02	0.00E+00
Case 2	2.19E-12	1.18E-08	0.00E+00	5.01E-10	0.00E+00	0.00E+00	1.14E-04	2.44E-11
Case 3	1.24E-10	2.03E-07	0.00E+00	9.01E-09	0.00E+00	0.00E+00	6.97E-03	3.14E-08
Case 4	7.01E-10	7.32E-07	0.00E+00	3.24E-08	3.49E-15	0.00E+00	8.62E-02	3.35E-07
Case 5	2.63E-09	1.54E-06	0.00E+00	6.81E-08	2.04E-13	0.00E+00	4.17E-01	1.18E-06
Case 6	1.38E-08	3.66E-06	0.00E+00	1.63E-07	2.54E-10	0.00E+00	1.89E+00	3.95E-06
Case 7	1.55E-07	2.10E-05	0.00E+00	9.34E-07	3.49E-09	5.83E-13	1.37E+01	2.13E-05
Case 8	3.37E-07	3.14E-05	1.56E-14	1.42E-06	3.58E-07	5.55E-11	2.27E+01	2.80E-05
Case 9	2.81E-07	1.64E-05	9.98E-14	7.48E-07	3.77E-07	1.77E-10	1.45E+01	1.37E-05
Total (1 Unit)	8.04E-07	9.83E-05	1.15E-13	4.41E-06	7.39E-07	2.33E-10	5.37E+01	6.95E-05

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**Table 7.2-3 (Sheet 2 of 3)  
Environmental Consequence Risk Results**

Release Category	Population Dose Risk		Risk of Fatalities		Risk of Exceeding Threshold Doses		Economic Risk	Risk of Farm Land Requiring Decontamination
	Water Ingestion (Person-Sv)/(Reactor-Year)	Total	Early (Person)/(Reactor-Year)	Late (Person)/(Reactor-Year)	25 (rem) (Person)/(Reactor-Year)	200 (rem) (Person)/(Reactor-Year)	(Dollars)/(Reactor-Year)	Hectares/(Reactor-Year)
	AP1000							
IC	2.32E-08	2.32E-05	0.00E+00	1.04E-06	0.00E+00	0.00E+00	2.61E-01	2.39E-06
CFE	1.58E-06	2.99E-04	1.11E-14	1.42E-05	3.55E-07	8.89E-10	1.71E+02	3.25E-04
CFI	2.68E-08	1.01E-05	0.00E+00	3.95E-07	5.37E-08	4.23E-11	6.10E+00	1.50E-05
CFL	5.97E-12	2.04E-08	0.00E+00	7.62E-10	0.00E+00	0.00E+00	2.12E-02	3.83E-08
CI	2.62E-07	5.40E-05	0.00E+00	3.13E-06	1.72E-06	6.54E-10	2.65E+01	5.49E-05
BP	1.05E-05	1.40E-03	8.36E-13	6.90E-05	8.23E-05	5.27E-08	8.26E+02	1.26E-03
Total (1 Unit)	1.24E-05	1.79E-03	8.47E-13	8.78E-05	8.44E-05	5.43E-08	1.03E+03	1.66E-03
Total (2 Units)	2.48E-05	3.57E-03	1.69E-12	1.76E-04	1.69E-04	1.09E-07	2.06E+03	3.31E-03
US-APWR								
RC1	9.98E-06	9.98E-04	2.57E-12	4.62E-05	6.05E-05	5.93E-08	6.62E+02	9.08E-04
RC2	7.12E-07	2.23E-04	1.93E-15	1.10E-05	2.31E-05	1.21E-08	1.00E+02	2.09E-04
RC3	6.46E-05	5.18E-03	1.24E-09	4.48E-04	2.96E-03	9.22E-05	2.56E+03	2.08E-03
RC4	3.69E-06	8.67E-04	1.06E-13	4.53E-05	2.88E-05	1.40E-08	4.13E+02	7.93E-04
RC5	8.39E-06	4.25E-03	0.00E+00	1.85E-04	8.91E-09	0.00E+00	1.29E+03	3.35E-03
RC6	1.25E-08	1.86E-05	0.00E+00	8.37E-07	0.00E+00	0.00E+00	1.78E-01	3.81E-07
Total (1 Unit)	8.74E-05	1.15E-02	1.24E-09	7.36E-04	3.07E-03	9.23E-05	5.03E+03	7.34E-03



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**Table 7.2-3 (Sheet 3 of 3)  
Environmental Consequence Risk Results**

Release Category	Population Dose Risk			Risk of Fatalities		Risk of Exceeding Threshold Doses		Economic Risk	Risk of Farm Land Requiring Decontamination
	Water Ingestion (Person-Sv)/(Reactor-Year)	Total	Early (Person)/(Reactor-Year)	Late (Person)/(Reactor-Year)	25 (rem) (Person)/(Reactor-Year)	200 (rem) (Person)/(Reactor-Year)	(Dollars)/(Reactor-Year)	Hectares/(Reactor-Year)	
	U.S. EPR								
RC101	1.11E-07	2.02E-04	0.00E+00	9.71E-06	0.00E+00	0.00E+00	3.77E+00	2.83E-05	
RC201	2.73E-07	1.88E-05	5.48E-14	8.37E-07	1.31E-06	2.47E-12	1.73E+01	1.41E-05	
RC202	4.53E-12	1.22E-09	0.00E+00	5.72E-11	2.75E-14	0.00E+00	7.27E-04	1.35E-09	
RC203	4.01E-10	9.22E-08	5.91E-19	4.63E-09	3.82E-09	5.55E-15	4.99E-02	8.26E-08	
RC204	3.28E-09	9.01E-07	0.00E+00	4.42E-08	6.59E-09	2.81E-16	5.25E-01	9.62E-07	
RC205	1.17E-07	2.33E-05	0.00E+00	1.20E-06	2.24E-06	3.99E-12	1.24E+01	1.93E-05	
RC206	1.08E-06	4.37E-04	0.00E+00	2.41E-05	3.53E-06	3.20E-09	2.44E+02	5.59E-04	
RC301	1.90E-10	5.13E-08	0.00E+00	2.40E-09	1.16E-12	0.00E+00	3.06E-02	5.69E-08	
RC302	4.56E-09	1.05E-06	6.71E-18	5.25E-08	4.34E-08	6.30E-14	5.67E-01	9.37E-07	
RC303	2.71E-07	7.45E-05	0.00E+00	3.66E-06	5.45E-07	2.32E-14	4.35E+01	7.96E-05	
RC304	5.02E-06	9.99E-04	0.00E+00	5.15E-05	9.59E-05	1.71E-10	5.30E+02	8.26E-04	
RC401	4.20E-10	1.99E-07	0.00E+00	8.90E-09	1.12E-12	0.00E+00	1.01E-01	2.54E-07	
RC402	2.63E-08	8.00E-06	0.00E+00	3.60E-07	6.66E-09	0.00E+00	4.40E+00	8.36E-06	
RC403	2.07E-08	9.82E-06	0.00E+00	4.40E-07	5.52E-11	0.00E+00	4.99E+00	1.25E-05	
RC404	1.28E-06	3.90E-04	0.00E+00	1.76E-05	3.24E-07	0.00E+00	2.14E+02	4.07E-04	
RC501	1.57E-12	3.30E-09	0.00E+00	1.47E-10	0.00E+00	0.00E+00	1.46E-04	3.13E-10	
RC502	7.63E-10	1.60E-06	0.00E+00	7.15E-08	0.00E+00	0.00E+00	7.06E-02	1.52E-07	
RC503	2.13E-10	3.92E-07	0.00E+00	1.76E-08	0.00E+00	0.00E+00	1.10E-02	8.95E-09	
RC504	4.21E-08	7.77E-05	0.00E+00	3.49E-06	0.00E+00	0.00E+00	2.18E+00	1.77E-06	
RC602	1.73E-09	3.62E-06	0.00E+00	1.62E-07	0.00E+00	0.00E+00	1.60E-01	3.43E-07	
RC701	5.01E-07	2.26E-04	0.00E+00	1.18E-05	5.75E-07	3.55E-11	1.22E+02	2.89E-04	
RC702	5.23E-06	8.55E-04	1.39E-11	7.59E-05	4.87E-04	1.19E-05	3.37E+02	3.79E-04	
RC802	1.38E-06	1.48E-04	3.99E-11	1.67E-05	8.03E-05	1.76E-05	3.14E+01	1.24E-05	
Total (1 Unit)	1.54E-05	3.48E-03	5.39E-11	2.18E-04	6.72E-04	2.95E-05	1.57E+03	2.64E-03	

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**Table 7.2-4  
Chemical Group Assignment<sup>(a)</sup>**

<b>Group</b>	<b>Nuclides</b>
1	Kr-85, Kr-85m, Kr-87, Kr-88, Xe-133, Xe-135
2	I-131, I-132, I-133, I-134, I-135
3	Rb-86, Cs-134, Cs-136, Cs-137
4	Sb-127, Sb-129, Te-127, Te-127m, Te-129, Te-129m, Te-131m, Te-132
5	Sr-89, Sr-90, Sr-91, Sr-92
6	Co-58, Co-60, Mo-99, Tc-99m, Ru-103, Ru-105, Ru-106, Rh-105
7	Y-90, Y-91, Y-92, Y-93, Zr-95, Zr-97, Nb-95, La-140, La-141, La-142, Pr-143, Nd-147, Am-241, Cm-242, Cm-244
8	Ce-141, Ce-143, Ce-144, Np-239, Pu-238, Pu-239, Pu-240, Pu-241
9	Ba-139, Ba-140

a) For the ABWR there are 7 groups. Groups 9 and 5 are combined into one (Group 5), and Groups 7 and 8 are combined into one (Group 7).

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Source Release Fractions

		ABWR						
Release Category	Plume No.	Group No. 1	Group No. 2	Group No. 3	Group No. 4	Group No. 5	Group No. 6	Group No. 7
NCL	1	4.40E-02	0.00E+00	2.30E-05	2.30E-05	0.00E+00	0.00E+00	0.00E+00
Case 1	1	1.00E+00	0.00E+00	1.50E-07	1.30E-05	0.00E+00	0.00E+00	0.00E+00
Case 2	1	1.00E+00	0.00E+00	5.00E-06	5.00E-06	0.00E+00	0.00E+00	0.00E+00
Case 3	1	1.00E+00	0.00E+00	2.80E-04	2.20E-03	0.00E+00	0.00E+00	0.00E+00
Case 4	1	1.00E+00	0.00E+00	1.60E-03	1.60E-03	0.00E+00	0.00E+00	0.00E+00
Case 5	1	1.00E+00	0.00E+00	6.00E-03	5.30E-04	0.00E+00	0.00E+00	0.00E+00
Case 6	1	1.00E+00	0.00E+00	3.10E-02	7.70E-02	0.00E+00	0.00E+00	0.00E+00
Case 7	1	1.00E+00	0.00E+00	8.90E-02	9.90E-02	0.00E+00	0.00E+00	0.00E+00
Case 8	1	1.00E+00	0.00E+00	1.90E-01	2.50E-01	0.00E+00	0.00E+00	0.00E+00
Case 9	1	1.00E+00	0.00E+00	3.70E-01	3.60E-01	0.00E+00	0.00E+00	0.00E+00

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**Table 7.2-5 (Sheet 2 of 4)  
Source Release Fractions**

AP1000										
Release Category	Plume No.	Group No. 1	Group No. 2	Group No. 3	Group No. 4	Group No. 5	Group No. 6	Group No. 7	Group No. 8	Group No. 9
CFI	1	5.40E-01	3.19E-03	3.18E-03	4.18E-04	2.11E-02	9.11E-03	3.53E-03	2.64E-05	1.62E-02
	2	2.58E-01	1.35E-04	1.35E-04	1.67E-05	6.50E-04	1.68E-04	4.53E-03	1.68E-05	3.40E-04
	3	8.40E-02	0.00E+00	0.00E+00	4.47E-06	0.00E+00	0.00E+00	6.00E-03	2.17E-05	0.00E+00
	4	3.83E-02	0.00E+00	0.00E+00	1.57E-06	0.00E+00	0.00E+00	5.22E-03	1.89E-05	0.00E+00
CFE	1	4.16E-01	5.53E-02	5.37E-02	1.23E-03	3.14E-03	1.16E-02	5.57E-05	9.54E-07	4.63E-03
	2	4.05E-01	1.26E-03	1.21E-03	1.61E-04	3.43E-04	2.58E-03	9.66E-06	4.56E-08	6.45E-04
	3	1.08E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	4	3.43E-02	0.00E+00	0.00E+00	6.04E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
IC	1	9.83E-04	1.20E-05	1.15E-05	8.04E-07	1.07E-05	1.31E-05	1.35E-06	5.85E-09	1.20E-05
	2	4.93E-04	0.00E+00	0.00E+00	4.83E-09	0.00E+00	0.00E+00	6.00E-09	3.20E-11	0.00E+00
	3	3.94E-04	0.00E+00	0.00E+00	1.21E-09	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	4	7.72E-04	0.00E+00	0.00E+00	6.04E-10	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
BP	1	1.00E+00	1.69E-01	1.62E-01	6.27E-03	3.57E-03	4.48E-02	1.30E-04	3.19E-06	8.93E-03
	2	0.00E+00	4.64E-02	3.38E-02	3.12E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.00E-06
	3	0.00E+00	2.31E-01	6.60E-02	5.32E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	4	0.00E+00	2.80E-03	9.96E-03	1.57E-03	0.00E+00	0.00E+00	0.00E+00	1.00E-06	0.00E+00
CI	1	5.73E-01	4.56E-02	2.10E-02	1.64E-03	2.03E-02	4.04E-02	2.39E-04	2.97E-06	3.16E-02
	2	1.13E-01	0.00E+00	0.00E+00	1.15E-05	0.00E+00	0.00E+00	1.00E-07	0.00E+00	0.00E+00
	3	5.66E-02	0.00E+00	0.00E+00	8.10E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	4	2.74E-02	0.00E+00	0.00E+00	1.27E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CFL	1	3.36E-04	1.20E-05	1.15E-05	1.00E-06	1.57E-05	1.68E-05	9.96E-07	7.41E-09	1.61E-05
	2	1.19E-03	5.00E-08	3.23E-08	1.75E-08	1.04E-06	2.90E-07	1.07E-05	4.05E-08	6.60E-07
	3	9.79E-01	2.13E-05	1.16E-05	2.47E-05	2.39E-03	1.26E-03	9.75E-02	3.68E-04	2.25E-03
	4	0.00E+00	0.00E+00	2.56E-07	1.20E-05	4.42E-04	1.55E-04	4.39E-02	1.66E-04	3.46E-04

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**Table 7.2-5 (Sheet 3 of 4)  
Source Release Fractions**

<b>US-APWR</b>										
<b>Release Category</b>	<b>Plume No.</b>	<b>Group No. 1</b>	<b>Group No. 2</b>	<b>Group No. 3</b>	<b>Group No. 4</b>	<b>Group No. 5</b>	<b>Group No. 6</b>	<b>Group No. 7</b>	<b>Group No. 8</b>	<b>Group No. 9</b>
RC1	1	6.88E-01	1.96E-01	1.56E-01	8.55E-02	3.49E-04	1.45E-02	1.47E-05	4.34E-05	2.90E-03
	2	2.48E-01	8.73E-02	3.91E-02	3.91E-02	4.55E-03	3.87E-03	2.25E-04	2.38E-04	8.82E-03
	3	2.72E-03	4.03E-03	8.47E-03	7.88E-03	3.71E-03	4.21E-03	2.12E-03	1.35E-03	3.50E-03
	4	4.87E-03	2.29E-03	2.66E-03	6.09E-04	1.85E-04	7.59E-05	6.23E-04	5.30E-04	9.68E-05
RC2	1	7.31E-01	3.61E-02	2.13E-02	3.56E-02	5.14E-03	1.50E-02	3.62E-03	1.95E-03	8.12E-03
	2	2.38E-01	3.22E-02	4.19E-03	7.24E-03	2.61E-04	7.07E-04	4.01E-04	3.65E-04	4.38E-04
	3	2.20E-02	1.65E-01	1.16E-02	2.86E-02	1.23E-03	4.00E-05	5.18E-05	1.58E-04	1.50E-03
	4	5.37E-03	4.70E-02	5.46E-03	5.88E-03	1.11E-03	6.12E-05	5.64E-05	2.47E-04	1.11E-03
RC3	1	9.38E-01	4.70E-01	4.58E-01	4.19E-01	4.22E-02	2.71E-01	1.49E-03	6.33E-03	1.02E-01
	2	4.74E-02	8.37E-03	6.51E-03	6.41E-03	1.77E-03	4.94E-03	6.60E-05	8.66E-05	3.49E-03
	3	1.45E-03	1.03E-03	1.11E-03	2.84E-03	4.37E-04	1.84E-04	6.37E-06	6.00E-05	2.24E-04
	4	5.54E-04	2.46E-04	1.80E-05	1.49E-03	5.37E-05	0.00E+00	2.33E-07	2.75E-06	2.42E-05
RC4	1	9.98E-01	3.79E-02	3.29E-02	4.88E-02	4.53E-03	2.38E-02	1.21E-04	3.67E-04	2.29E-02
	2	1.56E-03	1.66E-02	8.59E-03	3.77E-03	3.05E-04	2.79E-03	6.78E-07	3.49E-06	5.64E-04
	3	2.72E-04	7.50E-03	3.40E-03	7.78E-03	1.32E-03	1.08E-05	1.51E-05	4.73E-04	4.69E-04
	4	1.04E-04	6.34E-03	1.11E-03	2.78E-03	1.51E-06	0.00E+00	3.05E-08	9.57E-07	9.97E-07
RC5	1	9.28E-01	2.72E-03	1.06E-03	6.42E-03	8.05E-05	9.95E-05	2.99E-05	1.87E-05	6.61E-05
	2	3.53E-02	2.23E-02	4.21E-03	2.53E-03	1.45E-06	1.92E-06	5.29E-07	3.42E-07	1.60E-06
	3	1.83E-02	6.02E-02	8.03E-03	3.11E-03	5.15E-07	1.70E-06	5.69E-08	4.62E-08	1.30E-06
	4	6.47E-03	5.72E-02	6.42E-03	4.56E-03	1.64E-06	9.22E-07	2.10E-09	1.29E-08	3.67E-06
RC6	1	1.24E-04	1.68E-06	1.66E-06	1.30E-06	1.55E-07	6.31E-07	3.19E-09	5.31E-09	2.44E-07
	2	6.54E-04	1.46E-09	0.00E+00	6.96E-09	1.79E-08	6.46E-09	2.88E-10	2.76E-10	2.45E-08
	3	6.90E-04	1.86E-09	0.00E+00	5.08E-10	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	4	6.45E-04	0.00E+00	0.00E+00	8.88E-11	6.46E-11	4.43E-11	4.55E-13	1.23E-12	6.38E-11

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**Table 7.2-5 (Sheet 4 of 4)  
Source Release Fractions**

Release Category	Plume No.	U.S. EPR								
		Group No. 1	Group No. 2	Group No. 3	Group No. 4	Group No. 5	Group No. 6	Group No. 7	Group No. 8	Group No. 9
RC101	1	1.90E-03	2.40E-05	2.00E-05	5.30E-05	8.50E-06	4.40E-05	2.80E-07	7.30E-07	2.40E-05
RC201	1	3.60E-01	1.00E-01	9.50E-02	7.60E-03	7.80E-05	1.10E-03	3.40E-06	1.70E-05	4.10E-04
RC202	1	7.90E-01	2.30E-02	1.50E-02	2.00E-02	2.40E-04	3.40E-03	1.90E-05	6.80E-05	2.40E-03
RC203	1	8.90E-01	5.30E-02	2.80E-02	1.60E-01	1.40E-04	6.80E-03	1.50E-05	2.40E-04	2.20E-03
RC204	1	9.50E-01	2.80E-02	1.60E-02	3.60E-02	1.70E-04	5.30E-03	1.40E-05	6.20E-05	3.20E-03
RC205	1	9.80E-01	5.70E-02	3.60E-02	9.30E-02	4.00E-03	9.80E-03	3.00E-04	5.30E-04	6.10E-03
RC206	1	1.90E-01	5.60E-03	5.00E-03	9.00E-03	1.20E-03	7.30E-03	5.50E-05	1.80E-04	4.20E-03
RC301	1	7.90E-01	2.30E-02	1.50E-02	2.00E-02	2.40E-04	3.40E-03	1.90E-05	6.80E-05	2.40E-03
RC302	1	8.90E-01	5.30E-02	2.80E-02	1.60E-01	1.40E-04	6.80E-03	1.50E-05	2.40E-04	2.20E-03
RC303	1	9.50E-01	2.80E-02	1.60E-02	3.60E-02	1.70E-04	5.30E-03	1.40E-05	6.20E-05	3.20E-03
RC304	1	9.80E-01	5.70E-02	3.60E-02	9.30E-02	4.00E-03	9.80E-03	3.00E-04	5.30E-04	6.10E-03
RC401	1	8.00E-01	4.60E-03	2.30E-03	3.40E-03	2.70E-03	1.50E-03	8.00E-05	3.40E-04	5.20E-03
RC402	1	9.70E-01	2.00E-02	1.00E-02	1.20E-02	3.80E-03	2.10E-03	1.10E-04	4.90E-04	7.30E-03
RC403	1	8.00E-01	4.60E-03	2.30E-03	3.40E-03	2.70E-03	1.50E-03	8.00E-05	3.40E-04	5.20E-03
RC404	1	9.70E-01	2.00E-02	1.00E-02	1.20E-02	3.80E-03	2.10E-03	1.10E-04	4.90E-04	7.30E-03
RC501	1	9.90E-01	7.70E-04	4.00E-04	1.70E-02	7.40E-06	4.40E-05	2.20E-07	7.00E-07	2.40E-05
RC502	1	9.90E-01	7.70E-04	4.00E-04	1.70E-02	7.40E-06	4.40E-05	2.20E-07	7.00E-07	2.40E-05
RC503	1	1.00E+00	4.10E-04	6.90E-05	5.10E-05	8.50E-06	4.40E-05	2.80E-07	7.30E-07	2.40E-05
RC504	1	1.00E+00	4.10E-04	6.90E-05	5.10E-05	8.50E-06	4.40E-05	2.80E-07	7.30E-07	2.40E-05
RC602	1	9.90E-01	7.70E-04	4.00E-04	1.70E-02	7.40E-06	4.40E-05	2.20E-07	7.00E-07	2.40E-05
RC701	1	1.10E-01	4.20E-03	4.40E-03	6.90E-03	6.00E-04	4.80E-03	2.20E-05	1.10E-04	2.70E-03
RC702	1	1.10E-01	8.40E-02	8.70E-02	1.40E-01	1.20E-02	9.60E-02	4.50E-04	2.20E-03	5.40E-02
RC802	1	9.80E-01	7.10E-01	6.90E-01	6.40E-01	1.30E-01	5.70E-01	3.90E-03	2.20E-02	3.80E-01

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**7.3 SEVERE ACCIDENT MITIGATION ALTERNATIVES**

This section is not required for an ESPA.

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## 7.4 TRANSPORTATION ACCIDENTS

This section describes the environmental impacts of postulated transportation accidents involving the shipment of radioactive materials including unirradiated fuel, irradiated (spent) fuel and radioactive waste to and from the PSEG Site and alternative sites. The evaluations in this section assume that all fuel and radioactive waste shipments are by truck.

The evaluations of transportation accidents for the new plant are based on bounding information from the PPE in Section 1.3 of the SSAR. The reactor technologies considered are the ABWR, AP1000, U.S. EPR, and US-APWR. A description of PPE development and intended use is provided in Section 1.3 of the SSAR.

The NRC evaluated the environmental effects of fuel and waste transportation for light-water-cooled reactors in WASH-1238, *Environmental Survey of Transportation of Radioactive Materials to and from Nuclear Plants* (Reference 7.4-6), and NUREG-75/038, *Environmental Survey of Transportation of Radioactive Materials to and from Nuclear Power Plants, Supplement 1*, and found the impacts to be SMALL. These documents provide the basis for Table S-4 in 10 CFR 51.52, *Environmental Effects of Transportations of Fuel and Waste – Table S-4*, which summarizes the environmental impacts of fuel and waste transportation to and from one LWR of 3000 to 5000 MWt (1000 to 1500 megawatt electric [MWe]). Impacts are provided for normal transport conditions and accidents in transport for a reference 1100 MWe LWR at an 80 percent capacity factor.

As stated in 10 CFR 51.52:

“Under § 51.50, every environmental report prepared for the construction permit stage or early site permit stage or combined license stage of a light-water-cooled nuclear power reactor, and submitted after February 4, 1975, shall contain a statement concerning transportation of fuel and radioactive wastes to and from the reactor. That statement shall indicate that the reactor and this transportation either meet all of the conditions in paragraph (a) of this section or all of the conditions of paragraph (b) of this section.”

10 CFR 51.52(a)(1) through (5) delineate specific conditions the reactor licensee must meet to use Table S-4 as part of its ER. For reactors not meeting all of the conditions in 10 CFR 51.52 paragraph (a), paragraph (b) requires a further analysis of the transportation effects.

The technologies under consideration for the PSEG Site differ from some of the conditions of 10 CFR 51.52(a). Therefore, 10 CFR 51.52 (b) requires “... a full description and detailed analysis of the environmental effects of transportation of fuel and wastes to and from the reactor, including values for the environmental impact under normal conditions of transport and for the environmental risk from accidents in transport. The statement shall indicate that the values determined by the analysis represent the contribution of such effects to the environmental costs of licensing the reactor.”

A comparison to the parameters in Table S-4 for each of the reactor technologies being considered, including a discussion of the acceptability of the parameters that differ from Table S-4, is provided in Subsection 5.7.2.1. Table S-4 provides the environmental impact for “... one light-water-cooled nuclear powered reactor.” A dual unit AP1000 is also being considered for the



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PSEG Site. A single unit AP1000 is evaluated for transportation accidents in this section to be consistent with the Table S-4 basis.

These environmental impacts are determined using the TRAGIS (Reference 7.4-3) and RADTRAN (References 7.4-4 and 7.4-5) computer codes. The input and output streams for these codes are contained in Appendix 7A to this report.

#### 7.4.1 RADIOLOGICAL IMPACTS

Accident risks are the product of accident frequency and the consequence of the accident. NUREG-1815, *Environmental Impact Statement for an Early Site Permit (ESP) at the Exelon ESP Site*, Appendix G, 2006, indicates that accident frequencies are likely to be lower than those used in the WASH-1238 analysis, because traffic accident, injury, and fatality rates have fallen over the past 30 years.

##### 7.4.1.1 Transportation of Unirradiated Fuel

Consequences of accidents that are severe enough to result in a release of unirradiated fuel particles are not significantly different for advanced LWRs because the fuel form, cladding, and packaging are similar to those analyzed in WASH-1238. Consequently, the risks of accidents during transport of unirradiated fuel to advanced LWR sites are smaller than the WASH-1238 results that formed the basis for Table S-4.

##### 7.4.1.2 Transportation of Irradiated Fuel

The detailed analyses required by 10 CFR 51.52 are performed using TRAGIS (Reference 7.4-3) and RADTRAN (References 7.4-4 and 7.4-5) computer codes. The ABWR is the bounding reactor technology from the perspective of transportation accident consequences. The ABWR specific design information is used for the irradiated fuel accident analysis.

The evaluation model assumes that irradiated fuel is shipped to the proposed Yucca Mountain repository. The impacts of the transportation of spent fuel to a possible repository in Nevada (NV) provide a reasonable estimate of the transportation risks to a monitored retrievable storage facility because of the distances involved. The distance from the PSEG Site to the proposed repository is 2780 mi. (4474 km) as determined by the TRAGIS computer code for a highway route controlled quantity (HRCQ).

State-specific accident data from Table 4 of ANL/ESD/TM-150, *State-Level Accident Rates of Surface Freight Transportation: A Reexamination*, (Reference 7.4-1) is shown in Table 7.4-1. Only the interstate data is used because the HRCQ route is mainly on Interstate roads. The DOE Federal Motor Carrier Safety Administration evaluated the data underlying the Saricks and Tompkins (Reference 7.4-1) rates, which were taken from the Motor Carrier Management Information System (Reference 7.4-7), and determined that the rates were under-reported. Therefore, the accident, injury, and fatality rates in Saricks and Tompkins were adjusted using factors derived from data provided by the University of Michigan Transportation Research Institute (UMTRI) (Reference 7.4-8). The UMTRI data indicates that accident rates for 1994 to 1996, the same data used by Saricks and Tompkins, were under-reported by about 39 percent. Injury and fatality rates were under-reported by 16 and 36 percent, respectively. As a result, the

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accident, injury, and fatality rates were increased by factors of 1.64, 1.20, and 1.57, respectively, to account for the under-reporting.

Fuel shipments are summarized in Tables 5.7-5 and 5.7-6. The average annual quantity of irradiated fuel shipped is assumed to equal the average annual reload quantity, which is consistent with NUREG-1815. For the ABWR, this is 44.7 MTU of irradiated fuel per year. The initial irradiated fuel activity is decayed 5 years to account for the minimum decay period prior to shipment to the repository at Yucca Mountain, NV. The source term used for the analysis (i.e., with 5 years decay) is provided in Table 7.4-2. This source term bounds spent fuel inventories with a burnup of 55 GWt/MTU.

The radionuclides chosen are those in Table G-9 of NUREG-1815 with the addition of those in the RADTRAN 5.6 library (Table 7.4-2). In Appendix G of NUREG-1815, the NRC performed a screening analysis showing that these are the dominant nuclides.

In addition to the source term assumed above, Cobalt-60 is used to represent fuel surface contamination. Using Cobalt-60 in the model is consistent with previously performed studies that quantified fuel rod contamination levels and concluded that the maximum contribution from contamination is Cobalt-60 (Reference 7.4-2). NUREG/CR-6672, *Reexamination of Spent Fuel Shipment Risk Estimates*, 2002, estimates the maximum contamination from Cobalt-60 for PWR fuel at zero year decay is approximately 0.2 Ci/rod ( $7.4\text{E}+09$  Bq/rod) (Reference 7.4-2). The Cobalt-60 surface contamination used corresponds to the US-APWR value of approximately 0.3 Ci/rod ( $1.13\text{E}+10$  Bq/rod) prior to decay.

The accident severity categories and associated release fractions from Table 7.31 of NUREG/CR-6672 are used and shown in Table 7.4-3. The model severity fractions, release fractions, aerosol fractions, and respirable fractions are the conditional probabilities for specific severity categories of a postulated transportation accident. Other RADTRAN parameters used are the default values from the RADCAT 2.3 User Guide (Reference 7.4-5), and from Appendix G of NUREG-1815.

The dose impact from postulated transportation accidents involving irradiated fuel is  $4.49\text{E}-06$  person-rem per MTU shipped ( $4.49\text{E}-08$  person-Sv per MTU shipped). Using the average annual reload requirements for the ABWR of 44.7 MTU, the annual population dose impact is  $2.01\text{E}-04$  person-rem/year ( $2.01\text{E}-06$  person-Sv/year) from postulated transportation accidents involving irradiated fuel. These results are summarized in Table 7.4-5.

#### 7.4.1.3 Transportation of Radioactive Waste

The detailed analyses required by 10 CFR 51.52 are performed using TRAGIS (Reference 7.4-3) and RADTRAN (References 7.4-4 and 7.4-5) computer codes.

Radwaste shipments are summarized in Tables 5.7-4 and 5.7-7. The US-APWR is the bounding reactor technology with respect to annual radwaste volume. However, the overall activity is determined, on a radionuclide basis, across the four reactor technologies. The bounding value for each radionuclide in the PPE (SSAR Table 1.3-3) is used for the radwaste accident analysis.

New Jersey is a member of the Atlantic Interstate Low Level Radioactive Waste Management Compact. The PSEG Site repository is Barnwell, South Carolina (SC). The distance from the

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PSEG Site to the Barnwell repository is 689 mi. (1109 km) as determined by the TRAGIS computer code for a commercial route.

The accident severity categories and associated release fractions from Table 7.31 of NUREG/CR-6672 are used and shown in Table 7.4-3. The model severity fractions, release fractions, aerosol fractions, and respirable fractions are the conditional probabilities, given an accident occurs, for specific severity categories. Gases are not deposited and have a 0.0 m/s deposition velocity. Other RADTRAN parameters used are the default values from the RADCAT 2.3 User Guide (Reference 7.4-5), and from Appendix G of NUREG-1815.

State-specific accident data from Table 4 of ANL/ESD/TM-150 (Reference 7.4-1) are shown in Table 7.4-1. Only the interstate data are used because the commercial route is mainly on Interstate roads.

The evaluation determined that the average annual population dose impact is  $1.48\text{E-}05$  person-rem/year ( $1.48\text{E-}07$  person-Sv/year) from postulated transportation accidents involving radwaste. These results are summarized in Tables 7.4-5.

#### 7.4.2 NON-RADIOLOGICAL IMPACTS

Non-radiological impacts associated with the postulated accidents are calculated for:

- Injuries and fatalities during transportation of unirradiated fuel
- Injuries and fatalities during transportation of irradiated fuel
- Injuries and fatalities during transportation of radwaste

The non-radiological impacts from postulated accidents during transportation are evaluated using the TRAGIS code (Reference 7.4-3) to define appropriate routing and population density along the route, and the RADTRAN code (References 7.4-4 and 7.4-5) to calculate the non-radiological impacts (e.g., injuries and fatalities). The injury rate is calculated by substituting the state specific injury rates in Table 7.4-1 for the state specific fatality rates in the RADTRAN "fatalities per accident" array.

The non-radiological impacts are based on round-trip distances because the return of the empty truck is included in the evaluation. Therefore, the frequency (fatalities/reactor-yr and injuries/reactor-yr) is multiplied by two.

##### 7.4.2.1 Transportation of Unirradiated Fuel

It is assumed that all new fuel shipments came from the fuel fabrication facility located in Richland, Washington, which is the furthest fabrication facility from the PSEG Site.

The annual unirradiated fuel shipment requirements are summarized in Table 5.7-5. A review of the unirradiated fuel shipment requirements for the reactor technologies being considered indicates that the bounding case for the number of shipments is the U.S. EPR with 7.5 shipments/yr. The non-radiological fatality rate and injury rate per shipment, per 10 reactor-years (for injuries) and per 100 reactor-years (for fatalities) are provided in Tables 7.4-6 and 7.4-7.

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**7.4.2.2           Transportation of Irradiated Fuel**

The routing and accident parameters are the same as those used to analyze the radiological impacts of transporting irradiated fuel described in Subsection 7.4.1.2 above.

The annual irradiated fuel shipments are summarized in Table 5.7-6. The US-APWR average annual quantity of irradiated fuel shipped is assumed to equal the average annual reload quantity, consistent with NUREG-1815. A review of the annual unirradiated fuel requirements for the reactor technologies being considered indicates that the bounding case for the number of shipments is the ABWR with 44.7 MTU/yr.

Shipping cask capacity assumptions are based on current shipping cask designs. The irradiated fuel cask capacity is assumed to be 1.8 MTU (4000 lbs U) consistent with NUREG-1815. The irradiated fuel shipments are summarized in Table 5.7-6. As shown in Table 5.7-6, the bounding case for the new plant is the ABWR with 24.8 shipments/yr.

The non-radiological fatality rate and injury rate per shipment, per 10 reactor-years (for injuries) and per 100 reactor-years (for fatalities), are provided in Tables 7.4-6 and 7.4-7.

**7.4.2.3           Transportation of Radioactive Waste**

The routing and accident parameters are the same as those used to analyze the radiological impacts of transporting radioactive waste described in Subsection 7.4.1.3 above.

For the purposes of this evaluation, each radwaste container is assumed to be shipped separately, (i.e., one container per truck.) The total number of radwaste containers is determined by assuming that dry active waste is shipped in a Sea-Land container with an internal useable volume of 28.32 cubic meters ( $m^3$ ) (1000 cubic feet [ $ft^3$ ]). All other waste (e.g., resins, filters, etc.) are shipped in high integrity containers (HICs) with a useable internal volume of 2.55  $m^3$  (90  $ft^3$ ). The annual radwaste shipment requirements are summarized in Table 5.7-7.

The radioactive waste shipments are summarized in Table 5.7-7. A review of the annual radwaste requirements for the technologies being considered indicates that the bounding case is the U.S. APWR with 21.8 shipments/yr.

The non-radiological injury rate and fatality rate per shipment, per 10 reactor-years (for injuries) and per 100 reactor-years (for fatalities), are provided in Tables 7.4-6 and 7.4-7.

**7.4.2.4           Comparison to 10 CFR 51.52 Table S-4**

For an equal comparison to the reference reactor in 10 CFR 51.52 Table S-4, the normalized number of shipments in Table 5.7-13 is used to determine the environmental impacts due to transportation accidents. Table 7.4-9 and Table 7.4-10 indicate the fatal and non-fatal injury consequences, respectively, for unirradiated fuel, irradiated fuel, and radwaste shipments. Table 7.4-11 summarizes the environmental impacts from transportation accidents for the new plant bounding values based on the normalized number of shipments.

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**7.4.3 SUMMARY AND CONCLUSION**

A detailed accident analysis of the environmental impacts for the transportation of unirradiated fuel, irradiated fuel, and radioactive waste transported to and from the PSEG Site is performed in accordance with 10 CFR 51.52(b). An evaluation of the environmental impact due to transportation of unirradiated fuel, irradiated fuel, and radwaste at Alternative Sites 7-1, 7-2, 7-3, and 4-1 indicates that the Alternative Sites are not obviously superior to the PSEG Site.

The results of the radiological accident analysis are summarized in Table 7.4-5, and the results of the non-radiological accident analysis are summarized in Tables 7.4.9 and 7.4-10. The values determined by these analyses represent the contribution of such effects to the environmental costs of licensing the reactor.

These environmental impact results of these accidents exceed the values in Table S-4 in 10 CFR 51.52(c), as shown in Table 7.4-11. Subsection 5.7.2.4 addresses key reasons that the consequences from the transportation analysis exceed Table S-4 values.

Therefore, the corresponding impacts from accidents associated with the transportation of fuel and waste, to and from the proposed new plant, are SMALL.

**7.4.4 REFERENCES**

- 7.4-1 Argonne National Laboratory, "State-Level Accident Rates of Surface Freight Transportation: A Reexamination," ANL/ESD/TM-150, 1999.
- 7.4-2 Nuclear Regulatory Commission, "Re-Examination of Spent Fuel Shipment Risk Estimates," NUREG/CR-6672, 2000.
- 7.4-3 Oak Ridge National Laboratory, P. Johnson, and R. Michelhaugh, "Transportation Routing Analysis Geographic Information System (TRAGIS) User's Manual," ORNL/NTRC-006, 2003.
- 7.4-4 Sandia National Laboratories, K. S. Neuhauser, F.L. Kanipe, and R. F. Weiner, "RADTRAN 5," SAND2000-1256, 2000.
- 7.4-5 Sandia National Laboratories, R. Weiner, D. Osborn, G. Mills, D. Hinojosa, T. Heames, and D. Orcutt, "RADCAT 2.3 User Guide," SAND2006-6315, 2006. (bundled with RADTRAN 5.6).
- 7.4-6 U.S. Atomic Energy Commission, Environmental Survey of Transportation of Radioactive Materials to and from Nuclear Power Plants, WASH-1238, U.S. Atomic Energy Commission, Washington, D.C., December 1972.
- 7.4-7 MCMIS. 2009. U.S. Department of Transportation Federal Motor Carrier Safety Administration. *Motor Carrier Management Information System*. Accessed at <http://mciscatalog.fmcsa.dot.gov/>.

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- 7.4-8 University of Michigan Transportation Research Institute (UMTRI). 2003. *Evaluation of Motor Carrier Management Information System Crash Fire, Phase One*. UMTRI 2003-6. Ann Arbor, Michigan.

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**Table 7.4-1  
PSEG Site Model  
Accident, Fatality and Injury Rates**

<b>State</b>	<b>Accident Rate Accident/Truck-mi. (Accident/Truck-km)</b>	<b>Fatality Rate Fatality/Truck-mi. (Fatality/Truck-km)</b>	<b>Fatality Rate Fatality /Accident<sup>(a)</sup></b>	<b>Injury Rate Injury /Truck-mi. (Injury/Truck-km)</b>	<b>Injury Rate Injury/Accident<sup>(b)</sup></b>
AZ	2.12E-07 (1.32E-07)	1.51E-08 (9.40E-09)	7.12E-02	1.88E-07 (1.17E-07)	8.86E-01
DE	8.34E-07 (5.18E-07)	9.01E-09 (5.60E-09)	1.08E-02	5.5E-07 (3.42E-07)	6.60E-01
ID	4.75E-07 (2.95E-07)	6.12E-09 (3.80E-09)	1.29E-02	4.94E-07 (3.07E-07)	1.04E+00
IL	3.57E-07 (2.22E-07)	1.34E-08 (8.30E-09)	3.74E-02	2.41E-07 (1.50E-07)	6.76E-01
IN	3.62E-07 (2.25E-07)	1.08E-08 (6.70E-09)	2.98E-02	2.25E-07 (1.40E-07)	6.22E-01
IA	1.80E-07 (1.12E-07)	1.51E-08 (9.40E-09)	8.39E-02	1.38E-07 (8.60E-08)	7.68E-01
MD	8.69E-07 (5.40E-07)	1.05E-08 (6.50E-09)	1.20E-02	7.39E-07 (4.59E-07)	8.50E-01
NC	5.57E-07 (3.46E-07)	2.37E-08 (1.49E-08)	4.25E-02	5.10E-07 (3.17E-07)	9.16E-01
NE	5.13E-07 (3.19E-07)	2.20E-08 (1.37E-08)	4.29E-02	3.17E-07 (1.97E-07)	6.18E-01
NJ	9.09E-07 (5.65E-07)	1.95E-08 (1.21E-8)	2.14E-02	6.29E-07 (3.91E-07)	6.92E-01
NV	3.62E-07 (2.25E-07)	1.06E-08 (6.60E-09)	2.93E-02	2.38E-07 (1.48E-07)	6.58E-01
OH	2.64E-07 (1.64E-07)	6.28E-09 (3.90E-09)	2.38E-02	2.25E-07 (1.40E-07)	8.54E-01
OR	5.07E-07 (3.15E-07)	3.28E-08 (2.04E-08)	6.48E-02	3.65E-07 (2.27E-07)	7.21E-01
PA	8.27E-07 (5.14E-07)	2.17E-08 (1.35E-08)	2.63E-02	6.16E-07 (3.83E-07)	7.45E-01
SC	5.07E-07 (3.15E-07)	1.42E-08 (8.8E-09)	2.79E-02	3.65E-07 (2.27E-07)	7.21E-01
UT	4.67E-07 (2.90E-07)	1.92E-08 (1.19E-08)	4.10E-02	4.07E-07 (2.53E-07)	8.72E-01
VA	6.32E-07 (3.93E-07)	2.59E-08 (1.61E-08)	4.10E-02	4.99E-07 (3.10E-07)	7.89E-01
WA	4.26E-07 (2.65E-07)	2.70E-08 (1.68E-08)	6.34E-02	2.90E-07 (1.80E-07)	6.79E-01
WV	2.77E-07 (1.72E-07)	2.90E-09 (1.80E-09)	1.05E-02	1.80E-07 (1.12E-07)	6.51E-01
WY	1.08E-06 (6.74E-07)	1.74E-08 (1.08E-08)	1.60E-02	5.20E-07 (3.23E-07)	4.79E-01

a) Fatality/Accident = Fatality/Truck-km / Accident/Truck-km

b) Injury/Accident = Injury/Truck-km / Accident/Truck-km

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**Table 7.4-2  
PSEG Site Model  
Irradiated Fuel Source Term**

<b>Nuclide</b>	<b>ABWR Inventory (Ci/MTU)</b>	<b>ABWR Inventory (Bq/MTU)</b>
Am-241	1.44E+03	5.33E+13
Am-242m	3.30E+01	1.22E+12
Am-243	6.00E+01	2.22E+12
Ce-144	1.32E+04	4.88E+14
Cm-242	6.20E+01	2.29E+12
Cm-243	6.20E+01	2.29E+12
Cm-244	1.35E+04	5.00E+14
Cm-245	2.00E+00	7.40E+10
Co-60 (crud)	1.69E+02	6.25E+12
Co-60 (particulate)	3.63E+03	1.34E+14
Cs-134	7.76E+04	2.87E+15
Cs-137	1.58E+05	5.85E+15
Eu-154	1.56E+04	5.77E+14
Eu-155	8.27E+03	3.06E+14
Pm-147	3.13E+04	1.16E+15
Pu-238	1.09E+04	4.03E+14
Pu-239	4.27E+02	1.58E+13
Pu-240	8.52E+02	3.15E+13
Pu-241	1.35E+05	5.00E+15
Pu-242	3.00E+00	1.11E+11
Ru-106	2.29E+04	8.47E+14
Sb-125	7.17E+03	2.65E+14
Sr-90	1.06E+05	3.92E+15
Y-90	1.06E+05	3.92E+15
Total	7.12E+05	2.64E+16



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**Table 7.4-3  
PSEG Site Model  
Severity and Release Fractions<sup>(a)</sup>**

Severity Category	Severity Fraction	Gas	Release Fractions			Corrosion Product
			Cesium	Ruthenium	Particulate	
0	1.53E-08	0.8	2.40E-08	6.00E-07	6.00E-07	2.00E-03
1	5.88E-05	0.14	4.10E-09	1.00E-07	1.00E-07	1.40E-03
2	1.81E-06	0.18	5.40E-09	1.30E-07	1.30E-07	1.80E-03
3	7.49E-08	0.84	3.60E-05	3.80E-06	3.80E-06	3.20E-03
4	4.65E-07	0.43	1.30E-08	3.20E-07	3.20E-07	1.80E-03
5	3.31E-09	0.49	1.50E-08	3.70E-07	3.70E-07	2.10E-03
6	0	0.85	2.70E-05	2.10E-06	2.10E-06	3.10E-03
7	1.13E-08	0.82	2.40E-08	6.10E-07	6.10E-07	2.00E-03 <sup>(b)</sup>
8	8.03E-11	0.89	2.70E-08	6.70E-07	6.70E-07	2.20E-03
9	0	0.91	5.90E-06	6.80E-07	6.80E-07	2.50E-03
10	1.44E-10	0.82	2.40E-08	6.10E-07	6.10E-07	2.00E-03
11	1.02E-12	0.89	2.70E-08	6.70E-07	6.70E-07	2.20E-03
12	0	0.91	5.90E-06	6.80E-07	6.80E-07	2.50E-03
13	7.49E-11	0.84	9.60E-05	8.40E-05	1.80E-05	6.40E-03
14	0	0.85	5.50E-05	5.00E-05	9.00E-06	5.90E-03
15	0	0.91	5.90E-06	6.40E-06	6.80E-07	3.30E-03
16	0	0.91	5.90E-06	6.40E-06	6.80E-07	3.30E-03
17	5.86E-06	0.84	1.70E-05	6.70E-08	6.70E-08	2.50E-03
18	0.99993	0	0	0	0	0

a) Aerosol and Respirable Fractions set to 1.0.

b) A conservative value for the crud release fraction of 2.00E-02 was used to calculate the transportation accident risks in RADTRAN. See Appendix 7A.

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**Table 7.4-4 Not Used.**

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**Table 7.4-5  
PSEG Site Model  
Radiological Accident Analysis Results**

<b>Environmental Impact</b>	<b>Unirradiated Fuel</b>	<b>Irradiated Fuel</b>	<b>Radwaste</b>	<b>Total</b>
Person-rem per reactor-year (person-Sv per reactor-year)	See below	2.01E-04 (2.01E-06)	1.48E-05 (1.48E-07)	2.16E-04 (2.16E-06)

The dose from unirradiated fuel accidents is assumed to be negligible compared to the doses from Irradiated Fuel and Radioactive Waste as described in Subsection 7.4.1.1.

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**Table 7.4-6  
PSEG Site Model  
Non-Radiological Accident Analysis Results: Fatalities**

	<b>Fatalities per Shipment</b>	<b>Shipments per Year</b>	<b>Fatalities per Year<sup>(a)</sup></b>	<b>Fatalities per 100 Years</b>
<b>ABWR</b>				
New Fuel	7.33E-05	6.1	8.94E-04	8.94E-02
Spent Fuel	7.35E-05	24.8	3.65E-03	3.65E-01
Radwaste	2.09E-05	23.7	9.91E-04	9.91E-02
Total				5.54E-01
<b>Single AP1000 Unit</b>				
New Fuel	7.33E-05	3.8	5.57E-04	5.57E-02
Spent Fuel	7.35E-05	13.6	2.00E-03	2.00E-01
Radwaste	2.09E-05	7.9	3.30E-04	3.30E-02
Total				2.89E-01
<b>U.S. EPR</b>				
New Fuel	7.33E-05	7.5	1.10E-03	1.10E-01
Spent Fuel	7.35E-05	20.8	3.06E-03	3.06E-01
Radwaste	2.09E-05	12.1	5.06E-04	5.06E-02
Total				4.67E-01
<b>US-APWR</b>				
New Fuel	7.33E-05	5.3	7.77E-04	7.77E-02
Spent Fuel	7.35E-05	19.4	2.85E-03	2.85E-01
Radwaste	2.09E-05	21.8	9.11E-04	9.11E-02
Total				4.54E-01

a) The fatalities per year are calculated assuming a round trip for the truck

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**Table 7.4-7  
PSEG Site Model  
Non-Radiological Accident Analysis Results: Injuries**

	<b>Injuries per Shipment</b>	<b>Shipments per Year</b>	<b>Injuries per Year<sup>(a)</sup></b>	<b>Injuries per 10 Years</b>
<b>ABWR</b>				
New Fuel	1.22E-03	6.1	1.49E-02	1.49E-01
Spent Fuel	1.22E-03	24.8	6.05E-02	6.05E-01
Radwaste	4.25E-04	23.7	2.01E-02	2.01E-01
Total				9.55E-01
<b>Single AP1000 Unit</b>				
New Fuel	1.22E-03	3.8	9.27E-03	9.27E-02
Spent Fuel	1.22E-03	13.6	3.32E-02	3.32E-01
Radwaste	4.25E-04	7.9	6.72E-03	6.72E-02
Total				4.92E-01
<b>U.S. EPR</b>				
New Fuel	1.22E-03	7.5	1.83E-02	1.83E-01
Spent Fuel	1.22E-03	20.8	5.08E-02	5.08E-01
Radwaste	4.25E-04	12.1	1.03E-02	1.03E-01
Total				7.94E-01
<b>US-APWR</b>				
New Fuel	1.22E-03	5.3	1.29E-03	1.29E-02
Spent Fuel	1.22E-03	19.4	4.73E-02	4.73E-01
Radwaste	4.25E-04	21.8	1.85E-02	1.85E-01
Total				7.87E-01

a) The injuries per year are calculated assuming a round trip for the truck

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**Table 7.4-8 Not Used.**

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**Table 7.4-9  
PSEG Site Model  
Non-Radiological Accident Analysis Results for  
Normalized Number of Shipments: Fatalities**

	<b>Fatalities per Shipment</b>	<b>Normalized Shipments per Year</b>	<b>Fatalities per Year<sup>(a)</sup></b>	<b>Fatalities per 100 Years</b>
<b>ABWR</b>				
New Fuel	7.33E-05	4.3	6.30E-04	6.30E-02
Spent Fuel	7.35E-05	54.5	8.01E-03	8.01E-01
Radwaste	2.09E-05	15.5	6.48E-04	6.48E-02
Total				9.29E-01
<b>Single AP1000 Unit</b>				
New Fuel	7.33E-05	3.5	5.13E-04	5.13E-02
Spent Fuel	7.35E-05	39.0	5.73E-03	5.73E-01
Radwaste	2.09E-05	6.7	2.80E-04	2.80E-02
Total				6.52E-01
<b>U.S. EPR</b>				
New Fuel	7.33E-05	4.9	7.18E-04	7.18E-02
Spent Fuel	7.35E-05	42.7	6.28E-03	6.28E-01
Radwaste	2.09E-05	7.2	3.01E-04	3.01E-02
Total				7.30E-01
<b>US-APWR</b>				
New Fuel	7.33E-05	3.5	5.13E-04	5.13E-02
Spent Fuel	7.35E-05	39.8	5.85E-03	5.85E-01
Radwaste	2.09E-05	12.8	5.35E-04	5.35E-02
Total				6.90E-01

a) The fatalities per year are calculated assuming a round trip for the truck

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**Table 7.4-10  
PSEG Site Model  
Non-Radiological Accident Analysis Results for Normalized  
Number of Shipments: Injuries**

	Injuries per Shipment	Normalized Shipments per Year	Injuries per Year <sup>(a)</sup>	Injuries per 10 Years
<b>ABWR</b>				
New Fuel	1.22E-03	4.3	1.05E-02	1.05E-01
Spent Fuel	1.22E-03	54.5	1.33E-01	1.33E+00
Radwaste	4.25E-04	15.5	1.32E-02	1.32E-01
Total				1.57E+00
<b>Single AP1000 Unit</b>				
New Fuel	1.22E-03	3.5	8.54E-03	8.54E-02
Spent Fuel	1.22E-03	39.0	9.52E-02	9.52E-01
Radwaste	4.25E-04	6.7	5.70E-03	5.70E-02
Total				1.09E+00
<b>U.S. EPR</b>				
New Fuel	1.22E-03	4.9	1.20E-02	1.20E-01
Spent Fuel	1.22E-03	42.7	1.04E-01	1.04E+00
Radwaste	4.25E-04	7.2	6.12E-03	6.12E-02
Total				1.22E+00
<b>US-APWR</b>				
New Fuel	1.22E-03	3.5	8.54E-03	8.54E-02
Spent Fuel	1.22E-03	39.8	9.71E-02	9.71E-01
Radwaste	4.25E-04	12.8	1.09E-02	1.09E-01
Total				1.17E+00

a) The injuries per year are calculated assuming a round trip for the truck



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**Table 7.4-11  
PSEG Site Model Comparison to  
10 CFR 51.52 Summary Table S-4: "Accidents in Transport"  
Bounding Technology Summary**

<b>Types of Effects</b>	<b>Environmental Risk</b>	<b>PSEG Site Model</b>
	<b>10 CFR 51.52 Table S-4</b>	<b>Bounding Reactor</b>
Radiological effects	Small	
Person-rem per reactor-year (person-Sv per reactor-year)		2.16E-04 (2.16E-06)
Common (nonradiological) causes	1 fatal injury in 100 reactor years 1 nonfatal injury in 10 reactor years \$475 property damage per reactor year	9.29E-01 1.57E+00 (a)

a) No attempt has been made to update the property damage value to account for inflation or other considerations such as changes in the type and value of property that could be damaged. However, because the quantified environmental risk for the PSEG Site is less than the corresponding quantified risk determined for Table S-4, the property damage per reactor year attributable to the PSEG Site is also less than that which would be shown for a Table S-4 updated for the current year.

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**APPENDIX 7A**

**TRAGIS AND RADTRAN INPUT AND OUTPUT**

This appendix contains TRAGIS and RADCAT/RADTRAN input and output streams corresponding to the Irradiated Fuel Analysis, Radwaste Analysis, and New Fuel Analysis that are the basis for discussion in relevant Sections of 5.7 and 7.4.

Information pertaining to Irradiated Fuel Analysis is in Section 7A.1. This information contains the TRAGIS and RADCAT/RADTRAN input and output for one irradiated fuel shipment from the PSEG Site to Yucca Mt., NV. The nuclide inventories are for 1 MTU of irradiated fuel for the bounding technology, which, for irradiated fuel, is the ABWR.

Information pertaining to Radwaste Analysis is in Section 7A.2. This information contains the TRAGIS and RADCAT/RADTRAN input and output for one radwaste shipment from the PSEG Site to Barnwell, SC. The nuclide inventories are the total annual production for the bounding technology, which is the GE ABWR.

Information pertaining to New Fuel Analysis is in Section 7A.3. This information contains the TRAGIS and RADCAT/RADTRAN input and output for one new fuel shipment from Richland, WA to the PSEG Site.

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**7A.1 IRRADIATED FUEL ANALYSIS**

This attachment contains the TRAGIS and RADCAT/RADTRAN input and output for one irradiated fuel shipment from the PSEG Site to Yucca Mt., NV. The nuclide inventories are for 1 MTU of irradiated fuel for the bounding technology, which, for irradiated fuel, is the ABWR.

1	TRAGIS INPUT .....	7A-3
2	TRAGIS Output.....	7A-5
3	TRAGIS Generated Input for RADTRAN .....	7A-8
4	RADTRAN Input.....	7A-11
5	RADTRAN Fatalities Case Output .....	7A-26
6	RADTRAN Injuries Case Output.....	7A-40

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## 1 TRAGIS INPUT

The TRAGIS input screens are reproduced below.

WebTRAGIS Client Version: 4.6.2

Block Nodes/Links
Route Listings
Route Maps

Select Origin/Destination
Highway Routing Parameters
Rail Routing Parameters
Water Routing Parameters

**Mode**  
☒ Highway
 ☐ Railroad
 ☐ Water
 ☐ InterModal

**Origin**  

State	Node Name
MN	ROCKAWAY NE 180X37
MO	ROSS COR U206S15
MS	RUTHERFORD S S17 S3
MT	S BRUNSWICK U130S32
NC	S BRUNSWICK E TNJTX8A
ND	S TOMS RIVER W TGSPX80
NE	SADDLE BROOK 180X62
NH	SADDLE BROOK NW TGSPX159
NJ	SALEM S45 S49
NM	SALEM NW S49 LOCL
NV	SALEM NP
NY	SAYREVILLE W TNJTX9
OH	SEASIDE HTS S35 S37
OK	SEAVILLE U9 S50

**Selected Node Number**

☐ Enter Intermediate Node

**Destination**  

State	Node Name
NM	STEWART
NV	TNX AIRPORT
NY	TONOPAH
OH	TONOPAH E U6 LOCL
OK	TONOPAH E U6 S376
OR	TPH AIRPORT
PA	VGJ AIRPORT
RI	WARM SPRINGS
SC	WELLS 180X352
SD	WENDOVER 180X410
TN	WINNEMUCCA 180X178
TX	WINNEMUCCA SW 180X173
UT	WMC AIRPORT
VA	YUCCA MOUNTAIN

**Selected Node Number**

**Route Type**  

☐ Commercial  
☐ Quickest  
☐ Shortest

☒ HRCQ  
☐ HRCQ + Nevada  
☐ WIPP

**Calculate Route**

**Alternative Route Penalty**  
 Enter the alternative route penalty to be applied to next alternative routing  
 Link Penalty (1-100)

**Calculate Alternative Route**

**Preferred Route**  
 Enter a penalty factor for the non-preferred links (1-100)

**Date/Time Options**  
☒ Use Current Date  
  
☒ Use Current Time

**Population Options**  
☐ 400m Buffer Zone  
☒ 800m Buffer Zone  
☐ 2500m Buffer Zone

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WebTRAGIS Client Version: 4.6.2

Block Nodes/Links  
Select Origin/Destination

Route Listings  
**Highway Routing Parameters**

Route Maps  
Rail Routing Parameters

Water Routing Parameters

**Driver Options**  
☐ One Driver    ☒ Two Drivers

**Highway Inspection**  
☒ Include time for inspections upon entry into state  
 Enter est. average time to complete inspection per state. (in minutes)

**Toll Bias Factor**  
 Enter the toll bias factor. (0 - 1000)

☐ Include Nevada County Population Details

**Other Constraints**  
☒ Prohibit use of roads that restrict Commercial Trucks.  
☒ Prohibit the use of Ferry Crossings.  
☐ Prohibit the use of roads with Hazmat Restrictions.  
☒ Prohibit the use of roads with Radioactive restrictions.  
☐ Avoid the use of roads in Urban Areas.  
☐ Avoid the use of roads Inside of Beltways.  
☐ Prohibit the use of roads with Low Clearance.  
☐ Prohibit the use of roads with Narrow Clearance.  
☐ Prohibit the use of roads with Tunnels.  
☒ Las Vegas Beltway considered a Preferred Route.

**Road Lane Type Penalty**  
**Penalty Factor (0 - 100)**  

Lane Type 1 - Limited Access Multilane	<input style="width: 50px;" type="text" value="0"/>
Lane Type 2 - Limited Access Single Lane	<input style="width: 50px;" type="text" value="0"/>
Lane Type 3 - Multilane Divided	<input style="width: 50px;" type="text" value="0"/>
Lane Type 4 - Multilane Undivided	<input style="width: 50px;" type="text" value="0"/>
Lane Type 5 - Principal Highway	<input style="width: 50px;" type="text" value="0"/>
Lane Type 6 - Through Highway	<input style="width: 50px;" type="text" value="0"/>
Lane Type 7 - Other	<input style="width: 50px;" type="text" value="0"/>

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**2 TRAGIS OUTPUT**

TRAGIS Routing Engine Version 1.5.4                      -- Highway Data Network    4.0

FROM:        SALEM NP                                      NJ                      Leaving    : 06/26/09 17:15  
TO    :        YUCCA MOUNTAIN                            NV                      Arriving   : 06/28/09 20:50

Routing parameters used to calculate the route-

Routing type: HRCQ Preferred Route with 2 driver(s)  
Preferred roads        Time bias: 1.00    Mile bias: 0.00, Toll bias: 1.00  
Nonpreferred roads    Time bias: 0.00    Mile bias: 1.00, Toll bias: 1.00, Penalty factor:  
30.0

Constraints used on route:  
Prohibit use of links prohibiting truck use  
Prohibit use of ferry crossing  
Prohibit use of roads with Radioactive materials prohibition  
Las Vegas Beltway is considered a preferred route

Miles	Hwy Sign	City	Dir	Junction	State	Dist	Time	Date	Hour	
0.0		SALEM NP			NJ	0.0	0:00	06/26/09	17:15	
12.3	LOCAL	SALEM	NW	S49 LOCL	NJ	12.3	0:24	06/26/09	17:39	
3.0	S49	PENNSVILLE	S	S49 C551	NJ	15.3	0:29	06/26/09	17:44	
4.7	C551	DEEPWATER	SE	TNJT I295	NJ	19.9	0:36	06/26/09	17:51	
0.4	I295\$	DEEPWATER	S	I295X1	NJ	20.3	0:37	06/26/09	17:52	
0.9	I295#	crossing state border DE/NJ			BD	21.3	1:07	06/26/09	18:22	
		State Inspection took 30 minutes								
2.5	I295#	NEW CASTLE	N	I295S9	DE	23.8	1:10	06/26/09	18:25	
2.1	I295	NEWPORT	SE	I295I95	DE	25.9	1:12	06/26/09	18:27	
0.8	I95	NEWPORT	SE	I495I95	DE	26.6	1:13	06/26/09	18:28	
10.8	I495	CLAYMONT	N	I495I95	DE	37.5	1:25	06/26/09	18:40	
0.4	I95	crossing state border DE/PA			BD	37.9	1:56	06/26/09	19:11	
		State Inspection took 30 minutes								
6.6	I95	EDDYSTONE	N	I476I95	PA	44.5	2:02	06/26/09	19:17	
16.0	I476	CONSHOHOCKEN	SW	I476I76	PA	60.6	2:17	06/26/09	19:32	
5.3	I76	VALLEY FORGE	SE	I276I76	PA	65.8	2:22	06/26/09	19:37	
78.3	I76 \$	HIGHSPIRE	N	I283I76	PA	144.2	3:38	06/26/09	20:53	
3.1	I283	HARRISBURG	SE	I283I83	PA	147.3	3:41	06/26/09	20:56	
4.1	I83	PENBROOK	NE	I81 I83	PA	151.3	3:45	06/26/09	21:00	
		Rest 30 minutes								
81.1	I81	DRUMS	N	I80 I81	PA	232.4	5:31	06/26/09	22:46	
		Rest 30 minutes								
254.1	I80	WEST MIDDLESEX	NE	I80 X4	PA	486.4	9:56	06/27/09	03:11	
4.0	I80	crossing state border OH/PA			BD	490.5	10:30	06/27/09	03:45	
		State Inspection took 30 minutes								
17.9	I80	NORTH JACKSON	NE	I76 I80	OH	508.4	10:50	06/27/09	04:05	
76.0	I80 \$	ELYRIA	NW	I80 I90	OH	584.4	12:12	06/27/09	05:27	
		Rest 30 minutes								
128.7	I80 \$	I90 \$	WEST JEFFERSON	N	I80 X13	OH	713.1	15:03	06/27/09	08:18
13.1	I80 \$	I90 \$	crossing state border IN/OH		BD	726.1	15:47	06/27/09	09:02	
		State Inspection took 30 minutes								
		Rest 30 minutes								
135.4	I80 \$	I90 \$	PORTAGE	W	I80 I90	IN	861.5	18:33	06/27/09	10:48
0.5	I80	LAKE STATION	NE	I80 I94	IN	862.0	18:33	06/27/09	10:48	
14.5	I80	I94	HAMMOND	W	I80 X1	IN	876.5	18:49	06/27/09	11:04
0.9	I80	I94	crossing state border IL/IN		BD	877.4	19:20	06/27/09	11:35	
		State Inspection took 30 minutes								
3.0	I80	I94	LANSING	W	I294I94	IL	880.3	19:23	06/27/09	11:38
4.9	I294\$	I80 \$	HOMEWOOD	NW	I294I80	IL	885.3	19:28	06/27/09	11:43
		Rest 30 minutes								

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154.4	I80		RAPIDS CITY	W	I80 X1	IL	1039.7	22:47	06/27/09	15:02
0.3	I80		crossing state border	IA/IL		BD	1040.0	23:17	06/27/09	15:32
			State Inspection took 30 minutes							
			Rest 30 minutes							
168.0	I80		DES MOINES	N	I235I35	IA	1207.9	26:23	06/27/09	18:38
14.2	I35	I80	DES MOINES	W	I235I35	IA	1222.1	26:37	06/27/09	18:52
95.7	I80		MINDEN	NW	I680I80	IA	1317.8	28:05	06/27/09	20:20
16.5	I680		LOVELAND	SW	I29 I680	IA	1334.3	28:20	06/27/09	20:35
9.7	I29	I680	CRESCENT	W	I29 I680	IA	1344.0	28:29	06/27/09	20:44
3.0	I680		crossing state border	IA/NE		BD	1347.0	29:02	06/27/09	21:17
			State Inspection took 30 minutes							
13.4	I680		OMAHA	SW	I680I80	NE	1360.4	29:17	06/27/09	21:32
			Rest 30 minutes							
			Rest 30 minutes							
422.7	I80		KIMBALL	S	I80 X20	NE	1783.1	35:56	06/28/09	03:11
20.6	I80		crossing state border	NE/WY		BD	1803.6	36:43	06/28/09	03:58
			State Inspection took 30 minutes							
			Rest 30 minutes							
382.4	I80		EVANSTON	NE	I80 X18	WY	2186.0	42:19	06/28/09	09:34
18.2	I80		crossing state border	UT/WY		BD	2204.2	43:03	06/28/09	10:18
			Rest 30 minutes							
			State Inspection took 30 minutes							
68.4	I80		HOLLADAY	N	I215I80	UT	2272.5	44:28	06/28/09	11:43
10.2	I215		MIDVALE		I15 I215	UT	2282.8	44:37	06/28/09	11:52
			Rest 30 minutes							
294.2	I15		SGU AIRPORT		I15 X6	UT	2577.0	49:06	06/28/09	16:21
6.4	I15		crossing state border	AZ/UT		BD	2583.4	49:41	06/28/09	16:56
			State Inspection took 30 minutes							
20.6	I15		LITTLEFIELD		I15 X8	AZ	2604.0	49:58	06/28/09	16:13
8.6	I15		crossing state border	AZ/NV		BD	2612.7	50:35	06/28/09	16:50
			State Inspection took 30 minutes							
73.6	I15		N LAS VEGAS	NE	I15 S215	NV	2686.2	51:35	06/28/09	17:50
			Rest 30 minutes							
14.8	C215		LAS VEGAS	NW	U95 C215	NV	2701.0	52:04	06/28/09	18:19
46.1	U95		MERCURY	S	U95 LOCL	NV	2747.1	53:20	06/28/09	19:35
33.1	LOCAL		YUCCA MOUNTAIN			NV	2780.1	54:35	06/28/09	20:50

Total elapsed time: 54:35      Total trip mileage: 2780.1      Impedance: 5371.4

Mileage by State :

AZ:	29.2	DE:	16.6	IA:	307.1	IL:	162.6	IN:	151.2	NE:	456.6
NJ:	21.3	NV:	167.5	OH:	235.7	PA:	452.5	UT:	379.2	WY:	400.5

Mileage by Sign Type:

1-INTERSTATE:	2666.3	2-US:	46.1	3-STATE:	3.0	5-COUNTY:	19.4
6-LOCAL:	45.3						

Mileage by Lane Type:

1-Multi-Lane Controlled Access:	2666.3	3-Multi-Lane Divided Highway:	60.9
5-Principle Road:	3.0	7-Other:	50.0

Mileage by Tribal Lands:

Total Outside Tribal Lands	:	2766.2
Total Inside Tribal Lands	:	13.9

Las Vegas Colony	:	2.8	Moapa River Reservation	:	9.2
Paiute (UT) Reservation	:	1.9			

TRAGIS Routing Engine Version 1.5.4      --      2000 Census Data

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POPULATION DENSITY within 800 meter Buffer Zone:  
FROM: SALEM NP NJ  
TO : YUCCA MOUNTAIN NV

ST	MILES	0	>0.0 -22.7	22.7 -59.7	59.7 -139	139 -326	326 -821	821 -1861	1861 -3326	3326 -5815	5815 -9996	>9996
AZ	29.2	16.37	10.91	1.52	0.26	0.13	0.07	0.00	0.00	0.00	0.00	0.00
DE	16.6	3.25	0.34	0.47	0.65	1.61	2.37	2.24	2.42	1.83	0.99	0.45
IL	162.6	19.10	37.80	30.07	23.86	18.01	12.57	9.39	5.42	3.67	2.24	0.40
IN	151.2	1.73	19.97	37.40	25.85	28.69	17.16	8.92	5.71	3.55	1.89	0.41
IA	307.1	26.27	73.66	93.61	51.14	25.99	18.72	10.70	3.86	2.30	0.64	0.20
NE	456.6	167.07	80.87	107.72	49.64	24.69	10.77	7.27	4.24	2.75	1.02	0.59
NV	167.5	108.64	21.16	17.66	9.52	3.96	3.65	1.23	0.77	0.53	0.40	0.00
NJ	21.3	4.37	3.43	2.66	2.36	1.85	3.25	1.70	0.99	0.55	0.14	0.00
OH	235.7	5.72	33.46	51.22	42.02	37.15	29.12	17.51	10.25	6.65	1.89	0.68
PA	452.5	33.02	76.68	87.18	81.49	62.74	51.70	31.14	14.78	8.20	4.10	1.47
UT	379.2	118.00	70.04	66.60	38.43	23.87	17.36	14.41	10.53	10.42	8.06	1.52
WY	400.5	207.08	105.56	52.54	12.14	6.48	6.02	4.33	4.26	1.86	0.22	0.06

TOTALS

2780.1 710.62 533.88 548.65 337.36 235.17 172.76 108.84 63.23 42.31 21.59 5.78

PERCENTAGES

25.56 19.20 19.73 12.13 8.46 6.21 3.91 2.27 1.52 0.78 0.21

BASIS: 2000 Census data

RADTRAN Input Data	RURAL	SUBURBAN	URBAN
WEIGHTED POPULATION			
People/sq. mi.	29.8	799.5	6137.2
People/sq. km.	11.5	308.7	2369.6

DISTANCE				TOTALS
Miles	2130.5	580.0	69.7	2780.1
Kilometers	3428.6	933.4	112.1	4474.1
Percentages	76.6	20.9	2.5	

BASIS (people/sq mi.) <139 139-3326 >3326

Population within 800 meter Buffer Zone by State:

AZ 245 DE 28510 IL 72678 IN 79041 IA 60053 NE 59486 NV 12582 NJ 8552  
OH 123201 PA 189259 UT 159594 WY 32573

Total Population within 800 meter Buffer Zone: 825774



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**3 TRAGIS GENERATED INPUT FOR RADTRAN**

```
[TRAGIS]
TRAGIS Version=1.5.4
Mode=H
Network Version=4.0
Census Data=2000
Buffer Zone=800
[ROUTEINFO]
From CITY=SALEM NP
From STATE=NJ
From SUBNET=
To CITY=YUCCA MOUNTAIN
To STATE=NV
To SUBNET=
[AZ]
Rural - KM= 46.8
Suburban - KM= 0.3
Urban - KM= 0.0
Total - KM= 47.1
Rural Pop Density= 3.2
Suburban Pop Density= 135.8
Urban Pop Density= 0.0
[DE]
Rural - KM= 7.6
Suburban - KM= 13.9
Urban - KM= 5.3
Total - KM= 26.8
Rural Pop Density= 7.3
Suburban Pop Density= 492.2
Urban Pop Density=2496.1
[IL]
Rural - KM= 178.4
Suburban - KM= 73.0
Urban - KM= 10.2
Total - KM= 261.7
Rural Pop Density= 14.4
Suburban Pop Density= 323.6
Urban Pop Density=2379.1
[IN]
Rural - KM= 136.7
Suburban - KM= 97.3
Urban - KM= 9.4
Total - KM= 243.4
Rural Pop Density= 19.9
Suburban Pop Density= 276.3
Urban Pop Density=2354.7
[IA]
Rural - KM= 393.8
Suburban - KM= 95.4
Urban - KM= 5.1
Total - KM= 494.1
Rural Pop Density= 15.7
Suburban Pop Density= 268.0
Urban Pop Density=2185.2
[NE]
Rural - KM= 652.2
Suburban - KM= 75.6
```

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Urban - KM= 7.0  
Total - KM= 734.8  
Rural Pop Density= 10.0  
Suburban Pop Density= 268.5  
Urban Pop Density=2401.8  
[NV]  
Rural - KM= 252.6  
Suburban - KM= 15.5  
Urban - KM= 1.5  
Total - KM= 269.5  
Rural Pop Density= 4.8  
Suburban Pop Density= 267.6  
Urban Pop Density=2318.5  
[NJ]  
Rural - KM= 20.6  
Suburban - KM= 12.5  
Urban - KM= 1.1  
Total - KM= 34.3  
Rural Pop Density= 11.8  
Suburban Pop Density= 353.9  
Urban Pop Density=2025.9  
[OH]  
Rural - KM= 213.1  
Suburban - KM= 151.3  
Urban - KM= 14.8  
Total - KM= 379.3  
Rural Pop Density= 19.7  
Suburban Pop Density= 309.6  
Urban Pop Density=2211.7  
[PA]  
Rural - KM= 448.0  
Suburban - KM= 258.1  
Urban - KM= 22.2  
Total - KM= 728.3  
Rural Pop Density= 17.7  
Suburban Pop Density= 299.3  
Urban Pop Density=2413.1  
[UT]  
Rural - KM= 471.6  
Suburban - KM= 106.5  
Urban - KM= 32.2  
Total - KM= 610.3  
Rural Pop Density= 9.9  
Suburban Pop Density= 362.6  
Urban Pop Density=2472.3  
[WY]  
Rural - KM= 607.2  
Suburban - KM= 33.9  
Urban - KM= 3.4  
Total - KM= 644.6  
Rural Pop Density= 4.9  
Suburban Pop Density= 399.4  
Urban Pop Density=1966.6  
[Total]  
Rural - KM=3428.6  
Suburban - KM= 933.4  
Urban - KM= 112.1

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Total - KM=4474.1  
Rural Pop Density= 11.5  
Suburban Pop Density= 308.7  
Urban Pop Density=2369.6

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4 RADTRAN INPUT








The RADTRAN/RADCAT input screens are reproduced below.

Name	Long Dim (m)	Dose Rate (mrem/h)	Gamma Fraction	Neutron Fraction
PACKAGE_1	5.20E00	1.39E01	1.00E00	0.00E00

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Radcat 2.3 Project Panthro - Calc-06944: Irradiated Fuel to Yucca Mt.: Injuries & Fatalies

File Edit

Title Package **Radionuclides** Vehicle Link Stop Handling Accident Parameters

PACKAGE_1	Radionuclide	Phys/Chem Group	Curies
H3WTR	AM241	Part	1.44E03
H3GAS	AM242M	Part	3.30E01
BE10	CM245	Part	2.00E00
C14ORG	CM244	Part	1.35E04
C14GAS	CM243	Part	6.20E01
NA22	CM242	Part	6.20E01
P32	CE144	Part	1.32E04
S35	AM243	Part	6.00E01
CL36	EU154	Part	1.56E04
CA41	EU155	Part	8.27E03
CA45	PM147	Part	3.13E04
SC46	PU238	Part	1.09E04
CR51	PU239	Part	4.27E02
MN54	PU240	Part	8.52E02
FE55	PU241	Part	1.35E05
CO57	PU242	Part	3.00E00
CO58	SB125	Part	7.17E03
FE59	SR90	Part	1.06E05
NI59	Y90	Part	1.06E05
CO60	CS134	Cs	7.76E04
NI63	CS137	Cs	1.58E05
ZN65	RU106	Ru	2.29E04
GA67	CO60	Cor	1.69E02
KR85			

Add Library Radionuclide >

Modify User Defined Radionuclides

Add User Defined Radionuclide >

< Remove Radionuclide

# PSEG Site ESP Application Part 3, Environmental Report

Radcatt 2.3 Project Panthro - Calc. 2009-06944:Irradiated Fuel to Yucca Mt.: Fatalities

Link Name	Vehicle	Length (km)	Speed (km/h)	Population Density (persons/km <sup>2</sup> )	Vehicle Density (vehicles/hr)	Persons per Vehicle	Accident Rate (accidents/veh-km)	Fatalities per Accident	Zone
RURAL_AZ	VEHICLE_1	4.68E01	8.89E01	3.20E00	5.30E02	1.50E00	1.32E-07	7.12E-02	Rural
SUBURBN_AZ	VEHICLE_1	3.00E-01	8.89E01	1.36E02	7.60E02	1.50E00	1.32E-07	7.12E-02	Suburban
URBAN_AZ	VEHICLE_1	0.00E00	8.89E01	0.00E00	2.40E03	1.50E00	1.32E-07	7.12E-02	Urban
RURAL_DE	VEHICLE_1	7.60E00	8.89E01	7.30E00	5.30E02	1.50E00	5.18E-07	1.08E-02	Rural
SUBURBN_DE	VEHICLE_1	1.39E01	8.89E01	4.92E02	7.60E02	1.50E00	5.18E-07	1.08E-02	Suburban
URBAN_DE	VEHICLE_1	5.30E00	8.89E01	2.50E03	2.40E03	1.50E00	5.18E-07	1.08E-02	Urban
RURAL_IL	VEHICLE_1	1.78E02	8.89E01	1.44E01	5.30E02	1.50E00	2.22E-07	3.74E-02	Rural
SUBURBN_IL	VEHICLE_1	7.30E01	8.89E01	3.24E02	7.60E02	1.50E00	2.22E-07	3.74E-02	Suburban
URBAN_IL	VEHICLE_1	1.02E01	8.89E01	2.38E03	2.40E03	1.50E00	2.22E-07	3.74E-02	Urban
RURAL_IN	VEHICLE_1	1.37E02	8.89E01	1.99E01	5.30E02	1.50E00	2.25E-07	2.98E-02	Rural
SUBURBN_IN	VEHICLE_1	9.73E01	8.89E01	2.76E02	7.60E02	1.50E00	2.25E-07	2.98E-02	Suburban
URBAN_IN	VEHICLE_1	9.40E00	8.89E01	2.35E03	2.40E03	1.50E00	2.25E-07	2.98E-02	Urban
RURAL_IA	VEHICLE_1	3.94E02	8.89E01	1.57E01	5.30E02	1.50E00	1.12E-07	8.39E-02	Rural
SUBURBN_IA	VEHICLE_1	9.54E01	8.89E01	2.68E02	7.60E02	1.50E00	1.12E-07	8.39E-02	Suburban
URBAN_IA	VEHICLE_1	5.10E00	8.89E01	2.19E03	2.40E03	1.50E00	1.12E-07	8.39E-02	Urban
RURAL_NE	VEHICLE_1	6.52E02	8.89E01	1.00E01	5.30E02	1.50E00	3.19E-07	4.29E-02	Rural
SUBURBN_NE	VEHICLE_1	7.56E01	8.89E01	2.68E02	7.60E02	1.50E00	3.19E-07	4.29E-02	Suburban
URBAN_NE	VEHICLE_1	7.00E00	8.89E01	2.40E03	2.40E03	1.50E00	3.19E-07	4.29E-02	Urban
RURAL_NV	VEHICLE_1	2.53E02	8.89E01	4.80E00	5.30E02	1.50E00	2.25E-07	2.93E-02	Rural
SUBURBN_NV	VEHICLE_1	1.55E01	8.89E01	2.68E02	7.60E02	1.50E00	2.25E-07	2.93E-02	Suburban
URBAN_NV	VEHICLE_1	1.50E00	8.89E01	2.32E03	2.40E03	1.50E00	2.25E-07	2.93E-02	Urban
RURAL_NJ	VEHICLE_1	2.06E01	8.89E01	1.18E01	5.30E02	1.50E00	5.65E-07	2.14E-02	Rural
SUBURBN_NJ	VEHICLE_1	1.25E01	8.89E01	3.54E02	7.60E02	1.50E00	5.65E-07	2.14E-02	Suburban
URBAN_NJ	VEHICLE_1	1.10E00	8.89E01	2.03E03	2.40E03	1.50E00	5.65E-07	2.14E-02	Urban
RURAL_OH	VEHICLE_1	2.13E02	8.89E01	1.97E01	5.30E02	1.50E00	1.64E-07	2.38E-02	Rural
SUBURBN_OH	VEHICLE_1	1.51E02	8.89E01	3.10E02	7.60E02	1.50E00	1.64E-07	2.38E-02	Suburban
URBAN_OH	VEHICLE_1	1.48E01	8.89E01	2.21E03	2.40E03	1.50E00	1.64E-07	2.38E-02	Urban
RURAL_PA	VEHICLE_1	4.48E02	8.89E01	1.77E01	5.30E02	1.50E00	5.14E-07	2.63E-02	Rural
SUBURBN_PA	VEHICLE_1	2.58E02	8.89E01	2.99E02	7.60E02	1.50E00	5.14E-07	2.63E-02	Suburban
URBAN_PA	VEHICLE_1	2.22E01	8.89E01	2.41E03	2.40E03	1.50E00	5.14E-07	2.63E-02	Urban
RURAL_UT	VEHICLE_1	4.72E02	8.89E01	9.90E00	5.30E02	1.50E00	2.90E-07	4.10E-02	Rural
SUBURBN_UT	VEHICLE_1	1.06E02	8.89E01	3.63E02	7.60E02	1.50E00	2.90E-07	4.10E-02	Suburban
URBAN_UT	VEHICLE_1	3.22E01	8.89E01	2.47E03	2.40E03	1.50E00	2.90E-07	4.10E-02	Urban
RURAL_WY	VEHICLE_1	6.07E02	8.89E01	4.90E00	5.30E02	1.50E00	6.74E-07	1.60E-02	Rural
SUBURBN_WY	VEHICLE_1	3.39E01	8.89E01	3.99E02	7.60E02	1.50E00	6.74E-07	1.60E-02	Suburban
URBAN_WY	VEHICLE_1	3.40E00	8.89E01	1.97E03	2.40E03	1.50E00	6.74E-07	1.60E-02	Urban

Injuries per Accident in Column Labeled "Fatalities per Accident"









Radcatt 2.3 Project Panthro - Calc. 2009-06944:Irradiated Fuel to Yucca Mt.: Injuries

Link Name	Vehicle	Length (km)	Speed (km/h)	Population Density (persons/km <sup>2</sup> )	Vehicle Density (vehicles/hr)	Persons per Vehicle	Accident Rate (accidents/veh-km)	Fatalities per Accident	Zone	
RURAL_AZ	VEHICLE_1	4.68E01	8.89E01	3.20E00	5.30E02	1.50E00	1.32E-07	8.86E-01	Rural	Primary
SUBURBN_AZ	VEHICLE_1	3.00E-01	8.89E01	1.36E02	7.60E02	1.50E00	1.32E-07	8.86E-01	Suburban	Primary
URBAN_AZ	VEHICLE_1	0.00E00	8.89E01	0.00E00	2.40E03	1.50E00	1.32E-07	8.86E-01	Urban	Primary
RURAL_DE	VEHICLE_1	7.60E00	8.89E01	7.30E00	5.30E02	1.50E00	5.18E-07	6.60E-01	Rural	Primary
SUBURBN_DE	VEHICLE_1	1.39E01	8.89E01	4.92E02	7.60E02	1.50E00	5.18E-07	6.60E-01	Suburban	Primary
URBAN_DE	VEHICLE_1	5.30E00	8.89E01	2.50E03	2.40E03	1.50E00	5.18E-07	6.60E-01	Urban	Primary
RURAL_IL	VEHICLE_1	1.78E02	8.89E01	1.44E01	5.30E02	1.50E00	2.22E-07	6.76E-01	Rural	Primary
SUBURBN_IL	VEHICLE_1	7.30E01	8.89E01	3.24E02	7.60E02	1.50E00	2.22E-07	6.76E-01	Suburban	Primary
URBAN_IL	VEHICLE_1	1.02E01	8.89E01	2.38E03	2.40E03	1.50E00	2.22E-07	6.76E-01	Urban	Primary
RURAL_IN	VEHICLE_1	1.37E02	8.89E01	1.99E01	5.30E02	1.50E00	2.25E-07	6.22E-01	Rural	Primary
SUBURBN_IN	VEHICLE_1	9.73E01	8.89E01	2.76E02	7.60E02	1.50E00	2.25E-07	6.22E-01	Suburban	Primary
URBAN_IN	VEHICLE_1	9.40E00	8.89E01	2.35E03	2.40E03	1.50E00	2.25E-07	6.22E-01	Urban	Primary
RURAL_IA	VEHICLE_1	3.94E02	8.89E01	1.57E01	5.30E02	1.50E00	1.12E-07	7.68E-01	Rural	Primary
SUBURBN_IA	VEHICLE_1	9.54E01	8.89E01	2.68E02	7.60E02	1.50E00	1.12E-07	7.68E-01	Suburban	Primary
URBAN_IA	VEHICLE_1	5.10E00	8.89E01	2.19E03	2.40E03	1.50E00	1.12E-07	7.68E-01	Urban	Primary
RURAL_NE	VEHICLE_1	6.52E02	8.89E01	1.00E01	5.30E02	1.50E00	3.19E-07	6.18E-01	Rural	Primary
SUBURBN_NE	VEHICLE_1	7.56E01	8.89E01	2.68E02	7.60E02	1.50E00	3.19E-07	6.18E-01	Suburban	Primary
URBAN_NE	VEHICLE_1	7.00E00	8.89E01	2.40E03	2.40E03	1.50E00	3.19E-07	6.18E-01	Urban	Primary
RURAL_NV	VEHICLE_1	2.53E02	8.89E01	4.80E00	5.30E02	1.50E00	2.25E-07	6.58E-01	Rural	Primary
SUBURBN_NV	VEHICLE_1	1.55E01	8.89E01	2.68E02	7.60E02	1.50E00	2.25E-07	6.58E-01	Suburban	Primary
URBAN_NV	VEHICLE_1	1.50E00	8.89E01	2.32E03	2.40E03	1.50E00	2.25E-07	6.58E-01	Urban	Primary
RURAL_NJ	VEHICLE_1	2.06E01	8.89E01	1.18E01	5.30E02	1.50E00	5.65E-07	6.92E-01	Rural	Primary
SUBURBN_NJ	VEHICLE_1	1.25E01	8.89E01	3.54E02	7.60E02	1.50E00	5.65E-07	6.92E-01	Suburban	Primary
URBAN_NJ	VEHICLE_1	1.10E00	8.89E01	2.03E03	2.40E03	1.50E00	5.65E-07	6.92E-01	Urban	Primary
RURAL_OH	VEHICLE_1	2.13E02	8.89E01	1.97E01	5.30E02	1.50E00	1.64E-07	8.54E-01	Rural	Primary
SUBURBN_OH	VEHICLE_1	1.51E02	8.89E01	3.10E02	7.60E02	1.50E00	1.64E-07	8.54E-01	Suburban	Primary
URBAN_OH	VEHICLE_1	1.48E01	8.89E01	2.21E03	2.40E03	1.50E00	1.64E-07	8.54E-01	Urban	Primary
RURAL_PA	VEHICLE_1	4.48E02	8.89E01	1.77E01	5.30E02	1.50E00	5.14E-07	7.45E-01	Rural	Primary
SUBURBN_PA	VEHICLE_1	2.58E02	8.89E01	2.99E02	7.60E02	1.50E00	5.14E-07	7.45E-01	Suburban	Primary
URBAN_PA	VEHICLE_1	2.22E01	8.89E01	2.41E03	2.40E03	1.50E00	5.14E-07	7.45E-01	Urban	Primary
RURAL_UT	VEHICLE_1	4.72E02	8.89E01	9.90E00	5.30E02	1.50E00	2.90E-07	8.72E-01	Rural	Primary
SUBURBN_UT	VEHICLE_1	1.06E02	8.89E01	3.63E02	7.60E02	1.50E00	2.90E-07	8.72E-01	Suburban	Primary
URBAN_UT	VEHICLE_1	3.22E01	8.89E01	2.47E03	2.40E03	1.50E00	2.90E-07	8.72E-01	Urban	Primary
RURAL_WY	VEHICLE_1	6.07E02	8.89E01	4.90E00	5.30E02	1.50E00	6.74E-07	4.79E-01	Rural	Primary
SUBURBN_WY	VEHICLE_1	3.39E01	8.89E01	3.99E02	7.60E02	1.50E00	6.74E-07	4.79E-01	Suburban	Primary
URBAN_WY	VEHICLE_1	3.40E00	8.89E01	1.97E03	2.40E03	1.50E00	6.74E-07	4.79E-01	Urban	Primary

**PSEG Site  
ESP Application  
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Radcat 2.3 Project Panthro - Calc. 2009-06944:Irradiated Fuel to Yucca Mt.: Injuries & Fatalities

File Edit









Title Package Radionuclides Vehicle Link Stop Handling Accident Parameters

Name	Vehicle	Min Distance (m)	Max Distance (m)	People or People/km <sup>2</sup>	Shielding Factor	Time (h)
STOP_1	VEHICLE_1	1.00E00	1.00E01	3.00E04	1.00E00	6.00E00
STOP_2	VEHICLE_1	1.00E01	8.00E02	3.40E02	2.00E-01	6.00E00

Add Stop Remove Stop

Radcat 2.3 Project Panthro - Calc. 2009-06944:Irradiated Fuel to Yucca Mt.: Injuries & Fatalities

File Edit

Title Package Radionuclides Vehicle Link Stop Handling Accident Parameters

Name	Vehicle	Number of Handlers	Distance (m)	Time (h)
HANDLE_1	VEHICLE_1	5.00E00	1.00E00	5.00E-01

Add Handling Remove Handling

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File Edit

Index	Probability Fraction
0	1.53E-08
1	5.88E-05
2	1.81E-06
3	7.49E-08
4	4.65E-07
5	3.31E-09
6	0.00E00
7	1.13E-08
8	8.03E-11
9	0.00E00
10	1.44E-10
11	1.02E-12
12	0.00E00
13	7.49E-11
14	0.00E00
15	0.00E00
16	0.00E00
17	5.86E-06
18	1.00E00

Radcat 2.3 Project Panthro - Calc. 2009-06944:Irradiated Fuel to Yucca M...

File Edit

Group	Deposition Velocity (m/s)
Part	1.00E-02
Cs	1.00E-02
Ru	1.00E-02
Gas	0.00E00
Cor	1.00E-02



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Radcat 2.3 Project Panthro - Calc. 2009-06944:Irradiated Fuel to Yucca M...

File Edit

Title Package Radionuclides Vehicle Link Stop Handling Accident Parameters

Probability Deposition Velocity Release Aerosol Respirable Isopleth P Weather

Part

Index	Release Fraction
0	6.00E-07
1	1.00E-07
2	1.30E-07
3	3.80E-06
4	3.20E-07
5	3.70E-07
6	2.10E-06
7	6.10E-07
8	6.70E-07
9	6.80E-07
10	6.10E-07
11	6.70E-07
12	6.80E-07
13	1.80E-05
14	9.00E-06
15	6.80E-07
16	6.80E-07
17	6.70E-08
18	0.00E00

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Radcat 2.3 Project Panthro - Calc. 2009-06944:Irradiated Fuel to Yucca Mt.: Injuries & Fatalities

File Edit

Title Package Radionuclides Vehicle Link Stop Handling Accident Parameters

Probability Deposition Velocity Release Aerosol Respirable Isopleth P Weather

Cs

Index	Release Fraction
0	2.40E-08
1	4.10E-09
2	5.40E-09
3	3.60E-05
4	1.30E-08
5	1.50E-08
6	2.70E-05
7	2.40E-08
8	2.70E-08
9	5.90E-06
10	2.40E-08
11	2.70E-08
12	5.90E-06
13	9.60E-05
14	5.50E-05
15	5.90E-06
16	5.90E-06
17	1.70E-05
18	0.00E00

Radcat 2.3 Project Panthro - Calc. 2009-06944:Irradiated Fuel to Yucca Mt.: Injuries & Fatalities

File Edit

Title Package Radionuclides Vehicle Link Stop Handling Accident Parameters

Probability Deposition Velocity Release Aerosol Respirable Isopleth P Weather

Ru

Index	Release Fraction
0	6.00E-07
1	1.00E-07
2	1.30E-07
3	3.80E-06
4	3.20E-07
5	3.70E-07
6	2.10E-06
7	6.10E-07
8	6.70E-07
9	6.80E-07
10	6.10E-07
11	6.70E-07
12	6.80E-07
13	8.40E-05
14	5.00E-05
15	6.40E-06
16	6.40E-06
17	6.70E-08
18	0.00E00

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Radcat 2.3 Project Panthro - Calc. 2009-06944:Irradiated Fuel to Yucca Mt.: Injuries & Fatalities

File Edit

Title Package Radionuclides Vehicle Link Stop Handling Accident Parameters

Probability Deposition Velocity Release Aerosol Respirable Isopleth P Weather

Gas

Index	Release Fraction
0	8.00E-01
1	1.40E-01
2	1.80E-01
3	8.40E-01
4	4.30E-01
5	4.90E-01
6	8.50E-01
7	8.20E-01
8	8.90E-01
9	9.10E-01
10	8.20E-01
11	8.90E-01
12	9.10E-01
13	8.40E-01
14	8.50E-01
15	9.10E-01
16	9.10E-01
17	8.40E-01
18	0.00E00

Radcat 2.3 Project Panthro - Calc. 2009-06944:Irradiated Fuel to Yucca Mt.: Injuries & Fatalities

File Edit

Title Package Radionuclides Vehicle Link Stop Handling Accident Parameters

Probability Deposition Velocity Release Aerosol Respirable Isopleth P Weather

Cor

Index	Release Fraction
0	2.00E-03
1	1.40E-03
2	1.80E-03
3	3.20E-03
4	1.80E-03
5	2.10E-03
6	3.10E-03
7	2.00E-02
8	2.20E-03
9	2.50E-03
10	2.00E-03
11	2.20E-03
12	2.50E-03
13	6.40E-03
14	5.90E-03
15	3.30E-03
16	3.30E-03
17	2.50E-03
18	0.00E00

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File Edit

Title Package Radionuclides Vehicle Link Stop Handling Accident Parameters

Probability Deposition Velocity Release Aerosol Respirable Isopleth P Weather

Part

Index	Aerosol Fraction
0	1.00E00
1	1.00E00
2	1.00E00
3	1.00E00
4	1.00E00
5	1.00E00
6	1.00E00
7	1.00E00
8	1.00E00
9	1.00E00
10	1.00E00
11	1.00E00
12	1.00E00
13	1.00E00
14	1.00E00
15	1.00E00
16	1.00E00
17	1.00E00
18	1.00E00

Radcat 2.3 Project Panthro - Calc. 2009-06944:Irradiated Fuel to Yucca Mt.: Injuries & Fatalities

File Edit

Title Package Radionuclides Vehicle Link Stop Handling Accident Parameters

Probability Deposition Velocity Release Aerosol Respirable Isopleth P Weather

Cs

Index	Aerosol Fraction
0	1.00E00
1	1.00E00
2	1.00E00
3	1.00E00
4	1.00E00
5	1.00E00
6	1.00E00
7	1.00E00
8	1.00E00
9	1.00E00
10	1.00E00
11	1.00E00
12	1.00E00
13	1.00E00
14	1.00E00
15	1.00E00
16	1.00E00
17	1.00E00
18	1.00E00

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Radcat 2.3 Project Panthro - Calc. 2009-06944:Irradiated Fuel to Yucca Mt.: Injuries & Fatalities

File Edit

Title Package Radionuclides Vehicle Link Stop Handling Accident Parameters

Probability Deposition Velocity Release Aerosol Respirable Isopleth P Weather

Ru

Index	Aerosol Fraction
0	1.00E00
1	1.00E00
2	1.00E00
3	1.00E00
4	1.00E00
5	1.00E00
6	1.00E00
7	1.00E00
8	1.00E00
9	1.00E00
10	1.00E00
11	1.00E00
12	1.00E00
13	1.00E00
14	1.00E00
15	1.00E00
16	1.00E00
17	1.00E00
18	1.00E00

Radcat 2.3 Project Panthro - Calc. 2009-06944:Irradiated Fuel to Yucca Mt.: Injuries & Fatalities

File Edit

Title Package Radionuclides Vehicle Link Stop Handling Accident Parameters

Probability Deposition Velocity Release Aerosol Respirable Isopleth P Weather

Gas

Index	Aerosol Fraction
0	1.00E00
1	1.00E00
2	1.00E00
3	1.00E00
4	1.00E00
5	1.00E00
6	1.00E00
7	1.00E00
8	1.00E00
9	1.00E00
10	1.00E00
11	1.00E00
12	1.00E00
13	1.00E00
14	1.00E00
15	1.00E00
16	1.00E00
17	1.00E00
18	1.00E00

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File Edit

Title Package Radionuclides Vehicle Link Stop Handling Accident Parameters

Probability Deposition Velocity Release Aerosol Respirable Isopleth P Weather

Cor

Index	Aerosol Fraction
0	1.00E00
1	1.00E00
2	1.00E00
3	1.00E00
4	1.00E00
5	1.00E00
6	1.00E00
7	1.00E00
8	1.00E00
9	1.00E00
10	1.00E00
11	1.00E00
12	1.00E00
13	1.00E00
14	1.00E00
15	1.00E00
16	1.00E00
17	1.00E00
18	1.00E00

Radcat 2.3 Project Panthro - Calc. 2009-06944:Irradiated Fuel to Yucca Mt.: Injuries & Fatalities

File Edit

Title Package Radionuclides Vehicle Link Stop Handling Accident Parameters

Probability Deposition Velocity Release Aerosol Respirable Isopleth P Weather

Part

Index	Respirable Fraction
0	1.00E00
1	1.00E00
2	1.00E00
3	1.00E00
4	1.00E00
5	1.00E00
6	1.00E00
7	1.00E00
8	1.00E00
9	1.00E00
10	1.00E00
11	1.00E00
12	1.00E00
13	1.00E00
14	1.00E00
15	1.00E00
16	1.00E00
17	1.00E00
18	1.00E00

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Radcat 2.3 Project Panthro - Calc. 2009-06944:Irradiated Fuel to Yucca Mt.: Injuries & Fatalities

File Edit

Title Package Radionuclides Vehicle Link Stop Handling Accident Parameters

Probability Deposition Velocity Release Aerosol Respirable Isopleth P Weather

Cs

Index	Respirable Fraction
0	1.00E00
1	1.00E00
2	1.00E00
3	1.00E00
4	1.00E00
5	1.00E00
6	1.00E00
7	1.00E00
8	1.00E00
9	1.00E00
10	1.00E00
11	1.00E00
12	1.00E00
13	1.00E00
14	1.00E00
15	1.00E00
16	1.00E00
17	1.00E00
18	1.00E00

Radcat 2.3 Project Panthro - Calc. 2009-06944:Irradiated Fuel to Yucca Mt.: Injuries & Fatalities

File Edit

Title Package Radionuclides Vehicle Link Stop Handling Accident Parameters

Probability Deposition Velocity Release Aerosol Respirable Isopleth P Weather

Ru

Index	Respirable Fraction
0	1.00E00
1	1.00E00
2	1.00E00
3	1.00E00
4	1.00E00
5	1.00E00
6	1.00E00
7	1.00E00
8	1.00E00
9	1.00E00
10	1.00E00
11	1.00E00
12	1.00E00
13	1.00E00
14	1.00E00
15	1.00E00
16	1.00E00
17	1.00E00
18	1.00E00

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File Edit

Title Package Radionuclides Vehicle Link Stop Handling Accident Parameters

Probability Deposition Velocity Release Aerosol Respirable Isopleth P Weather

Gas

Index	Respirable Fraction
0	1.00E00
1	1.00E00
2	1.00E00
3	1.00E00
4	1.00E00
5	1.00E00
6	1.00E00
7	1.00E00
8	1.00E00
9	1.00E00
10	1.00E00
11	1.00E00
12	1.00E00
13	1.00E00
14	1.00E00
15	1.00E00
16	1.00E00
17	1.00E00
18	1.00E00

Radcat 2.3 Project Panthro - Calc. 2009-06944:Irradiated Fuel to Yucca Mt.: Injuries & Fatalities

File Edit

Title Package Radionuclides Vehicle Link Stop Handling Accident Parameters

Probability Deposition Velocity Release Aerosol Respirable Isopleth P Weather

Cor

Index	Respirable Fraction
0	1.00E00
1	1.00E00
2	1.00E00
3	1.00E00
4	1.00E00
5	1.00E00
6	1.00E00
7	1.00E00
8	1.00E00
9	1.00E00
10	1.00E00
11	1.00E00
12	1.00E00
13	1.00E00
14	1.00E00
15	1.00E00
16	1.00E00
17	1.00E00
18	1.00E00



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Radcat 2.3 Project Panthro - Calc. 2009-06944:Irradiated Fuel to Yucca Mt.: Injuries & Fatalities

File Edit

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

Title Package Radionuclides Vehicle Link Stop Handling Accident Parameters

Probability Deposition Velocity Release Aerosol Respirable Isopleth P Weather

☒ Use the default population densities  
☐ Specify your own population densities

people/km<sup>2</sup>

Add Isopleth P Remove Isopleth P

Radcat 2.3 Project Panthro - Calc. 2009-06944:Irradiated Fuel to Yucca Mt.: Injuries & Fatalities

File Edit

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

Title Package Radionuclides Vehicle Link Stop Handling Accident Parameters

Probability Deposition Velocity Release Aerosol Respirable Isopleth P Weather

☐ Pasquill ☒ Average ☐ User-Defined

Isopleth Area Size (m <sup>2</sup> )	Time Integrated Concentration	Center-Line Distance (m)
4.59E02	3.42E-03	3.30E01
1.53E03	1.72E-03	6.80E01
3.94E03	8.58E-04	1.05E02
1.25E04	3.42E-04	2.44E02
3.04E04	1.72E-04	3.69E02
6.85E04	8.58E-05	5.61E02
1.76E05	3.42E-05	1.02E03
4.45E05	1.72E-05	1.63E03
8.59E05	8.58E-06	2.31E03
2.55E06	3.42E-06	4.27E03
4.45E06	1.72E-06	5.47E03
1.03E07	8.58E-07	1.11E04
2.16E07	3.42E-07	1.31E04
5.52E07	1.72E-07	2.13E04
1.77E08	8.58E-08	4.05E04
4.89E08	5.42E-08	7.00E04
8.12E08	4.30E-08	8.99E04
1.35E09	3.42E-08	1.21E05

Add Average Area Remove Average Area

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Radcat 2.3 Project Panthro - Calc. 2009-06944:Irradiated Fuel to Yucca Mt.: Injuries & Fatalities

File Edit

Title Package Radionuclides Vehicle Link Stop Handling Accident **Parameters**

Parameter	Value
Shielding factor for rural residents	1.00E00
Shielding factor for suburban residents	8.70E-01
Shielding factor for urban residents	1.80E-02
Fraction of outside air in urban buildings	5.00E-02
Fraction of urban population occupying the sidewalk	4.80E-01
Fraction of urban population inside buildings	5.20E-01
Ratio of pedestrians/km <sup>2</sup> to residential population/km <sup>2</sup>	6.00E00
Minimum small package dimension for handling (m)	5.00E-01
Distance from shipment for maximum exposure (m)	3.00E01
Vehicle speed for maximum exposure (km/hr)	2.40E01
Imposed regulatory limit on vehicle external dose	Yes
Average breathing rate (m <sup>3</sup> /sec)	3.30E-04
Cleanup Level (microcuries/m <sup>2</sup> )	2.00E-01
Interdiction Threshold	4.00E01
Evacuation time for groundshine (days)	1.00E00
Survey interval for groundshine (days)	1.00E01
Occupational latent cancer fatalities per person-rem	4.00E-04
Public latent cancer fatalities per person-rem	5.00E-04
Genetic effects per person-rem (public)	1.00E-04
Campaign (year)	8.33E-02
Iodine	I129
Rem per curie thyroid via inhalation (Rem/Ci)	5.77E06
Distance of freeway vehicle carrying radioactive cargo to pede...	3.00E01
Distance of freeway vehicle carrying radioactive cargo to right-...	3.00E01
Distance of freeway vehicle carrying radioactive cargo to maxi...	8.00E02
Distance of non-freeway vehicle carrying radioactive cargo to p...	2.70E01
Distance of non-freeway vehicle carrying radioactive cargo to ri...	3.00E01
Distance of non-freeway vehicle carrying radioactive cargo to ...	8.00E02
Distance of city street vehicle carrying radioactive cargo to ped...	5.00E00
Distance of city street vehicle carrying radioactive cargo to righ...	8.00E00
Distance of city street vehicle carrying radioactive cargo to ma...	8.00E02
Perpendicular distance to freeway vehicle going in opposite dire...	1.50E01
Perpendicular distance to non-freeway vehicle going in opposit...	3.00E00
Perpendicular distance to city vehicle going in opposite direction...	3.00E00
Perpendicular distance to all vehicles going in same direction (m)	4.00E00

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**5 RADTRAN FATALITIES CASE OUTPUT**

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PAGE 1

RRRR	AAA	DDDD	TTTTT	RRRR	AAA	N	N	55555	6
R R A A D D	T	R R A A NN	N	5	6				
R R A A D D	T	R R A A NN	NN	5	6				
RRRR A A D D	T	RRRR A A N NN	5555	6666					
R R A A A A A D D	T	R R A A A A A N N	5	6	6				
R R A A D D	T	R R A A N N	5 5	6	6				
R R A A D D D D	T	R R A A N N	5555	*	666				

RADTRAN 5.6 February 20, 2006

INPUT ECHO

-----

TITLE Calc-06944: Irradiated Fuel to Yucca Mt.: Fatalities

INPUT STANDARD

STD: 0 10 18	&& DIMEN=NSEV NRAD NAREAS
STD: 1 3 3 0	&& PARM=IRNKC IANA ISEN IPSQSB
STD: .TRUE. .FALSE.	&& FORM = UNIT, SI-UNITS?
STD: 2.3E12	&& NEVAL FOR CF252
STD: 9.25E5 5.77E6 1.27E6	&& RPCTHY FOR I125, I129, I131
STD: 0.0 0.0 0.0 0.0 0.0	&& TRANSFER GAMMA
STD: 7.42E-3 2.02E-2 6.17E-5 3.17E-8 0.0	&& TRANSFER NEUTRON
STD: 30 24	&& MITDDIST MITDVEL
STD: 1 2 .0018	&& ITRAIN FMINCL DDRWEF
STD: 33 68 105 244 369	&& CENTER LINE
STD: 561 1018 1628 2308 4269	&& DISTANCES
STD: 5468 11136 13097 21334 40502	&& FOR AVERAGE
STD: 69986 89860 120878 0 0 0 0 0 0 0 0 0 0 0 0	&& US CLOUD
STD: 4.59E+02 1.53E+03 3.94E+03 1.25E+04 3.04E+04 6.85E+04 1.76E+05 4.45E+05	
STD: 8.59E+05 2.55E+06 4.45E+06 1.03E+07 2.16E+07 5.52E+07 1.77E+08 4.89E+08	
STD: 8.12E+08 1.35E+09 0 0 0 0 0 0 0 0 0 0 0	&& AREADA
STD: 3.42E-03 1.72E-03 8.58E-04 3.42E-04 1.72E-04 8.58E-05 3.42E-05 1.72E-05	
STD: 8.58E-06 3.42E-06 1.72E-06 8.58E-07 3.42E-07 1.72E-07 8.58E-08 5.42E-08	
STD: 4.30E-08 3.42E-08 0 0 0 0 0 0 0 0 0 0 0	&& DFLEV
STD: 3 6 9 12 15 30 61 91 152 305 0 0 0 0 0	
STD: 3 6 9 12 15 30 61 91 152 305 0 0 0 0 0	
STD: 3 6 9 12 15 30 61 91 152 305 0 0 0 0 0	&& RADIST
STD: 0.5	&& SMLPKG
STD: 1.0 0.87 0.018	&& SHIELDING FACTORS RR RS RU
STD: 30 30 800	&& OFFLINK {FREEWAY}
STD: 27 30 800	&& OFFLINK {NON-FREEWAY}
STD: 5 8 800	&& OFFLINK {CITY STREETS}
STD: 30 30 800	&& OFFLINK {RAILWAY}
STD: 200 200 1000	&& OFFLINK {WATERWAY}
STD: 15 3 3 3 4	&& ONLINK {FWAY NONFWY STREET RAIL ADJ}
STD: 6.0 4 40.0	&& RPD FNOATT INTERDICT
STD: 0.05 0.2 3.3E-4	&& BDF CULVL BRATE
STD: 0.9 0.1	&& UBF USWF
STD: 1.0 10.0 1.0	&& EVACUATION SURVEY CAMPAIGN

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Calc-06944: Irradiated Fuel to Yucca Mt.: Fatalities

```

STD: 0.0 0.0 1.5E-8 5.3E-8 && HIGHWAY - RURAL - NONRAD
STD: 0.0 0.0 3.7E-9 1.3E-8 && HIGHWAY - SUBURBAN - NONRAD
STD: 0.0 0.0 2.1E-9 7.5E-9 && HIGHWAY - URBAN - NONRAD
STD: 0.0 0.0 1.81E-9 2.64E-8 && GENERAL FREIGHT - R - NONRAD
STD: 0.0 0.0 1.81E-9 2.64E-8 && GENERAL FREIGHT - S - NONRAD
STD: 0.0 0.0 1.81E-9 2.64E-8 && GENERAL FREIGHT - U - NONRAD
STD: 0.0 0.0 1.27E-7 1.85E-6 && DEDICATED RAIL - R - NONRAD
STD: 0.0 0.0 1.27E-7 1.85E-6 && DEDICATED RAIL - S - NONRAD
STD: 0.0 0.0 1.27E-7 1.85E-6 && DEDICATED RAIL - U - NONRAD
STD: 0.0 0.0 0.0 0.0 0.0 0.0 && PSPROB
STD: 0.67 0.67 0.42 && TIMENDE NON-DISPERSAL EVAC TIME (LCF&EARLY)
STD: 2 2 1 && FLAGS=IUOPT IACC REGCHECK
STD: 5E-4, 4E-4, 1.0E-4 && LCFCN(1), LCFCN(2), GECON
STD: R5INGEST.BIN && INGESTION FILE
OUTPUT BQ_SV
FORM UNIT
DIMEN 19 10 18
PARM 1 3 1 0
SEVERITY
  NPOP=1
    NMODE=1
      1.53E-8
    5.88E-5 1.81E-6 7.49E-8 4.65E-7 3.31E-9
    0.0 1.13E-8 8.03E-11 0.0 1.44E-10
    1.02E-12 0.0 7.49E-11 0.0 0.0
    0.0 5.86E-6 0.99993
  NPOP=2
    NMODE=1
      1.53E-8
    5.88E-5 1.81E-6 7.49E-8 4.65E-7 3.31E-9
    0.0 1.13E-8 8.03E-11 0.0 1.44E-10
    1.02E-12 0.0 7.49E-11 0.0 0.0
    0.0 5.86E-6 0.99993
  NPOP=3
    NMODE=1
      1.53E-8
    5.88E-5 1.81E-6 7.49E-8 4.65E-7 3.31E-9
    0.0 1.13E-8 8.03E-11 0.0 1.44E-10
    1.02E-12 0.0 7.49E-11 0.0 0.0
    0.0 5.86E-6 0.99993
RELEASE
  GROUP=Part
  RFRAC
    6.0E-7
  1.0E-7 1.3E-7 3.8E-6 3.2E-7 3.7E-7
  2.1E-6 6.1E-7 6.7E-7 6.8E-7 6.1E-7
  6.7E-7 6.8E-7 1.8E-5 9.0E-6 6.8E-7
  6.8E-7 6.7E-8 0.0
  AERSOL
    1.0

```

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1.0 1.0 1.0 1.0 1.0  
1.0 1.0 1.0 1.0 1.0  
1.0 1.0 1.0 1.0 1.0  
1.0 1.0 1.0

RESP

1.0

1.0 1.0 1.0 1.0 1.0  
1.0 1.0 1.0 1.0 1.0  
1.0 1.0 1.0 1.0 1.0  
1.0 1.0 1.0

LOS

0.0

0.0 0.0 0.0 0.0 0.0  
0.0 0.0 0.0 0.0 0.0  
0.0 0.0 0.0 0.0 0.0  
0.0 0.0 0.0

DEPVEL 0.01

GROUP=Cs

RFRAC

2.4E-8

4.1E-9 5.4E-9 3.6E-5 1.3E-8 1.5E-8  
2.7E-5 2.4E-8 2.7E-8 5.9E-6 2.4E-8  
2.7E-8 5.9E-6 9.6E-5 5.5E-5 5.9E-6  
5.9E-6 1.7E-5 0.0

AERSOL

1.0

1.0 1.0 1.0 1.0 1.0  
1.0 1.0 1.0 1.0 1.0  
1.0 1.0 1.0 1.0 1.0  
1.0 1.0 1.0

RESP

1.0

1.0 1.0 1.0 1.0 1.0  
1.0 1.0 1.0 1.0 1.0  
1.0 1.0 1.0 1.0 1.0  
1.0 1.0 1.0

LOS

0.0

0.0 0.0 0.0 0.0 0.0  
0.0 0.0 0.0 0.0 0.0  
0.0 0.0 0.0 0.0 0.0  
0.0 0.0 0.0

DEPVEL 0.01

GROUP=Ru

RFRAC

6.0E-7

1.0E-7 1.3E-7 3.8E-6 3.2E-7 3.7E-7  
2.1E-6 6.1E-7 6.7E-7 6.8E-7 6.1E-7  
6.7E-7 6.8E-7 8.4E-5 5.0E-5 6.4E-6  
6.4E-6 6.7E-8 0.0

AERSOL

1.0

1.0 1.0 1.0 1.0 1.0

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```
1.0 1.0 1.0 1.0 1.0
1.0 1.0 1.0 1.0 1.0
1.0 1.0 1.0
  RESP
    1.0
1.0 1.0 1.0 1.0 1.0
1.0 1.0 1.0 1.0 1.0
1.0 1.0 1.0 1.0 1.0
1.0 1.0 1.0
  LOS
    0.0
0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0
  DEPVEL 0.01
  GROUP=Cor
  RFRAC
    0.0020
0.0014 0.0018 0.0032 0.0018 0.0021
0.0031 0.02 0.0022 0.0025 0.0020
0.0022 0.0025 0.0064 0.0059 0.0033
0.0033 0.0025 0.0
  AERSOL
    1.0
1.0 1.0 1.0 1.0 1.0
1.0 1.0 1.0 1.0 1.0
1.0 1.0 1.0 1.0 1.0
1.0 1.0 1.0
  RESP
    1.0
1.0 1.0 1.0 1.0 1.0
1.0 1.0 1.0 1.0 1.0
1.0 1.0 1.0 1.0 1.0
1.0 1.0 1.0
  LOS
    0.0
0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0
  DEPVEL 0.01
PACKAGE PACKAGE_1 13.9 1.0 0.0 5.2
  AM241 1440.0 Part
  AM242M 33.0 Part
  CM245 2.0 Part
  CM244 13500.0 Part
  CM243 62.0 Part
  CM242 62.0 Part
  CE144 13200.0 Part
  AM243 60.0 Part
  EU154 15600.0 Part
  EU155 8270.0 Part
```

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```
PM147 31300.0 Part
PU238 10900.0 Part
PU239 427.0 Part
PU240 852.0 Part
PU241 135000.0 Part
PU242 3.0 Part
SB125 7170.0 Part
SR90 106000.0 Part
Y90 106000.0 Part
CS134 77600.0 Cs
CS137 158000.0 Cs
RU106 22900.0 Ru
CO60 169.0 Cor
END
VEHICLE -1 VEHICLE_1 1.39E01 1.0 0.0 5.2 1.0 2.0 4.0 1.0 1.0
      PACKAGE_1 1.0
FLAGS
      IACC 2
      IUOPT 2
      REGCHECK 1
MODSTD
      DISTOFF FREEWAY 3.00E01 3.00E01 8.00E02
      DISTOFF SECONDARY 2.70E01 3.00E01 8.00E02
      DISTOFF STREET 5.00E00 8.00E00 8.00E02
      DISTON
          FREEWAY 1.50E01
          SECONDARY 3.00E00
          STREET 3.00E00
          ADJACENT 4.00E00
      BDF 5.00E-02
      BRATE 3.30E-04
      CULVL 2.00E-01
      EVACUATION 1.00E00
      GECON 1.00E-04
      INTERDICT 4.00E01
      LCFCON 5.00E-04 4.00E-04
      SURVEY 1.00E01
      UBF 5.20E-01
      USWF 4.80E-01
      CAMPAIGN 8.33E-02
      MITDDIST 3.00E01
      MITDVEL 2.40E01
      RPD 6.00E00
      RR 1.00E00
      RU 1.80E-02
      RS 8.70E-01
      SMALLPKG 5.00E-01
      RPCTHYROID
          I129 5.77E06
EOF
LINK RURAL_AZ VEHICLE_1 46.8 88.9 1.5 3.2 530.0 1.32E-7 0.0712 R 1 1.0
LINK SUBURBN_AZ VEHICLE_1 0.3 88.9 1.5 135.8 760.0 1.32E-7 0.0712 S 1 1.0
LINK URBAN_AZ VEHICLE_1 0.0 88.9 1.5 0.0 2400.0 1.32E-7 0.0712 U 1 1.0
```

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LINK RURAL\_DE VEHICLE\_1 7.6 88.9 1.5 7.3 530.0 5.18E-7 0.0108 R 1 1.0  
LINK SUBURBN\_DE VEHICLE\_1 13.9 88.9 1.5 492.2 760.0 5.18E-7 0.0108 S 1 1.0  
LINK URBAN\_DE VEHICLE\_1 5.3 88.9 1.5 2496.1 2400.0 5.18E-7 0.0108 U 1 1.0  
LINK RURAL\_IL VEHICLE\_1 178.4 88.9 1.5 14.4 530.0 2.22E-7 0.0374 R 1 1.0  
LINK SUBURBN\_IL VEHICLE\_1 73.0 88.9 1.5 323.6 760.0 2.22E-7 0.0374 S 1 1.0  
LINK URBAN\_IL VEHICLE\_1 10.2 88.9 1.5 2379.1 2400.0 2.22E-7 0.0374 U 1 1.0  
LINK RURAL\_IN VEHICLE\_1 136.7 88.9 1.5 19.9 530.0 2.25E-7 0.0298 R 1 1.0  
LINK SUBURBN\_IN VEHICLE\_1 97.3 88.9 1.5 276.3 760.0 2.25E-7 0.0298 S 1 1.0  
LINK URBAN\_IN VEHICLE\_1 9.4 88.9 1.5 2354.7 2400.0 2.25E-7 0.0298 U 1 1.0  
LINK RURAL\_IA VEHICLE\_1 393.8 88.9 1.5 15.7 530.0 1.12E-7 0.0839 R 1 1.0  
LINK SUBURBN\_IA VEHICLE\_1 95.4 88.9 1.5 268.0 760.0 1.12E-7 0.0839 S 1 1.0  
LINK URBAN\_IA VEHICLE\_1 5.1 88.9 1.5 2185.2 2400.0 1.12E-7 0.0839 U 1 1.0  
LINK RURAL\_NE VEHICLE\_1 652.2 88.9 1.5 10.0 530.0 3.19E-7 0.0429 R 1 1.0  
LINK SUBURBN\_NE VEHICLE\_1 75.6 88.9 1.5 268.5 760.0 3.19E-7 0.0429 S 1 1.0  
LINK URBAN\_NE VEHICLE\_1 7.0 88.9 1.5 2401.8 2400.0 3.19E-7 0.0429 U 1 1.0  
LINK RURAL\_NV VEHICLE\_1 252.6 88.9 1.5 4.8 530.0 2.25E-7 0.0293 R 1 1.0  
LINK SUBURBN\_NV VEHICLE\_1 15.5 88.9 1.5 267.6 760.0 2.25E-7 0.0293 S 1 1.0  
LINK URBAN\_NV VEHICLE\_1 1.5 88.9 1.5 2318.5 2400.0 2.25E-7 0.0293 U 1 1.0  
LINK RURAL\_NJ VEHICLE\_1 20.6 88.9 1.5 11.8 530.0 5.65E-7 0.0214 R 1 1.0  
LINK SUBURBN\_NJ VEHICLE\_1 12.5 88.9 1.5 353.9 760.0 5.65E-7 0.0214 S 1 1.0  
LINK URBAN\_NJ VEHICLE\_1 1.1 88.9 1.5 2025.9 2400.0 5.65E-7 0.0214 U 1 1.0  
LINK RURAL\_OH VEHICLE\_1 213.1 88.9 1.5 19.7 530.0 1.64E-7 0.0238 R 1 1.0  
LINK SUBURBN\_OH VEHICLE\_1 151.3 88.9 1.5 309.6 760.0 1.64E-7 0.0238 S 1 1.0  
LINK URBAN\_OH VEHICLE\_1 14.8 88.9 1.5 2211.7 2400.0 1.64E-7 0.0238 U 1 1.0  
LINK RURAL\_PA VEHICLE\_1 448.0 88.9 1.5 17.7 530.0 5.14E-7 0.0263 R 1 1.0  
LINK SUBURBN\_PA VEHICLE\_1 258.1 88.9 1.5 299.3 760.0 5.14E-7 0.0263 S 1 1.0  
LINK URBAN\_PA VEHICLE\_1 22.2 88.9 1.5 2413.1 2400.0 5.14E-7 0.0263 U 1 1.0  
LINK RURAL\_UT VEHICLE\_1 471.6 88.9 1.5 9.9 530.0 2.9E-7 0.041 R 1 1.0  
LINK SUBURBN\_UT VEHICLE\_1 106.5 88.9 1.5 362.6 760.0 2.9E-7 0.041 S 1 1.0  
LINK URBAN\_UT VEHICLE\_1 32.2 88.9 1.5 2472.3 2400.0 2.9E-7 0.041 U 1 1.0  
LINK RURAL\_WY VEHICLE\_1 607.2 88.9 1.5 4.9 530.0 6.74E-7 0.016 R 1 1.0  
LINK SUBURBN\_WY VEHICLE\_1 33.9 88.9 1.5 399.4 760.0 6.74E-7 0.016 S 1 1.0  
LINK URBAN\_WY VEHICLE\_1 3.4 88.9 1.5 1966.6 2400.0 6.74E-7 0.016 U 1 1.0

STOP STOP\_1 VEHICLE\_1 30000.0 1.0 10.0 1.0 6.0

STOP STOP\_2 VEHICLE\_1 340.0 10.0 800.0 0.2 6.0

HANDLING HANDLE\_1 VEHICLE\_1 5.0 1.0 0.5

EOF



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NON-RADIOLOGICAL DATA (ACCIDENTS and FATALITIES)  
\*\*\*\*\*

HIGHWAY

	ACCIDENT RATE	ACCIDENTS	FATALITIES
RURAL_AZ	1.32E-07	6.18E-06	4.40E-07
SUBURBN_AZ	1.32E-07	3.96E-08	2.82E-09
URBAN_AZ	1.32E-07	0.00E+00	0.00E+00
RURAL_DE	5.18E-07	3.94E-06	4.25E-08
SUBURBN_DE	5.18E-07	7.20E-06	7.78E-08
URBAN_DE	5.18E-07	2.75E-06	2.97E-08
RURAL_IL	2.22E-07	3.96E-05	1.48E-06
SUBURBN_IL	2.22E-07	1.62E-05	6.06E-07
URBAN_IL	2.22E-07	2.26E-06	8.47E-08
RURAL_IN	2.25E-07	3.08E-05	9.17E-07
SUBURBN_IN	2.25E-07	2.19E-05	6.52E-07
URBAN_IN	2.25E-07	2.12E-06	6.30E-08
RURAL_IA	1.12E-07	4.41E-05	3.70E-06
SUBURBN_IA	1.12E-07	1.07E-05	8.96E-07
URBAN_IA	1.12E-07	5.71E-07	4.79E-08
RURAL_NE	3.19E-07	2.08E-04	8.93E-06
SUBURBN_NE	3.19E-07	2.41E-05	1.03E-06
URBAN_NE	3.19E-07	2.23E-06	9.58E-08
RURAL_NV	2.25E-07	5.68E-05	1.67E-06
SUBURBN_NV	2.25E-07	3.49E-06	1.02E-07
URBAN_NV	2.25E-07	3.38E-07	9.89E-09
RURAL_NJ	5.65E-07	1.16E-05	2.49E-07
SUBURBN_NJ	5.65E-07	7.06E-06	1.51E-07
URBAN_NJ	5.65E-07	6.22E-07	1.33E-08
RURAL_OH	1.64E-07	3.49E-05	8.32E-07
SUBURBN_OH	1.64E-07	2.48E-05	5.91E-07
URBAN_OH	1.64E-07	2.43E-06	5.78E-08
RURAL_PA	5.14E-07	2.30E-04	6.06E-06
SUBURBN_PA	5.14E-07	1.33E-04	3.49E-06
URBAN_PA	5.14E-07	1.14E-05	3.00E-07
RURAL_UT	2.90E-07	1.37E-04	5.61E-06
SUBURBN_UT	2.90E-07	3.09E-05	1.27E-06
URBAN_UT	2.90E-07	9.34E-06	3.83E-07
RURAL_WY	6.74E-07	4.09E-04	6.55E-06
SUBURBN_WY	6.74E-07	2.28E-05	3.66E-07
URBAN_WY	6.74E-07	2.29E-06	3.67E-08
TOTALS:	1.19E-05	1.55E-03	4.68E-05

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REGULATORY CHECKS

FOR VEHICLE\_1 THE DOSE RATE AT 2 METERS COULD EXCEED 0.1 MSV/HR  
THE VEHICLE DOSE RATE HAS BEEN RESET TO EQUAL 0.13 MSV/HR

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CALCULATIONAL INFORMATION

FOR VEHICLE\_1 AREAS WITH TOTAL CONTAMINATION RATIO GREATER THAN 40.000  
(THE AREAS MARKED WITH AN 'X' ARE INTERDICTED AND HAVE  
NO 50 YEAR GROUNDSHINE DOSE AND NO INGESTION DOSE.)

AREA/SEVERITY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	-
2	X	-	-	X	-	X	X	X	X	X	X	X	X	X	X	X	X	X	-
3	-	-	-	X	-	-	X	X	-	X	-	-	X	X	X	X	X	X	-
4	-	-	-	X	-	-	X	X	-	-	-	-	-	X	X	-	-	X	-
5	-	-	-	X	-	-	X	-	-	-	-	-	-	X	X	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-	-	X	X	-	-	-	-
7	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-	-
8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

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INCIDENT-FREE SUMMARY

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IN-TRANSIT POPULATION EXPOSURE IN PERSON-SV  
\*INPUT DATA WERE ALTERED WITH REGULATORY CHECKS

	PASSENGER	CREW	OFF LINK	ON LINK	TOTALS
RURAL_AZ	0.00E+00	2.07E-05	5.07E-08	3.26E-06	2.41E-05
SUBURBN_AZ	0.00E+00	1.33E-07	1.20E-08	3.00E-08	1.75E-07
URBAN_AZ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RURAL_DE	0.00E+00	3.37E-06	1.88E-08	5.30E-07	3.92E-06
SUBURBN_DE	0.00E+00	6.16E-06	2.02E-06	1.39E-06	9.57E-06
URBAN_DE	0.00E+00	2.35E-06	8.07E-08	1.67E-06	4.10E-06
RURAL_IL	0.00E+00	7.91E-05	8.70E-07	1.24E-05	9.24E-05
SUBURBN_IL	0.00E+00	3.24E-05	6.96E-06	7.30E-06	4.66E-05
URBAN_IL	0.00E+00	4.52E-06	1.48E-07	3.22E-06	7.89E-06
RURAL_IN	0.00E+00	6.06E-05	9.22E-07	9.53E-06	7.11E-05
SUBURBN_IN	0.00E+00	4.31E-05	7.92E-06	9.73E-06	6.08E-05
URBAN_IN	0.00E+00	4.17E-06	1.35E-07	2.97E-06	7.27E-06
RURAL_IA	0.00E+00	1.75E-04	2.09E-06	2.75E-05	2.04E-04
SUBURBN_IA	0.00E+00	4.23E-05	7.54E-06	9.54E-06	5.94E-05
URBAN_IA	0.00E+00	2.26E-06	6.80E-08	1.61E-06	3.94E-06
RURAL_NE	0.00E+00	2.89E-04	2.21E-06	4.55E-05	3.37E-04
SUBURBN_NE	0.00E+00	3.35E-05	5.98E-06	7.56E-06	4.71E-05
URBAN_NE	0.00E+00	3.10E-06	1.03E-07	2.21E-06	5.42E-06
RURAL_NV	0.00E+00	1.12E-04	4.11E-07	1.76E-05	1.30E-04
SUBURBN_NV	0.00E+00	6.87E-06	1.22E-06	1.55E-06	9.64E-06
URBAN_NV	0.00E+00	6.65E-07	2.12E-08	4.74E-07	1.16E-06
RURAL_NJ	0.00E+00	9.13E-06	8.24E-08	1.44E-06	1.07E-05
SUBURBN_NJ	0.00E+00	5.54E-06	1.30E-06	1.25E-06	8.09E-06
URBAN_NJ	0.00E+00	4.88E-07	1.36E-08	3.47E-07	8.49E-07
RURAL_OH	0.00E+00	9.45E-05	1.42E-06	1.49E-05	1.11E-04
SUBURBN_OH	0.00E+00	6.71E-05	1.38E-05	1.51E-05	9.60E-05
URBAN_OH	0.00E+00	6.56E-06	2.00E-07	4.67E-06	1.14E-05
RURAL_PA	0.00E+00	1.99E-04	2.69E-06	3.12E-05	2.33E-04
SUBURBN_PA	0.00E+00	1.14E-04	2.28E-05	2.58E-05	1.63E-04
URBAN_PA	0.00E+00	9.84E-06	3.27E-07	7.01E-06	1.72E-05
RURAL_UT	0.00E+00	2.09E-04	1.58E-06	3.29E-05	2.44E-04
SUBURBN_UT	0.00E+00	4.72E-05	1.14E-05	1.07E-05	6.92E-05
URBAN_UT	0.00E+00	1.43E-05	4.86E-07	1.02E-05	2.49E-05
RURAL_WY	0.00E+00	2.69E-04	1.01E-06	4.23E-05	3.13E-04
SUBURBN_WY	0.00E+00	1.50E-05	3.99E-06	3.39E-06	2.24E-05
URBAN_WY	0.00E+00	1.51E-06	4.08E-08	1.07E-06	2.62E-06
RURAL	0.00E+00	1.52E-03	1.34E-05	2.39E-04	1.77E-03
SUBURB	0.00E+00	4.14E-04	8.49E-05	9.33E-05	5.92E-04
URBAN	0.00E+00	4.97E-05	1.62E-06	3.54E-05	8.68E-05
TOTALS:	0.00E+00	1.98E-03	9.99E-05	3.68E-04	2.45E-03

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 MAXIMUM INDIVIDUAL IN-TRANSIT DOSE

VEHICLE\_1    5.92E-09 SV

STOP EXPOSURE IN PERSON-SV

ANNULAR AREA	STOP_1	3.77E-03
ANNULAR AREA	STOP_2	1.63E-05
TOTAL:		3.79E-03

HANDLING EXPOSURE IN PERSON-SV

HANDLING	VEHICLE	MATERIAL	METHOD	DOSE
HANDLE_1	VEHICLE_1	PACKAGE_1	LINE-SOURCE	1.16E-03
TOTAL:				1.16E-03

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ACCIDENT SUMMARY

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EXPECTED VALUES OF POPULATION RISK IN PERSON-SV

	GROUND	INHALED	RESUSPD	CLOUDSH	TOTAL
RURAL_AZ	2.31E-12	1.60E-13	5.67E-16	1.91E-16	2.47E-12
SUBURBN_AZ	6.28E-13	4.35E-14	1.54E-16	5.21E-17	6.72E-13
URBAN_AZ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RURAL_DE	3.36E-12	2.33E-13	8.24E-16	2.78E-16	3.59E-12
SUBURBN_DE	4.14E-10	2.87E-11	1.02E-13	3.43E-14	4.43E-10
URBAN_DE	2.33E-09	1.61E-10	5.71E-13	1.93E-13	2.49E-09
RURAL_IL	6.66E-11	4.62E-12	1.63E-14	5.52E-15	7.13E-11
SUBURBN_IL	6.13E-10	4.25E-11	1.50E-13	5.08E-14	6.55E-10
URBAN_IL	1.83E-09	1.27E-10	4.49E-13	1.52E-13	1.96E-09
RURAL_IN	7.15E-11	4.96E-12	1.75E-14	5.92E-15	7.65E-11
SUBURBN_IN	7.07E-10	4.90E-11	1.73E-13	5.85E-14	7.56E-10
URBAN_IN	1.69E-09	1.17E-10	4.15E-13	1.40E-13	1.81E-09
RURAL_IA	8.09E-11	5.61E-12	1.99E-14	6.70E-15	8.65E-11
SUBURBN_IA	3.35E-10	2.32E-11	8.21E-14	2.77E-14	3.58E-10
URBAN_IA	4.24E-10	2.94E-11	1.04E-13	3.51E-14	4.53E-10
RURAL_NE	2.43E-10	1.68E-11	5.96E-14	2.01E-14	2.60E-10
SUBURBN_NE	7.57E-10	5.24E-11	1.86E-13	6.27E-14	8.09E-10
URBAN_NE	1.82E-09	1.26E-10	4.47E-13	1.51E-13	1.95E-09
RURAL_NV	3.19E-11	2.21E-12	7.82E-15	2.64E-15	3.41E-11
SUBURBN_NV	1.09E-10	7.56E-12	2.68E-14	9.03E-15	1.17E-10
URBAN_NV	2.66E-10	1.84E-11	6.52E-14	2.20E-14	2.84E-10
RURAL_NJ	1.60E-11	1.11E-12	3.94E-15	1.33E-15	1.72E-11
SUBURBN_NJ	2.92E-10	2.02E-11	7.17E-14	2.42E-14	3.12E-10
URBAN_NJ	4.28E-10	2.96E-11	1.05E-13	3.54E-14	4.57E-10
RURAL_OH	8.05E-11	5.57E-12	1.97E-14	6.66E-15	8.61E-11
SUBURBN_OH	8.98E-10	6.22E-11	2.20E-13	7.44E-14	9.60E-10
URBAN_OH	1.82E-09	1.26E-10	4.47E-13	1.51E-13	1.95E-09
RURAL_PA	4.76E-10	3.30E-11	1.17E-13	3.95E-14	5.09E-10
SUBURBN_PA	4.64E-09	3.22E-10	1.14E-12	3.84E-13	4.96E-09
URBAN_PA	9.35E-09	6.48E-10	2.29E-12	7.75E-13	1.00E-08
RURAL_UT	1.58E-10	1.10E-11	3.88E-14	1.31E-14	1.69E-10
SUBURBN_UT	1.31E-09	9.07E-11	3.21E-13	1.08E-13	1.40E-09
URBAN_UT	7.84E-09	5.43E-10	1.92E-12	6.49E-13	8.39E-09
RURAL_WY	2.34E-10	1.62E-11	5.75E-14	1.94E-14	2.51E-10
SUBURBN_WY	1.07E-09	7.39E-11	2.62E-13	8.83E-14	1.14E-09
URBAN_WY	1.53E-09	1.06E-10	3.75E-13	1.27E-13	1.64E-09
RURAL	1.47E-09	1.02E-10	3.59E-13	1.21E-13	1.57E-09
SUBURB	1.11E-08	7.72E-10	2.73E-12	9.23E-13	1.19E-08
URBAN	2.93E-08	2.03E-09	7.20E-12	2.43E-12	3.14E-08
TOTALS:	4.19E-08	2.91E-09	1.03E-11	3.47E-12	4.49E-08

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SOCIETAL INGESTION RISK - PERSON-SV

LINK	GONADS	EFFECTIVE
RURAL_AZ	1.36E-11	1.38E-11
RURAL_DE	8.68E-12	8.78E-12
RURAL_IL	8.73E-11	8.83E-11
RURAL_IN	6.78E-11	6.86E-11
RURAL_IA	9.72E-11	9.83E-11
RURAL_NE	4.59E-10	4.64E-10
RURAL_NV	1.25E-10	1.27E-10
RURAL_NJ	2.57E-11	2.59E-11
RURAL_OH	7.70E-11	7.79E-11
RURAL_PA	5.08E-10	5.13E-10
RURAL_UT	3.01E-10	3.05E-10
RURAL_WY	9.02E-10	9.12E-10
TOTAL	2.67E-09	2.70E-09

SOCIETAL INGESTION RISK BY ORGAN - PERSON-SV

LINK	BREAST	LUNGS	RED MARR	BONE SUR	THYROID	REMAINDER
RURAL_AZ	1.13E-11	1.15E-11	1.44E-11	2.43E-11	1.14E-11	1.51E-11
RURAL_DE	7.20E-12	7.33E-12	9.15E-12	1.55E-11	7.28E-12	9.60E-12
RURAL_IL	7.24E-11	7.38E-11	9.20E-11	1.56E-10	7.33E-11	9.65E-11
RURAL_IN	5.63E-11	5.73E-11	7.15E-11	1.21E-10	5.69E-11	7.50E-11
RURAL_IA	8.07E-11	8.21E-11	1.02E-10	1.73E-10	8.16E-11	1.07E-10
RURAL_NE	3.81E-10	3.87E-10	4.83E-10	8.17E-10	3.85E-10	5.07E-10
RURAL_NV	1.04E-10	1.06E-10	1.32E-10	2.23E-10	1.05E-10	1.39E-10
RURAL_NJ	2.13E-11	2.17E-11	2.70E-11	4.57E-11	2.15E-11	2.84E-11
RURAL_OH	6.39E-11	6.51E-11	8.12E-11	1.37E-10	6.46E-11	8.52E-11
RURAL_PA	4.21E-10	4.29E-10	5.35E-10	9.05E-10	4.26E-10	5.61E-10
RURAL_UT	2.50E-10	2.55E-10	3.18E-10	5.37E-10	2.53E-10	3.33E-10
RURAL_WY	7.49E-10	7.62E-10	9.51E-10	1.61E-09	7.57E-10	9.97E-10
TOTAL	2.22E-09	2.26E-09	2.82E-09	4.76E-09	2.24E-09	2.95E-09

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EXPECTED RISK VALUES - OTHER

LINK	EARLY FATALITY	EARLY MORBIDITY
RURAL_AZ	0.00E+00	0.00E+00
SUBURBN_AZ	0.00E+00	0.00E+00
URBAN_AZ	0.00E+00	0.00E+00
RURAL_DE	0.00E+00	0.00E+00
SUBURBN_DE	0.00E+00	0.00E+00
URBAN_DE	0.00E+00	0.00E+00
RURAL_IL	0.00E+00	0.00E+00
SUBURBN_IL	0.00E+00	0.00E+00
URBAN_IL	0.00E+00	0.00E+00
RURAL_IN	0.00E+00	0.00E+00
SUBURBN_IN	0.00E+00	0.00E+00
URBAN_IN	0.00E+00	0.00E+00
RURAL_IA	0.00E+00	0.00E+00
SUBURBN_IA	0.00E+00	0.00E+00
URBAN_IA	0.00E+00	0.00E+00
RURAL_NE	0.00E+00	0.00E+00
SUBURBN_NE	0.00E+00	0.00E+00
URBAN_NE	0.00E+00	0.00E+00
RURAL_NV	0.00E+00	0.00E+00
SUBURBN_NV	0.00E+00	0.00E+00
URBAN_NV	0.00E+00	0.00E+00
RURAL_NJ	0.00E+00	0.00E+00
SUBURBN_NJ	0.00E+00	0.00E+00
URBAN_NJ	0.00E+00	0.00E+00
RURAL_OH	0.00E+00	0.00E+00
SUBURBN_OH	0.00E+00	0.00E+00
URBAN_OH	0.00E+00	0.00E+00
RURAL_PA	0.00E+00	0.00E+00
SUBURBN_PA	0.00E+00	0.00E+00
URBAN_PA	0.00E+00	0.00E+00
RURAL_UT	0.00E+00	0.00E+00
SUBURBN_UT	0.00E+00	0.00E+00
URBAN_UT	0.00E+00	0.00E+00
RURAL_WY	0.00E+00	0.00E+00
SUBURBN_WY	0.00E+00	0.00E+00
URBAN_WY	0.00E+00	0.00E+00
TOTAL	0.00E+00	0.00E+00

EOI

END OF RUN

SUCCESSFUL COMPLETION



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**6 RADTRAN INJURIES CASE OUTPUT**

RUN DATE: [ 15-FEB-13 AT 13:47:07 ]

PAGE 1

RRRR	AAA	DDDD	TTTTT	RRRR	AAA	N	N	55555	6
R R A A D D	T	R R A A NN	N	5	6				
R R A A D D	T	R R A A N N N	5	6					
RRRR A A D D	T	RRRR A A N NN	5555	6666					
R R AAAAA D D	T	R R AAAAA N N	5	6	6				
R R A A D D	T	R R A A N N	5 5	6	6				
R R A A DDDD	T	R R A A N N	5555	*	666				

RADTRAN 5.6 February 20, 2006

INPUT ECHO

-----

TITLE Calc-06944: Irradiated Fuel to Yucca Mt.: Injuries

INPUT STANDARD

STD: 0 10 18	&& DIMEN=NSEV NRAD NAREAS
STD: 1 3 3 0	&& PARM=IRNKC IANA ISEN IPSQSB
STD: .TRUE. .FALSE.	&& FORM = UNIT, SI-UNITS?
STD: 2.3E12	&& NEVAL FOR CF252
STD: 9.25E5 5.77E6 1.27E6	&& RPCTHY FOR I125, I129, I131
STD: 0.0 0.0 0.0 0.0 0.0	&& TRANSFER GAMMA
STD: 7.42E-3 2.02E-2 6.17E-5 3.17E-8 0.0	&& TRANSFER NEUTRON
STD: 30 24	&& MITDDIST MITDVEL
STD: 1 2 .0018	&& ITRAIN FMINCL DDRWEF
STD: 33 68 105 244 369	&& CENTER LINE
STD: 561 1018 1628 2308 4269	&& DISTANCES
STD: 5468 11136 13097 21334 40502	&& FOR AVERAGE
STD: 69986 89860 120878 0 0 0 0 0 0 0 0 0 0 0 0	&& US CLOUD
STD: 4.59E+02 1.53E+03 3.94E+03 1.25E+04 3.04E+04 6.85E+04 1.76E+05 4.45E+05	
STD: 8.59E+05 2.55E+06 4.45E+06 1.03E+07 2.16E+07 5.52E+07 1.77E+08 4.89E+08	
STD: 8.12E+08 1.35E+09 0 0 0 0 0 0 0 0 0 0 0 0	&& AREADA
STD: 3.42E-03 1.72E-03 8.58E-04 3.42E-04 1.72E-04 8.58E-05 3.42E-05 1.72E-05	
STD: 8.58E-06 3.42E-06 1.72E-06 8.58E-07 3.42E-07 1.72E-07 8.58E-08 5.42E-08	
STD: 4.30E-08 3.42E-08 0 0 0 0 0 0 0 0 0 0 0 0	&& DFLEV
STD: 3 6 9 12 15 30 61 91 152 305 0 0 0 0 0	
STD: 3 6 9 12 15 30 61 91 152 305 0 0 0 0 0	
STD: 3 6 9 12 15 30 61 91 152 305 0 0 0 0 0	&& RADIST
STD: 0.5	&& SMLPKG
STD: 1.0 0.87 0.018	&& SHIELDING FACTORS RR RS RU
STD: 30 30 800	&& OFFLINK {FREEWAY}
STD: 27 30 800	&& OFFLINK {NON-FREEWAY}
STD: 5 8 800	&& OFFLINK {CITY STREETS}
STD: 30 30 800	&& OFFLINK {RAILWAY}
STD: 200 200 1000	&& OFFLINK {WATERWAY}
STD: 15 3 3 3 4	&& ONLINK {FWAY NONFWY STREET RAIL ADJ}
STD: 6.0 4 40.0	&& RPD FNOATT INTERDICT
STD: 0.05 0.2 3.3E-4	&& BDF CULVL BRATE
STD: 0.9 0.1	&& UBF USWF
STD: 1.0 10.0 1.0	&& EVACUATION SURVEY CAMPAIGN

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Calc-06944: Irradiated Fuel to Yucca Mt.: Injuries

```
STD: 0.0 0.0 1.5E-8 5.3E-8 && HIGHWAY - RURAL - NONRAD
STD: 0.0 0.0 3.7E-9 1.3E-8 && HIGHWAY - SUBURBAN - NONRAD
STD: 0.0 0.0 2.1E-9 7.5E-9 && HIGHWAY - URBAN - NONRAD
STD: 0.0 0.0 1.81E-9 2.64E-8 && GENERAL FREIGHT - R - NONRAD
STD: 0.0 0.0 1.81E-9 2.64E-8 && GENERAL FREIGHT - S - NONRAD
STD: 0.0 0.0 1.81E-9 2.64E-8 && GENERAL FREIGHT - U - NONRAD
STD: 0.0 0.0 1.27E-7 1.85E-6 && DEDICATED RAIL - R - NONRAD
STD: 0.0 0.0 1.27E-7 1.85E-6 && DEDICATED RAIL - S - NONRAD
STD: 0.0 0.0 1.27E-7 1.85E-6 && DEDICATED RAIL - U - NONRAD
STD: 0.0 0.0 0.0 0.0 0.0 0.0 && PSPROB
STD: 0.67 0.67 0.42 && TIMENDE NON-DISPERSAL EVAC TIME (LCF&EARLY)
STD: 2 2 1 && FLAGS=IUOPT IACC REGCHECK
STD: 5E-4, 4E-4, 1.0E-4 && LCFCN(1), LCFCN(2), GECON
STD: R5INGEST.BIN && INGESTION FILE
OUTPUT BQ_SV
FORM UNIT
DIMEN 19 10 18
PARM 1 3 1 0
SEVERITY
  NPOP=1
    NMODE=1
      1.53E-8
    5.88E-5 1.81E-6 7.49E-8 4.65E-7 3.31E-9
    0.0 1.13E-8 8.03E-11 0.0 1.44E-10
    1.02E-12 0.0 7.49E-11 0.0 0.0
    0.0 5.86E-6 0.99993
  NPOP=2
    NMODE=1
      1.53E-8
    5.88E-5 1.81E-6 7.49E-8 4.65E-7 3.31E-9
    0.0 1.13E-8 8.03E-11 0.0 1.44E-10
    1.02E-12 0.0 7.49E-11 0.0 0.0
    0.0 5.86E-6 0.99993
  NPOP=3
    NMODE=1
      1.53E-8
    5.88E-5 1.81E-6 7.49E-8 4.65E-7 3.31E-9
    0.0 1.13E-8 8.03E-11 0.0 1.44E-10
    1.02E-12 0.0 7.49E-11 0.0 0.0
    0.0 5.86E-6 0.99993
RELEASE
  GROUP=Part
    RFRAC
      6.0E-7
    1.0E-7 1.3E-7 3.8E-6 3.2E-7 3.7E-7
    2.1E-6 6.1E-7 6.7E-7 6.8E-7 6.1E-7
    6.7E-7 6.8E-7 1.8E-5 9.0E-6 6.8E-7
    6.8E-7 6.7E-8 0.0
    AERSOL
      1.0
```

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1.0 1.0 1.0 1.0 1.0  
1.0 1.0 1.0 1.0 1.0  
1.0 1.0 1.0 1.0 1.0  
1.0 1.0 1.0

RESP

1.0

1.0 1.0 1.0 1.0 1.0  
1.0 1.0 1.0 1.0 1.0  
1.0 1.0 1.0 1.0 1.0  
1.0 1.0 1.0

LOS

0.0

0.0 0.0 0.0 0.0 0.0  
0.0 0.0 0.0 0.0 0.0  
0.0 0.0 0.0 0.0 0.0  
0.0 0.0 0.0

DEPVEL 0.01

GROUP=Cs

RFRAC

2.4E-8

4.1E-9 5.4E-9 3.6E-5 1.3E-8 1.5E-8  
2.7E-5 2.4E-8 2.7E-8 5.9E-6 2.4E-8  
2.7E-8 5.9E-6 9.6E-5 5.5E-5 5.9E-6  
5.9E-6 1.7E-5 0.0

AERSOL

1.0

1.0 1.0 1.0 1.0 1.0  
1.0 1.0 1.0 1.0 1.0  
1.0 1.0 1.0 1.0 1.0  
1.0 1.0 1.0

RESP

1.0

1.0 1.0 1.0 1.0 1.0  
1.0 1.0 1.0 1.0 1.0  
1.0 1.0 1.0 1.0 1.0  
1.0 1.0 1.0

LOS

0.0

0.0 0.0 0.0 0.0 0.0  
0.0 0.0 0.0 0.0 0.0  
0.0 0.0 0.0 0.0 0.0  
0.0 0.0 0.0

DEPVEL 0.01

GROUP=Ru

RFRAC

6.0E-7

1.0E-7 1.3E-7 3.8E-6 3.2E-7 3.7E-7  
2.1E-6 6.1E-7 6.7E-7 6.8E-7 6.1E-7  
6.7E-7 6.8E-7 8.4E-5 5.0E-5 6.4E-6  
6.4E-6 6.7E-8 0.0

AERSOL

1.0

1.0 1.0 1.0 1.0 1.0

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```
1.0 1.0 1.0 1.0 1.0
1.0 1.0 1.0 1.0 1.0
1.0 1.0 1.0
  RESP
    1.0
1.0 1.0 1.0 1.0 1.0
1.0 1.0 1.0 1.0 1.0
1.0 1.0 1.0 1.0 1.0
1.0 1.0 1.0
  LOS
    0.0
0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0
  DEPVEL 0.01
  GROUP=Cor
  RFRAC
    0.0020
0.0014 0.0018 0.0032 0.0018 0.0021
0.0031 0.02 0.0022 0.0025 0.0020
0.0022 0.0025 0.0064 0.0059 0.0033
0.0033 0.0025 0.0
  AERSOL
    1.0
1.0 1.0 1.0 1.0 1.0
1.0 1.0 1.0 1.0 1.0
1.0 1.0 1.0 1.0 1.0
1.0 1.0 1.0
  RESP
    1.0
1.0 1.0 1.0 1.0 1.0
1.0 1.0 1.0 1.0 1.0
1.0 1.0 1.0 1.0 1.0
1.0 1.0 1.0
  LOS
    0.0
0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0
  DEPVEL 0.01
PACKAGE PACKAGE_1 13.9 1.0 0.0 5.2
  AM241 1440.0 Part
  AM242M 33.0 Part
  CM245 2.0 Part
  CM244 13500.0 Part
  CM243 62.0 Part
  CM242 62.0 Part
  CE144 13200.0 Part
  AM243 60.0 Part
  EU154 15600.0 Part
  EU155 8270.0 Part
```

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PM147 31300.0 Part  
PU238 10900.0 Part  
PU239 427.0 Part  
PU240 852.0 Part  
PU241 135000.0 Part  
PU242 3.0 Part  
SB125 7170.0 Part  
SR90 106000.0 Part  
Y90 106000.0 Part  
CS134 77600.0 Cs  
CS137 158000.0 Cs  
RU106 22900.0 Ru  
CO60 169.0 Cor

END

VEHICLE -1 VEHICLE\_1 1.39E01 1.0 0.0 5.2 1.0 2.0 4.0 1.0 1.0  
PACKAGE\_1 1.0

FLAGS

IACC 2  
IUOPT 2  
REGCHECK 1

MODSTD

DISTOFF FREEWAY 3.00E01 3.00E01 8.00E02  
DISTOFF SECONDARY 2.70E01 3.00E01 8.00E02  
DISTOFF STREET 5.00E00 8.00E00 8.00E02

DISTON

FREEWAY 1.50E01  
SECONDARY 3.00E00  
STREET 3.00E00  
ADJACENT 4.00E00

BDF 5.00E-02

BRATE 3.30E-04

CULVL 2.00E-01

EVACUATION 1.00E00

GECON 1.00E-04

INTERDICT 4.00E01

LCFCON 5.00E-04 4.00E-04

SURVEY 1.00E01

UBF 5.20E-01

USWF 4.80E-01

CAMPAIGN 8.33E-02

MITDDIST 3.00E01

MITDVEL 2.40E01

RPD 6.00E00

RR 1.00E00

RU 1.80E-02

RS 8.70E-01

SMALLPKG 5.00E-01

RPCTHYROID

I129 5.77E06

EOF

LINK RURAL\_AZ VEHICLE\_1 46.8 88.9 1.5 3.2 530.0 1.32E-7 0.886 R 1 1.0  
LINK SUBURBN\_AZ VEHICLE\_1 0.3 88.9 1.5 135.8 760.0 1.32E-7 0.886 S 1 1.0  
LINK URBAN\_AZ VEHICLE\_1 0.0 88.9 1.5 0.0 2400.0 1.32E-7 0.886 U 1 1.0

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LINK RURAL\_DE VEHICLE\_1 7.6 88.9 1.5 7.3 530.0 5.18E-7 0.66 R 1 1.0  
LINK SUBURBN\_DE VEHICLE\_1 13.9 88.9 1.5 492.2 760.0 5.18E-7 0.66 S 1 1.0  
LINK URBAN\_DE VEHICLE\_1 5.3 88.9 1.5 2496.1 2400.0 5.18E-7 0.66 U 1 1.0  
LINK RURAL\_IL VEHICLE\_1 178.4 88.9 1.5 14.4 530.0 2.22E-7 0.676 R 1 1.0  
LINK SUBURBN\_IL VEHICLE\_1 73.0 88.9 1.5 323.6 760.0 2.22E-7 0.676 S 1 1.0  
LINK URBAN\_IL VEHICLE\_1 10.2 88.9 1.5 2379.1 2400.0 2.22E-7 0.676 U 1 1.0  
LINK RURAL\_IN VEHICLE\_1 136.7 88.9 1.5 19.9 530.0 2.25E-7 0.622 R 1 1.0  
LINK SUBURBN\_IN VEHICLE\_1 97.3 88.9 1.5 276.3 760.0 2.25E-7 0.622 S 1 1.0  
LINK URBAN\_IN VEHICLE\_1 9.4 88.9 1.5 2354.7 2400.0 2.25E-7 0.622 U 1 1.0  
LINK RURAL\_IA VEHICLE\_1 393.8 88.9 1.5 15.7 530.0 1.12E-7 0.768 R 1 1.0  
LINK SUBURBN\_IA VEHICLE\_1 95.4 88.9 1.5 268.0 760.0 1.12E-7 0.768 S 1 1.0  
LINK URBAN\_IA VEHICLE\_1 5.1 88.9 1.5 2185.2 2400.0 1.12E-7 0.768 U 1 1.0  
LINK RURAL\_NE VEHICLE\_1 652.2 88.9 1.5 10.0 530.0 3.19E-7 0.618 R 1 1.0  
LINK SUBURBN\_NE VEHICLE\_1 75.6 88.9 1.5 268.5 760.0 3.19E-7 0.618 S 1 1.0  
LINK URBAN\_NE VEHICLE\_1 7.0 88.9 1.5 2401.8 2400.0 3.19E-7 0.618 U 1 1.0  
LINK RURAL\_NV VEHICLE\_1 252.6 88.9 1.5 4.8 530.0 2.25E-7 0.658 R 1 1.0  
LINK SUBURBN\_NV VEHICLE\_1 15.5 88.9 1.5 267.6 760.0 2.25E-7 0.658 S 1 1.0  
LINK URBAN\_NV VEHICLE\_1 1.5 88.9 1.5 2318.5 2400.0 2.25E-7 0.658 U 1 1.0  
LINK RURAL\_NJ VEHICLE\_1 20.6 88.9 1.5 11.8 530.0 5.65E-7 0.692 R 1 1.0  
LINK SUBURBN\_NJ VEHICLE\_1 12.5 88.9 1.5 353.9 760.0 5.65E-7 0.692 S 1 1.0  
LINK URBAN\_NJ VEHICLE\_1 1.1 88.9 1.5 2025.9 2400.0 5.65E-7 0.692 U 1 1.0  
LINK RURAL\_OH VEHICLE\_1 213.1 88.9 1.5 19.7 530.0 1.64E-7 0.854 R 1 1.0  
LINK SUBURBN\_OH VEHICLE\_1 151.3 88.9 1.5 309.6 760.0 1.64E-7 0.854 S 1 1.0  
LINK URBAN\_OH VEHICLE\_1 14.8 88.9 1.5 2211.7 2400.0 1.64E-7 0.854 U 1 1.0  
LINK RURAL\_PA VEHICLE\_1 448.0 88.9 1.5 17.7 530.0 5.14E-7 0.745 R 1 1.0  
LINK SUBURBN\_PA VEHICLE\_1 258.1 88.9 1.5 299.3 760.0 5.14E-7 0.745 S 1 1.0  
LINK URBAN\_PA VEHICLE\_1 22.2 88.9 1.5 2413.1 2400.0 5.14E-7 0.745 U 1 1.0  
LINK RURAL\_UT VEHICLE\_1 471.6 88.9 1.5 9.9 530.0 2.9E-7 0.872 R 1 1.0  
LINK SUBURBN\_UT VEHICLE\_1 106.5 88.9 1.5 362.6 760.0 2.9E-7 0.872 S 1 1.0  
LINK URBAN\_UT VEHICLE\_1 32.2 88.9 1.5 2472.3 2400.0 2.9E-7 0.872 U 1 1.0  
LINK RURAL\_WY VEHICLE\_1 607.2 88.9 1.5 4.9 530.0 6.74E-7 0.479 R 1 1.0  
LINK SUBURBN\_WY VEHICLE\_1 33.9 88.9 1.5 399.4 760.0 6.74E-7 0.479 S 1 1.0  
LINK URBAN\_WY VEHICLE\_1 3.4 88.9 1.5 1966.6 2400.0 6.74E-7 0.479 U 1 1.0

STOP STOP\_1 VEHICLE\_1 30000.0 1.0 10.0 1.0 6.0

STOP STOP\_2 VEHICLE\_1 340.0 10.0 800.0 0.2 6.0

HANDLING HANDLE\_1 VEHICLE\_1 5.0 1.0 0.5

EOF

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Calc-06944: Irradiated Fuel to Yucca Mt.: Injuries

NON-RADIOLOGICAL DATA (ACCIDENTS and FATALITIES)

\*\*\*\*\*

HIGHWAY

	ACCIDENT RATE	ACCIDENTS	FATALITIES
RURAL_AZ	1.32E-07	6.18E-06	5.47E-06
SUBURBN_AZ	1.32E-07	3.96E-08	3.51E-08
URBAN_AZ	1.32E-07	0.00E+00	0.00E+00
RURAL_DE	5.18E-07	3.94E-06	2.60E-06
SUBURBN_DE	5.18E-07	7.20E-06	4.75E-06
URBAN_DE	5.18E-07	2.75E-06	1.81E-06
RURAL_IL	2.22E-07	3.96E-05	2.68E-05
SUBURBN_IL	2.22E-07	1.62E-05	1.10E-05
URBAN_IL	2.22E-07	2.26E-06	1.53E-06
RURAL_IN	2.25E-07	3.08E-05	1.91E-05
SUBURBN_IN	2.25E-07	2.19E-05	1.36E-05
URBAN_IN	2.25E-07	2.12E-06	1.32E-06
RURAL_IA	1.12E-07	4.41E-05	3.39E-05
SUBURBN_IA	1.12E-07	1.07E-05	8.21E-06
URBAN_IA	1.12E-07	5.71E-07	4.39E-07
RURAL_NE	3.19E-07	2.08E-04	1.29E-04
SUBURBN_NE	3.19E-07	2.41E-05	1.49E-05
URBAN_NE	3.19E-07	2.23E-06	1.38E-06
RURAL_NV	2.25E-07	5.68E-05	3.74E-05
SUBURBN_NV	2.25E-07	3.49E-06	2.29E-06
URBAN_NV	2.25E-07	3.38E-07	2.22E-07
RURAL_NJ	5.65E-07	1.16E-05	8.05E-06
SUBURBN_NJ	5.65E-07	7.06E-06	4.89E-06
URBAN_NJ	5.65E-07	6.22E-07	4.30E-07
RURAL_OH	1.64E-07	3.49E-05	2.98E-05
SUBURBN_OH	1.64E-07	2.48E-05	2.12E-05
URBAN_OH	1.64E-07	2.43E-06	2.07E-06
RURAL_PA	5.14E-07	2.30E-04	1.72E-04
SUBURBN_PA	5.14E-07	1.33E-04	9.88E-05
URBAN_PA	5.14E-07	1.14E-05	8.50E-06
RURAL_UT	2.90E-07	1.37E-04	1.19E-04
SUBURBN_UT	2.90E-07	3.09E-05	2.69E-05
URBAN_UT	2.90E-07	9.34E-06	8.14E-06
RURAL_WY	6.74E-07	4.09E-04	1.96E-04
SUBURBN_WY	6.74E-07	2.28E-05	1.09E-05
URBAN_WY	6.74E-07	2.29E-06	1.10E-06
TOTALS:	1.19E-05	1.55E-03	1.02E-03

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Calc-06944: Irradiated Fuel to Yucca Mt.: Injuries

REGULATORY CHECKS

FOR VEHICLE\_1 THE DOSE RATE AT 2 METERS COULD EXCEED 0.1 MSV/HR  
THE VEHICLE DOSE RATE HAS BEEN RESET TO EQUAL 0.13 MSV/HR



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CALCULATIONAL INFORMATION

FOR VEHICLE\_1 AREAS WITH TOTAL CONTAMINATION RATIO GREATER THAN 40.000  
(THE AREAS MARKED WITH AN 'X' ARE INTERDICTED AND HAVE  
NO 50 YEAR GROUNDSHINE DOSE AND NO INGESTION DOSE.)

AREA/SEVERITY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	-
2	X	-	-	X	-	X	X	X	X	X	X	X	X	X	X	X	X	X	-
3	-	-	-	X	-	-	X	X	-	X	-	-	X	X	X	X	X	X	-
4	-	-	-	X	-	-	X	X	-	-	-	-	-	X	X	-	-	X	-
5	-	-	-	X	-	-	X	-	-	-	-	-	-	X	X	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-	-	X	X	-	-	-	-
7	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-	-
8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

**PSEG Site  
ESP Application  
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Calc-06944: Irradiated Fuel to Yucca Mt.: Injuries

INCIDENT-FREE SUMMARY

\*\*\*\*\*

IN-TRANSIT POPULATION EXPOSURE IN PERSON-SV  
\*INPUT DATA WERE ALTERED WITH REGULATORY CHECKS

	PASSENGER	CREW	OFF LINK	ON LINK	TOTALS
RURAL_AZ	0.00E+00	2.07E-05	5.07E-08	3.26E-06	2.41E-05
SUBURBN_AZ	0.00E+00	1.33E-07	1.20E-08	3.00E-08	1.75E-07
URBAN_AZ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RURAL_DE	0.00E+00	3.37E-06	1.88E-08	5.30E-07	3.92E-06
SUBURBN_DE	0.00E+00	6.16E-06	2.02E-06	1.39E-06	9.57E-06
URBAN_DE	0.00E+00	2.35E-06	8.07E-08	1.67E-06	4.10E-06
RURAL_IL	0.00E+00	7.91E-05	8.70E-07	1.24E-05	9.24E-05
SUBURBN_IL	0.00E+00	3.24E-05	6.96E-06	7.30E-06	4.66E-05
URBAN_IL	0.00E+00	4.52E-06	1.48E-07	3.22E-06	7.89E-06
RURAL_IN	0.00E+00	6.06E-05	9.22E-07	9.53E-06	7.11E-05
SUBURBN_IN	0.00E+00	4.31E-05	7.92E-06	9.73E-06	6.08E-05
URBAN_IN	0.00E+00	4.17E-06	1.35E-07	2.97E-06	7.27E-06
RURAL_IA	0.00E+00	1.75E-04	2.09E-06	2.75E-05	2.04E-04
SUBURBN_IA	0.00E+00	4.23E-05	7.54E-06	9.54E-06	5.94E-05
URBAN_IA	0.00E+00	2.26E-06	6.80E-08	1.61E-06	3.94E-06
RURAL_NE	0.00E+00	2.89E-04	2.21E-06	4.55E-05	3.37E-04
SUBURBN_NE	0.00E+00	3.35E-05	5.98E-06	7.56E-06	4.71E-05
URBAN_NE	0.00E+00	3.10E-06	1.03E-07	2.21E-06	5.42E-06
RURAL_NV	0.00E+00	1.12E-04	4.11E-07	1.76E-05	1.30E-04
SUBURBN_NV	0.00E+00	6.87E-06	1.22E-06	1.55E-06	9.64E-06
URBAN_NV	0.00E+00	6.65E-07	2.12E-08	4.74E-07	1.16E-06
RURAL_NJ	0.00E+00	9.13E-06	8.24E-08	1.44E-06	1.07E-05
SUBURBN_NJ	0.00E+00	5.54E-06	1.30E-06	1.25E-06	8.09E-06
URBAN_NJ	0.00E+00	4.88E-07	1.36E-08	3.47E-07	8.49E-07
RURAL_OH	0.00E+00	9.45E-05	1.42E-06	1.49E-05	1.11E-04
SUBURBN_OH	0.00E+00	6.71E-05	1.38E-05	1.51E-05	9.60E-05
URBAN_OH	0.00E+00	6.56E-06	2.00E-07	4.67E-06	1.14E-05
RURAL_PA	0.00E+00	1.99E-04	2.69E-06	3.12E-05	2.33E-04
SUBURBN_PA	0.00E+00	1.14E-04	2.28E-05	2.58E-05	1.63E-04
URBAN_PA	0.00E+00	9.84E-06	3.27E-07	7.01E-06	1.72E-05
RURAL_UT	0.00E+00	2.09E-04	1.58E-06	3.29E-05	2.44E-04
SUBURBN_UT	0.00E+00	4.72E-05	1.14E-05	1.07E-05	6.92E-05
URBAN_UT	0.00E+00	1.43E-05	4.86E-07	1.02E-05	2.49E-05
RURAL_WY	0.00E+00	2.69E-04	1.01E-06	4.23E-05	3.13E-04
SUBURBN_WY	0.00E+00	1.50E-05	3.99E-06	3.39E-06	2.24E-05
URBAN_WY	0.00E+00	1.51E-06	4.08E-08	1.07E-06	2.62E-06
RURAL	0.00E+00	1.52E-03	1.34E-05	2.39E-04	1.77E-03
SUBURB	0.00E+00	4.14E-04	8.49E-05	9.33E-05	5.92E-04
URBAN	0.00E+00	4.97E-05	1.62E-06	3.54E-05	8.68E-05
TOTALS:	0.00E+00	1.98E-03	9.99E-05	3.68E-04	2.45E-03
MAXIMUM INDIVIDUAL IN-TRANSIT DOSE					

VEHICLE\_1 5.92E-09 SV

**PSEG Site**  
**ESP Application**  
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STOP EXPOSURE IN PERSON-SV

ANNULAR AREA	STOP_1	3.77E-03
ANNULAR AREA	STOP_2	1.63E-05
TOTAL:		3.79E-03

HANDLING EXPOSURE IN PERSON-SV

HANDLING	VEHICLE	MATERIAL	METHOD	DOSE
HANDLE_1	VEHICLE_1	PACKAGE_1	LINE-SOURCE	1.16E-03
TOTAL:				1.16E-03

**PSEG Site  
ESP Application  
Part 3, Environmental Report**

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ACCIDENT SUMMARY

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EXPECTED VALUES OF POPULATION RISK IN PERSON-SV

	GROUND	INHALED	RESUSPD	CLOUDSH	TOTAL
RURAL_AZ	2.31E-12	1.60E-13	5.67E-16	1.91E-16	2.47E-12
SUBURBN_AZ	6.28E-13	4.35E-14	1.54E-16	5.21E-17	6.72E-13
URBAN_AZ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RURAL_DE	3.36E-12	2.33E-13	8.24E-16	2.78E-16	3.59E-12
SUBURBN_DE	4.14E-10	2.87E-11	1.02E-13	3.43E-14	4.43E-10
URBAN_DE	2.33E-09	1.61E-10	5.71E-13	1.93E-13	2.49E-09
RURAL_IL	6.66E-11	4.62E-12	1.63E-14	5.52E-15	7.13E-11
SUBURBN_IL	6.13E-10	4.25E-11	1.50E-13	5.08E-14	6.55E-10
URBAN_IL	1.83E-09	1.27E-10	4.49E-13	1.52E-13	1.96E-09
RURAL_IN	7.15E-11	4.96E-12	1.75E-14	5.92E-15	7.65E-11
SUBURBN_IN	7.07E-10	4.90E-11	1.73E-13	5.85E-14	7.56E-10
URBAN_IN	1.69E-09	1.17E-10	4.15E-13	1.40E-13	1.81E-09
RURAL_IA	8.09E-11	5.61E-12	1.99E-14	6.70E-15	8.65E-11
SUBURBN_IA	3.35E-10	2.32E-11	8.21E-14	2.77E-14	3.58E-10
URBAN_IA	4.24E-10	2.94E-11	1.04E-13	3.51E-14	4.53E-10
RURAL_NE	2.43E-10	1.68E-11	5.96E-14	2.01E-14	2.60E-10
SUBURBN_NE	7.57E-10	5.24E-11	1.86E-13	6.27E-14	8.09E-10
URBAN_NE	1.82E-09	1.26E-10	4.47E-13	1.51E-13	1.95E-09
RURAL_NV	3.19E-11	2.21E-12	7.82E-15	2.64E-15	3.41E-11
SUBURBN_NV	1.09E-10	7.56E-12	2.68E-14	9.03E-15	1.17E-10
URBAN_NV	2.66E-10	1.84E-11	6.52E-14	2.20E-14	2.84E-10
RURAL_NJ	1.60E-11	1.11E-12	3.94E-15	1.33E-15	1.72E-11
SUBURBN_NJ	2.92E-10	2.02E-11	7.17E-14	2.42E-14	3.12E-10
URBAN_NJ	4.28E-10	2.96E-11	1.05E-13	3.54E-14	4.57E-10
RURAL_OH	8.05E-11	5.57E-12	1.97E-14	6.66E-15	8.61E-11
SUBURBN_OH	8.98E-10	6.22E-11	2.20E-13	7.44E-14	9.60E-10
URBAN_OH	1.82E-09	1.26E-10	4.47E-13	1.51E-13	1.95E-09
RURAL_PA	4.76E-10	3.30E-11	1.17E-13	3.95E-14	5.09E-10
SUBURBN_PA	4.64E-09	3.22E-10	1.14E-12	3.84E-13	4.96E-09
URBAN_PA	9.35E-09	6.48E-10	2.29E-12	7.75E-13	1.00E-08
RURAL_UT	1.58E-10	1.10E-11	3.88E-14	1.31E-14	1.69E-10
SUBURBN_UT	1.31E-09	9.07E-11	3.21E-13	1.08E-13	1.40E-09
URBAN_UT	7.84E-09	5.43E-10	1.92E-12	6.49E-13	8.39E-09
RURAL_WY	2.34E-10	1.62E-11	5.75E-14	1.94E-14	2.51E-10
SUBURBN_WY	1.07E-09	7.39E-11	2.62E-13	8.83E-14	1.14E-09
URBAN_WY	1.53E-09	1.06E-10	3.75E-13	1.27E-13	1.64E-09
RURAL	1.47E-09	1.02E-10	3.59E-13	1.21E-13	1.57E-09
SUBURB	1.11E-08	7.72E-10	2.73E-12	9.23E-13	1.19E-08
URBAN	2.93E-08	2.03E-09	7.20E-12	2.43E-12	3.14E-08
TOTALS:	4.19E-08	2.91E-09	1.03E-11	3.47E-12	4.49E-08

**PSEG Site  
ESP Application  
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Calc-06944: Irradiated Fuel to Yucca Mt.: Injuries

SOCIETAL INGESTION RISK - PERSON-SV

LINK	GONADS	EFFECTIVE
RURAL_AZ	1.36E-11	1.38E-11
RURAL_DE	8.68E-12	8.78E-12
RURAL_IL	8.73E-11	8.83E-11
RURAL_IN	6.78E-11	6.86E-11
RURAL_IA	9.72E-11	9.83E-11
RURAL_NE	4.59E-10	4.64E-10
RURAL_NV	1.25E-10	1.27E-10
RURAL_NJ	2.57E-11	2.59E-11
RURAL_OH	7.70E-11	7.79E-11
RURAL_PA	5.08E-10	5.13E-10
RURAL_UT	3.01E-10	3.05E-10
RURAL_WY	9.02E-10	9.12E-10
TOTAL	2.67E-09	2.70E-09

SOCIETAL INGESTION RISK BY ORGAN - PERSON-SV

LINK	BREAST	LUNGS	RED MARR	BONE SUR	THYROID	REMAINDER
RURAL_AZ	1.13E-11	1.15E-11	1.44E-11	2.43E-11	1.14E-11	1.51E-11
RURAL_DE	7.20E-12	7.33E-12	9.15E-12	1.55E-11	7.28E-12	9.60E-12
RURAL_IL	7.24E-11	7.38E-11	9.20E-11	1.56E-10	7.33E-11	9.65E-11
RURAL_IN	5.63E-11	5.73E-11	7.15E-11	1.21E-10	5.69E-11	7.50E-11
RURAL_IA	8.07E-11	8.21E-11	1.02E-10	1.73E-10	8.16E-11	1.07E-10
RURAL_NE	3.81E-10	3.87E-10	4.83E-10	8.17E-10	3.85E-10	5.07E-10
RURAL_NV	1.04E-10	1.06E-10	1.32E-10	2.23E-10	1.05E-10	1.39E-10
RURAL_NJ	2.13E-11	2.17E-11	2.70E-11	4.57E-11	2.15E-11	2.84E-11
RURAL_OH	6.39E-11	6.51E-11	8.12E-11	1.37E-10	6.46E-11	8.52E-11
RURAL_PA	4.21E-10	4.29E-10	5.35E-10	9.05E-10	4.26E-10	5.61E-10
RURAL_UT	2.50E-10	2.55E-10	3.18E-10	5.37E-10	2.53E-10	3.33E-10
RURAL_WY	7.49E-10	7.62E-10	9.51E-10	1.61E-09	7.57E-10	9.97E-10
TOTAL	2.22E-09	2.26E-09	2.82E-09	4.76E-09	2.24E-09	2.95E-09

**PSEG Site  
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Calc-06944: Irradiated Fuel to Yucca Mt.: Injuries

EXPECTED RISK VALUES - OTHER

LINK	EARLY FATALITY	EARLY MORBIDITY
RURAL_AZ	0.00E+00	0.00E+00
SUBURBN_AZ	0.00E+00	0.00E+00
URBAN_AZ	0.00E+00	0.00E+00
RURAL_DE	0.00E+00	0.00E+00
SUBURBN_DE	0.00E+00	0.00E+00
URBAN_DE	0.00E+00	0.00E+00
RURAL_IL	0.00E+00	0.00E+00
SUBURBN_IL	0.00E+00	0.00E+00
URBAN_IL	0.00E+00	0.00E+00
RURAL_IN	0.00E+00	0.00E+00
SUBURBN_IN	0.00E+00	0.00E+00
URBAN_IN	0.00E+00	0.00E+00
RURAL_IA	0.00E+00	0.00E+00
SUBURBN_IA	0.00E+00	0.00E+00
URBAN_IA	0.00E+00	0.00E+00
RURAL_NE	0.00E+00	0.00E+00
SUBURBN_NE	0.00E+00	0.00E+00
URBAN_NE	0.00E+00	0.00E+00
RURAL_NV	0.00E+00	0.00E+00
SUBURBN_NV	0.00E+00	0.00E+00
URBAN_NV	0.00E+00	0.00E+00
RURAL_NJ	0.00E+00	0.00E+00
SUBURBN_NJ	0.00E+00	0.00E+00
URBAN_NJ	0.00E+00	0.00E+00
RURAL_OH	0.00E+00	0.00E+00
SUBURBN_OH	0.00E+00	0.00E+00
URBAN_OH	0.00E+00	0.00E+00
RURAL_PA	0.00E+00	0.00E+00
SUBURBN_PA	0.00E+00	0.00E+00
URBAN_PA	0.00E+00	0.00E+00
RURAL_UT	0.00E+00	0.00E+00
SUBURBN_UT	0.00E+00	0.00E+00
URBAN_UT	0.00E+00	0.00E+00
RURAL_WY	0.00E+00	0.00E+00
SUBURBN_WY	0.00E+00	0.00E+00
URBAN_WY	0.00E+00	0.00E+00
TOTAL	0.00E+00	0.00E+00

EOI

END OF RUN

SUCCESSFUL COMPLETION

**PSEG Site  
ESP Application  
Part 3, Environmental Report**

**7A.2 RADWASTE ANALYSIS**

This attachment contains the TRAGIS and RADCAT/RADTRAN input and output for one radwaste shipment from the PSEG Site to Barnwell, SC. The nuclide inventories are the total annual production for the bounding technology, which is the US-APWR.

1	TRAGIS Input.....	7A-55
2	TRAGIS Output.....	7A-57
3	TRAGIS Generated Input for RADTRAN .....	7A-59
4	RADTRAN Input.....	7A-61
5	RADTRAN Fatalities Case Output .....	7A-77
6	RADTRAN Injuries Case Output.....	7A-91

# PSEG Site ESP Application Part 3, Environmental Report

## 1 TRAGIS INPUT

The TRAGIS input screens are reproduced below.

WebTRAGIS Client Version: 4.6.2

**Block Nodes/Links**

**Select Origin/Destination**

**Route Listings**

Highway Routing Parameters

**Route Maps**

Rail Routing Parameters

Water Routing Parameters

**Mode**

☒ Highway
 ☐ Railroad
 ☐ Water
 ☐ InterModal

**Origin**

State	Node Name
MD	SALEM NW S49 LOCL
ME	SALEM NP
MI	SAYREVILLE W TNJT X9
MN	SEASIDE HTS S35 S37
MO	SEAVILLE U9 S50
MS	SEAVILLE SE TGSPX20
MT	SECAUCUS E I95EX16E
NC	SEVEN STARS S U9 S70
ND	SHARPTOWN NW U40 S48
NE	SINGAC N I80X53
NH	SOMERS POINT W TGSPX29
NJ	SOMERVILLE N I287X13
NM	SOMERVILLE NW U202U22
NV	SOMERVILLE W U202U206

**Selected Node Number**

341108491

☐ Enter Intermediate Node

**Destination**

State	Node Name
NJ	ASHLEY HEIGHTS I26X209
NM	BAKERS XROADS W U176S121
NV	BALDOCK S125S3
NY	BALLETINE N I26X97
OH	BAMBERG U301U78
OK	BAMBERG S U301U601
OR	BARNWELL S U278S3
PA	BARNWELL W U278S64
RI	BATESBURG U1 U178
SC	BEECH ISLAND U278S125
SD	BELVEDERE N I20X5
TN	BENNETTSTVILLE E U15 S9
TX	BISHOPVILLE SW I20X115
UT	BLACKSBURG W I85X100

**Selected Node Number**

451115493

**Route Type**

☒ Commercial
 ☐ HRCQ  
☐ Quickest
 ☐ Time  
☐ Shortest
 ☐ HRCQ + Nevada  
☐ WIPP

**Calculate Route**

**Alternative Route Penalty**

Enter the alternative route penalty to be applied to next alternative routing

Link Penalty (1-100)

**Calculate Alternative Route**

**Date/Time Options**

☒ Use Current Date  
☒ Use Current Time

**Population Options**

☐ 400m Buffer Zone  
☒ 800m Buffer Zone  
☐ 2500m Buffer Zone



# PSEG Site ESP Application Part 3, Environmental Report

WebTRAGIS Client Version: 4.6.2

Block Nodes/Links

Route Listings

Route Maps

Select Origin/Destination

Highway Routing Parameters

**Driver Options**

☐ One Driver
 ☒ Two Drivers

**Other Constraints**

- ☒ Prohibit use of roads that restrict Commercial Trucks
- ☒ Prohibit the use of roads with Hazmat Restrictions
- ☒ Prohibit the use of roads with Radioactive Restrictions
- ☐ Avoid the use of roads in Urban
- ☐ Avoid the use of roads inside or
- ☐ Prohibit the use of roads with Low Clearance
- ☐ Prohibit the use of roads with narrow
- ☐ Tunnels
- ☐ Las Vegas beltway considered a Preferred Route

**Highway Inspection**

☒ Include time for inspections upon entry into state

Enter est. average time to complete inspection per state. (in minutes)

30

**Road Lane Type Penalty**

Penalty Factor (0 - 100)

Lane Type 1 - Limited Access	0
Lane Type 2 - Limited Access	0
Lane Type 3 - Multilane Divided	0
Lane Type 4 - Multilane Undivided	0
Lane Type 5 - Principal Highway	0
Lane Type 6 - Through Highway	0
Lane Type 7 - Other	0

**Toll Bias Factor**

Enter the toll bias factor. (0 - 1000)

0

☐ Include Nevada County Population Details

**PSEG Site  
ESP Application  
Part 3, Environmental Report**

**2 TRAGIS OUTPUT**

TRAGIS Routing Engine Version 1.5.4                      -- Highway Data Network    4.0

FROM:        SALEM NP                                      NJ                      Leaving : 06/25/09 16:12  
TO :        BARNWELL                      S        U278S3        SC                      Arriving : 06/26/09 07:39

Routing parameters used to calculate the route-

Routing type: Commercial with 2 driver(s)  
Time bias: 0.70 Mile bias: 0.30, Toll bias: 1.00

Constraints used on route:  
Prohibit use of links prohibiting truck use  
Prohibit use of ferry crossing  
Prohibit use of roads with Radioactive materials prohibition

Miles	Hwy Sign	City	Dir	Junction	State	Dist	Time	Date	Hour
0.0		SALEM NP			NJ	0.0	0:00	06/25/09	16:12
12.3	LOCAL	SALEM	NW	S49 LOCL	NJ	12.3	0:24	06/25/09	16:36
3.0	S49	PENNSVILLE	S	S49 C551	NJ	15.3	0:29	06/25/09	16:41
4.7	C551	DEEPWATER	SE	TNJT I295	NJ	19.9	0:36	06/25/09	16:48
0.4	I295\$	TNJT\$ DEEPWATER	S	I295X1	NJ	20.3	0:37	06/25/09	16:49
0.9	I295#	crossing state border DE/NJ			BD	21.3	1:07	06/25/09	17:19
		State Inspection took 30 minutes							
2.5	I295#	NEW CASTLE	N	I295S9	DE	23.8	1:10	06/25/09	17:22
2.1	I295	NEWPORT	SE	I295I95	DE	25.9	1:12	06/25/09	17:24
0.7	I95	NEWPORT	S	I95 X5	DE	26.6	1:13	06/25/09	17:25
8.7	I95 \$	NEWARK	S	I95 X1	DE	35.3	1:21	06/25/09	17:33
2.3	I95 \$	crossing state border DE/MD			BD	37.6	1:53	06/25/09	18:05
		State Inspection took 30 minutes							
0.8	I95 \$	ELK MILLS	SE	I95 X109	MD	38.3	1:54	06/25/09	18:06
14.8	I95	AIKEN	N	I95 X93	MD	53.2	2:08	06/25/09	18:20
8.9	S222	CONOWINGO		U1 S222	MD	62.1	2:21	06/25/09	18:33
30.0	U1	FULLERTON	SW	I695X32	MD	92.1	3:00	06/25/09	19:12
8.2	I695	TIMONIUM	S	I695I83	MD	100.3	3:09	06/25/09	19:21
1.5	I695	I83 BALTIMORE	N	I695I83	MD	101.8	3:11	06/25/09	19:23
10.1	I695	BALTIMORE	W	I695I70	MD	112.0	3:22	06/25/09	19:34
4.6	I70	DANIELS	S	I70 X87	MD	116.6	3:26	06/25/09	19:38
23.1	U29	FOUR CORNERS	SW	I495X30	MD	139.7	3:53	06/25/09	20:05
		Rest 30 minutes							
9.5	I495	EMERY CORNERS	E	I495X39	MD	149.2	4:34	06/25/09	20:46
2.3	I495	crossing state border MD/VA			BD	151.4	5:06	06/25/09	21:18
		State Inspection took 30 minutes							
14.6	I495	SPRINGFIELD	N	I495I95	VA	166.1	5:22	06/25/09	21:34
92.3	I95	RICHMOND	NW	I64 I95	VA	258.3	6:50	06/25/09	23:02
3.4	I64	I95 RICHMOND	N	I64 I95	VA	261.7	6:53	06/25/09	23:05
65.0	I95	EMPORIA	N	I95 X11	VA	326.7	7:58	06/26/09	00:10
11.2	I95	crossing state border NC/VA			BD	337.9	8:38	06/26/09	00:50
		Rest 30 minutes							
		State Inspection took 30 minutes							
182.1	I95	ROWLAND	SW	I95 X2	NC	520.0	11:45	06/26/09	03:57
0.1	I95	crossing state border NC/SC			BD	520.1	12:15	06/26/09	04:27
		State Inspection took 30 minutes							
		Rest 30 minutes							
102.4	I95	SANTEE	S	I95 X97	SC	622.4	14:12	06/26/09	06:24
22.3	U301	ORANGEBURG		U301U601	SC	644.7	14:35	06/26/09	06:47
18.4	U301	U601 BAMBERG		U301U78	SC	663.1	14:53	06/26/09	07:05
14.9	U78	BLACKVILLE		U78 S3	SC	678.0	15:11	06/26/09	07:23
10.8	S3	BARNWELL	S	U278S3	SC	688.8	15:27	06/26/09	07:39

**PSEG Site  
ESP Application  
Part 3, Environmental Report**

Total elapsed time: 15:27      Total trip mileage: 688.8      Impedance: 688.0

Mileage by State :

DE: 16.3    MD: 113.9    NC: 182.1    NJ: 21.3    SC: 168.8    VA: 186.5

Mileage by Sign Type:

1-INTERSTATE: 540.5      2-US: 108.7      3-STATE: 22.7      5-COUNTY: 4.7  
6-LOCAL: 12.3

Mileage by Lane Type:

1-Multi-Lane Controlled Access: 540.5      3-Multi-Lane Divided Highway: 63.8  
5-Principle Road: 56.8      6-Through Road: 10.8  
7-Other: 17.0

Mileage by Tribal Lands:

Total Outside Tribal Lands : 688.8  
Total Inside Tribal Lands : 0.0

TRAGIS Routing Engine Version 1.5.4      --      2000 Census Data

POPULATION DENSITY within 800 meter Buffer Zone:

FROM: SALEM NP      NJ  
TO : BARNWELL      S      U278S3      SC

		>0.0	22.7	59.7	139	326	821	1861	3326	5815		
ST	MILES	0	-22.7	-59.7	-139	-326	-821	-1861	-3326	-5815	-9996	>9996
DE	16.3	0.94	0.24	0.93	1.55	2.04	3.38	3.56	1.53	1.34	0.60	0.14
MD	113.9	4.50	1.53	8.92	14.06	13.87	13.95	13.03	16.63	14.86	8.61	3.91
NJ	21.3	4.37	3.43	2.66	2.36	1.85	3.25	1.70	0.99	0.55	0.14	0.00
NC	182.1	9.05	27.62	42.00	30.09	27.49	26.36	13.94	4.44	1.05	0.06	0.00
SC	168.8	22.05	42.19	30.51	15.61	20.55	20.09	11.81	4.66	1.20	0.06	0.07
VA	186.5	9.45	14.99	20.88	25.55	25.70	33.45	27.00	14.91	9.51	3.36	1.73
TOTALS		688.8	50.36	90.00	105.90	89.22	91.50	100.48	71.04	43.16	28.51	12.83
PERCENTAGES			7.31	13.07	15.37	12.95	13.28	14.59	10.31	6.27	4.14	1.86

BASIS: 2000 Census data

RADTRAN Input Data	RURAL	SUBURBAN	URBAN
WEIGHTED POPULATION			
People/sq. mi.	43.1	934.4	6274.3
People/sq. km.	16.7	360.8	2422.5

DISTANCE				TOTALS
Miles	335.5	306.2	47.2	688.8
Kilometers	539.9	492.7	75.9	1108.5
Percentages	48.7	44.5	6.9	

BASIS (people/sq mi.)      <139      139-3326      >3326

Population within 800 meter Buffer Zone by State:

DE 20882    MD 218122    NJ 8552    NC 46512    SC 42498    VA 157765

Total Population within 800 meter Buffer Zone: 494331

**PSEG Site  
ESP Application  
Part 3, Environmental Report**

**3 TRAGIS GENERATED INPUT FOR RADTRAN**

```
[TRAGIS]
TRAGIS Version=1.5.4
Mode=H
Network Version=4.0
Census Data=2000
Buffer Zone=800
[ROUTEINFO]
From CITY=SALEM NP
From STATE=NJ
From SUBNET=
To CITY=BARNWELL      S      U278S3
To STATE=SC
To SUBNET=
[DE]
Rural - KM= 5.9
Suburban - KM= 16.9
Urban - KM= 3.3
Total - KM= 26.2
Rural Pop Density= 20.6
Suburban Pop Density= 409.8
Urban Pop Density=2303.2
[MD]
Rural - KM= 46.7
Suburban - KM= 92.5
Urban - KM= 44.1
Total - KM= 183.3
Rural Pop Density= 23.8
Suburban Pop Density= 482.5
Urban Pop Density=2524.1
[NJ]
Rural - KM= 20.6
Suburban - KM= 12.5
Urban - KM= 1.1
Total - KM= 34.3
Rural Pop Density= 11.8
Suburban Pop Density= 353.9
Urban Pop Density=2025.9
[NC]
Rural - KM= 175.0
Suburban - KM= 116.2
Urban - KM= 1.8
Total - KM= 293.1
Rural Pop Density= 18.1
Suburban Pop Density= 276.5
Urban Pop Density=1834.3
[SC]
Rural - KM= 177.6
Suburban - KM= 91.9
Urban - KM= 2.1
Total - KM= 271.6
Rural Pop Density= 11.9
Suburban Pop Density= 299.0
Urban Pop Density=1953.4
[VA]
Rural - KM= 114.1
```

**PSEG Site  
ESP Application  
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Suburban - KM= 162.6  
Urban - KM= 23.5  
Total - KM= 300.1  
Rural Pop Density= 19.6  
Suburban Pop Density= 382.2  
Urban Pop Density=2355.2  
[Total]  
Rural - KM= 539.9  
Suburban - KM= 492.7  
Urban - KM= 75.9  
Total - KM=1108.5  
Rural Pop Density= 16.7  
Suburban Pop Density= 360.8  
Urban Pop Density=2422.5

**PSEG Site  
ESP Application  
Part 3, Environmental Report**

**4 RADTRAN INPUT**

The RADCAT input screens are reproduced below.

The screenshot displays the Radcat 2.3 software window titled "Radcat 2.3 Project Panthro - Calc. 2009-06944: Radwaste: PSEG ESP to Barnwell SC [unsaved]". The interface includes a menu bar with "File" and "Edit", a toolbar with various icons, and a tabbed interface with tabs for "Title", "Package", "Radionuclides", "Vehicle", "Link", "Stop", "Handling", "Accident", and "Parameters". The "Title" tab is active, showing a text field with the title "Calc. 2009-06944: Radwaste: PSEG ESP to Barnwell SC" and a large "Remarks" text area below it. At the bottom of the window, there are three sections: "Accident Options" with checkboxes for "Incident Free", "Accident", and "SI Output"; "Output Level" with radio buttons for levels 1, 2, 3, and 4; and "Health Effects" with radio buttons for "Rem/Person-rem" and "Latent Cancer Fatalities".

Radcat 2.3 Project Panthro - Calc. 2009-06944: Radwaste: PSEG ESP to Barnwell SC [unsaved]

File Edit

Package Radionuclides Vehicle Link Stop Handling Accident Parameters

Title: Calc. 2009-06944: Radwaste: PSEG ESP to Barnwell SC

Remarks

Add Remark Remove Remark

Accident Options

- ☒ Incident Free
- ☒ Accident
- ☒ SI Output

Output Level

- ☒ 1
- ☐ 2
- ☐ 3
- ☐ 4

Health Effects

- ☒ Rem/Person-rem
- ☐ Latent Cancer Fatalities

**PSEG Site  
ESP Application  
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Radcat 2.3 Project Panthro - Calc. 2009-06944: Radwaste: PSEG ESP to Barnwell SC

File Edit

Icons: New, Open, Save, Print, Find, Copy, Paste, Undo, Redo, Help

Buttons: Title, Package, Radionuclides, Vehicle, Link, Stop, Handling, Accident, Parameters

Name	Long Dim (m)	Dose Rate (mrem/h)	Gamma Fraction	Neutron Fraction
PACKAGE_1	5.20E00	1.39E01	1.00E00	0.00E00

Add Package Remove Package

# PSEG Site ESP Application Part 3, Environmental Report

Radcat 2.3 Project Panthro - Calc. 2009-06944: Radwaste: PSEG ESP to Barnwell SC

File Edit

Title Package **Radionuclides** Vehicle Link Stop Handling Accident Parameters

PACKAGE_1	Radionuclide	Phys/Chem Group	Curies
H3WTR	CO60	Cor	1.04E03
H3GAS	CO58	Cor	1.14E03
BE10	NI63	Cor	1.09E03
C14ORG	CR51	Cor	5.24E03
C14GAS	FE55	Cor	2.60E03
NA22	FE59	Cor	5.33E-01
P32	MN54	Cor	1.69E03
S35	NB95	Cor	9.49E01
CL36	ZR95	Cor	6.24E01
CA41	MO99	Cor	3.25E03
CA45	ZN65	Cor	4.16E02
SC46	H3WTR	gas	1.61E00
CR51	C14ORG	gas	2.85E-01
MN54	BA140	part	3.40E02
FE55	PU241	part	3.39E-01
CO57	CE141	part	3.12E01
CO58	CE144	part	1.69E02
FE59	EU154	part	3.51E00
NI59	PM147	part	3.12E01
CO60	SR89	part	2.60E02
NI63	SR90	part	1.56E02
ZN65	Y90	part	1.56E02
GA67	Y91	part	4.81E01
	TE125M	part	6.63E01
	TE127M	part	4.94E02
	TE129M	part	5.20E02
	TE132	part	1.43E03
	CS134	Cs	4.16E05
	CS137	Cs	3.12E05
	II131	Cs	3.38E04
	RB86	Cs	2.21E02
	RU103	Ru	3.12E01
	RU106	Ru	7.80E01

Radcat 2.3 Project Panthro - Calc. 2009-06944: Radwaste: PSEG ESP to Barnwell SC

File Edit

Title Package Radionuclides **Vehicle** Link Stop Handling Accident Parameters

Vehicle Name	Number of Shipments	Vehicle Size (m)	Vehicle Dose Rate (mrem/h)	Gamma Fraction	Neutron Fraction	Crew Size	Crew Distance (m)	Crew Shielding Factor	Crew View (m)	Exclusive Use
VEHICLE_1	1.00E00	5.20E00	1.39E01	1.00E00	0.00E00	2.00E00	4.00E00	1.00E00	1.00E00	Yes

Package Number of Packages



# PSEG Site ESP Application Part 3, Environmental Report

Radcat 2.3 Project Panthro - Calc. 2009-06944: Radwaste: PSEG ESP to Barnwell SC: Fatalities

File Edit

Title Package Radionuclides Vehicle Link Stop Handling Accident Parameters

Link Name	Vehicle	Length (km)	Speed (km/h)	Population Density (persons/km <sup>2</sup> )	Vehicle Density (vehicles/hr)	Persons per Vehicle	Accident Rate (accidents/veh-km)	Fatalities per Accident	Zor
RURAL_DE	VEHICLE_1	5.90E00	8.89E01	2.06E01	5.30E03	1.50E00	5.18E-07	1.08E-02	Rura
SUBURBN_DE	VEHICLE_1	1.69E01	8.89E01	4.10E02	7.60E02	1.50E00	5.18E-07	1.08E-02	Subu
URBAN_DE	VEHICLE_1	3.30E00	8.89E01	2.30E03	2.40E03	1.50E00	5.18E-07	1.08E-02	Urba
RURAL_MD	VEHICLE_1	4.67E01	8.89E01	2.38E01	5.30E02	1.50E00	5.40E-07	1.20E-02	Rura
SUBURBN_MD	VEHICLE_1	9.25E01	8.89E01	4.82E02	7.60E02	1.50E00	5.40E-07	1.20E-02	Subu
URBAN_MD	VEHICLE_1	4.41E01	8.89E01	2.52E03	2.40E03	1.50E00	5.40E-07	1.20E-02	Urba
RURAL_NJ	VEHICLE_1	2.06E01	8.89E01	1.18E01	5.30E02	1.50E00	5.65E-07	2.14E-02	Rura
SUBURBN_NJ	VEHICLE_1	1.25E01	8.89E01	3.54E02	7.60E02	1.50E00	5.65E-07	2.14E-02	Subu
URBAN_NJ	VEHICLE_1	1.10E00	8.89E01	2.03E03	2.40E03	1.50E00	5.65E-07	2.14E-02	Urba
RURAL_NC	VEHICLE_1	1.75E02	8.89E01	1.81E01	5.30E02	1.50E00	3.46E-07	4.25E-02	Rura
SUBURBN_NC	VEHICLE_1	1.16E02	8.89E01	2.76E02	7.60E02	1.50E00	3.46E-07	4.25E-02	Subu
URBAN_NC	VEHICLE_1	1.80E00	8.89E01	1.83E03	2.40E03	1.50E00	3.46E-07	4.25E-02	Urba
RURAL_SC	VEHICLE_1	1.78E02	8.89E01	1.19E01	5.30E02	1.50E00	3.15E-07	2.79E-02	Rura
SUBURBN_SC	VEHICLE_1	9.19E01	8.89E01	2.99E02	7.60E02	1.50E00	3.15E-07	2.79E-02	Subu
URBAN_SC	VEHICLE_1	2.10E00	8.89E01	1.95E03	2.40E03	1.50E00	3.15E-07	2.79E-02	Urba
RURAL_VA	VEHICLE_1	1.14E02	8.89E01	1.96E01	5.30E02	1.50E00	3.93E-07	4.10E-02	Rura
SUBURBN_VA	VEHICLE_1	1.63E02	8.89E01	3.82E02	7.60E02	1.50E00	3.93E-07	4.10E-02	Subu
URBAN_VA	VEHICLE_1	2.35E01	8.89E01	2.36E03	2.40E03	1.50E00	3.93E-07	4.10E-02	Urba

Add Link Remove Link Import Web Trags

Injuries per Accident in Column Labeled "Fatalities per Accident"

Radcat 2.3 Project Panthro - Calc. 2009-06944: Radwaste: PSEG ESP to Barnwell SC: Injuries

File Edit

Title Package Radionuclides Vehicle Link Stop Handling Accident Parameters

Link Name	Vehicle	Length (km)	Speed (km/h)	Population Density (persons/km <sup>2</sup> )	Vehicle Density (vehicles/hr)	Persons per Vehicle	Accident Rate (accidents/veh-km)	Fatalities per Accident
RURAL_DE	VEHICLE_1	5.90E00	8.89E01	2.06E01	5.30E03	1.50E00	5.18E-07	6.60E-01
SUBURBN_DE	VEHICLE_1	1.69E01	8.89E01	4.10E02	7.60E02	1.50E00	5.18E-07	6.60E-01
URBAN_DE	VEHICLE_1	3.30E00	8.89E01	2.30E03	2.40E03	1.50E00	5.18E-07	6.60E-01
RURAL_MD	VEHICLE_1	4.67E01	8.89E01	2.38E01	5.30E02	1.50E00	5.40E-07	8.50E-01
SUBURBN_MD	VEHICLE_1	9.25E01	8.89E01	4.82E02	7.60E02	1.50E00	5.40E-07	8.50E-01
URBAN_MD	VEHICLE_1	4.41E01	8.89E01	2.52E03	2.40E03	1.50E00	5.40E-07	8.50E-01
RURAL_NJ	VEHICLE_1	2.06E01	8.89E01	1.18E01	5.30E02	1.50E00	5.65E-07	6.92E-01
SUBURBN_NJ	VEHICLE_1	1.25E01	8.89E01	3.54E02	7.60E02	1.50E00	5.65E-07	6.92E-01
URBAN_NJ	VEHICLE_1	1.10E00	8.89E01	2.03E03	2.40E03	1.50E00	5.65E-07	6.92E-01
RURAL_NC	VEHICLE_1	1.75E02	8.89E01	1.81E01	5.30E02	1.50E00	3.46E-07	9.16E-01
SUBURBN_NC	VEHICLE_1	1.16E02	8.89E01	2.76E02	7.60E02	1.50E00	3.46E-07	9.16E-01
URBAN_NC	VEHICLE_1	1.80E00	8.89E01	1.83E03	2.40E03	1.50E00	3.46E-07	9.16E-01
RURAL_SC	VEHICLE_1	1.78E02	8.89E01	1.19E01	5.30E02	1.50E00	3.15E-07	7.21E-01
SUBURBN_SC	VEHICLE_1	9.19E01	8.89E01	2.99E02	7.60E02	1.50E00	3.15E-07	7.21E-01
URBAN_SC	VEHICLE_1	2.10E00	8.89E01	1.95E03	2.40E03	1.50E00	3.15E-07	7.21E-01
RURAL_VA	VEHICLE_1	1.14E02	8.89E01	1.96E01	5.30E02	1.50E00	3.93E-07	7.89E-01
SUBURBN_VA	VEHICLE_1	1.63E02	8.89E01	3.82E02	7.60E02	1.50E00	3.93E-07	7.89E-01
URBAN_VA	VEHICLE_1	2.35E01	8.89E01	2.36E03	2.40E03	1.50E00	3.93E-07	7.89E-01

Add Link Remove Link Import Web Trags

**PSEG Site  
ESP Application  
Part 3, Environmental Report**

Radcat 2.3 Project Panthro - Calc. 2009-06944: Radwaste: PSEG ESP to Barnwell SC

File Edit

Title Package Radionuclides Vehicle Link **Stop** Handling Accident Parameters

Name	Vehicle	Min Distance (m)	Max Distance (m)	People or People/km <sup>2</sup>	Shielding Factor	Time (h)
STOP_1	VEHICLE_1	1.00E00	1.00E01	3.00E04	1.00E00	1.50E00
STOP_2	VEHICLE_1	1.00E01	8.00E02	3.40E02	2.00E-01	1.50E00

Radcat 2.3 Project Panthro - Calc. 2009-06944: Radwaste: PSEG ESP to Barnwell SC [unsaved]

File Edit

Title Package Radionuclides Vehicle Link Stop **Handling** Accident Parameters

Name	Vehicle	Number of Handlers	Distance (m)	Time (h)
HANDLE_1	VEHICLE_1	5.00E00	1.00E00	5.00E-01

**PSEG Site  
ESP Application  
Part 3, Environmental Report**

Radcat 2.3 Project Panthro - Calc. 2009-06944: Radwaste: PSEG ESP to Barnwell SC [unsaved]

File Edit

Title Package Radionuclides Vehicle Link Stop Handling Accident Parameters

Probability Deposition Velocity Release Aerosol Respirable Isopleth P Weather

Index	Probability Fraction
0	1.53E-08
1	5.88E-05
2	1.81E-06
3	7.49E-08
4	4.65E-07
5	3.31E-09
6	0.00E00
7	1.13E-08
8	8.03E-11
9	0.00E00
10	1.44E-10
11	1.02E-12
12	0.00E00
13	7.49E-11
14	0.00E00
15	0.00E00
16	0.00E00
17	5.86E-06
18	1.00E00

Add severity fraction Remove severity fraction

Radcat 2.3 Project Panthro - Calc. 2009-06944: Radwaste: PSEG ESP to Barnwell SC

File Edit

Title Package Radionuclides Vehicle Link Stop Handling Accident Parameters

Probability Deposition Velocity Release Aerosol Respirable Isopleth P Weather

Group	Deposition Velocity (m/s)
Cor	1.00E-02
gas	0.00E00
part	1.00E-02
Cs	1.00E-02
Ru	1.00E-02

**PSEG Site  
ESP Application  
Part 3, Environmental Report**

Radcat 2.3 Project Panthro - Calc. 2009-06944: Radwaste: PSEG ESP to Barnwell ...

File Edit

Title Package Radionuclides Vehicle Link Stop Handling Accident Parameters

Probability Deposition Velocity Release Aerosol Respirable Isopleth P Weather

Cor

Index	Release Fraction
0	2.00E-03
1	1.40E-03
2	1.80E-03
3	3.20E-03
4	1.80E-03
5	2.10E-03
6	3.10E-03
7	2.00E-02
8	2.20E-03
9	2.50E-03
10	2.00E-03
11	2.20E-03
12	2.50E-03
13	6.40E-03
14	5.90E-03
15	3.30E-03
16	3.30E-03
17	2.50E-03
18	0.00E00

**PSEG Site  
ESP Application  
Part 3, Environmental Report**

Radcat 2.3 Project Panthro - Calc. 2009-06944: Radwaste: PSEG ESP to Barnwell SC

File Edit

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

Title Package Radionuclides Vehicle Link Stop Handling Accident Parameters

Probability Deposition Velocity Release Aerosol Respirable Isopleth P Weather

gas

Index	Release Fraction
0	8.00E-01
1	1.40E-01
2	1.80E-01
3	8.40E-01
4	4.30E-01
5	4.90E-01
6	8.50E-01
7	8.20E-01
8	8.90E-01
9	9.10E-01
10	8.20E-01
11	8.90E-01
12	9.10E-01
13	8.40E-01
14	8.50E-01
15	9.10E-01
16	9.10E-01
17	8.40E-01
18	0.00E00

Radcat 2.3 Project Panthro - Calc. 2009-06944: Radwaste: PSEG ESP to Barnwell SC

File Edit

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

Title Package Radionuclides Vehicle Link Stop Handling Accident Parameters

Probability Deposition Velocity Release Aerosol Respirable Isopleth P Weather

part

Index	Release Fraction
0	6.00E-07
1	1.00E-07
2	1.30E-07
3	3.80E-06
4	3.20E-07
5	3.70E-07
6	2.10E-06
7	6.10E-07
8	6.70E-07
9	6.80E-07
10	6.10E-07
11	6.70E-07
12	6.80E-07
13	1.80E-05
14	9.00E-06
15	6.80E-07
16	6.80E-07
17	6.70E-08
18	0.00E00

**PSEG Site  
ESP Application  
Part 3, Environmental Report**

Radcat 2.3 Project Panthro - Calc. 2009-06944: Radwaste: PSEG ESP to Barnwell SC

File Edit

Title Package Radionuclides Vehicle Link Stop Handling Accident Parameters

Probability Deposition Velocity Release Aerosol Respirable Isopleth P Weather

Cs

Index	Release Fraction
0	2.40E-08
1	4.10E-09
2	5.40E-09
3	3.60E-05
4	1.30E-08
5	1.50E-08
6	2.70E-05
7	2.40E-08
8	2.70E-08
9	5.90E-06
10	2.40E-08
11	2.70E-08
12	5.90E-06
13	9.60E-05
14	5.50E-05
15	5.90E-06
16	5.90E-06
17	1.70E-05
18	0.00E00

Radcat 2.3 Project Panthro - Calc. 2009-06944: Radwaste: PSEG ESP to Barnwell SC

File Edit

Title Package Radionuclides Vehicle Link Stop Handling Accident Parameters

Probability Deposition Velocity Release Aerosol Respirable Isopleth P Weather

Ru

Index	Release Fraction
0	6.00E-07
1	1.00E-07
2	1.30E-07
3	3.80E-06
4	3.20E-07
5	3.70E-07
6	2.10E-06
7	6.10E-07
8	6.70E-07
9	6.80E-07
10	6.10E-07
11	6.70E-07
12	6.80E-07
13	1.80E-05
14	9.00E-06
15	6.80E-07
16	6.80E-07
17	6.70E-08
18	0.00E00

**PSEG Site  
ESP Application  
Part 3, Environmental Report**

Radcat 2.3 Project Panthro - Calc. 2009-06944: Radwaste: PSEG ESP to Barnwell SC

File Edit

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

Title Package Radionuclides Vehicle Link Stop Handling Accident Parameters

Probability Deposition Velocity Release Aerosol Respirable Isopleth P Weather

Cor

Index	Aerosol Fraction
0	1.00E00
1	1.00E00
2	1.00E00
3	1.00E00
4	1.00E00
5	1.00E00
6	1.00E00
7	1.00E00
8	1.00E00
9	1.00E00
10	1.00E00
11	1.00E00
12	1.00E00
13	1.00E00
14	1.00E00
15	1.00E00
16	1.00E00
17	1.00E00
18	1.00E00

Radcat 2.3 Project Panthro - Calc. 2009-06944: Radwaste: PSEG ESP to Barnwell SC...

File Edit

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Title Package Radionuclides Vehicle Link Stop Handling Accident Parameters

Probability Deposition Velocity Release Aerosol Respirable Isopleth P Weather

gas

Index	Aerosol Fraction
0	1.00E00
1	1.00E00
2	1.00E00
3	1.00E00
4	1.00E00
5	1.00E00
6	1.00E00
7	1.00E00
8	1.00E00
9	1.00E00
10	1.00E00
11	1.00E00
12	1.00E00
13	1.00E00
14	1.00E00
15	1.00E00
16	1.00E00
17	1.00E00
18	1.00E00

**PSEG Site  
ESP Application  
Part 3, Environmental Report**

Radcat 2.3 Project Panthro - Calc. 2009-06944: Radwaste: PSEG ESP to Barnwell SC...

File Edit

Title Package Radionuclides Vehicle Link Stop Handling Accident Parameters

Probability Deposition Velocity Release Aerosol Respirable Isopleth P Weather

part

Index	Aerosol Fraction
0	1.00E00
1	1.00E00
2	1.00E00
3	1.00E00
4	1.00E00
5	1.00E00
6	1.00E00
7	1.00E00
8	1.00E00
9	1.00E00
10	1.00E00
11	1.00E00
12	1.00E00
13	1.00E00
14	1.00E00
15	1.00E00
16	1.00E00
17	1.00E00
18	1.00E00

Radcat 2.3 Project Panthro - Calc. 2009-06944: Radwaste: PSEG ESP to Barnwell SC...

File Edit

Title Package Radionuclides Vehicle Link Stop Handling Accident Parameters

Probability Deposition Velocity Release Aerosol Respirable Isopleth P Weather

Cs

Index	Aerosol Fraction
0	1.00E00
1	1.00E00
2	1.00E00
3	1.00E00
4	1.00E00
5	1.00E00
6	1.00E00
7	1.00E00
8	1.00E00
9	1.00E00
10	1.00E00
11	1.00E00
12	1.00E00
13	1.00E00
14	1.00E00
15	1.00E00
16	1.00E00
17	1.00E00
18	1.00E00



**PSEG Site  
ESP Application  
Part 3, Environmental Report**

Radcat 2.3 Project Panthro - Calc. 2009-06944: Radwaste: PSEG ESP to Barnwell SC...

File Edit

Title Package Radionuclides Vehicle Link Stop Handling Accident Parameters  
 Probability Deposition Velocity Release Aerosol Respirable Isopleth P Weather

Ru

Index	Aerosol Fraction
0	1.00E00
1	1.00E00
2	1.00E00
3	1.00E00
4	1.00E00
5	1.00E00
6	1.00E00
7	1.00E00
8	1.00E00
9	1.00E00
10	1.00E00
11	1.00E00
12	1.00E00
13	1.00E00
14	1.00E00
15	1.00E00
16	1.00E00
17	1.00E00
18	1.00E00

Radcat 2.3 Project Panthro - Calc. 2009-06944: Radwaste: PSEG ESP to Barnwell SC...

File Edit

Title Package Radionuclides Vehicle Link Stop Handling Accident Parameters  
 Probability Deposition Velocity Release Aerosol Respirable Isopleth P Weather

Cor

Index	Respirable Fraction
0	1.00E00
1	1.00E00
2	1.00E00
3	1.00E00
4	1.00E00
5	1.00E00
6	1.00E00
7	1.00E00
8	1.00E00
9	1.00E00
10	1.00E00
11	1.00E00
12	1.00E00
13	1.00E00
14	1.00E00
15	1.00E00
16	1.00E00
17	1.00E00
18	1.00E00

**PSEG Site  
ESP Application  
Part 3, Environmental Report**

Radcat 2.3 Project Panthro - Calc. 2009-06944: Radwaste: PSEG ESP to Barnwell SC...

File Edit

Title Package Radionuclides Vehicle Link Stop Handling Accident Parameters

Probability Deposition Velocity Release Aerosol Respirable Isopleth P Weather

Cor

Index	Respirable Fraction
0	1.00E00
1	1.00E00
2	1.00E00
3	1.00E00
4	1.00E00
5	1.00E00
6	1.00E00
7	1.00E00
8	1.00E00
9	1.00E00
10	1.00E00
11	1.00E00
12	1.00E00
13	1.00E00
14	1.00E00
15	1.00E00
16	1.00E00
17	1.00E00
18	1.00E00

Radcat 2.3 Project Panthro - Calc. 2009-06944: Radwaste: PSEG ESP to Barnwell SC...

File Edit

Title Package Radionuclides Vehicle Link Stop Handling Accident Parameters

Probability Deposition Velocity Release Aerosol Respirable Isopleth P Weather

part

Index	Respirable Fraction
0	1.00E00
1	1.00E00
2	1.00E00
3	1.00E00
4	1.00E00
5	1.00E00
6	1.00E00
7	1.00E00
8	1.00E00
9	1.00E00
10	1.00E00
11	1.00E00
12	1.00E00
13	1.00E00
14	1.00E00
15	1.00E00
16	1.00E00
17	1.00E00
18	1.00E00

**PSEG Site  
ESP Application  
Part 3, Environmental Report**

Radcat 2.3 Project Panthro - Calc. 2009-06944: Radwaste: PSEG ESP to Barnwell SC...

File Edit

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Title Package Radionuclides Vehicle Link Stop Handling Accident Parameters

Probability Deposition Velocity Release Aerosol Respirable Isopleth P Weather

Cs

Index	Respirable Fraction
0	1.00E00
1	1.00E00
2	1.00E00
3	1.00E00
4	1.00E00
5	1.00E00
6	1.00E00
7	1.00E00
8	1.00E00
9	1.00E00
10	1.00E00
11	1.00E00
12	1.00E00
13	1.00E00
14	1.00E00
15	1.00E00
16	1.00E00
17	1.00E00
18	1.00E00

Radcat 2.3 Project Panthro - Calc. 2009-06944: Radwaste: PSEG ESP to Barnwell SC...

File Edit

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Title Package Radionuclides Vehicle Link Stop Handling Accident Parameters

Probability Deposition Velocity Release Aerosol Respirable Isopleth P Weather

Ru

Index	Respirable Fraction
0	1.00E00
1	1.00E00
2	1.00E00
3	1.00E00
4	1.00E00
5	1.00E00
6	1.00E00
7	1.00E00
8	1.00E00
9	1.00E00
10	1.00E00
11	1.00E00
12	1.00E00
13	1.00E00
14	1.00E00
15	1.00E00
16	1.00E00
17	1.00E00
18	1.00E00

**PSEG Site  
ESP Application  
Part 3, Environmental Report**

Radcat 2.3 Project Panthro - Calc. 2009-06944: Radwaste: PSEG ESP to Barn...

File Edit

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Title Package Radionuclides Vehicle Link Stop Handling Accident Parameters

Probability Deposition Velocity Release Aerosol Respirable Isopleth P Weather

☒ Use the default population densities  
☐ Specify your own population densities

people/km<sup>2</sup>

Add Isopleth P Remove Isopleth P

Radcat 2.3 Project Panthro - Calc. 2009-06944: Radwaste: PSEG ESP to Barn...

File Edit

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

Title Package Radionuclides Vehicle Link Stop Handling Accident Parameters

Probability Deposition Velocity Release Aerosol Respirable Isopleth P Weather

☐ Pasquill ☒ Average ☐ User-Defined

Isopleth Area Size (m <sup>2</sup> )	Time Integrated Concentration	Center-Line Distance (m)
4.59E02	3.42E-03	3.30E01
1.53E03	1.72E-03	6.80E01
3.94E03	8.58E-04	1.05E02
1.25E04	3.42E-04	2.44E02
3.04E04	1.72E-04	3.69E02
6.85E04	8.58E-05	5.61E02
1.76E05	3.42E-05	1.02E03
4.45E05	1.72E-05	1.63E03
8.59E05	8.58E-06	2.31E03
2.55E06	3.42E-06	4.27E03
4.45E06	1.72E-06	5.47E03
1.03E07	8.58E-07	1.11E04
2.16E07	3.42E-07	1.31E04
5.52E07	1.72E-07	2.13E04
1.77E08	8.58E-08	4.05E04
4.89E08	5.42E-08	7.00E04
8.12E08	4.30E-08	8.99E04
1.35E09	3.42E-08	1.21E05

Add Average Area Remove Average Area

**PSEG Site  
ESP Application  
Part 3, Environmental Report**

Radcat 2.3 Project Panthro - Calc. 2009-06944: Radwaste: PSEG ESP to Barn...

File Edit

Title Package Radionuclides Vehicle Link Stop Handling Accident **Parameters**

Parameter	Value
Shielding factor for rural residents	1.00E00
Shielding factor for suburban residents	8.70E-01
Shielding factor for urban residents	1.80E-02
Fraction of outside air in urban buildings	5.00E-02
Fraction of urban population occupying the sidewalk	4.80E-01
Fraction of urban population inside buildings	5.20E-01
Ratio of pedestrians/km <sup>2</sup> to residential population/km <sup>2</sup>	6.00E00
Minimum small package dimension for handling (m)	5.00E-01
Distance from shipment for maximum exposure (m)	3.00E01
Vehicle speed for maximum exposure (km/hr)	2.40E01
Imposed regulatory limit on vehicle external dose	Yes
Average breathing rate (m <sup>3</sup> /sec)	3.30E-04
Cleanup Level (microcuries/m <sup>2</sup> )	2.00E-01
Interdiction Threshold	4.00E01
Evacuation time for groundshine (days)	1.00E00
Survey interval for groundshine (days)	1.00E01
Occupational latent cancer fatalities per person-rem	4.00E-04
Public latent cancer fatalities per person-rem	5.00E-04
Genetic effects per person-rem (public)	1.00E-04
Campaign (year)	8.33E-02
Iodine	I131
Rem per curie thyroid via inhalation (Rem/Ci)	1.27E06
Distance of freeway vehicle carrying radioactive cargo to pede...	3.00E01
Distance of freeway vehicle carrying radioactive cargo to right-...	3.00E01
Distance of freeway vehicle carrying radioactive cargo to maxi...	8.00E02
Distance of non-freeway vehicle carrying radioactive cargo to p...	2.70E01
Distance of non-freeway vehicle carrying radioactive cargo to ri...	3.00E01
Distance of non-freeway vehicle carrying radioactive cargo to ...	8.00E02
Distance of city street vehicle carrying radioactive cargo to ped...	5.00E00
Distance of city street vehicle carrying radioactive cargo to righ...	8.00E00
Distance of city street vehicle carrying radioactive cargo to ma...	8.00E02
Perpendicular distance to freeway vehicle going in opposite dire...	1.50E01
Perpendicular distance to non-freeway vehicle going in opposit...	3.00E00
Perpendicular distance to city vehicle going in opposite direction...	3.00E00
Perpendicular distance to all vehicles going in same direction (m)	4.00E00

**PSEG Site  
ESP Application  
Part 3, Environmental Report**

**5 RADTRAN FATALITIES CASE OUTPUT**

RUN DATE: [ 29-JUL-09

AT 20:49:42 ]

PAGE 1

RRRR	AAA	DDDD	TTTTT	RRRR	AAA	N	N	55555	6
R R A A D D	T	R R A A NN	N	5	6				
R R A A D D	T	R R A A NN	NN	5	6				
RRRR A A D D	T	RRRR A A N NN	5555	6666					
R R AAAAA D D	T	R R AAAAA N N	5	6 6					
R R A A D D	T	R R A A N N	5 5	6 6					
R R A A DDDD	T	R R A A N N	5555	* 666					

RADTRAN 5.6 February 20, 2006

INPUT ECHO

-----

TITLE Calc. 2009-06944: Radwaste: PSEG ESP to Barnwell SC: Fatalities

INPUT STANDARD

STD: 0 10 18	&& DIMEN=NSEV NRAD NAREAS
STD: 1 3 3 0	&& PARM=IRNKC IANA ISEN IPSQSB
STD: .TRUE. .FALSE.	&& FORM = UNIT, SI-UNITS?
STD: 2.3E12	&& NEVAL FOR CF252
STD: 9.25E5 5.77E6 1.27E6	&& RPCTHY FOR I125, I129, I131
STD: 0.0 0.0 0.0 0.0 0.0	&& TRANSFER GAMMA
STD: 7.42E-3 2.02E-2 6.17E-5 3.17E-8 0.0	&& TRANSFER NEUTRON
STD: 30 24	&& MITDDIST MITDVCL
STD: 1 2 .0018	&& ITRAIN FMINCL DDRWEF
STD: 33 68 105 244 369	&& CENTER LINE
STD: 561 1018 1628 2308 4269	&& DISTANCES
STD: 5468 11136 13097 21334 40502	&& FOR AVERAGE
STD: 69986 89860 120878 0 0 0 0 0 0 0 0 0 0 0 0	&& US CLOUD
STD: 4.59E+02 1.53E+03 3.94E+03 1.25E+04 3.04E+04 6.85E+04 1.76E+05 4.45E+05	
STD: 8.59E+05 2.55E+06 4.45E+06 1.03E+07 2.16E+07 5.52E+07 1.77E+08 4.89E+08	
STD: 8.12E+08 1.35E+09 0 0 0 0 0 0 0 0 0 0 0	&& AREADA
STD: 3.42E-03 1.72E-03 8.58E-04 3.42E-04 1.72E-04 8.58E-05 3.42E-05 1.72E-05	
STD: 8.58E-06 3.42E-06 1.72E-06 8.58E-07 3.42E-07 1.72E-07 8.58E-08 5.42E-08	
STD: 4.30E-08 3.42E-08 0 0 0 0 0 0 0 0 0 0	&& DFLEV
STD: 3 6 9 12 15 30 61 91 152 305 0 0 0 0	
STD: 3 6 9 12 15 30 61 91 152 305 0 0 0 0	
STD: 3 6 9 12 15 30 61 91 152 305 0 0 0 0	&& RADIST
STD: 0.5	&& SMLPKG
STD: 1.0 0.87 0.018	&& SHIELDING FACTORS RR RS RU
STD: 30 30 800	&& OFFLINK {FREEWAY}
STD: 27 30 800	&& OFFLINK {NON-FREEWAY}
STD: 5 8 800	&& OFFLINK {CITY STREETS}
STD: 30 30 800	&& OFFLINK {RAILWAY}
STD: 200 200 1000	&& OFFLINK {WATERWAY}
STD: 15 3 3 3 4	&& ONLINK {FWAY NONFWY STREET RAIL ADJ}
STD: 6.0 4 40.0	&& RPD FNOATT INTERDICT
STD: 0.05 0.2 3.3E-4	&& BDF CULVL BRATE
STD: 0.9 0.1	&& UBF USWF
STD: 1.0 10.0 1.0	&& EVACUATION SURVEY CAMPAIGN

**PSEG Site  
ESP Application  
Part 3, Environmental Report**

RUN DATE: [ 29-JUL-09 AT 20:49:42 ]

PAGE 2

Calc. 2009-06944: Radwaste: PSEG ESP to Barnwell SC: Fatalities

```
STD: 0.0 0.0 1.5E-8 5.3E-8 && HIGHWAY - RURAL - NONRAD
STD: 0.0 0.0 3.7E-9 1.3E-8 && HIGHWAY - SUBURBAN - NONRAD
STD: 0.0 0.0 2.1E-9 7.5E-9 && HIGHWAY - URBAN - NONRAD
STD: 0.0 0.0 1.81E-9 2.64E-8 && GENERAL FREIGHT - R - NONRAD
STD: 0.0 0.0 1.81E-9 2.64E-8 && GENERAL FREIGHT - S - NONRAD
STD: 0.0 0.0 1.81E-9 2.64E-8 && GENERAL FREIGHT - U - NONRAD
STD: 0.0 0.0 1.27E-7 1.85E-6 && DEDICATED RAIL - R - NONRAD
STD: 0.0 0.0 1.27E-7 1.85E-6 && DEDICATED RAIL - S - NONRAD
STD: 0.0 0.0 1.27E-7 1.85E-6 && DEDICATED RAIL - U - NONRAD
STD: 0.0 0.0 0.0 0.0 0.0 0.0 && PSPROB
STD: 0.67 0.67 0.42 && TIMENDE NON-DISPERSAL EVAC TIME
(LCF&EARLY)
STD: 2 2 1 && FLAGS=IUOPT IACC REGCHECK
STD: 5E-4, 4E-4, 1.0E-4 && LCFCON(1), LCFCON(2), GECON
STD: R5INGEST.BIN && INGESTION FILE
OUTPUT BQ_SV
FORM UNIT
DIMEN 19 10 18
PARAM 1 3 1 0
SEVERITY
NPOP=1
NMODE=1
1.53E-8
5.88E-5 1.81E-6 7.49E-8 4.65E-7 3.31E-9
0.0 1.13E-8 8.03E-11 0.0 1.44E-10
1.02E-12 0.0 7.49E-11 0.0 0.0
0.0 5.86E-6 0.99993
NPOP=2
NMODE=1
1.53E-8
5.88E-5 1.81E-6 7.49E-8 4.65E-7 3.31E-9
0.0 1.13E-8 8.03E-11 0.0 1.44E-10
1.02E-12 0.0 7.49E-11 0.0 0.0
0.0 5.86E-6 0.99993
NPOP=3
NMODE=1
1.53E-8
5.88E-5 1.81E-6 7.49E-8 4.65E-7 3.31E-9
0.0 1.13E-8 8.03E-11 0.0 1.44E-10
1.02E-12 0.0 7.49E-11 0.0 0.0
0.0 5.86E-6 0.99993
RELEASE
GROUP=Cor
RFRAC
0.0020
0.0014 0.0018 0.0032 0.0018 0.0021
0.0031 0.02 0.0022 0.0025 0.0020
0.0022 0.0025 0.0064 0.0059 0.0033
0.0033 0.0025 0.0
AERSOL
1.0
```

**PSEG Site  
ESP Application  
Part 3, Environmental Report**

RUN DATE: [ 29-JUL-09 AT 20:49:42 ]

PAGE 3

Calc. 2009-06944: Radwaste: PSEG ESP to Barnwell SC: Fatalities

1.0 1.0 1.0 1.0 1.0  
1.0 1.0 1.0 1.0 1.0  
1.0 1.0 1.0 1.0 1.0  
1.0 1.0 1.0

RESP

1.0

1.0 1.0 1.0 1.0 1.0  
1.0 1.0 1.0 1.0 1.0  
1.0 1.0 1.0 1.0 1.0  
1.0 1.0 1.0

LOS

0.0

0.0 0.0 0.0 0.0 0.0  
0.0 0.0 0.0 0.0 0.0  
0.0 0.0 0.0 0.0 0.0  
0.0 0.0 0.0

DEPVEL 0.01

GROUP=gas

RFRAC

0.8

0.14 0.18 0.84 0.43 0.49  
0.85 0.82 0.89 0.91 0.82  
0.89 0.91 0.84 0.85 0.91  
0.91 0.84 0.0

AERSOL

1.0

1.0 1.0 1.0 1.0 1.0  
1.0 1.0 1.0 1.0 1.0  
1.0 1.0 1.0 1.0 1.0  
1.0 1.0 1.0

RESP

1.0

1.0 1.0 1.0 1.0 1.0  
1.0 1.0 1.0 1.0 1.0  
1.0 1.0 1.0 1.0 1.0  
1.0 1.0 1.0

LOS

0.0

0.0 0.0 0.0 0.0 0.0  
0.0 0.0 0.0 0.0 0.0  
0.0 0.0 0.0 0.0 0.0  
0.0 0.0 0.0

DEPVEL 0.0

GROUP=part

RFRAC

6.0E-7

1.0E-7 1.3E-7 3.8E-6 3.2E-7 3.7E-7  
2.1E-6 6.1E-7 6.7E-7 6.8E-7 6.1E-7  
6.7E-7 6.8E-7 1.8E-5 9.0E-6 6.8E-7  
6.8E-7 6.7E-8 0.0

AERSOL

1.0

1.0 1.0 1.0 1.0 1.0



**PSEG Site  
ESP Application  
Part 3, Environmental Report**

RUN DATE: [ 29-JUL-09 AT 20:49:42 ]

PAGE 4

Calc. 2009-06944: Radwaste: PSEG ESP to Barnwell SC: Fatalities

1.0 1.0 1.0 1.0 1.0  
1.0 1.0 1.0 1.0 1.0  
1.0 1.0 1.0

RESP

1.0  
1.0 1.0 1.0 1.0 1.0  
1.0 1.0 1.0 1.0 1.0  
1.0 1.0 1.0 1.0 1.0  
1.0 1.0 1.0

LOS

0.0  
0.0 0.0 0.0 0.0 0.0  
0.0 0.0 0.0 0.0 0.0  
0.0 0.0 0.0 0.0 0.0  
0.0 0.0 0.0

DEPVEL 0.01

GROUP=Cs

RFRAC

2.4E-8  
4.1E-9 5.4E-9 3.6E-5 1.3E-8 1.5E-8  
2.7E-5 2.4E-8 2.7E-8 5.9E-6 2.4E-8  
2.7E-8 5.9E-6 9.6E-5 5.5E-5 5.9E-6  
5.9E-6 1.7E-5 0.0

AERSOL

1.0  
1.0 1.0 1.0 1.0 1.0  
1.0 1.0 1.0 1.0 1.0  
1.0 1.0 1.0 1.0 1.0  
1.0 1.0 1.0

RESP

1.0  
1.0 1.0 1.0 1.0 1.0  
1.0 1.0 1.0 1.0 1.0  
1.0 1.0 1.0 1.0 1.0  
1.0 1.0 1.0

LOS

0.0  
0.0 0.0 0.0 0.0 0.0  
0.0 0.0 0.0 0.0 0.0  
0.0 0.0 0.0 0.0 0.0  
0.0 0.0 0.0

DEPVEL 0.01

GROUP=Ru

RFRAC

6.0E-7  
1.0E-7 1.3E-7 3.8E-6 3.2E-7 3.7E-7  
2.1E-6 6.1E-7 6.7E-7 6.8E-7 6.1E-7  
6.7E-7 6.8E-7 1.8E-5 9.0E-6 6.8E-7  
6.8E-7 6.7E-8 0.0

AERSOL

1.0  
1.0 1.0 1.0 1.0 1.0  
1.0 1.0 1.0 1.0 1.0

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```
1.0 1.0 1.0 1.0 1.0
1.0 1.0 1.0
  RESP
    1.0
1.0 1.0 1.0 1.0 1.0
1.0 1.0 1.0 1.0 1.0
1.0 1.0 1.0 1.0 1.0
1.0 1.0 1.0
  LOS
    0.0
0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0
  DEPVEL 0.01
PACKAGE PACKAGE_1 13.9 0.5 0.5 5.2
  CO60 1040.0 Cor
  CO58 1140.0 Cor
  NI63 1090.0 Cor
  CR51 5240.0 Cor
  FE55 2600.0 Cor
  FE59 0.533 Cor
  MN54 1690.0 Cor
  NB95 94.9 Cor
  ZR95 62.4 Cor
  MO99 3250.0 Cor
  ZN65 416.0 Cor
  H3WTR 1.61 gas
  C14ORG 0.285 gas
  BA140 340.0 part
  PU241 0.339 part
  CE141 31.2 part
  CE144 169.0 part
  EU154 3.51 part
  PM147 31.2 part
  SR89 260.0 part
  SR90 156.0 part
  Y90 156.0 part
  Y91 48.1 part
  TE125M 66.3 part
  TE127M 494.0 part
  TE129M 520.0 part
  TE132 1430.0 part
  CS134 416000.0 Cs
  CS137 312000.0 Cs
  I131 33800.0 Cs
  RB86 221.0 Cs
  RU103 31.2 Ru
  RU106 78.0 Ru
END
VEHICLE -1 VEHICLE_1 1.39E01 1.0 0.0 5.2 1.0 2.0 4.0 1.0 1.0
  PACKAGE_1 1.0
FLAGS
```

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IACC 2  
IUOPT 2  
REGCHECK 1  
MODSTD  
DISTOFF FREEWAY 3.00E01 3.00E01 8.00E02  
DISTOFF SECONDARY 2.70E01 3.00E01 8.00E02  
DISTOFF STREET 5.00E00 8.00E00 8.00E02  
DISTON  
    FREEWAY 1.50E01  
    SECONDARY 3.00E00  
    STREET 3.00E00  
    ADJACENT 4.00E00  
BDF 5.00E-02  
BRATE 3.30E-04  
CULVL 2.00E-01  
EVACUATION 1.00E00  
GECON 1.00E-04  
INTERDICT 4.00E01  
LCFCON 5.00E-04 4.00E-04  
SURVEY 1.00E01  
UBF 5.20E-01  
USWF 4.80E-01  
CAMPAIGN 8.33E-02  
MITDDIST 3.00E01  
MITDVEL 2.40E01  
RPD 6.00E00  
RR 1.00E00  
RU 1.80E-02  
RS 8.70E-01  
SMALLPKG 5.00E-01  
RPCTHYROID  
    I131 1.27E06  
EOF  
LINK RURAL\_DE VEHICLE\_1 5.9 88.9 1.5 20.6 5301.5 5.18E-7 0.0108 R 1 1.0  
LINK SUBURBN\_DE VEHICLE\_1 16.9 88.9 1.5 409.8 760.0 5.18E-7 0.0108 S 1 1.0  
LINK URBAN\_DE VEHICLE\_1 3.3 88.9 1.5 2303.2 2400.0 5.18E-7 0.0108 U 1 1.0  
LINK RURAL\_MD VEHICLE\_1 46.7 88.9 1.5 23.8 530.0 5.4E-7 0.012 R 1 1.0  
LINK SUBURBN\_MD VEHICLE\_1 92.5 88.9 1.5 482.5 760.0 5.4E-7 0.012 S 1 1.0  
LINK URBAN\_MD VEHICLE\_1 44.1 88.9 1.5 2524.1 2400.0 5.4E-7 0.012 U 1 1.0  
LINK RURAL\_NJ VEHICLE\_1 20.6 88.9 1.5 11.8 530.0 5.65E-7 0.0214 R 1 1.0  
LINK SUBURBN\_NJ VEHICLE\_1 12.5 88.9 1.5 353.9 760.0 5.65E-7 0.0214 S 1 1.0  
LINK URBAN\_NJ VEHICLE\_1 1.1 88.9 1.5 2025.9 2400.0 5.65E-7 0.0214 U 1 1.0  
LINK RURAL\_NC VEHICLE\_1 175.0 88.9 1.5 18.1 530.0 3.46E-7 0.0425 R 1 1.0  
LINK SUBURBN\_NC VEHICLE\_1 116.2 88.9 1.5 276.5 760.0 3.46E-7 0.0425 S 1 1.0  
LINK URBAN\_NC VEHICLE\_1 1.8 88.9 1.5 1834.3 2400.0 3.46E-7 0.0425 U 1 1.0  
LINK RURAL\_SC VEHICLE\_1 177.6 88.9 1.5 11.9 530.0 3.15E-7 0.0279 R 1 1.0  
LINK SUBURBN\_SC VEHICLE\_1 91.9 88.9 1.5 299.0 760.0 3.15E-7 0.0279 S 1 1.0  
LINK URBAN\_SC VEHICLE\_1 2.1 88.9 1.5 1953.4 2400.0 3.15E-7 0.0279 U 1 1.0  
LINK RURAL\_VA VEHICLE\_1 114.1 88.9 1.5 19.6 530.0 3.93E-7 0.041 R 1 1.0  
LINK SUBURBN\_VA VEHICLE\_1 162.6 88.9 1.5 382.2 760.0 3.93E-7 0.041 S 1 1.0  
LINK URBAN\_VA VEHICLE\_1 23.5 88.9 1.5 2355.2 2400.0 3.93E-7 0.041 U 1 1.0  
  
STOP STOP\_1 VEHICLE\_1 30000.0 1.0 10.0 1.0 1.5

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STOP STOP\_2 VEHICLE\_1 340.0 10.0 800.0 0.2 1.5

HANDLING HANDLE\_1 VEHICLE\_1 5.0 1.0 0.5

EOF

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NON-RADIOLOGICAL DATA (ACCIDENTS and FATALITIES)

\*\*\*\*\*

HIGHWAY

	ACCIDENT RATE	ACCIDENTS	FATALITIES
RURAL_DE	5.18E-07	3.06E-06	3.30E-08
SUBURBN_DE	5.18E-07	8.75E-06	9.45E-08
URBAN_DE	5.18E-07	1.71E-06	1.85E-08
RURAL_MD	5.40E-07	2.52E-05	3.03E-07
SUBURBN_MD	5.40E-07	5.00E-05	5.99E-07
URBAN_MD	5.40E-07	2.38E-05	2.86E-07
RURAL_NJ	5.65E-07	1.16E-05	2.49E-07
SUBURBN_NJ	5.65E-07	7.06E-06	1.51E-07
URBAN_NJ	5.65E-07	6.22E-07	1.33E-08
RURAL_NC	3.46E-07	6.06E-05	2.57E-06
SUBURBN_NC	3.46E-07	4.02E-05	1.71E-06
URBAN_NC	3.46E-07	6.23E-07	2.65E-08
RURAL_SC	3.15E-07	5.59E-05	1.56E-06
SUBURBN_SC	3.15E-07	2.89E-05	8.08E-07
URBAN_SC	3.15E-07	6.62E-07	1.85E-08
RURAL_VA	3.93E-07	4.48E-05	1.84E-06
SUBURBN_VA	3.93E-07	6.39E-05	2.62E-06
URBAN_VA	3.93E-07	9.24E-06	3.79E-07
TOTALS:	8.03E-06	4.37E-04	1.33E-05

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REGULATORY CHECKS

FOR VEHICLE\_1 THE DOSE RATE AT 2 METERS COULD EXCEED 0.1 MSV/HR  
THE VEHICLE DOSE RATE HAS BEEN RESET TO EQUAL 0.13 MSV/HR

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CALCULATIONAL INFORMATION

FOR VEHICLE\_1 AREAS WITH TOTAL CONTAMINATION RATIO GREATER THAN 40.000  
(THE AREAS MARKED WITH AN 'X' ARE INTERDICTED AND HAVE  
NO 50 YEAR GROUNDSHINE DOSE AND NO INGESTION DOSE.)

AREA/SEVERITY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	-
2	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	-
3	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	-
4	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	-
5	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	-
6	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	-
7	X	-	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	-
8	-	-	-	X	-	-	X	X	-	-	-	-	-	X	X	-	-	-	-
9	-	-	-	-	-	-	-	X	-	-	-	-	-	X	X	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

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INCIDENT-FREE SUMMARY  
\*\*\*\*\*

IN-TRANSIT POPULATION EXPOSURE IN PERSON-SV  
\*INPUT DATA WERE ALTERED WITH REGULATORY CHECKS

	PASSENGER	CREW	OFF LINK	ON LINK	TOTALS
RURAL_DE	0.00E+00	2.62E-06	4.12E-08	4.12E-06	6.77E-06
SUBURBN_DE	0.00E+00	7.49E-06	2.04E-06	1.69E-06	1.12E-05
URBAN_DE	0.00E+00	1.46E-06	4.64E-08	1.04E-06	2.55E-06
RURAL_MD	0.00E+00	2.07E-05	3.77E-07	3.26E-06	2.43E-05
SUBURBN_MD	0.00E+00	4.10E-05	1.32E-05	9.25E-06	6.34E-05
URBAN_MD	0.00E+00	1.95E-05	6.79E-07	1.39E-05	3.42E-05
RURAL_NJ	0.00E+00	9.13E-06	8.24E-08	1.44E-06	1.07E-05
SUBURBN_NJ	0.00E+00	5.54E-06	1.30E-06	1.25E-06	8.09E-06
URBAN_NJ	0.00E+00	4.88E-07	1.36E-08	3.47E-07	8.49E-07
RURAL_NC	0.00E+00	7.76E-05	1.07E-06	1.22E-05	9.09E-05
SUBURBN_NC	0.00E+00	5.15E-05	9.47E-06	1.16E-05	7.26E-05
URBAN_NC	0.00E+00	7.98E-07	2.01E-08	5.68E-07	1.39E-06
RURAL_SC	0.00E+00	7.87E-05	7.16E-07	1.24E-05	9.18E-05
SUBURBN_SC	0.00E+00	4.07E-05	8.10E-06	9.19E-06	5.80E-05
URBAN_SC	0.00E+00	9.31E-07	2.50E-08	6.63E-07	1.62E-06
RURAL_VA	0.00E+00	5.06E-05	7.58E-07	7.96E-06	5.93E-05
SUBURBN_VA	0.00E+00	7.21E-05	1.83E-05	1.63E-05	1.07E-04
URBAN_VA	0.00E+00	1.04E-05	3.38E-07	7.42E-06	1.82E-05
RURAL	0.00E+00	2.39E-04	3.05E-06	4.14E-05	2.84E-04
SUBURB	0.00E+00	2.18E-04	5.24E-05	4.93E-05	3.20E-04
URBAN	0.00E+00	3.36E-05	1.12E-06	2.40E-05	5.87E-05
TOTALS:	0.00E+00	4.91E-04	5.66E-05	1.15E-04	6.62E-04

MAXIMUM INDIVIDUAL IN-TRANSIT DOSE

VEHICLE\_1 5.92E-09 SV

STOP EXPOSURE IN PERSON-SV

ANNULAR AREA	STOP_1	9.43E-04
ANNULAR AREA	STOP_2	4.07E-06
TOTAL:		9.47E-04

HANDLING EXPOSURE IN PERSON-SV

HANDLING	VEHICLE	MATERIAL	METHOD	DOSE
HANDLE_1	VEHICLE_1	PACKAGE_1	LINE-SOURCE	1.17E-03
TOTAL:				1.17E-03



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ACCIDENT SUMMARY

\*\*\*\*\*

EXPECTED VALUES OF POPULATION RISK IN PERSON-SV

	GROUND	INHALED	RESUSPD	CLOUDSH	TOTAL
RURAL_DE	2.73E-11	1.73E-13	8.90E-18	6.91E-15	2.75E-11
SUBURBN_DE	1.56E-09	9.88E-12	5.07E-16	3.94E-13	1.57E-09
URBAN_DE	4.96E-09	3.15E-11	1.62E-15	1.26E-12	5.00E-09
RURAL_MD	2.60E-10	1.65E-12	8.48E-17	6.58E-14	2.62E-10
SUBURBN_MD	1.05E-08	6.64E-11	3.41E-15	2.64E-12	1.05E-08
URBAN_MD	7.58E-08	4.81E-10	2.47E-14	1.92E-11	7.63E-08
RURAL_NJ	5.96E-11	3.78E-13	1.94E-17	1.51E-14	6.00E-11
SUBURBN_NJ	1.08E-09	6.88E-12	3.53E-16	2.74E-13	1.09E-09
URBAN_NJ	1.59E-09	1.01E-11	5.17E-16	4.01E-13	1.60E-09
RURAL_NC	4.76E-10	3.02E-12	1.55E-16	1.20E-13	4.79E-10
SUBURBN_NC	4.82E-09	3.06E-11	1.57E-15	1.22E-12	4.86E-09
URBAN_NC	1.44E-09	9.14E-12	4.69E-16	3.64E-13	1.45E-09
RURAL_SC	2.89E-10	1.83E-12	9.41E-17	7.30E-14	2.91E-10
SUBURBN_SC	3.76E-09	2.38E-11	1.22E-15	9.50E-13	3.78E-09
URBAN_SC	1.63E-09	1.03E-11	5.31E-16	4.12E-13	1.64E-09
RURAL_VA	3.81E-10	2.42E-12	1.24E-16	9.64E-14	3.84E-10
SUBURBN_VA	1.06E-08	6.72E-11	3.45E-15	2.68E-12	1.07E-08
URBAN_VA	2.74E-08	1.74E-10	8.93E-15	6.93E-12	2.76E-08
RURAL	1.49E-09	9.47E-12	4.86E-16	3.78E-13	1.50E-09
SUBURB	3.23E-08	2.05E-10	1.05E-14	8.16E-12	3.25E-08
URBAN	1.13E-07	7.16E-10	3.67E-14	2.85E-11	1.14E-07
TOTALS:	1.47E-07	9.30E-10	4.77E-14	3.71E-11	1.48E-07

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SOCIETAL INGESTION RISK - PERSON-SV

LINK	GONADS	EFFECTIVE
RURAL_DE	2.13E-11	2.09E-11
RURAL_MD	1.76E-10	1.73E-10
RURAL_NJ	8.12E-11	7.97E-11
RURAL_NC	4.23E-10	4.15E-10
RURAL_SC	3.90E-10	3.83E-10
RURAL_VA	3.13E-10	3.07E-10
TOTAL	1.40E-09	1.38E-09

SOCIETAL INGESTION RISK BY ORGAN - PERSON-SV

LINK	BREAST	LUNGS	RED MARR	BONE SUR	THYROID	REMAINDER
RURAL_DE	1.71E-11	1.71E-11	1.95E-11	1.84E-11	1.89E-11	2.51E-11
RURAL_MD	1.41E-10	1.41E-10	1.61E-10	1.52E-10	1.56E-10	2.07E-10
RURAL_NJ	6.53E-11	6.52E-11	7.41E-11	7.00E-11	7.21E-11	9.56E-11
RURAL_NC	3.40E-10	3.39E-10	3.85E-10	3.64E-10	3.75E-10	4.97E-10
RURAL_SC	3.14E-10	3.13E-10	3.56E-10	3.36E-10	3.47E-10	4.59E-10
RURAL_VA	2.52E-10	2.51E-10	2.85E-10	2.70E-10	2.78E-10	3.68E-10
TOTAL	1.13E-09	1.13E-09	1.28E-09	1.21E-09	1.25E-09	1.65E-09

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EXPECTED RISK VALUES - OTHER

LINK	EARLY FATALITY	EARLY MORBIDITY
RURAL_DE	0.00E+00	0.00E+00
SUBURBN_DE	0.00E+00	0.00E+00
URBAN_DE	0.00E+00	0.00E+00
RURAL_MD	0.00E+00	0.00E+00
SUBURBN_MD	0.00E+00	0.00E+00
URBAN_MD	0.00E+00	0.00E+00
RURAL_NJ	0.00E+00	0.00E+00
SUBURBN_NJ	0.00E+00	0.00E+00
URBAN_NJ	0.00E+00	0.00E+00
RURAL_NC	0.00E+00	0.00E+00
SUBURBN_NC	0.00E+00	0.00E+00
URBAN_NC	0.00E+00	0.00E+00
RURAL_SC	0.00E+00	0.00E+00
SUBURBN_SC	0.00E+00	0.00E+00
URBAN_SC	0.00E+00	0.00E+00
RURAL_VA	0.00E+00	0.00E+00
SUBURBN_VA	0.00E+00	0.00E+00
URBAN_VA	0.00E+00	0.00E+00
TOTAL	0.00E+00	0.00E+00

EOI  
END OF RUN  
SUCCESSFUL COMPLETION

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**6 RADTRAN INJURIES CASE OUTPUT**

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RRRR	AAA	DDDD	TTTTT	RRRR	AAA	N	N	55555	6
R R A A D D	T	R R A A NN	N	5	6				
R R A A D D	T	R R A A NN	NN	5	6				
RRRR A A D D	T	RRRR A A N NN	5555	6666					
R R AAAAA D D	T	R R AAAAA N N	5	6 6					
R R A A D D	T	R R A A N N	5 5	6 6					
R R A A DDDD	T	R R A A N N	5555	* 666					

RADTRAN 5.6 February 20, 2006

INPUT ECHO

-----

TITLE Calc. 2009-06944: Radwaste: PSEG ESP to Barnwell SC: Injuries

INPUT STANDARD

STD: 0 10 18	&& DIMEN=NSEV NRAD NAREAS
STD: 1 3 3 0	&& PARM=IRNKC IANA ISEN IPSQSB
STD: .TRUE. .FALSE.	&& FORM = UNIT, SI-UNITS?
STD: 2.3E12	&& NEVAL FOR CF252
STD: 9.25E5 5.77E6 1.27E6	&& RPCTHY FOR I125, I129, I131
STD: 0.0 0.0 0.0 0.0 0.0	&& TRANSFER GAMMA
STD: 7.42E-3 2.02E-2 6.17E-5 3.17E-8 0.0	&& TRANSFER NEUTRON
STD: 30 24	&& MITDDIST MITDVEL
STD: 1 2 .0018	&& ITRAIN FMINCL DDRWEF
STD: 33 68 105 244 369	&& CENTER LINE
STD: 561 1018 1628 2308 4269	&& DISTANCES
STD: 5468 11136 13097 21334 40502	&& FOR AVERAGE
STD: 69986 89860 120878 0 0 0 0 0 0 0 0 0 0 0 0	&& US CLOUD
STD: 4.59E+02 1.53E+03 3.94E+03 1.25E+04 3.04E+04 6.85E+04 1.76E+05 4.45E+05	
STD: 8.59E+05 2.55E+06 4.45E+06 1.03E+07 2.16E+07 5.52E+07 1.77E+08 4.89E+08	
STD: 8.12E+08 1.35E+09 0 0 0 0 0 0 0 0 0 0 0	&& AREADA
STD: 3.42E-03 1.72E-03 8.58E-04 3.42E-04 1.72E-04 8.58E-05 3.42E-05 1.72E-05	
STD: 8.58E-06 3.42E-06 1.72E-06 8.58E-07 3.42E-07 1.72E-07 8.58E-08 5.42E-08	
STD: 4.30E-08 3.42E-08 0 0 0 0 0 0 0 0 0 0	&& DFLEV
STD: 3 6 9 12 15 30 61 91 152 305 0 0 0 0	
STD: 3 6 9 12 15 30 61 91 152 305 0 0 0 0	
STD: 3 6 9 12 15 30 61 91 152 305 0 0 0 0	&& RADIST
STD: 0.5	&& SMLPKG
STD: 1.0 0.87 0.018	&& SHIELDING FACTORS RR RS RU
STD: 30 30 800	&& OFFLINK {FREEWAY}
STD: 27 30 800	&& OFFLINK {NON-FREEWAY}
STD: 5 8 800	&& OFFLINK {CITY STREETS}
STD: 30 30 800	&& OFFLINK {RAILWAY}
STD: 200 200 1000	&& OFFLINK {WATERWAY}
STD: 15 3 3 3 4	&& ONLINK {FWAY NONFWY STREET RAIL ADJ}
STD: 6.0 4 40.0	&& RPD FNOATT INTERDICT
STD: 0.05 0.2 3.3E-4	&& BDF CULVL BRATE
STD: 0.9 0.1	&& UBF USWF
STD: 1.0 10.0 1.0	&& EVACUATION SURVEY CAMPAIGN

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```

STD: 0.0 0.0 1.5E-8 5.3E-8 && HIGHWAY - RURAL - NONRAD
STD: 0.0 0.0 3.7E-9 1.3E-8 && HIGHWAY - SUBURBAN - NONRAD
STD: 0.0 0.0 2.1E-9 7.5E-9 && HIGHWAY - URBAN - NONRAD
STD: 0.0 0.0 1.81E-9 2.64E-8 && GENERAL FREIGHT - R - NONRAD
STD: 0.0 0.0 1.81E-9 2.64E-8 && GENERAL FREIGHT - S - NONRAD
STD: 0.0 0.0 1.81E-9 2.64E-8 && GENERAL FREIGHT - U - NONRAD
STD: 0.0 0.0 1.27E-7 1.85E-6 && DEDICATED RAIL - R - NONRAD
STD: 0.0 0.0 1.27E-7 1.85E-6 && DEDICATED RAIL - S - NONRAD
STD: 0.0 0.0 1.27E-7 1.85E-6 && DEDICATED RAIL - U - NONRAD
STD: 0.0 0.0 0.0 0.0 0.0 0.0 && PSPROB
STD: 0.67 0.67 0.42 && TIMENDE NON-DISPERSAL EVAC TIME
(LCF&EARLY)
STD: 2 2 1 && FLAGS=IUOPT IACC REGCHECK
STD: 5E-4, 4E-4, 1.0E-4 && LCFCON(1), LCFCON(2), GECON
STD: R5INGEST.BIN && INGESTION FILE
OUTPUT BQ_SV
FORM UNIT
DIMEN 19 10 18
PARAM 1 3 1 0
SEVERITY
  NPOP=1
    NMODE=1
      1.53E-8
    5.88E-5 1.81E-6 7.49E-8 4.65E-7 3.31E-9
    0.0 1.13E-8 8.03E-11 0.0 1.44E-10
    1.02E-12 0.0 7.49E-11 0.0 0.0
    0.0 5.86E-6 0.99993
  NPOP=2
    NMODE=1
      1.53E-8
    5.88E-5 1.81E-6 7.49E-8 4.65E-7 3.31E-9
    0.0 1.13E-8 8.03E-11 0.0 1.44E-10
    1.02E-12 0.0 7.49E-11 0.0 0.0
    0.0 5.86E-6 0.99993
  NPOP=3
    NMODE=1
      1.53E-8
    5.88E-5 1.81E-6 7.49E-8 4.65E-7 3.31E-9
    0.0 1.13E-8 8.03E-11 0.0 1.44E-10
    1.02E-12 0.0 7.49E-11 0.0 0.0
    0.0 5.86E-6 0.99993
RELEASE
  GROUP=Cor
  RFRAC
    0.0020
  0.0014 0.0018 0.0032 0.0018 0.0021
  0.0031 0.02 0.0022 0.0025 0.0020
  0.0022 0.0025 0.0064 0.0059 0.0033
  0.0033 0.0025 0.0
  AERSOL
    1.0

```

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1.0 1.0 1.0 1.0 1.0  
1.0 1.0 1.0 1.0 1.0  
1.0 1.0 1.0 1.0 1.0  
1.0 1.0 1.0

RESP

1.0

1.0 1.0 1.0 1.0 1.0  
1.0 1.0 1.0 1.0 1.0  
1.0 1.0 1.0 1.0 1.0  
1.0 1.0 1.0

LOS

0.0

0.0 0.0 0.0 0.0 0.0  
0.0 0.0 0.0 0.0 0.0  
0.0 0.0 0.0 0.0 0.0  
0.0 0.0 0.0

DEPVEL 0.01

GROUP=gas

RFRAC

0.8

0.14 0.18 0.84 0.43 0.49  
0.85 0.82 0.89 0.91 0.82  
0.89 0.91 0.84 0.85 0.91  
0.91 0.84 0.0

AERSOL

1.0

1.0 1.0 1.0 1.0 1.0  
1.0 1.0 1.0 1.0 1.0  
1.0 1.0 1.0 1.0 1.0  
1.0 1.0 1.0

RESP

1.0

1.0 1.0 1.0 1.0 1.0  
1.0 1.0 1.0 1.0 1.0  
1.0 1.0 1.0 1.0 1.0  
1.0 1.0 1.0

LOS

0.0

0.0 0.0 0.0 0.0 0.0  
0.0 0.0 0.0 0.0 0.0  
0.0 0.0 0.0 0.0 0.0  
0.0 0.0 0.0

DEPVEL 0.0

GROUP=part

RFRAC

6.0E-7

1.0E-7 1.3E-7 3.8E-6 3.2E-7 3.7E-7  
2.1E-6 6.1E-7 6.7E-7 6.8E-7 6.1E-7  
6.7E-7 6.8E-7 1.8E-5 9.0E-6 6.8E-7  
6.8E-7 6.7E-8 0.0

AERSOL

1.0

1.0 1.0 1.0 1.0 1.0

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1.0 1.0 1.0 1.0 1.0  
1.0 1.0 1.0 1.0 1.0  
1.0 1.0 1.0

RESP

1.0

1.0 1.0 1.0 1.0 1.0  
1.0 1.0 1.0 1.0 1.0  
1.0 1.0 1.0 1.0 1.0  
1.0 1.0 1.0

LOS

0.0

0.0 0.0 0.0 0.0 0.0  
0.0 0.0 0.0 0.0 0.0  
0.0 0.0 0.0 0.0 0.0  
0.0 0.0 0.0

DEPVEL 0.01

GROUP=Cs

RFRAC

2.4E-8

4.1E-9 5.4E-9 3.6E-5 1.3E-8 1.5E-8  
2.7E-5 2.4E-8 2.7E-8 5.9E-6 2.4E-8  
2.7E-8 5.9E-6 9.6E-5 5.5E-5 5.9E-6  
5.9E-6 1.7E-5 0.0

AERSOL

1.0

1.0 1.0 1.0 1.0 1.0  
1.0 1.0 1.0 1.0 1.0  
1.0 1.0 1.0 1.0 1.0  
1.0 1.0 1.0

RESP

1.0

1.0 1.0 1.0 1.0 1.0  
1.0 1.0 1.0 1.0 1.0  
1.0 1.0 1.0 1.0 1.0  
1.0 1.0 1.0

LOS

0.0

0.0 0.0 0.0 0.0 0.0  
0.0 0.0 0.0 0.0 0.0  
0.0 0.0 0.0 0.0 0.0  
0.0 0.0 0.0

DEPVEL 0.01

GROUP=Ru

RFRAC

6.0E-7

1.0E-7 1.3E-7 3.8E-6 3.2E-7 3.7E-7  
2.1E-6 6.1E-7 6.7E-7 6.8E-7 6.1E-7  
6.7E-7 6.8E-7 1.8E-5 9.0E-6 6.8E-7  
6.8E-7 6.7E-8 0.0

AERSOL

1.0

1.0 1.0 1.0 1.0 1.0  
1.0 1.0 1.0 1.0 1.0

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```
1.0 1.0 1.0 1.0 1.0
1.0 1.0 1.0
  RESP
    1.0
1.0 1.0 1.0 1.0 1.0
1.0 1.0 1.0 1.0 1.0
1.0 1.0 1.0 1.0 1.0
1.0 1.0 1.0
  LOS
    0.0
0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0
  DEPVEL 0.01
PACKAGE PACKAGE_1 13.9 0.5 0.5 5.2
  CO60 1040.0 Cor
  CO58 1140.0 Cor
  NI63 1090.0 Cor
  CR51 5240.0 Cor
  FE55 2600.0 Cor
  FE59 0.533 Cor
  MN54 1690.0 Cor
  NB95 94.9 Cor
  ZR95 62.4 Cor
  MO99 3250.0 Cor
  ZN65 416.0 Cor
  H3WTR 1.61 gas
  C14ORG 0.285 gas
  BA140 340.0 part
  PU241 0.339 part
  CE141 31.2 part
  CE144 169.0 part
  EU154 3.51 part
  PM147 31.2 part
  SR89 260.0 part
  SR90 156.0 part
  Y90 156.0 part
  Y91 48.1 part
  TE125M 66.3 part
  TE127M 494.0 part
  TE129M 520.0 part
  TE132 1430.0 part
  CS134 416000.0 Cs
  CS137 312000.0 Cs
  I131 33800.0 Cs
  RB86 221.0 Cs
  RU103 31.2 Ru
  RU106 78.0 Ru
END
VEHICLE -1 VEHICLE_1 1.39E01 1.0 0.0 5.2 1.0 2.0 4.0 1.0 1.0
  PACKAGE_1 1.0
FLAGS
```



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```
IACC 2
IUOPT 2
REGCHECK 1
MODSTD
  DISTOFF FREEWAY 3.00E01 3.00E01 8.00E02
  DISTOFF SECONDARY 2.70E01 3.00E01 8.00E02
  DISTOFF STREET 5.00E00 8.00E00 8.00E02
  DISTON
    FREEWAY 1.50E01
    SECONDARY 3.00E00
    STREET 3.00E00
    ADJACENT 4.00E00
  BDF 5.00E-02
  BRATE 3.30E-04
  CULVL 2.00E-01
  EVACUATION 1.00E00
  GECON 1.00E-04
  INTERDICT 4.00E01
  LCFCON 5.00E-04 4.00E-04
  SURVEY 1.00E01
  UBF 5.20E-01
  USWF 4.80E-01
  CAMPAIGN 8.33E-02
  MITDDIST 3.00E01
  MITDVEL 2.40E01
  RPD 6.00E00
  RR 1.00E00
  RU 1.80E-02
  RS 8.70E-01
  SMALLPKG 5.00E-01
  RPCTHYROID
    I131 1.27E06
EOF
LINK RURAL_DE VEHICLE_1 5.9 88.9 1.5 20.6 5301.5 5.18E-7 0.66 R 1 1.0
LINK SUBURBN_DE VEHICLE_1 16.9 88.9 1.5 409.8 760.0 5.18E-7 0.66 S 1 1.0
LINK URBAN_DE VEHICLE_1 3.3 88.9 1.5 2303.2 2400.0 5.18E-7 0.66 U 1 1.0
LINK RURAL_MD VEHICLE_1 46.7 88.9 1.5 23.8 530.0 5.4E-7 0.85 R 1 1.0
LINK SUBURBN_MD VEHICLE_1 92.5 88.9 1.5 482.5 760.0 5.4E-7 0.85 S 1 1.0
LINK URBAN_MD VEHICLE_1 44.1 88.9 1.5 2524.1 2400.0 5.4E-7 0.85 U 1 1.0
LINK RURAL_NJ VEHICLE_1 20.6 88.9 1.5 11.8 530.0 5.65E-7 0.692 R 1 1.0
LINK SUBURBN_NJ VEHICLE_1 12.5 88.9 1.5 353.9 760.0 5.65E-7 0.692 S 1 1.0
LINK URBAN_NJ VEHICLE_1 1.1 88.9 1.5 2025.9 2400.0 5.65E-7 0.692 U 1 1.0
LINK RURAL_NC VEHICLE_1 175.0 88.9 1.5 18.1 530.0 3.46E-7 0.916 R 1 1.0
LINK SUBURBN_NC VEHICLE_1 116.2 88.9 1.5 276.5 760.0 3.46E-7 0.916 S 1 1.0
LINK URBAN_NC VEHICLE_1 1.8 88.9 1.5 1834.3 2400.0 3.46E-7 0.916 U 1 1.0
LINK RURAL_SC VEHICLE_1 177.6 88.9 1.5 11.9 530.0 3.15E-7 0.721 R 1 1.0
LINK SUBURBN_SC VEHICLE_1 91.9 88.9 1.5 299.0 760.0 3.15E-7 0.721 S 1 1.0
LINK URBAN_SC VEHICLE_1 2.1 88.9 1.5 1953.4 2400.0 3.15E-7 0.721 U 1 1.0
LINK RURAL_VA VEHICLE_1 114.1 88.9 1.5 19.6 530.0 3.93E-7 0.789 R 1 1.0
LINK SUBURBN_VA VEHICLE_1 162.6 88.9 1.5 382.2 760.0 3.93E-7 0.789 S 1 1.0
LINK URBAN_VA VEHICLE_1 23.5 88.9 1.5 2355.2 2400.0 3.93E-7 0.789 U 1 1.0

STOP STOP_1 VEHICLE_1 30000.0 1.0 10.0 1.0 1.5
```

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STOP STOP\_2 VEHICLE\_1 340.0 10.0 800.0 0.2 1.5

HANDLING HANDLE\_1 VEHICLE\_1 5.0 1.0 0.5

EOF

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NON-RADIOLOGICAL DATA (ACCIDENTS and FATALITIES)

\*\*\*\*\*

HIGHWAY

	ACCIDENT RATE	ACCIDENTS	FATALITIES
RURAL_DE	5.18E-07	3.06E-06	2.02E-06
SUBURBN_DE	5.18E-07	8.75E-06	5.78E-06
URBAN_DE	5.18E-07	1.71E-06	1.13E-06
RURAL_MD	5.40E-07	2.52E-05	2.14E-05
SUBURBN_MD	5.40E-07	5.00E-05	4.25E-05
URBAN_MD	5.40E-07	2.38E-05	2.02E-05
RURAL_NJ	5.65E-07	1.16E-05	8.05E-06
SUBURBN_NJ	5.65E-07	7.06E-06	4.89E-06
URBAN_NJ	5.65E-07	6.22E-07	4.30E-07
RURAL_NC	3.46E-07	6.06E-05	5.55E-05
SUBURBN_NC	3.46E-07	4.02E-05	3.68E-05
URBAN_NC	3.46E-07	6.23E-07	5.70E-07
RURAL_SC	3.15E-07	5.59E-05	4.03E-05
SUBURBN_SC	3.15E-07	2.89E-05	2.09E-05
URBAN_SC	3.15E-07	6.62E-07	4.77E-07
RURAL_VA	3.93E-07	4.48E-05	3.54E-05
SUBURBN_VA	3.93E-07	6.39E-05	5.04E-05
URBAN_VA	3.93E-07	9.24E-06	7.29E-06
TOTALS:	8.03E-06	4.37E-04	3.54E-04

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REGULATORY CHECKS

FOR VEHICLE\_1 THE DOSE RATE AT 2 METERS COULD EXCEED 0.1 MSV/HR  
THE VEHICLE DOSE RATE HAS BEEN RESET TO EQUAL 0.13 MSV/HR

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CALCULATIONAL INFORMATION

FOR VEHICLE\_1 AREAS WITH TOTAL CONTAMINATION RATIO GREATER THAN 40.000  
(THE AREAS MARKED WITH AN 'X' ARE INTERDICTED AND HAVE  
NO 50 YEAR GROUNDSHINE DOSE AND NO INGESTION DOSE.)

AREA/SEVERITY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	-
2	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	-
3	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	-
4	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	-
5	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	-
6	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	-
7	X	-	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	-
8	-	-	-	X	-	-	X	X	-	-	-	-	-	X	X	-	-	-	-
9	-	-	-	-	-	-	-	X	-	-	-	-	-	X	X	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

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INCIDENT-FREE SUMMARY

\*\*\*\*\* \*\*\*\*\*

IN-TRANSIT POPULATION EXPOSURE IN PERSON-SV  
\*INPUT DATA WERE ALTERED WITH REGULATORY CHECKS

	PASSENGER	CREW	OFF LINK	ON LINK	TOTALS
RURAL_DE	0.00E+00	2.62E-06	4.12E-08	4.12E-06	6.77E-06
SUBURBN_DE	0.00E+00	7.49E-06	2.04E-06	1.69E-06	1.12E-05
URBAN_DE	0.00E+00	1.46E-06	4.64E-08	1.04E-06	2.55E-06
RURAL_MD	0.00E+00	2.07E-05	3.77E-07	3.26E-06	2.43E-05
SUBURBN_MD	0.00E+00	4.10E-05	1.32E-05	9.25E-06	6.34E-05
URBAN_MD	0.00E+00	1.95E-05	6.79E-07	1.39E-05	3.42E-05
RURAL_NJ	0.00E+00	9.13E-06	8.24E-08	1.44E-06	1.07E-05
SUBURBN_NJ	0.00E+00	5.54E-06	1.30E-06	1.25E-06	8.09E-06
URBAN_NJ	0.00E+00	4.88E-07	1.36E-08	3.47E-07	8.49E-07
RURAL_NC	0.00E+00	7.76E-05	1.07E-06	1.22E-05	9.09E-05
SUBURBN_NC	0.00E+00	5.15E-05	9.47E-06	1.16E-05	7.26E-05
URBAN_NC	0.00E+00	7.98E-07	2.01E-08	5.68E-07	1.39E-06
RURAL_SC	0.00E+00	7.87E-05	7.16E-07	1.24E-05	9.18E-05
SUBURBN_SC	0.00E+00	4.07E-05	8.10E-06	9.19E-06	5.80E-05
URBAN_SC	0.00E+00	9.31E-07	2.50E-08	6.63E-07	1.62E-06
RURAL_VA	0.00E+00	5.06E-05	7.58E-07	7.96E-06	5.93E-05
SUBURBN_VA	0.00E+00	7.21E-05	1.83E-05	1.63E-05	1.07E-04
URBAN_VA	0.00E+00	1.04E-05	3.38E-07	7.42E-06	1.82E-05
RURAL	0.00E+00	2.39E-04	3.05E-06	4.14E-05	2.84E-04
SUBURB	0.00E+00	2.18E-04	5.24E-05	4.93E-05	3.20E-04
URBAN	0.00E+00	3.36E-05	1.12E-06	2.40E-05	5.87E-05
TOTALS:	0.00E+00	4.91E-04	5.66E-05	1.15E-04	6.62E-04

MAXIMUM INDIVIDUAL IN-TRANSIT DOSE

VEHICLE\_1 5.92E-09 SV

STOP EXPOSURE IN PERSON-SV

ANNULAR AREA	STOP_1	9.43E-04
ANNULAR AREA	STOP_2	4.07E-06
TOTAL:		9.47E-04

**PSEG Site**  
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HANDLING EXPOSURE IN PERSON-SV

HANDLING	VEHICLE	MATERIAL	METHOD	DOSE
HANDLE_1	VEHICLE_1	PACKAGE_1	LINE-SOURCE	
			TOTAL:	1.17E-03

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ACCIDENT SUMMARY

\*\*\*\*\*

EXPECTED VALUES OF POPULATION RISK IN PERSON-SV

	GROUND	INHALED	RESUSPD	CLOUDSH	TOTAL
RURAL_DE	2.73E-11	1.73E-13	8.90E-18	6.91E-15	2.75E-11
SUBURBN_DE	1.56E-09	9.88E-12	5.07E-16	3.94E-13	1.57E-09
URBAN_DE	4.96E-09	3.15E-11	1.62E-15	1.26E-12	5.00E-09
RURAL_MD	2.60E-10	1.65E-12	8.48E-17	6.58E-14	2.62E-10
SUBURBN_MD	1.05E-08	6.64E-11	3.41E-15	2.64E-12	1.05E-08
URBAN_MD	7.58E-08	4.81E-10	2.47E-14	1.92E-11	7.63E-08
RURAL_NJ	5.96E-11	3.78E-13	1.94E-17	1.51E-14	6.00E-11
SUBURBN_NJ	1.08E-09	6.88E-12	3.53E-16	2.74E-13	1.09E-09
URBAN_NJ	1.59E-09	1.01E-11	5.17E-16	4.01E-13	1.60E-09
RURAL_NC	4.76E-10	3.02E-12	1.55E-16	1.20E-13	4.79E-10
SUBURBN_NC	4.82E-09	3.06E-11	1.57E-15	1.22E-12	4.86E-09
URBAN_NC	1.44E-09	9.14E-12	4.69E-16	3.64E-13	1.45E-09
RURAL_SC	2.89E-10	1.83E-12	9.41E-17	7.30E-14	2.91E-10
SUBURBN_SC	3.76E-09	2.38E-11	1.22E-15	9.50E-13	3.78E-09
URBAN_SC	1.63E-09	1.03E-11	5.31E-16	4.12E-13	1.64E-09
RURAL_VA	3.81E-10	2.42E-12	1.24E-16	9.64E-14	3.84E-10
SUBURBN_VA	1.06E-08	6.72E-11	3.45E-15	2.68E-12	1.07E-08
URBAN_VA	2.74E-08	1.74E-10	8.93E-15	6.93E-12	2.76E-08
RURAL	1.49E-09	9.47E-12	4.86E-16	3.78E-13	1.50E-09
SUBURB	3.23E-08	2.05E-10	1.05E-14	8.16E-12	3.25E-08
URBAN	1.13E-07	7.16E-10	3.67E-14	2.85E-11	1.14E-07
TOTALS:	1.47E-07	9.30E-10	4.77E-14	3.71E-11	1.48E-07



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SOCIETAL INGESTION RISK - PERSON-SV

LINK	GONADS	EFFECTIVE
RURAL_DE	2.13E-11	2.09E-11
RURAL_MD	1.76E-10	1.73E-10
RURAL_NJ	8.12E-11	7.97E-11
RURAL_NC	4.23E-10	4.15E-10
RURAL_SC	3.90E-10	3.83E-10
RURAL_VA	3.13E-10	3.07E-10
TOTAL	1.40E-09	1.38E-09

SOCIETAL INGESTION RISK BY ORGAN - PERSON-SV

LINK	BREAST	LUNGS	RED MARR	BONE SUR	THYROID	REMAINDER
RURAL_DE	1.71E-11	1.71E-11	1.95E-11	1.84E-11	1.89E-11	2.51E-11
RURAL_MD	1.41E-10	1.41E-10	1.61E-10	1.52E-10	1.56E-10	2.07E-10
RURAL_NJ	6.53E-11	6.52E-11	7.41E-11	7.00E-11	7.21E-11	9.56E-11
RURAL_NC	3.40E-10	3.39E-10	3.85E-10	3.64E-10	3.75E-10	4.97E-10
RURAL_SC	3.14E-10	3.13E-10	3.56E-10	3.36E-10	3.47E-10	4.59E-10
RURAL_VA	2.52E-10	2.51E-10	2.85E-10	2.70E-10	2.78E-10	3.68E-10
TOTAL	1.13E-09	1.13E-09	1.28E-09	1.21E-09	1.25E-09	1.65E-09

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EXPECTED RISK VALUES - OTHER

LINK	EARLY FATALITY	EARLY MORBIDITY
RURAL_DE	0.00E+00	0.00E+00
SUBURBN_DE	0.00E+00	0.00E+00
URBAN_DE	0.00E+00	0.00E+00
RURAL_MD	0.00E+00	0.00E+00
SUBURBN_MD	0.00E+00	0.00E+00
URBAN_MD	0.00E+00	0.00E+00
RURAL_NJ	0.00E+00	0.00E+00
SUBURBN_NJ	0.00E+00	0.00E+00
URBAN_NJ	0.00E+00	0.00E+00
RURAL_NC	0.00E+00	0.00E+00
SUBURBN_NC	0.00E+00	0.00E+00
URBAN_NC	0.00E+00	0.00E+00
RURAL_SC	0.00E+00	0.00E+00
SUBURBN_SC	0.00E+00	0.00E+00
URBAN_SC	0.00E+00	0.00E+00
RURAL_VA	0.00E+00	0.00E+00
SUBURBN_VA	0.00E+00	0.00E+00
URBAN_VA	0.00E+00	0.00E+00
TOTAL	0.00E+00	0.00E+00

EOI  
END OF RUN  
SUCCESSFUL COMPLETION

**PSEG Site  
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**7A.3 NEW FUEL ANALYSIS**

This attachment contains the TRAGIS and RADCAT/RADTRAN input and output for one new fuel shipment from Richland, WA to the PSEG Site.

1	TRAGIS INPUT .....	7A-107
2	TRAGIS Output.....	7A-109
3	TRAGIS Generated Input for RADTRAN .....	7A-111
4	RADTRAN Input.....	7A-114
5	RADTRAN Fatalities Case Output .....	7A-119
6	RADTRAN Injuries Case Output.....	7A-127

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**1 TRAGIS INPUT**

The TRAGIS input screens are reproduced below.

WebTRAGIS Client Version: 4.6.2

Block Nodes/Links	Route Listings	Route Maps	
<b>Select Origin/Destination</b>	Highway Routing Parameters	Rail Routing Parameters	Water Routing Parameters

**Mode**

☒ Highway   ☐ Railroad   ☐ Water   ☐ InterModal

**Calculate Route**

**Origin**

State	Node Name
OR	PWT AIRPORT
PA	QUINCY S28 S281
RI	RAYMOND U101S6
SC	REDMOND SE S202S520
SD	RENTON S I405X2
TN	RENTON W I405I5
TX	<b>RICHLAND</b>
UT	RICHLAND N S240LR4S
VA	RICHLAND NW S240LR10
VT	RICHLAND SE I182X5
WA	RITZVILLE I90X221
WI	RITZVILLE SW I90X220
WV	RIVERTON HGTS S518LOCL
WY	RLD AIRPORT

**Selected Node Number**

☐ Enter Intermediate Node

**Alternative Route Penalty**

Enter the alternative route penalty to be applied to next alternative routing calculation.

Link Penalty (1-100)

**Calculate Alternative Route**

**Destination**

State	Node Name
MS	S BRUNSWICK E TNJTX8A
MT	S TOMS RIVER W TGSPX80
NC	SADDLE BROOK I80X62
ND	SADDLE BROOK NW TGSPX159
NE	SALEM S45 S49
NH	SALEM NW S49 LOCL
<b>NJ</b>	<b>SALEM NP</b>
NM	SAYREVILLE W TNJTX9
NV	SEASIDE HTS S35 S37
NY	SEAVILLE U9 S50
OH	SEAVILLE SE TGSPX20
OK	SECAUCUS E I95EX16E
OR	SEVEN STARS S U9 S70
PA	SHARPTOWN NW U40 S48

**Selected Node Number**

**Date/Time Options**

☒ Use Current Date

☒ Use Current Time

**Population Options**

☐ 400m Buffer Zone

☒ 800m Buffer Zone

☐ 2500m Buffer Zone

**Route Type**

☒ Commercial

☐ Quickest

☐ Shortest

☐ HRCQ

☐ HRCQ + Nevada

☐ WIPP

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WebTRAGIS Client Version: 4.6.2

Block Nodes/Links Select Origin/Destination	Route Listings <b>Highway Routing Parameters</b>	Route Maps Rail Routing Parameters	Water Routing Parameters														
<b>Driver Options</b>  <input type="radio"/> One Driver <input checked="" type="radio"/> Two Drivers     <b>Highway Inspection</b>  <input checked="" type="checkbox"/> Include time for inspections upon entry into state Enter est. average time to complete inspection per state. (in minutes) <input type="text" value="30"/>  <b>Toll Bias Factor</b> Enter the toll bias factor. (0 - 1000) <input type="text" value="0"/>  <input type="checkbox"/> Include Nevada County Population Details	<b>Other Constraints</b>  <input checked="" type="checkbox"/> Prohibit use of roads that restrict Commercial Trucks. <input checked="" type="checkbox"/> Prohibit the use of Ferry Crossings. <input type="checkbox"/> Prohibit the use of roads with Hazmat Restrictions. <input checked="" type="checkbox"/> Prohibit the use of roads with Radioactive restrictions. <input type="checkbox"/> Avoid the use of roads in Urban Areas. <input type="checkbox"/> Avoid the use of roads Inside of Beltways. <input type="checkbox"/> Prohibit the use of roads with Low Clearance. <input type="checkbox"/> Prohibit the use of roads with Narrow Clearance. <input type="checkbox"/> Prohibit the use of roads with Tunnels. <input type="checkbox"/> Las Vegas Beltway considered a Preferred Route.  <b>Road Lane Type Penalty</b> <b>Penalty Factor (0 - 100)</b> <table style="width: 100%;"><tr><td>Lane Type 1 - Limited Access Multilane</td><td><input type="text" value="0"/></td></tr><tr><td>Lane Type 2 - Limited Access Single Lane</td><td><input type="text" value="0"/></td></tr><tr><td>Lane Type 3 - Multilane Divided</td><td><input type="text" value="0"/></td></tr><tr><td>Lane Type 4 - Multilane Undivided</td><td><input type="text" value="0"/></td></tr><tr><td>Lane Type 5 - Principal Highway</td><td><input type="text" value="0"/></td></tr><tr><td>Lane Type 6 - Through Highway</td><td><input type="text" value="0"/></td></tr><tr><td>Lane Type 7 - Other</td><td><input type="text" value="0"/></td></tr></table>	Lane Type 1 - Limited Access Multilane	<input type="text" value="0"/>	Lane Type 2 - Limited Access Single Lane	<input type="text" value="0"/>	Lane Type 3 - Multilane Divided	<input type="text" value="0"/>	Lane Type 4 - Multilane Undivided	<input type="text" value="0"/>	Lane Type 5 - Principal Highway	<input type="text" value="0"/>	Lane Type 6 - Through Highway	<input type="text" value="0"/>	Lane Type 7 - Other	<input type="text" value="0"/>		
Lane Type 1 - Limited Access Multilane	<input type="text" value="0"/>																
Lane Type 2 - Limited Access Single Lane	<input type="text" value="0"/>																
Lane Type 3 - Multilane Divided	<input type="text" value="0"/>																
Lane Type 4 - Multilane Undivided	<input type="text" value="0"/>																
Lane Type 5 - Principal Highway	<input type="text" value="0"/>																
Lane Type 6 - Through Highway	<input type="text" value="0"/>																
Lane Type 7 - Other	<input type="text" value="0"/>																

[Help](#)    [Client Software Parameters](#)

**PSEG Site  
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## 2 TRAGIS OUTPUT

TRAGIS Routing Engine Version 1.5.4      -- Highway Data Network      4.0

FROM:      RICHLAND      WA      Leaving : 06/26/09 15:33  
TO :      SALEM NP      NJ      Arriving : 06/29/09 01:54

Routing parameters used to calculate the route-

Routing type: Commercial with 2 driver(s)  
Time bias: 0.70 Mile bias: 0.30, Toll bias: 1.00

Constraints used on route:  
Prohibit use of links prohibiting truck use  
Prohibit use of ferry crossing  
Prohibit use of roads with Radioactive materials prohibition

Miles	Hwy Sign	City	Dir	Junction	State	Dist	Time	Date	Hour
0.0		RICHLAND			WA	0.0	0:00	06/26/09	15:33
10.1	S240	KENNEWICK	NW	U395S240	WA	10.1	0:13	06/26/09	15:46
5.8	U395	KENNEWICK	SW	I82 X113	WA	15.9	0:21	06/26/09	15:54
19.1	I82	PLYMOUTH		I82 X131	WA	35.0	0:40	06/26/09	16:13
0.7	I82	crossing state border		OR/WA	BD	35.6	1:11	06/26/09	16:44
		State Inspection took 30 minutes							
10.6	I82	HERMISTON	SW	I82 I84	OR	46.2	1:22	06/26/09	16:55
		Rest 30 minutes							
196.6	I84	ONTARIO	E	I84 X376	OR	242.8	5:27	06/26/09	22:00
1.3	I84	crossing state border		ID/OR	BD	244.1	5:58	06/26/09	22:31
		State Inspection took 30 minutes							
		Rest 30 minutes							
221.6	I84	RAFT RIVER	W	I84 I86	ID	465.7	9:53	06/27/09	02:26
54.0	I84	crossing state border		ID/UT	BD	519.7	11:13	06/27/09	03:46
		State Inspection took 30 minutes							
41.8	I84	TREMONTON	W	I15 I84	UT	561.5	11:48	06/27/09	04:21
		Rest 30 minutes							
39.4	I15	OGDEN	S	I15 I84	UT	600.9	12:52	06/27/09	05:25
38.5	I84	ECHO		I80 I84	UT	639.5	13:23	06/27/09	05:56
29.4	I80	crossing state border		UT/WY	BD	668.9	14:17	06/27/09	06:50
		State Inspection took 30 minutes							
		Rest 30 minutes							
360.1	I80	CHEYENNE	S	I80 X362	WY	1028.9	19:35	06/27/09	12:08
40.5	I80	crossing state border		NE/WY	BD	1069.4	20:37	06/27/09	13:10
		Rest 30 minutes							
		State Inspection took 30 minutes							
		Rest 30 minutes							
450.5	I80	OMAHA	S	I80 X453	NE	1520.0	27:41	06/27/09	21:14
2.2	I80	crossing state border		IA/NE	BD	1522.1	28:13	06/27/09	21:46
		State Inspection took 30 minutes							
0.9	I80	COUNCIL BLUFFS	SW	I29 I80	IA	1523.0	28:14	06/27/09	21:47
2.8	I29	COUNCIL BLUFFS	SE	I29 I80	IA	1525.8	28:17	06/27/09	21:50
		Rest 30 minutes							
119.5	I80	DES MOINES	W	I235I35	IA	1645.3	30:38	06/28/09	00:11
14.2	I35	DES MOINES	N	I235I35	IA	1659.5	30:52	06/28/09	00:25
		Rest 30 minutes							
167.6	I80	LE CLAIRE	SW	I80 X306	IA	1827.1	33:27	06/28/09	03:00
0.4	I80	crossing state border		IA/IL	BD	1827.4	34:28	06/28/09	04:01
		State Inspection took 30 minutes							
154.7	I80	HOMEWOOD	NW	I294I80	IL	1982.1	37:16	06/28/09	06:49
4.9	I294\$	LANSING	W	I294I94	IL	1987.1	37:22	06/28/09	06:55
3.0	I80	crossing state border		IL/IN	BD	1990.0	37:55	06/28/09	07:28

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Rest 30 minutes									
State Inspection took 30 minutes									
15.4	I80	I94	LAKE STATION	NE	I80 I94	IN	2005.4	38:41	06/28/09 08:14
0.5	I80		PORTAGE	W	I80 I90	IN	2005.9	38:42	06/28/09 08:15
122.2	I80 \$	I90 \$	JAMESTOWN	SE	I69 I80	IN	2128.1	40:44	06/28/09 10:17
13.2	I80 \$	I90 \$	crossing state border	IN/OH	BD		2141.3	41:27	06/28/09 11:00
State Inspection took 30 minutes									
Rest 30 minutes									
141.8	I80 \$	I90 \$	ELYRIA	NW	I80 I90	OH	2283.0	44:32	06/28/09 15:05
76.0	I80 \$		NORTH JACKSON	NE	I76 I80	OH	2359.0	45:55	06/28/09 16:28
15.2	I80		HUBBARD	N	I80 X234	OH	2374.2	46:12	06/28/09 16:45
2.7	I80		crossing state border	OH/PA	BD		2376.9	46:44	06/28/09 17:17
Rest 30 minutes									
State Inspection took 30 minutes									
121.8	I80		NEEDFUL	S	I80 X123	PA	2498.7	49:08	06/28/09 19:41
1.6	S970		WOODLAND	E	U322S970	PA	2500.3	49:10	06/28/09 19:43
22.9	U322		PORT MATILDA		U220U322	PA	2523.2	49:38	06/28/09 20:11
2.9	U220	U322	MARTHA FURNACE		U220U322	PA	2526.1	49:41	06/28/09 20:14
38.6	U322		LEWISTOWN	NE	U322U522	PA	2564.7	50:27	06/28/09 21:00
0.5	U322	U522	LEWISTOWN	E	U322U522	PA	2565.2	50:27	06/28/09 21:00
1.9	U322		LEWISTOWN	SE	U22 U322	PA	2567.1	50:29	06/28/09 21:02
Rest 30 minutes									
52.1	U22	U322	ROCKVILLE	S	I81 X67	PA	2619.1	51:23	06/28/09 21:56
2.6	I81		PENBROOK	NE	I81 I83	PA	2621.7	51:55	06/28/09 22:28
4.1	I83		HARRISBURG	SE	I283I83	PA	2625.8	51:59	06/28/09 22:32
2.8	I283		HIGHSPIRE	N	I283X1	PA	2628.6	52:02	06/28/09 22:35
28.4	S283		LANCASTER	NW	U30 S283	PA	2656.9	52:30	06/28/09 23:03
1.0	U30		LANCASTER	N	U222U30	PA	2657.9	52:31	06/28/09 23:04
1.0	U222	U30	LANCASTER	NE	U222U30	PA	2658.9	52:32	06/28/09 23:05
15.5	U30		GAP	NW	U30 S41	PA	2674.4	52:51	06/28/09 23:24
21.6	S41		KAOLIN		S41 S7	PA	2696.1	53:23	06/28/09 23:56
0.7	S41		crossing state border	DE/PA	BD		2696.7	53:54	06/29/09 00:27
State Inspection took 30 minutes									
7.4	S41		NEWPORT		S141S41	DE	2704.2	54:06	06/29/09 00:39
1.7	S141		NEWPORT	S	I95 X5	DE	2705.9	54:07	06/29/09 00:40
0.7	I95		NEWPORT	SE	I295I95	DE	2706.6	54:08	06/29/09 00:41
2.1	I295		NEW CASTLE	N	I295S9	DE	2708.7	54:10	06/29/09 00:43
2.5	I295#		crossing state border	DE/NJ	BD		2711.2	54:43	06/29/09 01:16
State Inspection took 30 minutes									
0.9	I295#		DEEPWATER	S	I295X1	NJ	2712.2	54:44	06/29/09 01:17
0.4	I295\$	TNJT\$	DEEPWATER	SE	TNJT I295	NJ	2712.6	54:44	06/29/09 01:17
4.7	C551		PENNSVILLE	S	S49 C551	NJ	2717.2	54:51	06/29/09 01:24
3.0	S49		SALEM	NW	S49 LOCL	NJ	2720.2	54:56	06/29/09 01:29
12.3	LOCAL		SALEM NP			NJ	2732.5	55:21	06/29/09 01:54

Total elapsed time: 55:21      Total trip mileage: 2732.5      Impedance: 2640.8

Mileage by State :

DE:	14.5	IA:	305.3	ID:	275.6	IL:	162.6	IN:	151.2	NE:	452.7
NJ:	21.3	OH:	235.7	OR:	208.5	PA:	319.8	UT:	149.1	WA:	35.6
WY:	400.5										

Mileage by Sign Type:

1-INTERSTATE:	2498.9	2-US:	142.2	3-STATE:	74.4	5-COUNTY:	4.7
6-LOCAL:	12.3						

Mileage by Lane Type:

1-Multi-Lane Controlled Access:	2596.1	3-Multi-Lane Divided Highway:	13.5
5-Principle Road:	104.4	7-Other:	18.5

Mileage by Tribal Lands:

Total Outside Tribal Lands	:	2705.6
Total Inside Tribal Lands	:	26.9

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**3 TRAGIS GENERATED INPUT FOR RADTRAN**

```
[TRAGIS]
TRAGIS Version=1.5.4
Mode=H
Network Version=4.0
Census Data=2000
Buffer Zone=800
[ROUTEINFO]
From CITY=RICHLAND
From STATE=WA
From SUBNET=
To CITY=SALEM NP
To STATE=NJ
To SUBNET=
[DE]
Rural - KM= 3.3
Suburban - KM= 14.0
Urban - KM= 6.0
Total - KM= 23.3
Rural Pop Density= 18.8
Suburban Pop Density= 549.2
Urban Pop Density=2168.9
[ID]
Rural - KM= 357.0
Suburban - KM= 79.3
Urban - KM= 7.3
Total - KM= 443.5
Rural Pop Density= 11.3
Suburban Pop Density= 278.7
Urban Pop Density=2219.6
[IL]
Rural - KM= 178.4
Suburban - KM= 73.0
Urban - KM= 10.2
Total - KM= 261.7
Rural Pop Density= 14.4
Suburban Pop Density= 323.6
Urban Pop Density=2379.1
[IN]
Rural - KM= 136.7
Suburban - KM= 97.3
Urban - KM= 9.4
Total - KM= 243.4
Rural Pop Density= 19.9
Suburban Pop Density= 276.3
Urban Pop Density=2354.7
[IA]
Rural - KM= 377.8
Suburban - KM= 107.7
Urban - KM= 5.8
Total - KM= 491.3
Rural Pop Density= 16.4
Suburban Pop Density= 272.7
Urban Pop Density=2191.1
[NE]
Rural - KM= 649.1
Suburban - KM= 71.5
Urban - KM= 8.0
Total - KM= 728.5
Rural Pop Density= 9.9
Suburban Pop Density= 270.2
Urban Pop Density=2410.2
```



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[NJ]

Rural - KM= 20.6  
Suburban - KM= 12.5  
Urban - KM= 1.1  
Total - KM= 34.3  
Rural Pop Density= 11.8  
Suburban Pop Density= 353.9  
Urban Pop Density=2025.9

[OH]

Rural - KM= 213.1  
Suburban - KM= 151.3  
Urban - KM= 14.8  
Total - KM= 379.3  
Rural Pop Density= 19.7  
Suburban Pop Density= 309.6  
Urban Pop Density=2211.7

[OR]

Rural - KM= 301.0  
Suburban - KM= 32.2  
Urban - KM= 2.3  
Total - KM= 335.5  
Rural Pop Density= 8.2  
Suburban Pop Density= 313.2  
Urban Pop Density=1976.3

[PA]

Rural - KM= 321.7  
Suburban - KM= 172.2  
Urban - KM= 20.7  
Total - KM= 514.7  
Rural Pop Density= 18.4  
Suburban Pop Density= 313.8  
Urban Pop Density=2452.8

[UT]

Rural - KM= 186.8  
Suburban - KM= 51.6  
Urban - KM= 1.5  
Total - KM= 240.0  
Rural Pop Density= 9.7  
Suburban Pop Density= 257.8  
Urban Pop Density=2112.2

[WA]

Rural - KM= 44.1  
Suburban - KM= 8.6  
Urban - KM= 4.7  
Total - KM= 57.4  
Rural Pop Density= 1.5  
Suburban Pop Density= 604.4  
Urban Pop Density=2293.2

[WY]

Rural - KM= 607.2  
Suburban - KM= 33.9  
Urban - KM= 3.4  
Total - KM= 644.6  
Rural Pop Density= 4.9  
Suburban Pop Density= 399.4  
Urban Pop Density=1966.6

**PSEG Site  
ESP Application  
Part 3, Environmental Report**

[Total]  
Rural - KM=3396.8  
Suburban - KM= 905.4  
Urban - KM= 95.3  
Total - KM=4397.4  
Rural Pop Density= 11.7  
Suburban Pop Density= 305.4  
Urban Pop Density=2294.9

**PSEG Site  
ESP Application  
Part 3, Environmental Report**

**4 RADTRAN INPUT**

The RADTRAN/RADCAT input screens are reproduced below.

Radcat 2.3 Project Panthro - Calc. 2009-06944:New Fuel: Richland, WA to PSEG ESP [unsaved]

File Edit

Title Package Radionuclides Vehicle Link Stop Handling Accident Parameters

Title: Calc. 2009-06944:New Fuel: Richland, WA to PSEG ESP

Remarks

Add Remark Remove Remark

Accident Options

☒ Incident Free

☐ Accident

☒ SI Output

Output Level

☒ 1

☐ 2

☐ 3

☐ 4

Health Effects

☒ Rem/Person-rem

☐ Latent Cancer Fatalities

Radcat 2.3 Project Panthro - Calc. 2009-06944:New Fuel: Richland, WA to PSEG ESP: ...

File Edit

Title Package Radionuclides Vehicle Link Stop Handling Accident Parameters

Name	Long Dim (m)	Dose Rate (mrem/h)	Gamma Fraction	Neutron Fraction
PACKAGE_1	5.20E00	1.00E-01	1.00E00	0.00E00

Add Package Remove Package

# PSEG Site ESP Application Part 3, Environmental Report

Radcat 2.3 Project Panthro - Calc. 2009-06944:New Fuel: Richland, WA to PSEG ESP

File Edit

Radionuclides

PACKAGE\_1

Add Library Radionuclide

Radionuclide Phys/Chem Group Curies

Modify User Defined Radionuclides

Add User Defined Radionuclide

Remove Radionuclide

Radcat 2.3 Project Panthro - Calc. 2009-06944:New Fuel: Richland, WA to PSEG ESP: Fatalities [unsaved]

File Edit

Vehicle

Vehicle Name	Number of Shipments	Vehicle Size (m)	Vehicle Dose Rate (mrem/h)	Gamma Fraction	Neutron Fraction	Crew Size	Crew Distance (m)	Crew Shielding Factor	Crew View (m)	Exclusive
VEHICLE_1	1.00E00	5.20E00	1.00E-01	1.00E00	0.00E00	2.00E00	4.00E00	1.00E00	1.00E00	Yes

Add Vehicle Remove Vehicle

Package Number of Packages

PACKAGE\_1 1.00E00

Note: This screen is the same for both the “fatalities” case and the “injuries” case.

Radcat 2.3 Project Panthro - Calc. 2009-06944:New Fuel: Richland, WA to PSEG ESP: Injuries

File Edit

Vehicle

Vehicle Name	Number of Shipments	Vehicle Size (m)	Vehicle Dose Rate (mrem/h)	Gamma Fraction	Neutron Fraction	Crew Size	Crew Distance (m)	Crew Shielding Factor	Crew View (m)	Exclusive
VEHICLE_1	1.00E00	5.20E00	1.00E-01	1.00E00	0.00E00	2.00E00	4.00E00	1.00E00	1.00E00	Yes

Add Vehicle Remove Vehicle

Package Number of Packages

# PSEG Site ESP Application Part 3, Environmental Report

Radcat 2.3 Project Panthro - Calc. 2009-06944:New Fuel: Richland, WA to PSEG ESP: Fatalities

File Edit

Package Radionuclides Vehicle **Link** Stop Handling Accident Parameters

Link-Name	Vehicle	Length (km)	Speed (km/h)	Population Density (persons/km²)	Vehicle Density (vehicles/hr)	Persons per Vehicle	Accident Rate (accidents/veh-km)	Fatalities per Accident	Zone	
RURAL_DE	VEHICLE_1	3.30E00	8.89E01	1.88E01	5.30E02	1.50E00	5.18E-07	1.08E-02	Rural	Primary H
SUBURBN_DE	VEHICLE_1	1.40E01	8.89E01	5.49E02	7.60E02	1.50E00	5.18E-07	1.08E-02	Suburban	Primary H
URBAN_DE	VEHICLE_1	6.00E00	8.89E01	2.17E03	2.40E03	1.50E00	5.18E-07	1.08E-02	Urban	Primary H
RURAL_ID	VEHICLE_1	3.57E02	8.89E01	1.13E01	5.30E02	1.50E00	2.95E-07	1.29E-02	Rural	Primary H
SUBURBN_ID	VEHICLE_1	7.93E01	8.89E01	2.79E02	7.60E02	1.50E00	2.95E-07	1.29E-02	Suburban	Primary H
URBAN_ID	VEHICLE_1	7.30E00	8.89E01	2.22E03	2.40E03	1.50E00	2.95E-07	1.29E-02	Urban	Primary H
RURAL_IL	VEHICLE_1	1.78E02	8.89E01	1.44E01	5.30E02	1.50E00	2.22E-07	3.74E-02	Rural	Primary H
SUBURBN_IL	VEHICLE_1	7.30E01	8.89E01	3.24E02	7.60E02	1.50E00	2.22E-07	3.74E-02	Suburban	Primary H
URBAN_IL	VEHICLE_1	1.02E01	8.89E01	2.38E03	2.40E03	1.50E00	2.22E-07	3.74E-02	Urban	Primary H
RURAL_IN	VEHICLE_1	1.37E02	8.89E01	1.99E01	5.30E02	1.50E00	2.25E-07	2.98E-02	Rural	Primary H
SUBURBN_IN	VEHICLE_1	9.73E01	8.89E01	2.76E02	7.60E02	1.50E00	2.25E-07	2.98E-02	Suburban	Primary H
URBAN_IN	VEHICLE_1	9.40E00	8.89E01	2.35E03	2.40E03	1.50E00	2.25E-07	2.98E-02	Urban	Primary H
RURAL_IA	VEHICLE_1	3.78E02	8.89E01	1.64E01	5.30E02	1.50E00	1.12E-07	8.39E-02	Rural	Primary H
SUBURBN_IA	VEHICLE_1	1.08E02	8.89E01	2.73E02	7.60E02	1.50E00	1.12E-07	8.39E-02	Suburban	Primary H
URBAN_IA	VEHICLE_1	5.80E00	8.89E01	2.19E03	2.40E03	1.50E00	1.12E-07	8.39E-02	Urban	Primary H
RURAL_NE	VEHICLE_1	6.49E02	8.89E01	9.90E00	5.30E02	1.50E00	3.19E-07	4.29E-02	Rural	Primary H
SUBURBN_NE	VEHICLE_1	7.15E01	8.89E01	2.70E02	7.60E02	1.50E00	3.19E-07	4.29E-02	Suburban	Primary H
URBAN_NE	VEHICLE_1	8.00E00	8.89E01	2.41E03	2.40E03	1.50E00	3.19E-07	4.29E-02	Urban	Primary H
RURAL_NJ	VEHICLE_1	2.06E01	8.89E01	1.18E01	5.30E02	1.50E00	5.65E-07	2.14E-02	Rural	Primary H
SUBURBN_NJ	VEHICLE_1	1.25E01	8.89E01	3.54E02	7.60E02	1.50E00	5.65E-07	2.14E-02	Suburban	Primary H
URBAN_NJ	VEHICLE_1	1.10E00	8.89E01	2.03E03	2.40E03	1.50E00	5.65E-07	2.14E-02	Urban	Primary H
RURAL_OH	VEHICLE_1	2.13E02	8.89E01	1.97E01	5.30E02	1.50E00	1.64E-07	2.38E-02	Rural	Primary H
SUBURBN_OH	VEHICLE_1	1.51E02	8.89E01	3.10E02	7.60E02	1.50E00	1.64E-07	2.38E-02	Suburban	Primary H
URBAN_OH	VEHICLE_1	1.48E01	8.89E01	2.21E03	2.40E03	1.50E00	1.64E-07	2.38E-02	Urban	Primary H
RURAL_OR	VEHICLE_1	3.01E02	8.89E01	8.20E00	5.30E02	1.50E00	3.15E-07	6.48E-02	Rural	Primary H
SUBURBN_OR	VEHICLE_1	3.22E01	8.89E01	3.13E02	7.60E02	1.50E00	3.15E-07	6.48E-02	Suburban	Primary H
URBAN_OR	VEHICLE_1	2.30E00	8.89E01	1.98E03	2.40E03	1.50E00	3.15E-07	6.48E-02	Urban	Primary H
RURAL_PA	VEHICLE_1	3.22E02	8.89E01	1.84E01	5.30E02	1.50E00	5.14E-07	2.63E-02	Rural	Primary H
SUBURBN_PA	VEHICLE_1	1.72E02	8.89E01	3.14E02	7.60E02	1.50E00	5.14E-07	2.63E-02	Suburban	Primary H
URBAN_PA	VEHICLE_1	2.07E01	8.89E01	2.45E03	2.40E03	1.50E00	5.14E-07	2.63E-02	Urban	Primary H
RURAL_UT	VEHICLE_1	1.87E02	8.89E01	9.70E00	5.30E02	1.50E00	2.90E-07	4.10E-02	Rural	Primary H
SUBURBN_UT	VEHICLE_1	5.16E01	8.89E01	2.58E02	7.60E02	1.50E00	2.90E-07	4.10E-02	Suburban	Primary H
URBAN_UT	VEHICLE_1	1.50E00	8.89E01	2.11E03	2.40E03	1.50E00	2.90E-07	4.10E-02	Urban	Primary H
RURAL_WA	VEHICLE_1	4.41E01	8.89E01	1.50E00	5.30E02	1.50E00	2.65E-07	6.34E-02	Rural	Primary H
SUBURBN_WA	VEHICLE_1	8.60E00	8.89E01	6.04E02	7.60E02	1.50E00	2.65E-07	6.34E-02	Suburban	Primary H
URBAN_WA	VEHICLE_1	4.70E00	8.89E01	2.29E03	2.40E03	1.50E00	2.65E-07	6.34E-02	Urban	Primary H
RURAL_WY	VEHICLE_1	6.07E02	8.89E01	4.90E00	5.30E02	1.50E00	6.74E-07	1.60E-02	Rural	Primary H
SUBURBN_WY	VEHICLE_1	3.39E01	8.89E01	3.99E02	7.60E02	1.50E00	6.74E-07	1.60E-02	Suburban	Primary H
URBAN_WY	VEHICLE_1	3.40E00	8.89E01	1.97E03	2.40E03	1.50E00	6.74E-07	1.60E-02	Urban	Primary H

Add Link Remove Link Import Web Trags

Injuries per Accident in Column Labeled “Fatalities per Accident”

Radcat 2.3 Project Panthro - Calc. 2009-06944:New Fuel: Richland, WA to PSEG ESP: Injuries

File Edit

Package Radionuclides Vehicle **Link** Stop Handling Accident Parameters



Link-Name	Vehicle	Length (km)	Speed (km/h)	Population Density (persons/km²)	Vehicle Density (vehicles/hr)	Persons per Vehicle	Accident Rate (accidents/veh-km)	Fatalities per Accident	Zone	
RURAL_DE	VEHICLE_1	3.30E00	8.89E01	1.88E01	5.30E02	1.50E00	5.18E-07	6.60E-01	Rural	
SUBURBN_DE	VEHICLE_1	1.40E01	8.89E01	5.49E02	7.60E02	1.50E00	5.18E-07	6.60E-01	Suburban	
URBAN_DE	VEHICLE_1	6.00E00	8.89E01	2.17E03	2.40E03	1.50E00	5.18E-07	6.60E-01	Urban	
RURAL_ID	VEHICLE_1	3.57E02	8.89E01	1.13E01	5.30E02	1.50E00	2.95E-07	1.04E00	Rural	
SUBURBN_ID	VEHICLE_1	7.93E01	8.89E01	2.79E02	7.60E02	1.50E00	2.95E-07	1.04E00	Suburban	
URBAN_ID	VEHICLE_1	7.30E00	8.89E01	2.22E03	2.40E03	1.50E00	2.95E-07	1.04E00	Urban	
RURAL_IL	VEHICLE_1	1.78E02	8.89E01	1.44E01	5.30E02	1.50E00	2.22E-07	6.76E-01	Rural	
SUBURBN_IL	VEHICLE_1	7.30E01	8.89E01	3.24E02	7.60E02	1.50E00	2.22E-07	6.76E-01	Suburban	
URBAN_IL	VEHICLE_1	1.02E01	8.89E01	2.38E03	2.40E03	1.50E00	2.22E-07	6.76E-01	Urban	
RURAL_IN	VEHICLE_1	1.37E02	8.89E01	1.99E01	5.30E02	1.50E00	2.25E-07	6.22E-01	Rural	
SUBURBN_IN	VEHICLE_1	9.73E01	8.89E01	2.76E02	7.60E02	1.50E00	2.25E-07	6.22E-01	Suburban	
URBAN_IN	VEHICLE_1	9.40E00	8.89E01	2.35E03	2.40E03	1.50E00	2.25E-07	6.22E-01	Urban	
RURAL_IA	VEHICLE_1	3.78E02	8.89E01	1.64E01	5.30E02	1.50E00	1.12E-07	7.68E-01	Rural	
SUBURBN_IA	VEHICLE_1	1.08E02	8.89E01	2.73E02	7.60E02	1.50E00	1.12E-07	7.68E-01	Suburban	
URBAN_IA	VEHICLE_1	5.80E00	8.89E01	2.19E03	2.40E03	1.50E00	1.12E-07	7.68E-01	Urban	
RURAL_NE	VEHICLE_1	6.49E02	8.89E01	9.90E00	5.30E02	1.50E00	3.19E-07	6.18E-01	Rural	
SUBURBN_NE	VEHICLE_1	7.15E01	8.89E01	2.70E02	7.60E02	1.50E00	3.19E-07	6.18E-01	Suburban	
URBAN_NE	VEHICLE_1	8.00E00	8.89E01	2.41E03	2.40E03	1.50E00	3.19E-07	6.18E-01	Urban	
RURAL_NJ	VEHICLE_1	2.06E01	8.89E01	1.18E01	5.30E02	1.50E00	5.65E-07	6.92E-01	Rural	
SUBURBN_NJ	VEHICLE_1	1.25E01	8.89E01	3.54E02	7.60E02	1.50E00	5.65E-07	6.92E-01	Suburban	
URBAN_NJ	VEHICLE_1	1.10E00	8.89E01	2.03E03	2.40E03	1.50E00	5.65E-07	6.92E-01	Urban	
RURAL_OH	VEHICLE_1	2.13E02	8.89E01	1.97E01	5.30E02	1.50E00	1.64E-07	8.54E-01	Rural	
SUBURBN_OH	VEHICLE_1	1.51E02	8.89E01	3.10E02	7.60E02	1.50E00	1.64E-07	8.54E-01	Suburban	
URBAN_OH	VEHICLE_1	1.48E01	8.89E01	2.21E03	2.40E03	1.50E00	1.64E-07	8.54E-01	Urban	
RURAL_OR	VEHICLE_1	3.01E02	8.89E01	8.20E00	5.30E02	1.50E00	3.15E-07	7.21E-01	Rural	
SUBURBN_OR	VEHICLE_1	3.22E01	8.89E01	3.13E02	7.60E02	1.50E00	3.15E-07	7.21E-01	Suburban	
URBAN_OR	VEHICLE_1	2.30E00	8.89E01	1.98E03	2.40E03	1.50E00	3.15E-07	7.21E-01	Urban	
RURAL_PA	VEHICLE_1	3.22E02	8.89E01	1.84E01	5.30E02	1.50E00	5.14E-07	7.45E-01	Rural	
SUBURBN_PA	VEHICLE_1	1.72E02	8.89E01	3.14E02	7.60E02	1.50E00	5.14E-07	7.45E-01	Suburban	
URBAN_PA	VEHICLE_1	2.07E01	8.89E01	2.45E03	2.40E03	1.50E00	5.14E-07	7.45E-01	Urban	
RURAL_UT	VEHICLE_1	1.87E02	8.89E01	9.70E00	5.30E02	1.50E00	2.90E-07	8.72E-01	Rural	
SUBURBN_UT	VEHICLE_1	5.16E01	8.89E01	2.58E02	7.60E02	1.50E00	2.90E-07	8.72E-01	Suburban	
URBAN_UT	VEHICLE_1	1.50E00	8.89E01	2.11E03	2.40E03	1.50E00	2.90E-07	8.72E-01	Urban	
RURAL_WA	VEHICLE_1	4.41E01	8.89E01	1.50E00	5.30E02	1.50E00	2.65E-07	6.79E-01	Rural	
SUBURBN_WA	VEHICLE_1	8.60E00	8.89E01	6.04E02	7.60E02	1.50E00	2.65E-07	6.79E-01	Suburban	
URBAN_WA	VEHICLE_1	4.70E00	8.89E01	2.29E03	2.40E03	1.50E00	2.65E-07	6.79E-01	Urban	
RURAL_WY	VEHICLE_1	6.07E02	8.89E01	4.90E00	5.30E02	1.50E00	6.74E-07	4.79E-01	Rural	
SUBURBN_WY	VEHICLE_1	3.39E01	8.89E01	3.99E02	7.60E02	1.50E00	6.74E-07	4.79E-01	Suburban	
URBAN_WY	VEHICLE_1	3.40E00	8.89E01	1.97E03	2.40E03	1.50E00	6.74E-07	4.79E-01	Urban	


Add Link Remove Link Import Web Trags


**PSEG Site  
ESP Application  
Part 3, Environmental Report**

Radcat 2.3 Project Panthro - Calc. 2009-06944:New Fuel: Richland, WA to PSEG ESP

File Edit




Title Package Radionuclides Vehicle Link **Stop** Handling Accident Parameters


Name	Vehicle	Min Distance (m)	Max Distance (m)	People or People/km <sup>2</sup>	Shielding Factor	Time (h)
STOP_1	VEHICLE_1	1.00E00	1.00E01	3.00E04	1.00E00	6.00E00
STOP_2	VEHICLE_1	1.00E01	8.00E02	3.40E02	2.00E-01	6.00E00

Add Stop Remove Stop

Radcat 2.3 Project Panthro - Calc. 2009-06944:New Fuel: Richland, WA to PSEG ESP

File Edit













Title Package Radionuclides Vehicle Link Stop **Handling** Accident Parameters

Name	Vehicle	Number of Handlers	Distance (m)	Time (h)
HANDLE_1	VEHICLE_1	5.00E00	1.00E00	5.00E-01

Add Handling Remove Handling

Radcat 2.3 Project Panthro - Calc. 2009-06944:New Fuel: Richland, WA to PSEG ESP

File Edit

Title Package Radionuclides Vehicle Link Stop Handling **Accident** Parameters

Probability Deposition Velocity Release Aerosol Respirable Isopleth P Weather

Index Probability Fraction

Add severity fraction Remove severity fraction

**PSEG Site  
ESP Application  
Part 3, Environmental Report**

Radcat 2.3 Project Panthro - Calc. 2009-06944:New Fuel: Richland, WA to PSEG ESP

File Edit

Parameters

Parameter	Value
Shielding factor for rural residents	1.00E00
Shielding factor for suburban residents	8.70E-01
Shielding factor for urban residents	1.80E-02
Fraction of outside air in urban buildings	5.00E-02
Fraction of urban population occupying the sidewalk	4.80E-01
Fraction of urban population inside buildings	5.20E-01
Ratio of pedestrians/km <sup>2</sup> to residential population/km <sup>2</sup>	6.00E00
Minimum small package dimension for handling (m)	5.00E-01
Distance from shipment for maximum exposure (m)	3.00E01
Vehicle speed for maximum exposure (km/hr)	2.40E01
Imposed regulatory limit on vehicle external dose	Yes
Average breathing rate (m <sup>3</sup> /sec)	3.30E-04
Cleanup Level (microcuries/m <sup>2</sup> )	2.00E-01
Interdiction Threshold	4.00E01
Evacuation time for groundshine (days)	1.00E00
Survey interval for groundshine (days)	1.00E01
Occupational latent cancer fatalities per person-rem	4.00E-04
Public latent cancer fatalities per person-rem	5.00E-04
Genetic effects per person-rem (public)	1.00E-04
Campaign (year)	8.33E-02
Iodine	I129
Rem per curie thyroid via inhalation (Rem/Ci)	5.77E06
Distance of freeway vehicle carrying radioactive cargo to pede...	3.00E01
Distance of freeway vehicle carrying radioactive cargo to right-...	3.00E01
Distance of freeway vehicle carrying radioactive cargo to maxi...	8.00E02
Distance of non-freeway vehicle carrying radioactive cargo to p...	2.70E01
Distance of non-freeway vehicle carrying radioactive cargo to ri...	3.00E01
Distance of non-freeway vehicle carrying radioactive cargo to ...	8.00E02
Distance of city street vehicle carrying radioactive cargo to ped...	5.00E00
Distance of city street vehicle carrying radioactive cargo to righ...	8.00E00
Distance of city street vehicle carrying radioactive cargo to ma...	8.00E02
Perpendicular distance to freeway vehicle going in opposite dire...	1.50E01
Perpendicular distance to non-freeway vehicle going in opposit...	3.00E00
Perpendicular distance to city vehicle going in opposite direction...	3.00E00
Perpendicular distance to all vehicles going in same direction (m)	4.00E00

**PSEG Site  
ESP Application  
Part 3, Environmental Report**

**5 RADTRAN FATALITIES CASE OUTPUT**

RUN DATE: [ 01-JUL-09 AT 13:38:08 ]

PAGE 1

RRRR	AAA	DDDD	TTTTT	RRRR	AAA	N	N	55555	6
R R A A D D	T	R R A A NN	N	5	6				
R R A A D D	T	R R A A N N N	5	6					
RRRR A A D D	T	RRRR A A N NN	5555	6666					
R R A A A A A	D D	T R R A A A A	N N	5	6	6			
R R A A D D	T	R R A A N N	5 5	6	6				
R R A A D D D D	T	R R A A N N	5555	*	666				

RADTRAN 5.6 February 20, 2006

INPUT ECHO

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TITLE Calc. 2009-06944:New Fuel: Richland, WA to PSEG ESP: Fatalities
INPUT STANDARD
STD: 0 10 18                                && DIMEN=NSEV NRAD NAREAS
STD: 1 3 3 0                                && PARM=IRNKC IANA ISEN IPSQSB
STD: .TRUE. .FALSE.                        && FORM = UNIT, SI-UNITS?
STD: 2.3E12                                && NEVAL FOR CF252
STD: 9.25E5 5.77E6 1.27E6                  && RPCTHY FOR I125, I129, I131
STD: 0.0 0.0 0.0 0.0 0.0                  && TRANSFER GAMMA
STD: 7.42E-3 2.02E-2 6.17E-5 3.17E-8 0.0 && TRANSFER NEUTRON
STD: 30 24                                && MITDDIST MITDVEL
STD: 1 2 .0018                             && ITRAIN FMINCL DDRWEF
STD: 33 68 105 244 369                    && CENTER LINE
STD: 561 1018 1628 2308 4269              && DISTANCES
STD: 5468 11136 13097 21334 40502         && FOR AVERAGE
STD: 69986 89860 120878 0 0 0 0 0 0 0 0 && US CLOUD
STD: 4.59E+02 1.53E+03 3.94E+03 1.25E+04 3.04E+04 6.85E+04 1.76E+05 4.45E+05
STD: 8.59E+05 2.55E+06 4.45E+06 1.03E+07 2.16E+07 5.52E+07 1.77E+08 4.89E+08
STD: 8.12E+08 1.35E+09 0 0 0 0 0 0 0 0 && AREADA
STD: 3.42E-03 1.72E-03 8.58E-04 3.42E-04 1.72E-04 8.58E-05 3.42E-05 1.72E-05
STD: 8.58E-06 3.42E-06 1.72E-06 8.58E-07 3.42E-07 1.72E-07 8.58E-08 5.42E-08
STD: 4.30E-08 3.42E-08 0 0 0 0 0 0 0 0 && DFLEV
STD: 3 6 9 12 15 30 61 91 152 305 0 0 0 0
STD: 3 6 9 12 15 30 61 91 152 305 0 0 0 0
STD: 3 6 9 12 15 30 61 91 152 305 0 0 0 0 && RADIST
STD: 0.5                                && SMLPKG
STD: 1.0 0.87 0.018                      && SHIELDING FACTORS RR RS RU
STD: 30 30 800                          && OFFLINK {FREEWAY}
STD: 27 30 800                          && OFFLINK {NON-FREEWAY}
STD: 5 8 800                            && OFFLINK {CITY STREETS}
STD: 30 30 800                          && OFFLINK {RAILWAY}
STD: 200 200 1000                       && OFFLINK {WATERWAY}
STD: 15 3 3 3 4                          && ONLINK {FWAY NONFWY STREET RAIL ADJ}
STD: 6.0 4 40.0                         && RPD FNOATT INTERDICT
STD: 0.05 0.2 3.3E-4                    && BDF CULVL BRATE
STD: 0.9 0.1                            && UBF USWF
STD: 1.0 10.0 1.0                       && EVACUATION SURVEY CAMPAIGN

```



**PSEG Site  
ESP Application  
Part 3, Environmental Report**

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Calc. 2009-06944:New Fuel: Richland, WA to PSEG ESP: Fatalities

```
STD: 0.0 0.0 1.5E-8 5.3E-8 && HIGHWAY - RURAL - NONRAD
STD: 0.0 0.0 3.7E-9 1.3E-8 && HIGHWAY - SUBURBAN - NONRAD
STD: 0.0 0.0 2.1E-9 7.5E-9 && HIGHWAY - URBAN - NONRAD
STD: 0.0 0.0 1.81E-9 2.64E-8 && GENERAL FREIGHT - R - NONRAD
STD: 0.0 0.0 1.81E-9 2.64E-8 && GENERAL FREIGHT - S - NONRAD
STD: 0.0 0.0 1.81E-9 2.64E-8 && GENERAL FREIGHT - U - NONRAD
STD: 0.0 0.0 1.27E-7 1.85E-6 && DEDICATED RAIL - R - NONRAD
STD: 0.0 0.0 1.27E-7 1.85E-6 && DEDICATED RAIL - S - NONRAD
STD: 0.0 0.0 1.27E-7 1.85E-6 && DEDICATED RAIL - U - NONRAD
STD: 0.0 0.0 0.0 0.0 0.0 0.0 && PSPROB
STD: 0.67 0.67 0.42 && TIMENDE NON-DISPERSAL EVAC TIME
(LCF&EARLY)
STD: 2 2 1 && FLAGS=IUOPT IACC REGCHECK
STD: 5E-4, 4E-4, 1.0E-4 && LCFCON(1), LCFCON(2), GECON
STD: R5INGEST.BIN && INGESTION FILE
OUTPUT BQ_SV
FORM UNIT
DIMEN 0 10 18
PARAM 1 1 1 0
SEVERITY
  NPOP=1
    NMODE=1

  NPOP=2
    NMODE=1

  NPOP=3
    NMODE=1

RELEASE
PACKAGE PACKAGE_1 0.1 1.0 0.0 5.2
END
VEHICLE -1 VEHICLE_1 1.00E-01 1.0 0.0 5.2 1.0 2.0 4.0 1.0 1.0
  PACKAGE_1 1.0
FLAGS
  IACC 2
  IUOPT 2
  REGCHECK 1
MODSTD
  DISTOFF FREEWAY 3.00E01 3.00E01 8.00E02
  DISTOFF SECONDARY 2.70E01 3.00E01 8.00E02
  DISTOFF STREET 5.00E00 8.00E00 8.00E02
  DISTON
    FREEWAY 1.50E01
    SECONDARY 3.00E00
    STREET 3.00E00
    ADJACENT 4.00E00
  BDF 5.00E-02
  BRATE 3.30E-04
  CULVL 2.00E-01
  EVACUATION 1.00E00
```

**PSEG Site  
ESP Application  
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PAGE 3

Calc. 2009-06944:New Fuel: Richland, WA to PSEG ESP: Fatalities

GECON 1.00E-04  
INTERDICT 4.00E01  
LCFCON 5.00E-04 4.00E-04  
SURVEY 1.00E01  
UBF 5.20E-01  
USWF 4.80E-01  
CAMPAIGN 8.33E-02  
MITDDIST 3.00E01  
MITDVEL 2.40E01  
RPD 6.00E00  
RR 1.00E00  
RU 1.80E-02  
RS 8.70E-01  
SMALLPKG 5.00E-01  
RPCTHYROID  
I129 5.77E06

EOF

LINK RURAL\_DE VEHICLE\_1 3.3 88.9 1.5 18.8 530.0 5.18E-7 0.0108 R 1 1.0  
LINK SUBURBN\_DE VEHICLE\_1 14.0 88.9 1.5 549.2 760.0 5.18E-7 0.0108 S 1 1.0  
LINK URBAN\_DE VEHICLE\_1 6.0 88.9 1.5 2168.9 2400.0 5.18E-7 0.0108 U 1 1.0  
LINK RURAL\_ID VEHICLE\_1 357.0 88.9 1.5 11.3 530.0 2.95E-7 0.0129 R 1 1.0  
LINK SUBURBN\_ID VEHICLE\_1 79.3 88.9 1.5 278.7 760.0 2.95E-7 0.0129 S 1 1.0  
LINK URBAN\_ID VEHICLE\_1 7.3 88.9 1.5 2219.6 2400.0 2.95E-7 0.0129 U 1 1.0  
LINK RURAL\_IL VEHICLE\_1 178.4 88.9 1.5 14.4 530.0 2.22E-7 0.0374 R 1 1.0  
LINK SUBURBN\_IL VEHICLE\_1 73.0 88.9 1.5 323.6 760.0 2.22E-7 0.0374 S 1 1.0  
LINK URBAN\_IL VEHICLE\_1 10.2 88.9 1.5 2379.1 2400.0 2.22E-7 0.0374 U 1 1.0  
LINK RURAL\_IN VEHICLE\_1 136.7 88.9 1.5 19.9 530.0 2.25E-7 0.0298 R 1 1.0  
LINK SUBURBN\_IN VEHICLE\_1 97.3 88.9 1.5 276.3 760.0 2.25E-7 0.0298 S 1 1.0  
LINK URBAN\_IN VEHICLE\_1 9.4 88.9 1.5 2354.7 2400.0 2.25E-7 0.0298 U 1 1.0  
LINK RURAL\_IA VEHICLE\_1 377.8 88.9 1.5 16.4 530.0 1.12E-7 0.0839 R 1 1.0  
LINK SUBURBN\_IA VEHICLE\_1 107.7 88.9 1.5 272.7 760.0 1.12E-7 0.0839 S 1 1.0  
LINK URBAN\_IA VEHICLE\_1 5.8 88.9 1.5 2191.1 2400.0 1.12E-7 0.0839 U 1 1.0  
LINK RURAL\_NE VEHICLE\_1 649.1 88.9 1.5 9.9 530.0 3.19E-7 0.0429 R 1 1.0  
LINK SUBURBN\_NE VEHICLE\_1 71.5 88.9 1.5 270.2 760.0 3.19E-7 0.0429 S 1 1.0  
LINK URBAN\_NE VEHICLE\_1 8.0 88.9 1.5 2410.2 2400.0 3.19E-7 0.0429 U 1 1.0  
LINK RURAL\_NJ VEHICLE\_1 20.6 88.9 1.5 11.8 530.0 5.65E-7 0.0214 R 1 1.0  
LINK SUBURBN\_NJ VEHICLE\_1 12.5 8.9 1.5 353.9 760.0 5.65E-7 0.0214 S 1 1.0  
LINK URBAN\_NJ VEHICLE\_1 1.1 88.9 1.5 2025.9 2400.0 5.65E-7 0.0214 U 1 1.0  
LINK RURAL\_OH VEHICLE\_1 213.1 88.9 1.5 19.7 530.0 1.64E-7 0.0238 R 1 1.0  
LINK SUBURBN\_OH VEHICLE\_1 151.3 88.9 1.5 309.6 760.0 1.64E-7 0.0238 S 1 1.0  
LINK URBAN\_OH VEHICLE\_1 14.8 88.9 1.5 2211.7 2400.0 1.64E-7 0.0238 U 1 1.0  
LINK RURAL\_OR VEHICLE\_1 301.0 88.9 1.5 8.2 530.0 3.15E-7 0.0648 R 1 1.0  
LINK SUBURBN\_OR VEHICLE\_1 32.2 88.9 1.5 313.2 760.0 3.15E-7 0.0648 S 1 1.0  
LINK URBAN\_OR VEHICLE\_1 2.3 88.9 1.5 1976.3 2400.0 3.15E-7 0.0648 U 1 1.0  
LINK RURAL\_PA VEHICLE\_1 321.7 88.9 1.5 18.4 530.0 5.14E-7 0.0263 R 1 1.0  
LINK SUBURBN\_PA VEHICLE\_1 172.2 88.9 1.5 313.8 760.0 5.14E-7 0.0263 S 1 1.0  
LINK URBAN\_PA VEHICLE\_1 20.7 88.9 1.5 2452.8 2400.0 5.14E-7 0.0263 U 1 1.0  
LINK RURAL\_UT VEHICLE\_1 186.8 88.9 1.5 9.7 530.0 2.9E-7 0.041 R 1 1.0  
LINK SUBURBN\_UT VEHICLE\_1 51.6 88.9 1.5 257.8 760.0 2.9E-7 0.041 S 1 1.0  
LINK URBAN\_UT VEHICLE\_1 1.5 88.9 1.5 2112.2 2400.0 2.9E-7 0.041 U 1 1.0  
LINK RURAL\_WA VEHICLE\_1 44.1 88.9 1.5 1.5 530.0 2.65E-7 0.0634 R 1 1.0  
LINK SUBURBN\_WA VEHICLE\_1 8.6 88.9 1.5 604.4 760.0 2.65E-7 0.0634 S 1 1.0  
LINK URBAN\_WA VEHICLE\_1 4.7 88.9 1.5 2293.2 2400.0 2.65E-7 0.0634 U 1 1.0

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LINK RURAL\_WY VEHICLE\_1 607.2 88.9 1.5 4.9 530.0 6.74E-7 0.016 R 1 1.0  
LINK SUBURBN\_WY VEHICLE\_1 33.9 88.9 1.5 399.4 760.0 6.74E-7 0.016 S 1 1.0  
LINK URBAN\_WY VEHICLE\_1 3.4 88.9 1.5 1966.6 2400.0 6.74E-7 0.016 U 1 1.0

STOP STOP\_1 VEHICLE\_1 30000.0 1.0 10.0 1.0 6.0  
STOP STOP\_2 VEHICLE\_1 340.0 10.0 800.0 0.2 6.0

HANDLING HANDLE\_1 VEHICLE\_1 5.0 1.0 0.5

EOF

**PSEG Site  
ESP Application  
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Calc. 2009-06944:New Fuel: Richland, WA to PSEG ESP: Fatalities

NON-RADIOLOGICAL DATA (ACCIDENTS and FATALITIES)  
\*\*\*\*\*

HIGHWAY

	ACCIDENT RATE	ACCIDENTS	FATALITIES
RURAL_DE	5.18E-07	1.71E-06	1.85E-08
SUBURBN_DE	5.18E-07	7.25E-06	7.83E-08
URBAN_DE	5.18E-07	3.11E-06	3.36E-08
RURAL_ID	2.95E-07	1.05E-04	1.36E-06
SUBURBN_ID	2.95E-07	2.34E-05	3.02E-07
URBAN_ID	2.95E-07	2.15E-06	2.78E-08
RURAL_IL	2.22E-07	3.96E-05	1.48E-06
SUBURBN_IL	2.22E-07	1.62E-05	6.06E-07
URBAN_IL	2.22E-07	2.26E-06	8.47E-08
RURAL_IN	2.25E-07	3.08E-05	9.17E-07
SUBURBN_IN	2.25E-07	2.19E-05	6.52E-07
URBAN_IN	2.25E-07	2.12E-06	6.30E-08
RURAL_IA	1.12E-07	4.23E-05	3.55E-06
SUBURBN_IA	1.12E-07	1.21E-05	1.01E-06
URBAN_IA	1.12E-07	6.50E-07	5.45E-08
RURAL_NE	3.19E-07	2.07E-04	8.88E-06
SUBURBN_NE	3.19E-07	2.28E-05	9.78E-07
URBAN_NE	3.19E-07	2.55E-06	1.09E-07
RURAL_NJ	5.65E-07	1.16E-05	2.49E-07
SUBURBN_NJ	5.65E-07	7.06E-06	1.51E-07
URBAN_NJ	5.65E-07	6.22E-07	1.33E-08
RURAL_OH	1.64E-07	3.49E-05	8.32E-07
SUBURBN_OH	1.64E-07	2.48E-05	5.91E-07
URBAN_OH	1.64E-07	2.43E-06	5.78E-08
RURAL_OR	3.15E-07	9.48E-05	6.14E-06
SUBURBN_OR	3.15E-07	1.01E-05	6.57E-07
URBAN_OR	3.15E-07	7.25E-07	4.69E-08
RURAL_PA	5.14E-07	1.65E-04	4.35E-06
SUBURBN_PA	5.14E-07	8.85E-05	2.33E-06
URBAN_PA	5.14E-07	1.06E-05	2.80E-07
RURAL_UT	2.90E-07	5.42E-05	2.22E-06
SUBURBN_UT	2.90E-07	1.50E-05	6.14E-07
URBAN_UT	2.90E-07	4.35E-07	1.78E-08
RURAL_WA	2.65E-07	1.17E-05	7.41E-07
SUBURBN_WA	2.65E-07	2.28E-06	1.44E-07
URBAN_WA	2.65E-07	1.25E-06	7.90E-08
RURAL_WY	6.74E-07	4.09E-04	6.55E-06
SUBURBN_WY	6.74E-07	2.28E-05	3.66E-07
URBAN_WY	6.74E-07	2.29E-06	3.67E-08
TOTALS:	1.34E-05	1.51E-03	4.67E-05

**PSEG Site  
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Calc. 2009-06944:New Fuel: Richland, WA to PSEG ESP: Fatalities

REGULATORY CHECKS

THE SHIPMENT BY VEHICLE\_1 IS DESIGNATED AS EXCLUSIVE USE  
BUT IS NOT REQUIRED TO BE SO DESIGNATED BY REGULATIONS

**PSEG Site  
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Calc. 2009-06944:New Fuel: Richland, WA to PSEG ESP: Fatalities

INCIDENT-FREE SUMMARY

\*\*\*\*\* \*\*\*\*\*

IN-TRANSIT POPULATION EXPOSURE IN PERSON-SV

	PASSENGER	CREW	OFF LINK	ON LINK	TOTALS
RURAL_DE	0.00E+00	1.05E-08	1.62E-10	1.77E-09	1.25E-08
SUBURBN_DE	0.00E+00	4.46E-08	1.74E-08	1.08E-08	7.29E-08
URBAN_DE	0.00E+00	1.91E-08	6.11E-10	1.46E-08	3.43E-08
RURAL_ID	0.00E+00	1.14E-06	1.05E-08	1.92E-07	1.34E-06
SUBURBN_ID	0.00E+00	2.53E-07	5.01E-08	6.10E-08	3.64E-07
URBAN_ID	0.00E+00	2.33E-08	7.60E-10	1.77E-08	4.18E-08
RURAL_IL	0.00E+00	5.69E-07	6.70E-09	9.57E-08	6.71E-07
SUBURBN_IL	0.00E+00	2.33E-07	5.36E-08	5.62E-08	3.43E-07
URBAN_IL	0.00E+00	3.25E-08	1.14E-09	2.48E-08	5.85E-08
RURAL_IN	0.00E+00	4.36E-07	7.09E-09	7.34E-08	5.16E-07
SUBURBN_IN	0.00E+00	3.10E-07	6.10E-08	7.49E-08	4.46E-07
URBAN_IN	0.00E+00	3.00E-08	1.04E-09	2.28E-08	5.39E-08
RURAL_IA	0.00E+00	1.20E-06	1.62E-08	2.03E-07	1.42E-06
SUBURBN_IA	0.00E+00	3.43E-07	6.66E-08	8.29E-08	4.93E-07
URBAN_IA	0.00E+00	1.85E-08	5.96E-10	1.41E-08	3.32E-08
RURAL_NE	0.00E+00	2.07E-06	1.68E-08	3.48E-07	2.44E-06
SUBURBN_NE	0.00E+00	2.28E-07	4.38E-08	5.50E-08	3.27E-07
URBAN_NE	0.00E+00	2.55E-08	9.05E-10	1.94E-08	4.59E-08
RURAL_NJ	0.00E+00	6.57E-08	6.34E-10	1.11E-08	7.74E-08
SUBURBN_NJ	0.00E+00	3.98E-07	1.00E-07	1.32E-06	1.82E-06
URBAN_NJ	0.00E+00	3.51E-09	1.05E-10	2.67E-09	6.29E-09
RURAL_OH	0.00E+00	6.80E-07	1.09E-08	1.14E-07	8.05E-07
SUBURBN_OH	0.00E+00	4.82E-07	1.06E-07	1.16E-07	7.05E-07
URBAN_OH	0.00E+00	4.72E-08	1.54E-09	3.60E-08	8.47E-08
RURAL_OR	0.00E+00	9.60E-07	6.44E-09	1.62E-07	1.13E-06
SUBURBN_OR	0.00E+00	1.03E-07	2.29E-08	2.48E-08	1.50E-07
URBAN_OR	0.00E+00	7.33E-09	2.13E-10	5.59E-09	1.31E-08
RURAL_PA	0.00E+00	1.03E-06	1.54E-08	1.73E-07	1.21E-06
SUBURBN_PA	0.00E+00	5.49E-07	1.23E-07	1.33E-07	8.04E-07
URBAN_PA	0.00E+00	6.60E-08	2.38E-09	5.03E-08	1.19E-07
RURAL_UT	0.00E+00	5.96E-07	4.72E-09	1.00E-07	7.01E-07
SUBURBN_UT	0.00E+00	1.65E-07	3.02E-08	3.97E-08	2.34E-07
URBAN_UT	0.00E+00	4.78E-09	1.49E-10	3.65E-09	8.58E-09
RURAL_WA	0.00E+00	1.41E-07	1.72E-10	2.37E-08	1.64E-07
SUBURBN_WA	0.00E+00	2.74E-08	1.18E-08	6.62E-09	4.58E-08
URBAN_WA	0.00E+00	1.50E-08	5.06E-10	1.14E-08	2.69E-08
RURAL_WY	0.00E+00	1.94E-06	7.76E-09	3.26E-07	2.27E-06
SUBURBN_WY	0.00E+00	1.08E-07	3.07E-08	2.61E-08	1.65E-07
URBAN_WY	0.00E+00	1.08E-08	3.14E-10	8.26E-09	1.94E-08
RURAL	0.00E+00	1.08E-05	1.03E-07	1.82E-06	1.28E-05
SUBURB	0.00E+00	3.24E-06	7.17E-07	2.01E-06	5.97E-06
URBAN	0.00E+00	3.04E-07	1.03E-08	2.31E-07	5.45E-07

**PSEG Site  
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TOTALS: 0.00E+00 1.44E-05 8.31E-07 4.07E-06 1.93E-05

MAXIMUM INDIVIDUAL IN-TRANSIT DOSE

VEHICLE\_1 4.26E-11 SV

STOP EXPOSURE IN PERSON-SV

ANNULAR AREA STOP\_1 2.90E-05

ANNULAR AREA STOP\_2 1.25E-07

TOTAL: 2.92E-05

HANDLING EXPOSURE IN PERSON-SV

HANDLING	VEHICLE	MATERIAL	METHOD	DOSE
HANDLE_1	VEHICLE_1	PACKAGE_1	LINE-SOURCE	8.35E-06

TOTAL: 8.35E-06

EOI

END OF RUN

SUCCESSFUL COMPLETION

**PSEG Site  
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**6 RADTRAN INJURIES CASE OUTPUT**

RUN DATE: [ 01-JUL-09 AT 14:08:12 ]

PAGE 1

RRRR	AAA	DDDD	TTTTT	RRRR	AAA	N	N	55555	6
R R A A D D	T	R R A A NN N	5	6					
R R A A D D	T	R R A A NN N	5	6					
RRRR A A D D	T	RRRR A A N NN	5555	6666					
R R AAAAA D D	T	R R AAAAA N N	5	6 6					
R R A A D D	T	R R A A N N	5 5	6 6					
R R A A DDDD	T	R R A A N N	5555	* 666					

RADTRAN 5.6 February 20, 2006

INPUT ECHO

-----

```

TITLE Calc. 2009-06944:New Fuel: Richland, WA to PSEG ESP: Injuries
INPUT STANDARD
STD: 0 10 18                                && DIMEN=NSEV NRAD NAREAS
STD: 1 3 3 0                                && PARM=IRNKC IANA ISEN IPSQSB
STD: .TRUE. .FALSE.                        && FORM = UNIT, SI-UNITS?
STD: 2.3E12                                && NEVAL FOR CF252
STD: 9.25E5 5.77E6 1.27E6                  && RPCTHY FOR I125, I129, I131
STD: 0.0 0.0 0.0 0.0 0.0                  && TRANSFER GAMMA
STD: 7.42E-3 2.02E-2 6.17E-5 3.17E-8 0.0  && TRANSFER NEUTRON
STD: 30 24                                && MITDDIST MITDVCL
STD: 1 2 .0018                             && ITRAIN FMINCL DDRWEF
STD: 33 68 105 244 369                    && CENTER LINE
STD: 561 1018 1628 2308 4269              && DISTANCES
STD: 5468 11136 13097 21334 40502         && FOR AVERAGE
STD: 69986 89860 120878 0 0 0 0 0 0 0 0  && US CLOUD
STD: 4.59E+02 1.53E+03 3.94E+03 1.25E+04 3.04E+04 6.85E+04 1.76E+05 4.45E+05
STD: 8.59E+05 2.55E+06 4.45E+06 1.03E+07 2.16E+07 5.52E+07 1.77E+08 4.89E+08
STD: 8.12E+08 1.35E+09 0 0 0 0 0 0 0 0 0  && AREADA
STD: 3.42E-03 1.72E-03 8.58E-04 3.42E-04 1.72E-04 8.58E-05 3.42E-05 1.72E-05
STD: 8.58E-06 3.42E-06 1.72E-06 8.58E-07 3.42E-07 1.72E-07 8.58E-08 5.42E-08
STD: 4.30E-08 3.42E-08 0 0 0 0 0 0 0 0 0  && DFLEV
STD: 3 6 9 12 15 30 61 91 152 305 0 0 0 0
STD: 3 6 9 12 15 30 61 91 152 305 0 0 0 0
STD: 3 6 9 12 15 30 61 91 152 305 0 0 0 0 && RADIST
STD: 0.5                                && SMLPKG
STD: 1.0 0.87 0.018                      && SHIELDING FACTORS RR RS RU
STD: 30 30 800                          && OFFLINK {FREEWAY}
STD: 27 30 800                          && OFFLINK {NON-FREEWAY}
STD: 5 8 800                            && OFFLINK {CITY STREETS}
STD: 30 30 800                          && OFFLINK {RAILWAY}
STD: 200 200 1000                       && OFFLINK {WATERWAY}
STD: 15 3 3 3 4                          && ONLINK {FWAY NONFWY STREET RAIL ADJ}
STD: 6.0 4 40.0                         && RPD FNOATT INTERDICT
STD: 0.05 0.2 3.3E-4                    && BDF CULVL BRATE
STD: 0.9 0.1                            && UBF USWF
STD: 1.0 10.0 1.0                       && EVACUATION SURVEY CAMPAIGN

```



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```
STD: 0.0 0.0 1.5E-8 5.3E-8 && HIGHWAY - RURAL - NONRAD
STD: 0.0 0.0 3.7E-9 1.3E-8 && HIGHWAY - SUBURBAN - NONRAD
STD: 0.0 0.0 2.1E-9 7.5E-9 && HIGHWAY - URBAN - NONRAD
STD: 0.0 0.0 1.81E-9 2.64E-8 && GENERAL FREIGHT - R - NONRAD
STD: 0.0 0.0 1.81E-9 2.64E-8 && GENERAL FREIGHT - S - NONRAD
STD: 0.0 0.0 1.81E-9 2.64E-8 && GENERAL FREIGHT - U - NONRAD
STD: 0.0 0.0 1.27E-7 1.85E-6 && DEDICATED RAIL - R - NONRAD
STD: 0.0 0.0 1.27E-7 1.85E-6 && DEDICATED RAIL - S - NONRAD
STD: 0.0 0.0 1.27E-7 1.85E-6 && DEDICATED RAIL - U - NONRAD
STD: 0.0 0.0 0.0 0.0 0.0 0.0 && PSPROB
STD: 0.67 0.67 0.42 && TIMENDE NON-DISPERSAL EVAC TIME
(LCF&EARLY)
STD: 2 2 1 && FLAGS=IUOPT IACC REGCHECK
STD: 5E-4, 4E-4, 1.0E-4 && LCFCN(1), LCFCN(2), GECON
STD: R5INGEST.BIN && INGESTION FILE
OUTPUT BQ_SV
FORM UNIT
DIMEN 0 10 18
PARAM 1 1 1 0
SEVERITY
  NPOP=1
    NMODE=1

  NPOP=2
    NMODE=1

  NPOP=3
    NMODE=1

RELEASE
PACKAGE PACKAGE_1 0.1 1.0 0.0 5.2
END
VEHICLE -1 VEHICLE_1 1.00E-01 1.0 0.0 5.2 1.0 2.0 4.0 1.0 1.0
  PACKAGE_1 1.0
FLAGS
  IACC 2
  IUOPT 2
  REGCHECK 1
MODSTD
  DISTOFF FREEWAY 3.00E01 3.00E01 8.00E02
  DISTOFF SECONDARY 2.70E01 3.00E01 8.00E02
  DISTOFF STREET 5.00E00 8.00E00 8.00E02
  DISTON
    FREEWAY 1.50E01
    SECONDARY 3.00E00
    STREET 3.00E00
    ADJACENT 4.00E00
  BDF 5.00E-02
  BRATE 3.30E-04
  CULVL 2.00E-01
  EVACUATION 1.00E00
```

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GECON 1.00E-04  
INTERDICT 4.00E01  
LCFCON 5.00E-04 4.00E-04  
SURVEY 1.00E01  
UBF 5.20E-01  
USWF 4.80E-01  
CAMPAIGN 8.33E-02  
MITDDIST 3.00E01  
MITDVEL 2.40E01  
RPD 6.00E00  
RR 1.00E00  
RU 1.80E-02  
RS 8.70E-01  
SMALLPKG 5.00E-01  
RPCTHYROID  
I129 5.77E06

EOF

LINK RURAL\_DE VEHICLE\_1 3.3 88.9 1.5 18.8 530.0 5.18E-7 0.66 R 1 1.0  
LINK SUBURBN\_DE VEHICLE\_1 14.0 88.9 1.5 549.2 760.0 5.18E-7 0.66 S 1 1.0  
LINK URBAN\_DE VEHICLE\_1 6.0 88.9 1.5 2168.9 2400.0 5.18E-7 0.66 U 1 1.0  
LINK RURAL\_ID VEHICLE\_1 357.0 88.9 1.5 11.3 530.0 2.95E-7 1.04 R 1 1.0  
LINK SUBURBN\_ID VEHICLE\_1 79.3 88.9 1.5 278.7 760.0 2.95E-7 1.04 S 1 1.0  
LINK URBAN\_ID VEHICLE\_1 7.3 88.9 1.5 2219.6 2400.0 2.95E-7 1.04 U 1 1.0  
LINK RURAL\_IL VEHICLE\_1 178.4 88.9 1.5 14.4 530.0 2.22E-7 0.676 R 1 1.0  
LINK SUBURBN\_IL VEHICLE\_1 73.0 88.9 1.5 323.6 760.0 2.22E-7 0.676 S 1 1.0  
LINK URBAN\_IL VEHICLE\_1 10.2 88.9 1.5 2379.1 2400.0 2.22E-7 0.676 U 1 1.0  
LINK RURAL\_IN VEHICLE\_1 136.7 88.9 1.5 19.9 530.0 2.25E-7 0.622 R 1 1.0  
LINK SUBURBN\_IN VEHICLE\_1 97.3 88.9 1.5 276.3 760.0 2.25E-7 0.622 S 1 1.0  
LINK URBAN\_IN VEHICLE\_1 9.4 88.9 1.5 2354.7 2400.0 2.25E-7 0.622 U 1 1.0  
LINK RURAL\_IA VEHICLE\_1 377.8 88.9 1.5 16.4 530.0 1.12E-7 0.768 R 1 1.0  
LINK SUBURBN\_IA VEHICLE\_1 107.7 88.9 1.5 272.7 760.0 1.12E-7 0.768 S 1 1.0  
LINK URBAN\_IA VEHICLE\_1 5.8 88.9 1.5 2191.1 2400.0 1.12E-7 0.768 U 1 1.0  
LINK RURAL\_NE VEHICLE\_1 649.1 88.9 1.5 9.9 530.0 3.19E-7 0.618 R 1 1.0  
LINK SUBURBN\_NE VEHICLE\_1 71.5 88.9 1.5 270.2 760.0 3.19E-7 0.618 S 1 1.0  
LINK URBAN\_NE VEHICLE\_1 8.0 88.9 1.5 2410.2 2400.0 3.19E-7 0.618 U 1 1.0  
LINK RURAL\_NJ VEHICLE\_1 20.6 88.9 1.5 11.8 530.0 5.65E-7 0.692 R 1 1.0  
LINK SUBURBN\_NJ VEHICLE\_1 12.5 8.9 1.5 353.9 760.0 5.65E-7 0.692 S 1 1.0  
LINK URBAN\_NJ VEHICLE\_1 1.1 88.9 1.5 2025.9 2400.0 5.65E-7 0.692 U 1 1.0  
LINK RURAL\_OH VEHICLE\_1 213.1 88.9 1.5 19.7 530.0 1.64E-7 0.854 R 1 1.0  
LINK SUBURBN\_OH VEHICLE\_1 151.3 88.9 1.5 309.6 760.0 1.64E-7 0.854 S 1 1.0  
LINK URBAN\_OH VEHICLE\_1 14.8 88.9 1.5 2211.7 2400.0 1.64E-7 0.854 U 1 1.0  
LINK RURAL\_OR VEHICLE\_1 301.0 88.9 1.5 8.2 530.0 3.15E-7 0.721 R 1 1.0  
LINK SUBURBN\_OR VEHICLE\_1 32.2 88.9 1.5 313.2 760.0 3.15E-7 0.721 S 1 1.0  
LINK URBAN\_OR VEHICLE\_1 2.3 88.9 1.5 1976.3 2400.0 3.15E-7 0.721 U 1 1.0  
LINK RURAL\_PA VEHICLE\_1 321.7 88.9 1.5 18.4 530.0 5.14E-7 0.745 R 1 1.0  
LINK SUBURBN\_PA VEHICLE\_1 172.2 88.9 1.5 313.8 760.0 5.14E-7 0.745 S 1 1.0  
LINK URBAN\_PA VEHICLE\_1 20.7 88.9 1.5 2452.8 2400.0 5.14E-7 0.745 U 1 1.0  
LINK RURAL\_UT VEHICLE\_1 186.8 88.9 1.5 9.7 530.0 2.9E-7 0.872 R 1 1.0  
LINK SUBURBN\_UT VEHICLE\_1 51.6 88.9 1.5 257.8 760.0 2.9E-7 0.872 S 1 1.0  
LINK URBAN\_UT VEHICLE\_1 1.5 88.9 1.5 2112.2 2400.0 2.9E-7 0.872 U 1 1.0  
LINK RURAL\_WA VEHICLE\_1 44.1 88.9 1.5 1.5 530.0 2.65E-7 0.679 R 1 1.0  
LINK SUBURBN\_WA VEHICLE\_1 8.6 88.9 1.5 604.4 760.0 2.65E-7 0.679 S 1 1.0  
LINK URBAN\_WA VEHICLE\_1 4.7 88.9 1.5 2293.2 2400.0 2.65E-7 0.679 U 1 1.0

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LINK RURAL\_WY VEHICLE\_1 607.2 88.9 1.5 4.9 530.0 6.74E-7 0.479 R 1 1.0  
LINK SUBURBN\_WY VEHICLE\_1 33.9 88.9 1.5 399.4 760.0 6.74E-7 0.479 S 1 1.0  
LINK URBAN\_WY VEHICLE\_1 3.4 88.9 1.5 1966.6 2400.0 6.74E-7 0.479 U 1 1.0

STOP STOP\_1 VEHICLE\_1 30000.0 1.0 10.0 1.0 6.0  
STOP STOP\_2 VEHICLE\_1 340.0 10.0 800.0 0.2 6.0

HANDLING HANDLE\_1 VEHICLE\_1 5.0 1.0 0.5

EOF

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NON-RADIOLOGICAL DATA (ACCIDENTS and FATALITIES)  
\*\*\*\*\*

HIGHWAY

	ACCIDENT RATE	ACCIDENTS	FATALITIES
RURAL_DE	5.18E-07	1.71E-06	1.13E-06
SUBURBN_DE	5.18E-07	7.25E-06	4.79E-06
URBAN_DE	5.18E-07	3.11E-06	2.05E-06
RURAL_ID	2.95E-07	1.05E-04	1.10E-04
SUBURBN_ID	2.95E-07	2.34E-05	2.43E-05
URBAN_ID	2.95E-07	2.15E-06	2.24E-06
RURAL_IL	2.22E-07	3.96E-05	2.68E-05
SUBURBN_IL	2.22E-07	1.62E-05	1.10E-05
URBAN_IL	2.22E-07	2.26E-06	1.53E-06
RURAL_IN	2.25E-07	3.08E-05	1.91E-05
SUBURBN_IN	2.25E-07	2.19E-05	1.36E-05
URBAN_IN	2.25E-07	2.12E-06	1.32E-06
RURAL_IA	1.12E-07	4.23E-05	3.25E-05
SUBURBN_IA	1.12E-07	1.21E-05	9.26E-06
URBAN_IA	1.12E-07	6.50E-07	4.99E-07
RURAL_NE	3.19E-07	2.07E-04	1.28E-04
SUBURBN_NE	3.19E-07	2.28E-05	1.41E-05
URBAN_NE	3.19E-07	2.55E-06	1.58E-06
RURAL_NJ	5.65E-07	1.16E-05	8.05E-06
SUBURBN_NJ	5.65E-07	7.06E-06	4.89E-06
URBAN_NJ	5.65E-07	6.22E-07	4.30E-07
RURAL_OH	1.64E-07	3.49E-05	2.98E-05
SUBURBN_OH	1.64E-07	2.48E-05	2.12E-05
URBAN_OH	1.64E-07	2.43E-06	2.07E-06
RURAL_OR	3.15E-07	9.48E-05	6.84E-05
SUBURBN_OR	3.15E-07	1.01E-05	7.31E-06
URBAN_OR	3.15E-07	7.25E-07	5.22E-07
RURAL_PA	5.14E-07	1.65E-04	1.23E-04
SUBURBN_PA	5.14E-07	8.85E-05	6.59E-05
URBAN_PA	5.14E-07	1.06E-05	7.93E-06
RURAL_UT	2.90E-07	5.42E-05	4.72E-05
SUBURBN_UT	2.90E-07	1.50E-05	1.30E-05
URBAN_UT	2.90E-07	4.35E-07	3.79E-07
RURAL_WA	2.65E-07	1.17E-05	7.94E-06
SUBURBN_WA	2.65E-07	2.28E-06	1.55E-06
URBAN_WA	2.65E-07	1.25E-06	8.46E-07
RURAL_WY	6.74E-07	4.09E-04	1.96E-04
SUBURBN_WY	6.74E-07	2.28E-05	1.09E-05
URBAN_WY	6.74E-07	2.29E-06	1.10E-06
TOTALS:	1.34E-05	1.51E-03	1.02E-03

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REGULATORY CHECKS

THE SHIPMENT BY VEHICLE\_1 IS DESIGNATED AS EXCLUSIVE USE  
BUT IS NOT REQUIRED TO BE SO DESIGNATED BY REGULATIONS

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INCIDENT-FREE SUMMARY

\*\*\*\*\* \*\*\*\*\*

IN-TRANSIT POPULATION EXPOSURE IN PERSON-SV

	PASSENGER	CREW	OFF LINK	ON LINK	TOTALS
RURAL_DE	0.00E+00	1.05E-08	1.62E-10	1.77E-09	1.25E-08
SUBURBN_DE	0.00E+00	4.46E-08	1.74E-08	1.08E-08	7.29E-08
URBAN_DE	0.00E+00	1.91E-08	6.11E-10	1.46E-08	3.43E-08
RURAL_ID	0.00E+00	1.14E-06	1.05E-08	1.92E-07	1.34E-06
SUBURBN_ID	0.00E+00	2.53E-07	5.01E-08	6.10E-08	3.64E-07
URBAN_ID	0.00E+00	2.33E-08	7.60E-10	1.77E-08	4.18E-08
RURAL_IL	0.00E+00	5.69E-07	6.70E-09	9.57E-08	6.71E-07
SUBURBN_IL	0.00E+00	2.33E-07	5.36E-08	5.62E-08	3.43E-07
URBAN_IL	0.00E+00	3.25E-08	1.14E-09	2.48E-08	5.85E-08
RURAL_IN	0.00E+00	4.36E-07	7.09E-09	7.34E-08	5.16E-07
SUBURBN_IN	0.00E+00	3.10E-07	6.10E-08	7.49E-08	4.46E-07
URBAN_IN	0.00E+00	3.00E-08	1.04E-09	2.28E-08	5.39E-08
RURAL_IA	0.00E+00	1.20E-06	1.62E-08	2.03E-07	1.42E-06
SUBURBN_IA	0.00E+00	3.43E-07	6.66E-08	8.29E-08	4.93E-07
URBAN_IA	0.00E+00	1.85E-08	5.96E-10	1.41E-08	3.32E-08
RURAL_NE	0.00E+00	2.07E-06	1.68E-08	3.48E-07	2.44E-06
SUBURBN_NE	0.00E+00	2.28E-07	4.38E-08	5.50E-08	3.27E-07
URBAN_NE	0.00E+00	2.55E-08	9.05E-10	1.94E-08	4.59E-08
RURAL_NJ	0.00E+00	6.57E-08	6.34E-10	1.11E-08	7.74E-08
SUBURBN_NJ	0.00E+00	3.98E-07	1.00E-07	1.32E-06	1.82E-06
URBAN_NJ	0.00E+00	3.51E-09	1.05E-10	2.67E-09	6.29E-09
RURAL_OH	0.00E+00	6.80E-07	1.09E-08	1.14E-07	8.05E-07
SUBURBN_OH	0.00E+00	4.82E-07	1.06E-07	1.16E-07	7.05E-07
URBAN_OH	0.00E+00	4.72E-08	1.54E-09	3.60E-08	8.47E-08
RURAL_OR	0.00E+00	9.60E-07	6.44E-09	1.62E-07	1.13E-06
SUBURBN_OR	0.00E+00	1.03E-07	2.29E-08	2.48E-08	1.50E-07
URBAN_OR	0.00E+00	7.33E-09	2.13E-10	5.59E-09	1.31E-08
RURAL_PA	0.00E+00	1.03E-06	1.54E-08	1.73E-07	1.21E-06
SUBURBN_PA	0.00E+00	5.49E-07	1.23E-07	1.33E-07	8.04E-07
URBAN_PA	0.00E+00	6.60E-08	2.38E-09	5.03E-08	1.19E-07
RURAL_UT	0.00E+00	5.96E-07	4.72E-09	1.00E-07	7.01E-07
SUBURBN_UT	0.00E+00	1.65E-07	3.02E-08	3.97E-08	2.34E-07
URBAN_UT	0.00E+00	4.78E-09	1.49E-10	3.65E-09	8.58E-09
RURAL_WA	0.00E+00	1.41E-07	1.72E-10	2.37E-08	1.64E-07
SUBURBN_WA	0.00E+00	2.74E-08	1.18E-08	6.62E-09	4.58E-08
URBAN_WA	0.00E+00	1.50E-08	5.06E-10	1.14E-08	2.69E-08
RURAL_WY	0.00E+00	1.94E-06	7.76E-09	3.26E-07	2.27E-06
SUBURBN_WY	0.00E+00	1.08E-07	3.07E-08	2.61E-08	1.65E-07
URBAN_WY	0.00E+00	1.08E-08	3.14E-10	8.26E-09	1.94E-08
RURAL	0.00E+00	1.08E-05	1.03E-07	1.82E-06	1.28E-05
SUBURB	0.00E+00	3.24E-06	7.17E-07	2.01E-06	5.97E-06
URBAN	0.00E+00	3.04E-07	1.03E-08	2.31E-07	5.45E-07

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TOTALS: 0.00E+00 1.44E-05 8.31E-07 4.07E-06 1.93E-05

MAXIMUM INDIVIDUAL IN-TRANSIT DOSE

VEHICLE\_1 4.26E-11 SV

STOP EXPOSURE IN PERSON-SV

ANNULAR AREA	STOP_1	2.90E-05
ANNULAR AREA	STOP_2	1.25E-07
TOTAL:		2.92E-05

HANDLING EXPOSURE IN PERSON-SV

HANDLING	VEHICLE	MATERIAL	METHOD	DOSE
HANDLE_1	VEHICLE_1	PACKAGE_1	LINE-SOURCE	8.35E-06
TOTAL:				8.35E-06

EOI  
END OF RUN  
SUCCESSFUL COMPLETION