

**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 ³	cubic feet
ft ³ /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 ³	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, *Inservice Inspection of Pressurized Water Reactor Steam Generator Tubes*, 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.

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

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atmospheric dispersion of the activity during transport from the release point to the dose point, the breathing rate of the individual at the dose point location and the activity-to-dose conversion factors. The atmospheric dispersion factor (χ/Q) is the only site-specific parameter required for determining the dose to an individual. The Design Certification Documents (DCDs) have developed χ/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 χ/Q values for each respective reactor technology and then compared to the acceptance criteria in RG 1.183 and NUREG-0800. Site-specific χ/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 χ/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 χ/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 χ/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 95th percentile χ/Q values. These analyses overstate the environmental impact of the DBAs. Consistent with NUREG-1555, this section uses 50th percentile χ/Q values that correspond to the annual average meteorology, and 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). Activity releases for other accidents are calculated for a reactor power level equal to or less than that of the LOCA.

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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 annual average χ/Q value to the DCD χ/Q value. All PSEG Site-specific annual average χ/Q values are bounded by the DCD χ/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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<u>Reactor Technology</u>	<u>γ/Q Data Table</u>	<u>Dose Data Table</u>
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 7.1-48 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**

NUREG-1555 DBA Descriptions	Consequences Tabulated	Remarks
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	
Other Accident Descriptions	Consequences Tabulated	Remarks
Spectrum of Rod Ejection Accidents (PWR)	Yes	

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

NUREG-1555 DBA Descriptions	Consequences Tabulated		Remarks
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		
Other Accident Descriptions	Consequences Tabulated		Remarks
Main Steam Line Break	Yes		

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

NUREG-1555 DBA Descriptions	Consequences Tabulated	Remarks
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	
Other Accident Descriptions	Consequences Tabulated	Remarks
Spectrum of Rod Cluster Control Assembly Ejection Accidents	Yes	

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

NUREG-1555 DBA Descriptions	Consequences Tabulated	Remarks
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	
Other Accident Descriptions	Consequences Tabulated	Remarks
Rod Ejection Accident	Yes	

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**Table 7.1-5 (Sheet 1 of 2)
US-APWR Source Terms
Time Dependent Released Activity during LOCA (Ci)**

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

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

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

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

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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)^(a)**

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

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

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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)^(a)**

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

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

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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)^(a)**

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

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

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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)^(a)**

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

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

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

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

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

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

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

- a) Rod ejection accident is calculated at a reactor power level of 4540 MWt (102 percent of 4451 MWt core thermal power).

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

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

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

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

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

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**Table 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.
A. Release from Reactor Building to Environment (MBq)					
I-131	3.2E+04	2.9E+06	1.1E+07	1.1E+07	1.1E+07
I-132	4.5E+04	4.1E+06	1.4E+07	1.4E+07	1.5E+07
I-133	6.5E+04	6.1E+06	2.2E+07	2.2E+07	2.3E+07
I-134	7.3E+04	6.1E+06	2.1E+07	2.1E+07	2.1E+07
I-135	6.1E+04	5.7E+06	2.1E+07	2.1E+07	2.2E+07
Total	2.8E+05	2.5E+07	8.9E+07	8.9E+07	9.2E+07
B.1 MSIV Pathway Release to Environment—Elemental (MBq)					
I-131	0.0E+00	0.0E+00	6.1E+01	1.0E+03	1.0E+04
I-132	0.0E+00	0.0E+00	6.9E+01	9.3E+02	6.1E+03
I-133	0.0E+00	0.0E+00	1.2E+02	2.1E+03	1.9E+04
I-134	0.0E+00	0.0E+00	6.9E+01	6.9E+02	2.5E+03
I-135	0.0E+00	0.0E+00	1.1E+02	1.8E+03	1.4E+04
Total	0.0E+00	0.0E+00	4.3E+02	6.5E+03	5.2E+04
B.2 MSIV Pathway Release to Environment—Organic (MBq)					
I-131	0.0E+00	0.0E+00	7.3E+02	1.2E+04	1.2E+05
I-132	0.0E+00	0.0E+00	8.1E+02	1.1E+04	7.3E+04
I-133	0.0E+00	0.0E+00	1.4E+03	2.5E+04	2.3E+05
I-134	0.0E+00	0.0E+00	8.5E+02	8.5E+03	3.1E+04
I-135	0.0E+00	0.0E+00	1.3E+03	2.1E+04	1.8E+05
Total	0.0E+00	0.0E+00	5.1E+03	7.8E+04	6.3E+05
B.3 MSIV Pathway Release to Environment—Resuspended Organic (MBq)					
I-131	0.0E+00	0.0E+00	7.3E+00	3.0E+01	2.4E+02
I-132	0.0E+00	0.0E+00	6.1E+00	2.3E+01	8.9E+01
I-133	0.0E+00	0.0E+00	1.4E+01	5.7E+01	4.5E+02
I-134	0.0E+00	0.0E+00	4.5E+00	1.4E+01	3.1E+01
I-135	0.0E+00	0.0E+00	1.2E+01	4.5E+01	2.9E+02
Total	0.0E+00	0.0E+00	4.4E+01	1.7E+02	1.1E+03
B.4 Release from Condenser to Environment—Sum of B.1+B.2+B.3 (MBq)					
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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ABWR Source Terms
Iodine Activity Release to the Environment during a LOCA**

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

Isotope	1 min	10 min	1 hr.	2 hr.	4 hr.
A. Reactor Building Release to Environment (MBq)					
Kr-83m	3.0E+04	2.5E+06	1.0E+07	1.3E+07	2.1E+07
Kr-85	2.8E+03	2.5E+05	1.1E+06	1.6E+06	3.9E+06
Kr-85m	6.1E+04	5.7E+06	2.3E+07	3.4E+07	6.5E+07
Kr-87	1.2E+05	1.0E+07	3.9E+07	4.8E+07	6.9E+07
Kr-88	1.8E+05	1.5E+07	6.1E+07	8.5E+07	1.5E+08
Kr-89	1.9E+05	5.3E+06	7.3E+06	7.3E+06	7.3E+06
Xe-131m	1.4E+03	1.3E+05	5.7E+05	8.5E+05	2.1E+06
Xe-133	5.3E+05	4.5E+07	2.0E+08	3.1E+08	7.3E+08
Xe-133m	2.2E+04	2.0E+06	8.1E+06	1.2E+07	3.0E+07
Xe-135	6.5E+04	6.1E+06	2.5E+07	3.7E+07	8.1E+07
Xe-135m	9.3E+04	6.5E+06	1.9E+07	2.0E+07	2.0E+07
Xe-137	4.1E+05	1.4E+07	2.1E+07	2.1E+07	2.1E+07
Xe-138	4.1E+05	2.8E+07	8.1E+07	8.1E+07	8.1E+07
Total	2.1E+06	1.4E+08	4.7E+08	6.2E+08	1.3E+09
B. Condenser Release to Environment (MBq)					
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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ABWR Source Terms
Noble Gas Activity Release to the Environment during a LOCA**

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

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

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

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

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**Table 7.1-17
ABWR Source Terms
Isotopic Releases during an Instrument Line Break Accident (MBq)**

Isotope	1 min	10 min	1 hr.	2 hr.	4 hr.	8 hr.
Reactor Building Inventory						
I-131	3.77E+01	3.27E+02	2.60E+04	1.73E+04	1.38E+04	4.59E+00
I-132	3.68E+02	3.11E+03	2.31E+05	1.44E+05	1.17E+05	1.17E+01
I-133	2.59E+02	2.24E+03	1.75E+05	1.16E+05	9.29E+04	2.72E+01
I-134	7.22E+02	5.92E+03	3.89E+05	2.26E+05	1.86E+05	2.65E+00
I-135	3.77E+02	3.25E+03	2.52E+05	1.64E+05	1.32E+05	2.90E+01
Total	1.76E+03	1.48E+04	1.07E+06	6.68E+05	5.41E+05	7.52E+01
Isotopic Releases to Environment						
I-131	6.36E-01	5.77E+01	2.77E+04	6.81E+04	1.27E+05	1.41E+05
I-132	6.18E+00	5.51E+02	2.52E+05	5.96E+05	1.09E+06	1.19E+06
I-133	4.37E+00	3.96E+02	1.87E+05	4.59E+05	8.51E+05	9.44E+05
I-134	1.21E+01	1.06E+03	4.44E+05	9.92E+05	1.76E+06	1.90E+06
I-135	6.36E+00	5.74E+02	2.71E+05	6.59E+05	1.21E+06	1.34E+06
Total	2.97E+01	2.64E+03	1.18E+06	2.77E+06	5.04E+06	5.51E+06

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**Table 7.1-18
ABWR Source Terms
Isotopic Release to Environment during a Fuel Handling Accident (MBq)**

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

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**Table 7.1-19
AP1000 Source Terms
Activity Releases for Steam System Piping Failure with Pre-Existing Iodine Spike (Ci)**

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

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**Table 7.1-20
AP1000 Source Terms
Activity Releases for Steam System Piping Failure with Accident-Initiated
Iodine Spike (Ci)**

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

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**Table 7.1-21
AP1000 Source Terms
Activity Releases for Reactor Coolant Pump Shaft Seizure (Ci)**

Isotope	No Feedwater	Feedwater Available			Total
	0 to 1.5 hr.	0 to 2 hr.	2 to 8 hr.	6 to 8 hr.	
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)**

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

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

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

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**Table 7.1-24
AP1000 Source Terms
Activity Releases for Steam Generator Tube Rupture with Pre-Existing Iodine Spike (Ci)**

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

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**Table 7.1-25
AP1000 Source Terms
Activity Releases for Steam Generator Tube Rupture with Accident-Initiated
Iodine Spike (Ci)**

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

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**Table 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)**

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

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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)**

Isotope	1.4 to 3.4 hr.	0 to 8 hr.	8 to 24 hr.	24 to 96 hr.	96 to 720 hr.	Total
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)**

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

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**Table 7.1-28
U.S. EPR Source Terms
Radionuclide Releases to Atmosphere for Main Steamline Break with Pre-Accident Iodine
Spike (Ci)**

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

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**Table 7.1-29
U.S. EPR Source Terms
Radionuclide Releases to Atmosphere for Main Steamline Break with Accident-Induced
(Coincident) Iodine Spike (Ci)**

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

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**Table 7.1-30A
U.S. EPR Source Terms
Radionuclide Releases to Atmosphere for Main Steamline Break with Accident-Induced
3.3% Clad Failure (Ci)**

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

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**Table 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)**

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

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**Table 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)**

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

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**Table 7.1-32
U.S. EPR Source Terms
Radionuclide Releases to Atmosphere for Design Basis Small Line Break (Ci)**

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

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**Table 7.1-33
U.S. EPR Source Terms
Radionuclide Releases to Atmosphere for Steam Generator Tube Rupture
with Pre-Accident Spike (Ci)**

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

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**Table 7.1-34
U.S. EPR Source Terms
Radionuclide Releases to Atmosphere for Steam Generator Tube Rupture with Accident-
Induced (Coincident) Iodine Spike (Ci)**

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

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**Table 7.1-35 (Sheet 1 of 6)
U.S. EPR Source Terms
Radionuclide Releases to Atmosphere for Design Basis LOCA (Ci)**

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

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**Table 7.1-35 (Sheet 2 of 6)
U.S. EPR Source Terms
Radionuclide Releases to Atmosphere for Design Basis LOCA (Ci)**

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

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**Table 7.1-35 (Sheet 3 of 6)
U.S. EPR Source Terms
Radionuclide Releases to Atmosphere for Design Basis LOCA (Ci)**

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

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**Table 7.1-35 (Sheet 4 of 6)
U.S. EPR Source Terms
Radionuclide Releases to Atmosphere for Design Basis LOCA (Ci)**

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

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**Table 7.1-35 (Sheet 5 of 6)
U.S. EPR Source Terms
Radionuclide Releases to Atmosphere for Design Basis LOCA (Ci)**

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

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**Table 7.1-35 (Sheet 6 of 6)
U.S. EPR Source Terms
Radionuclide Releases to Atmosphere for Design Basis LOCA (Ci)**

Isotope	8 to 24 hr.	24 to 96 hr.	96 to 720 hr.	Total
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)**

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

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**Table 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)**

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

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**Table 7.1-38
US-APWR Radiological Consequences
Atmospheric Dispersion Factors**

Location	Time (hr.)	DCD χ/Q (sec/m³)	Site χ/Q (sec/m³)	χ/Q Ratio (Site/DCD)
EAB	0 to 2	5.00E-04	6.71E-06	0.013
LPZ	0 to 8	2.10E-04	1.08E-07	0.001
	8 to 24	1.30E-04	1.08E-07	0.001
	24 to 96	6.90E-05	1.08E-07	0.002
	96 to 720	2.80E-05	1.08E-07	0.004

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

Accident	DCD Dose (rem TEDE)		χ/Q ratio (Site/DCD)		Site Dose (rem TEDE)		Limit
	EAB	LPZ	EAB	LPZ^(a)	EAB	LPZ	
Steam System Piping Failure - Pre-Existing Iodine Spike	0.19	0.11	0.013	0.004	0.00	0.00	25
Steam System Piping Failure - Accident-Initiated Iodine Spike	0.32	0.28	0.013	0.004	0.00	0.00	2.5
Reactor Coolant Pump Rotor Seizure	0.49	0.7	0.013	0.004	0.01	0.00	2.5
Spectrum of Rod Cluster Control Assembly Ejection Accidents	5.1	4.5	0.013	0.004	0.07	0.02	6.3
Failure of Small Lines Carrying Primary Coolant Outside Containment	1.5	0.6	0.013	0.004	0.02	0.00	2.5
Steam Generator Tube Rupture - Pre-Existing Iodine Spike	3.6	1.5	0.013	0.004	0.05	0.01	25
Steam Generator Tube Rupture - Accident-Initiated Iodine Spike	0.96	0.43	0.013	0.004	0.01	0.00	2.5
LOCA	13	13	0.013	0.004	0.17	0.05	25
Fuel Handling Accident	3.3	1.4	0.013	0.004	0.04	0.01	6.3

a) As LPZ doses are not given in time-dependent form, the most conservative Site/DCD χ /Q ratio (from the 96 to 720 hour interval) is used.

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

Accident	Location	Time (hr.)	DCD χ/Q (sec/m³)	Site χ/Q (sec/m³)	χ/Q Ratio (Site/DCD)
All Accidents	EAB	0 to 2	1.37E-03	6.71E-06	0.005
	LPZ	0 to 2	4.11E-04	1.08E-07	0.000
LOCA Only		0 to 8	1.56E-04	1.08E-07	0.001
		8 to 24	9.61E-05	1.08E-07	0.001
		24 to 96	3.36E-05	1.08E-07	0.003
		96 to 720	7.42E-06	1.08E-07	0.015

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

Accident	Thyroid Dose (Sv)	Whole Body Dose (Sv)	Thyroid Limit (Sv)	Whole Body Limit (Sv)
Failure of Small Lines Carrying Primary Coolant Outside Containment ^(a)	2.35E-04	4.60E-06	3.00E-01	2.50E-02
LOCA - EAB	1.02E-02	2.20E-04	3.00E+00	2.50E-01
LOCA - LPZ	2.08E-02	2.00E-04	3.00E+00	2.50E-01
Fuel Handling Accident ^(a)	4.02E-03	6.44E-05	7.50E-01	6.25E-02
Main Steamline Break Case 1 ^{(a)(b)}	1.27E-04	3.04E-06	3.00E-01	2.50E-02
Main Steamline Break Case 2 ^{(a)(b)}	2.50E-03	6.37E-05	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.

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

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**Table 7.1-42
ABWR Radiological Consequences
Doses for an Instrument Line Break Accident**

DCD			Site	
Thyroid Dose (Sv)	Whole Body Dose (Sv)	χ/Q Ratio (Site/DCD)	Thyroid Dose (Sv)	Whole Body Dose (Sv)
4.80E-02	9.40E-04	0.005	2.35E-04	4.60E-06

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

DCD		χ/Q Ratio (Site/DCD)	Uprate Ratio	Site	
Thyroid Dose (Sv)	Whole Body Dose (Sv)			Thyroid Dose (Sv)	Whole Body Dose (Sv)
7.50E-01	1.20E-02	0.005	1.095	4.02E-03	6.44E-05

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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)	χ/Q Ratio (Site/DCD)		Thyroid Dose (Sv)	Whole Body Dose (Sv)
EAB	0 to 2	1.90E+00	4.10E-02	0.005	1.095	1.02E-02	2.20E-04
LPZ	0 to 8	3.10E-01	1.00E-02	0.001	1.095	2.35E-04	7.58E-06
	0 to 24	5.10E-01	1.80E-02	0.001	1.095	4.81E-04	1.74E-05
	0 to 96	1.30E+00	2.90E-02	0.003	1.095	3.26E-03	5.61E-05
	0 to 720	2.40E+00	3.80E-02	0.015	1.095	2.08E-02	2.00E-04

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

	DCD			Site	
	Thyroid Dose (Sv)	Whole Body Dose (Sv)	χ/Q Ratio (Site/DCD)	Thyroid Dose (Sv)	Whole Body Dose (Sv)
Case 1	2.60E-02	6.20E-04	0.005	1.27E-04	3.04E-06
Case 2	5.10E-01	1.30E-02	0.005	2.50E-03	6.37E-05

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

Accident	Location	Time (hr.)	DCD χ/Q (sec/m³)	Site χ/Q (sec/m³)	χ/Q Ratio (Site/DCD)
LOCA	EAB	0 to 2	5.10E-04	6.71E-06	0.013
	LPZ	0 to 8	2.20E-04	1.08E-07	0.000
		8 to 24	1.60E-04	1.08E-07	0.001
		24 to 96	1.00E-04	1.08E-07	0.001
		96 to 720	8.00E-05	1.08E-07	0.001
Other Accidents	EAB	0 to 2	8.00E-04	6.71E-06	0.008
	LPZ	0 to 8	5.00E-04	1.08E-07	0.000
		8 to 24	3.00E-04	1.08E-07	0.000
		24 to 96	1.50E-04	1.08E-07	0.001
		96 to 720	8.00E-05	1.08E-07	0.001

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

Accident	Site Dose (rem TEDE)		
	EAB	LPZ	Limit
Steam System Piping Failure – Pre-Existing Iodine Spike	0.01	0.00	25
Steam System Piping Failure – Accident-Initiated Iodine Spike	0.01	0.00	2.5
Reactor Coolant Pump Shaft Seizure – No Feedwater	0.01	0.00	2.5
Reactor Coolant Pump Shaft Seizure – Feedwater Available	0.01	0.00	2.5
Spectrum of Rod Cluster Control Assembly Ejection Accidents	0.03	0.00	6.3
Failure of Small Lines Carrying Primary Coolant Outside Containment	0.02	0.00	2.5
Steam Generator Tube Rupture – Pre-Existing Iodine Spike	0.02	0.00	25
Steam Generator Tube Rupture – Accident-Initiated Iodine Spike	0.01	0.00	2.5
LOCA	0.32	0.01	25
Fuel Handling Accident	0.04	0.00	6.3

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

Doses for Steam System Piping Failure with Pre-Existing Iodine Spike					
Time (hr.)	DCD Dose (rem TEDE)		χ/Q Ratio (Site/DCD)	Site Dose (rem TEDE)	
	EAB	LPZ		EAB	LPZ
0 to 2	1.00E+00		0.008	8.39E-03	
0 to 8		5.81E-01	0.000		1.25E-04
8 to 24		7.18E-02	0.000		2.58E-05
24 to 96		1.08E-01	0.001		7.78E-05
96 to 720		0.00E+00	0.001		0.00E+00
Total	1.00E+00	7.61E-01		8.39E-03	2.29E-04
Limit				25	25

Doses for Steam System Piping Failure with Accident-Initiated Iodine Spike					
Time (hr.)	DCD Dose (rem TEDE)		χ/Q Ratio (Site/DCD)	Site Dose (rem TEDE)	
	EAB	LPZ		EAB	LPZ
0 to 2	1.10E+00		0.008	9.23E-03	
0 to 8		1.02E+00	0.000		2.20E-04
8 to 24		3.77E-01	0.000		1.36E-04
24 to 96		5.36E-01	0.001		3.86E-04
96 to 720		0.00E+00	0.001		0.00E+00
Total	1.10E+00	1.93E+00		9.23E-03	7.42E-04
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**

Doses for Reactor Coolant Pump Shaft Seizure with No Feedwater					
Time (hr.)	DCD Dose (rem TEDE)		χ/Q Ratio (Site/DCD)	Site Dose (rem TEDE)	
	EAB	LPZ		EAB	LPZ
0 to 2	8.00E-01		0.008	6.71E-03	
0 to 8		3.89E-01	0.000		8.40E-05
8 to 24		0.00E+00	0.000		0.00E+00
24 to 96		0.00E+00	0.001		0.00E+00
96 to 720		0.00E+00	0.001		0.00E+00
Total	8.00E-01	3.89E-01		6.71E-03	8.40E-05
Limit				2.5	2.5

Doses for Reactor Coolant Pump Shaft Seizure with Feedwater Available					
Time (hr.)	DCD Dose (rem TEDE)		χ/Q Ratio (Site/DCD)	Site Dose (rem TEDE)	
	EAB	LPZ		EAB	LPZ
0 to 2	6.00E-01		0.008	5.03E-03	
0 to 8		7.94E-01	0.000		1.72E-04
8 to 24		0.00E+00	0.000		0.00E+00
24 to 96		0.00E+00	0.001		0.00E+00
96 to 720		0.00E+00	0.001		0.00E+00
Total	6.00E-01	7.94E-01		5.03E-03	1.72E-04
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.)	DCD Dose (rem TEDE)		χ/Q Ratio (Site/DCD)	Site Dose (rem TEDE)	
	EAB	LPZ		EAB	LPZ
0 to 2	3.60E+00		0.008	3.02E-02	
0 to 8		4.58E+00	0.000		9.89E-04
8 to 24		7.84E-01	0.000		2.82E-04
24 to 96		6.32E-02	0.001		4.55E-05
96 to 720		2.06E-02	0.001		2.78E-05
Total	3.60E+00	5.45E+00		3.02E-02	1.34E-03
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**

Time (hr.)	<u>DCD Dose (rem TEDE)</u>		χ/Q Ratio (Site/DCD)	<u>Site Dose (rem TEDE)</u>	
	EAB	LPZ		EAB	LPZ
0 to 2	2.10E+00		0.008	1.76E-02	
0 to 8		1.02E+00	0.000		2.20E-04
8 to 24		0.00E+00	0.000		0.00E+00
24 to 96		0.00E+00	0.001		0.00E+00
96 to 720		0.00E+00	0.001		0.00E+00
Total	2.10E+00	1.02E+00		1.76E-02	2.20E-04
Limit				2.5	2.5

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

Doses for Steam Generator Tube Rupture with Pre-Existing Iodine Spike					
Time (hr.)	DCD Dose (rem TEDE)		χ/Q Ratio (Site/DCD)	Site Dose (rem TEDE)	
	EAB	LPZ		EAB	LPZ
0 to 2	2.20E+00		0.008	1.85E-02	
0 to 8		1.16E+00	0.000		2.51E-04
8 to 24		7.24E-02	0.000		2.61E-05
24 to 96		0.00E+00	0.001		0.00E+00
96 to 720		0.00E+00	0.001		0.00E+00
Total	2.20E+00	1.23E+00		1.85E-02	2.77E-04
Limit				25	25

Doses for Steam Generator Tube Rupture with Accident-Initiated Iodine Spike					
Time (hr.)	DCD Dose (rem TEDE)		χ/Q Ratio (Site/DCD)	Site Dose (rem TEDE)	
	EAB	LPZ		EAB	LPZ
0 to 2	1.10E+00		0.008	9.23E-03	
0 to 8		6.27E-01	0.000		1.35E-04
8 to 24		1.69E-01	0.000		6.08E-05
24 to 96		0.00E+00	0.001		0.00E+00
96 to 720		0.00E+00	0.001		0.00E+00
Total	1.10E+00	7.96E-01		9.23E-03	1.96E-04
Limit				2.5	2.5

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

Time (hr.)	<u>DCD Dose (rem TEDE)</u>		χ/Q Ratio (Site/DCD)	<u>Site Dose (rem TEDE)</u>	
	EAB	LPZ		EAB	LPZ
0 to 2	2.43E+01		0.013	3.20E-01	
0 to 8		2.17E+01	0.000		1.07E-02
8 to 24		7.69E-01	0.001		5.19E-04
24 to 96		3.71E-01	0.001		4.01E-04
96 to 720		8.70E-01	0.001		1.17E-03
Total	2.43E+01	2.37E+01		3.20E-01	1.27E-02
Limit				25	25

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

Time (hr.)	<u>DCD Dose (rem TEDE)</u>		χ/Q Ratio (Site/DCD)	<u>Site Dose (rem TEDE)</u>	
	EAB	LPZ		EAB	LPZ
0 to 2	5.20E+00		0.008	4.36E-02	
0 to 8		3.44E+00	0.000		7.43E-04
8 to 24		0.00E+00	0.000		0.00E+00
24 to 96		0.00E+00	0.001		0.00E+00
96 to 720		0.00E+00	0.001		0.00E+00
Total	5.20E+00	3.44E+00		4.36E-02	7.43E-04
Limit				25	25

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

Location	Time (hr.)	DCD χ/Q (sec/m³)	Site χ/Q (sec/m³)	χ/Q Ratio (Site/DCD)
EAB	0 to 2	1.00E-03	6.71E-06	0.007
LPZ	0 to 8	1.35E-04	1.08E-07	0.001
	8 to 24	1.00E-04	1.08E-07	0.001
	24 to 96	5.40E-05	1.08E-07	0.002
	96 to 720	2.20E-05	1.08E-07	0.005

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

Accident	DCD Dose (rem TEDE)		χ/Q ratio (Site/DCD)		Site Dose (rem TEDE)		Max
	EAB	LPZ	EAB	LPZ^(a)	EAB	LPZ	
Main Steam Line Break - Pre-Existing Iodine Spike	0.2	0.1	0.007	0.005	1.40E-03	5.00E-04	25
Main Steam Line Break - Accident-Initiated Iodine Spike	0.3	0.2	0.007	0.005	2.10E-03	1.00E-03	2.5
Main Steam Line Break - Fuel Rod Clad Failure	5.3	2.6	0.007	0.005	3.71E-02	1.30E-02	25
Main Steam Line Break - Fuel Overheat	5.8	2.8	0.007	0.005	4.06E-02	1.40E-02	25
Reactor Coolant Pump Shaft Seizure	2.3	0.9	0.007	0.005	1.61E-02	4.50E-03	2.5
Spectrum of Rod Cluster Control Assembly Ejection Accidents	5.7	3.5	0.007	0.005	3.99E-02	1.75E-02	6.3
Failure of Small Lines Carrying Primary Coolant Outside Containment	1.8	0.3	0.007	0.005	1.26E-02	1.50E-03	2.5
Steam Generator Tube Rupture - Pre-Existing Iodine Spike	1.1	0.3	0.007	0.005	7.70E-03	1.50E-03	25
Steam Generator Tube Rupture - Accident-Initiated Iodine Spike	0.7	0.5	0.007	0.005	4.90E-03	2.50E-03	2.5
LOCA	12.2	11.1	0.007	0.005	8.54E-02	5.55E-02	25
Fuel Handling Accident	5.6	1	0.007	0.005	3.92E-02	5.00E-03	6.3

a) As LPZ doses are not given in time-dependent form, the most conservative Site/DCD χ/Q ratio (from the 96 to 720 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 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 $4.56\text{E}+01$ person-rem/year ($4.56\text{E}-01$ person-Sv/year) and $1.45\text{E}+01$ person-rem/year ($1.45\text{E}-01$ person-Sv/year), respectively. The sum of these two components is the total collective dose and is equal to $6.00\text{E}+01$ person-rem/year ($6.00\text{E}-01$ 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 $6.00\text{E}+01$ person-rem/reactor-year ($6.00\text{E}-01$ person-Sv/reactor-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 1.9 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**

Release Category	Accident Scenario Description
ABWR	
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.
AP1000	
IC	Intact containment.
CFE	Early containment failure.
CFI	Intermediate containment failure.
CFL	Late containment failure.
CI	Containment isolation failure.
BP	Containment bypass.
US-APWR	
RC1	Containment bypass.
RC2	Containment isolation failure.
RC3	Containment failure before core damage.
RC4	Early containment failure.
RC5	Late containment failure.
RC6	Intact containment.
U.S. EPR	
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**

Release Category	Accident Scenario Description
RC204	Containment fails before vessel breach due to isolation failure, melt released from vessel, without MCCl, melt flooded ex-vessel with containment sprays.
RC205	Containment failures before vessel breach due to isolation failure, melt released from vessel, without MCCl, 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 MCCl, melt not flooded ex-vessel, with containment sprays.
RC302	Containment fails before vessel breach due to containment rupture, with MCCl, melt not flooded ex-vessel, without containment sprays.
RC303	Containment fails before vessel breach due to containment rupture, without MCCl, melt flooded ex-vessel, with containment sprays.
RC304	Containment fails before vessel breach due to containment rupture, without MCCl, melt flooded ex-vessel, without containment sprays.
RC401	Containment failures after breach and up to melt transfer to the spreading area, with MCCl, without debris flooding, with containment spray.
RC402	Containment failures after breach and up to melt transfer to the spreading area, with MCCl, without debris flooding, without containment spray.
RC403	Containment failures after breach and up to melt transfer to the spreading area, without MCCl, with debris flooding, with containment spray.
RC404	Containment failures after breach and up to melt transfer to the spreading area, without MCCl, with debris flooding, without containment spray.
RC501	Long term containment failure during and after debris quench, due to rupture, with MCCl, without debris flooding, with containment sprays.
RC502	Long term containment failure during and after debris quench, due to rupture, with MCCl, without debris flooding, without containment sprays.
RC503	Long term containment failure during and after debris quench, due to rupture, without MCCl, with debris flooding, with containment sprays.
RC504	Long term containment failure during and after debris quench, due to rupture, without MCCl, 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**

ABWR		AP1000		US-APWR		U.S. EPR	
Release Category	Frequency (Reactor Year)	Release Category	Frequency (Reactor Year)	Release Category	Frequency (Reactor Year)	Release Category	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 (Person-Sv)/ (Reactor-Year)	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 (Person-Sv)/ (Reactor-Year)	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^(a)**

Group	Nuclides
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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**Table 7.2-5 (Sheet 1 of 4)
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**

Release Category	Plume No.	AP1000								
		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**

US-APWR										
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
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. 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 US-APWR is the bounding reactor technology with regard to fission product inventory, Ci/MTU. Therefore, US-APWR-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.

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 US-APWR, this is 35 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.

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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 (7.4E+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 (1.13E+10 Bq/rod) prior to decay.

The accident severity categories and associated release fractions from Appendix G of NUREG-1815 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 2.88E-06 person-rem per MTU shipped (2.88E-08 person-Sv per MTU shipped). Using the average annual reload requirements for a US-APWR of 35 MTU, the annual population dose impact is 1.01E-04 person-rem/year (1.01E-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 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 Appendix G of NUREG-1815 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.

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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.

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.

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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.

7.4.3 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).

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 7.4-6 and 7.4-7. 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 are bounded by Table S-4 in 10 CFR 51.52(c), as shown in Table 7.4-8.

Therefore, the corresponding impacts from accidents associated with the transportation of fuel and waste, to and from the proposed new plant, are SMALL and are less than those specified in 10 CFR 51.52.

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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.

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

State	Accident Rate Accident/Truck-mi. (Accident/Truck-km)	Fatality Rate Fatality/Truck-mi. (Fatality/Truck-km)	Fatality Rate Fatality /Accident^(a)	Injury Rate Injury /Truck-mi. (Injury/Truck-km)	Injury Rate Injury/Accident^(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**

Nuclide^(a)	US- APWR 5 Year Decay Ci/MTU	US- APWR 5 Year Decay Bq/MTU
Am-241	1.81E+03	6.70E+13
Am-242m	2.04E+01	7.54E+11
Am-243	7.45E+01	2.76E+12
Ce-144	1.39E+04	5.13E+14
Pr-144 (D)		
Pr-144m (D)		
Cm-242	6.08E+01	2.25E+12
Cm-243	5.76E+01	2.13E+12
Cm-244	1.25E+04	4.64E+14
Cm-245		
Co-60	8.58E+01	3.17E+12
Cs-134	6.41E+04	2.37E+15
Cs-137	1.76E+05	6.51E+15
Ba-137m (D)		
Eu-154	1.03E+04	3.80E+14
Eu-155	2.74E+03	1.01E+14
Kr-85	1.09E+04	4.04E+14
Pm-147	5.17E+04	1.91E+15
Pu-238	9.51E+03	3.52E+14
Pu-239	4.08E+02	1.51E+13
Np-239	7.45E+01	2.76E+12
Pu-240	6.97E+02	2.58E+13
Pu-241	1.68E+05	6.22E+15
Ru-106	2.46E+04	9.12E+14
Rh-106 (D)		
Sb-125	3.39E+03	1.25E+14
Sr-90	1.20E+05	4.43E+15
Y-90	1.20E+05	4.43E+15
H-3 ^(b)	6.49E+02	2.40E+13
Tc-99 ^(b)	2.33E+01	8.64E+11
Cd-113m ^(b)	4.98E+01	1.84E+12
Te-125m ^(b)	8.30E+02	3.07E+13
Sm-151 ^(b)	6.47E+02	2.39E+13
Total	7.93E+05	2.93E+16

- a) The radionuclides labeled with a (D) are daughter products and are included with the parent in the RADTRAN program (References 7.4-5 and 7.4-6)
- b) These radionuclides are from the US-APWR inventory but are not included in Table G-9 of NUREG-1815. It should be noted that all the nuclides in this table are in the RADTRAN library. Those not marked ^(b) are also in Table G-9 of NUREG-1815.

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**Table 7.4-3
PSEG Site Model
Severity and Release Fractions^(a)**

Severity Category	Severity Fraction	Release Fractions				Corrosion Product
		Gas	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-02
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.

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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**

Environmental Impact	Unirradiated Fuel	Irradiated Fuel	Radwaste	Total
Person-rem per reactor-year (person-Sv per reactor-year)	See below	1.01E-04 (1.01E-06)	1.48E-05 (1.48E-07)	1.16E-04 (1.16E-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**

	Fatalities per Shipment	Shipments per Year	Fatalities per Year	Fatalities per 100 Years
ABWR				
New Fuel	4.67E-05	6.1	5.70E-04	5.70E-02
Spent Fuel	4.68E-05	24.8	2.32E-03	2.32E-01
Radwaste	1.33E-05	23.7	6.30E-04	6.30E-02
Total				3.52E-01
Single AP 1000 Unit				
New Fuel	4.67E-05	3.8	3.55E-04	3.55E-02
Spent Fuel	4.68E-05	13.6	1.27E-03	1.27E-01
Radwaste	1.33E-05	7.9	2.09E-04	2.09E-02
Total				1.83E-01
U.S. EPR				
New Fuel	4.67E-05	7.5	7.01E-04	7.01E-02
Spent Fuel	4.68E-05	20.8	1.95E-03	1.95E-01
Radwaste	1.33E-05	12.1	3.21E-04	3.21E-02
Total				2.97E-01
US-APWR				
New Fuel	4.67E-05	2.3	2.15E-04	2.15E-02
Spent Fuel	4.68E-05	19.4	1.82E-03	1.82E-01
Radwaste	1.33E-05	21.8	5.81E-04	5.81E-02
Total				2.62E-01

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

	Injuries per Shipment	Shipments per Year	Injuries per Year	Injuries per 10 Years
ABWR				
New Fuel	1.02E-03	6.1	1.24E-02	1.24E-01
Spent Fuel	1.02E-03	24.8	5.07E-02	5.07E-01
Radwaste	3.54E-04	23.7	1.68E-02	1.68E-01
Total				7.99E-01
Single AP 1000 Unit				
New Fuel	1.02E-03	3.8	7.75E-03	7.75E-02
Spent Fuel	1.02E-03	13.6	2.77E-02	2.77E-01
Radwaste	3.54E-04	7.9	5.56E-03	5.56E-02
Total				4.10E-01
U.S. EPR				
New Fuel	1.02E-03	7.5	1.53E-02	1.53E-01
Spent Fuel	1.02E-03	20.8	4.25E-02	4.25E-01
Radwaste	3.54E-04	12.1	8.56E-03	8.56E-02
Total				6.64E-01
US-APWR				
New Fuel	1.02E-03	2.3	4.69E-03	4.69E-02
Spent Fuel	1.02E-03	19.4	3.97E-02	3.97E-01
Radwaste	3.54E-04	21.8	1.55E-02	1.55E-01
Total				5.98E-01

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**Table 7.4-8
PSEG Site Model Comparison to
10 CFR 51.52 Summary Table S-4: "Accidents in Transport"
Bounding Technology Summary**

Types of Effects	Environmental Risk 10 CFR 51.52 Table S-4	PSEG Site Model Bounding Reactor
Radiological effects	Small	
Person-rem per reactor-year (person-Sv per reactor-year)		1.16E-04 (1.16E-06)
Common (nonradiological) causes	1 fatal injury in 100 reactor years 1 nonfatal injury in 10 reactor years \$475 property damage per reactor year	3.52E-01 7.99E-01 (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 AREVA U.S. EPR.

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 US-APWR.

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-41

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1 TRAGIS INPUT

The TRAGIS input screens are reproduced below.

WebTRAGIS Client Version: 4.6.2

Select Origin/Destination

Mode
☒ Highway
☐ Railroad
☐ Water
☐ InterModal

Origin

State	Node Name
MN	ROCKAWAY NE I80X37
MO	ROSS COR U206S15
MS	RUTHERFORD S S17 S3
MT	S BRUNSWICK U130S32
NC	S BRUNSWICK E TNJT X8A
ND	S TOMS RIVER W TGSPX80
NE	SADDLE BROOK I80X62
NH	SADDLE BROOK NW TGSPX159
NJ	SALEM S45 S49
NM	SALEM NW S49 LOCL
NV	SALEM NP
NY	SAYREVILLE W TNJT X9
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	VGT AIRPORT
RI	WARM SPRINGS
SC	WELLS I80X352
SD	WENDOVER I80X410
TN	WINNEMUCCA I80X178
TX	WINNEMUCCA SW I80X173
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 at 100

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

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

Help **Client Software Parameters**

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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 <input type="radio"/> One Driver <input checked="" type="radio"/> Two Drivers Highway Inspection <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"/> Toll Bias Factor Enter the toll bias factor. (0 - 1000) <input type="text" value="0"/> <input type="checkbox"/> Include Nevada County Population Details	Other Constraints <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 checked="" type="checkbox"/> Las Vegas Beltway considered a Preferred Route. Road Lane Type Penalty Penalty Factor (0 - 100) <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](#)

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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

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Time		Location		Direction		Time		Date		Time	
154.4	I80					1039.7	22:47	06/27/09	15:02		
0.3	I80					1040.0	23:17	06/27/09	15:32		
State Inspection took 30 minutes											
Rest 30 minutes											
168.0	I80					1207.9	26:23	06/27/09	18:38		
14.2	I35	I80				1222.1	26:37	06/27/09	18:52		
95.7	I80					1317.8	28:05	06/27/09	20:20		
16.5	I680					1334.3	28:20	06/27/09	20:35		
9.7	I29	I680				1344.0	28:29	06/27/09	20:44		
3.0	I680					1347.0	29:02	06/27/09	21:17		
State Inspection took 30 minutes											
13.4	I680					1360.4	29:17	06/27/09	21:32		
Rest 30 minutes											
Rest 30 minutes											
422.7	I80					1783.1	35:56	06/28/09	03:11		
20.6	I80					1803.6	36:43	06/28/09	03:58		
State Inspection took 30 minutes											
Rest 30 minutes											
382.4	I80					2186.0	42:19	06/28/09	09:34		
18.2	I80					2204.2	43:03	06/28/09	10:18		
Rest 30 minutes											
State Inspection took 30 minutes											
68.4	I80					2272.5	44:28	06/28/09	11:43		
10.2	I215					2282.8	44:37	06/28/09	11:52		
Rest 30 minutes											
294.2	I15					2577.0	49:06	06/28/09	16:21		
6.4	I15					2583.4	49:41	06/28/09	16:56		
State Inspection took 30 minutes											
20.6	I15					2604.0	49:58	06/28/09	16:13		
8.6	I15					2612.7	50:35	06/28/09	16:50		
State Inspection took 30 minutes											
73.6	I15					2686.2	51:35	06/28/09	17:50		
Rest 30 minutes											
14.8	C215					2701.0	52:04	06/28/09	18:19		
46.1	U95					2747.1	53:20	06/28/09	19:35		
33.1	LOCAL					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			

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TRAGIS Routing Engine Version 1.5.4 -- 2000 Census Data

POPULATION DENSITY within 800 meter Buffer Zone:

FROM: SALEM NP

NJ

TO : YUCCA MOUNTAIN

NV

		>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
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
```

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Suburban - KM= 75.6
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

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[Total]
Rural - KM=3428.6
Suburban - KM= 933.4
Urban - KM= 112.1
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.

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

File Edit

Package Radionuclides Vehicle Link Stop Handling Accident Parameters

Title: Calc. 2009-06944:Irradiated Fuel to Yucca Mt.: Injuries & Fatalities

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:Irradiated Fuel to Yucca Mt....

File Edit

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

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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

PACKAGE_1	Radionuclide	Phys/Chem Group	Curies
H3WTR	AM241	Part	1.81E03
H3GAS	AM242M	Part	2.04E01
BE10	CM245	Part	0.00E00
C14ORG	CM244	Part	1.25E04
C14GAS	CM243	Part	5.76E01
NA22	CM242	Part	6.08E01
P32	CE144	Part	1.39E04
S35	AM243	Part	7.45E01
CL36	EU154	Part	1.03E04
CA41	EU155	Part	2.74E03
CA45	PM147	Part	5.17E04
SC46	PU238	Part	9.51E03
CR51	PU239	Part	4.08E02
MN54	PU240	Part	6.97E02
FE55	PU241	Part	1.68E05
CO57	PU242	Part	0.00E00
CO58	SB125	Part	3.39E03
FE59	SR90	Part	1.20E05
NI59	Y90	Part	1.20E05
CO60	NP239	Part	7.45E01
NI63	TC99	Part	2.33E01
	CD113M	Part	4.98E01
	TE125M	Part	8.30E02
	SM151	Part	6.47E02
	CS134	Cs	6.41E04
	CS137	Cs	1.76E05
	I129	Cs	0.00E00
	RU106	Ru	2.46E04
	KR85	Gas	1.09E04
	H3GAS	Gas	6.49E02
	CO60	Cor	8.58E01

Add Library Radionuclide >>

Modify User Defined Radionuclides

Add User Defined Radionuclide >>

<< Remove Radionuclide

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Radcat 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 ²)	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"

Radcat 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 ²)	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

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File Edit

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

Name	Vehicle	Min Distance (m)	Max Distance (m)	People or People/km ²	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

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

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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: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

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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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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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

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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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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

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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	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

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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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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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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	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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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	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/km²

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 ²)	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 ² to residential population/km ²	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 ³ /sec)	3.30E-04
Cleanup Level (microcuries/m ²)	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

RUN DATE: [29-JUL-09 AT 20:38:42]

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 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

TITLE Calc. 2009-06944: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	&& 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	&& 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 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. 2009-06944: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 && 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=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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Calc. 2009-06944:Irradiated Fuel to Yucca Mt.: 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=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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Calc. 2009-06944:Irradiated Fuel to Yucca Mt.: 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=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=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

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Calc. 2009-06944:Irradiated Fuel to Yucca Mt.: Fatalities

```
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 1810.0 Part
  AM242M 20.4 Part
  CM245 0.0 Part
  CM244 12500.0 Part
  CM243 57.6 Part
  CM242 60.8 Part
  CE144 13900.0 Part
  AM243 74.5 Part
  EU154 10300.0 Part
  EU155 2740.0 Part
  PM147 51700.0 Part
  PU238 9510.0 Part
  PU239 408.0 Part
  PU240 697.0 Part
  PU241 168000.0 Part
  PU242 0.0 Part
  SB125 3390.0 Part
  SR90 120000.0 Part
  Y90 120000.0 Part
  NP239 74.5 Part
  TC99 23.3 Part
  CD113M 49.8 Part
  TE125M 830.0 Part
  SM151 647.0 Part
  CS134 64100.0 Cs
  CS137 176000.0 Cs
  I129 0.0 Cs
  RU106 24600.0 Ru
  KR85 10900.0 Gas
  H3GAS 649.0 Gas
  CO60 85.8 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
```

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```
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
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
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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)

	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	-
2	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	-
5	-	-	-	X	-	-	X	-	-	-	-	-	-	X	X	-	-	-	-
6	-	-	-	X	-	-	-	-	-	-	-	-	-	X	X	-	-	-	-
7	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-	-
8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
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_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

EXPECTED VALUES OF POPULATION RISK IN PERSON-SV

	GROUND	INHALED	RESUSPD	CLOUDSH	TOTAL
RURAL_AZ	1.72E-12	1.51E-13	1.09E-15	2.00E-15	1.88E-12
SUBURBN_AZ	4.69E-13	4.11E-14	2.97E-16	5.45E-16	5.11E-13
URBAN_AZ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RURAL_DE	2.51E-12	2.20E-13	1.59E-15	2.91E-15	2.73E-12
SUBURBN_DE	3.09E-10	2.71E-11	1.96E-13	3.59E-13	3.37E-10
URBAN_DE	1.74E-09	1.52E-10	1.10E-12	2.02E-12	1.89E-09
RURAL_IL	4.97E-11	4.36E-12	3.15E-14	5.78E-14	5.42E-11
SUBURBN_IL	4.57E-10	4.01E-11	2.90E-13	5.32E-13	4.98E-10
URBAN_IL	1.37E-09	1.20E-10	8.66E-13	1.59E-12	1.49E-09
RURAL_IN	5.34E-11	4.68E-12	3.38E-14	6.21E-14	5.82E-11
SUBURBN_IN	5.27E-10	4.63E-11	3.34E-13	6.13E-13	5.75E-10
URBAN_IN	1.26E-09	1.11E-10	8.00E-13	1.47E-12	1.37E-09
RURAL_IA	6.04E-11	5.30E-12	3.83E-14	7.02E-14	6.58E-11
SUBURBN_IA	2.50E-10	2.19E-11	1.58E-13	2.90E-13	2.72E-10
URBAN_IA	3.16E-10	2.77E-11	2.01E-13	3.68E-13	3.45E-10
RURAL_NE	1.81E-10	1.59E-11	1.15E-13	2.11E-13	1.98E-10
SUBURBN_NE	5.65E-10	4.95E-11	3.58E-13	6.57E-13	6.15E-10
URBAN_NE	1.36E-09	1.19E-10	8.62E-13	1.58E-12	1.48E-09
RURAL_NV	2.38E-11	2.09E-12	1.51E-14	2.77E-14	2.59E-11
SUBURBN_NV	8.14E-11	7.14E-12	5.16E-14	9.46E-14	8.87E-11
URBAN_NV	1.98E-10	1.74E-11	1.26E-13	2.31E-13	2.16E-10
RURAL_NJ	1.20E-11	1.05E-12	7.59E-15	1.39E-14	1.30E-11
SUBURBN_NJ	2.18E-10	1.91E-11	1.38E-13	2.53E-13	2.37E-10
URBAN_NJ	3.19E-10	2.80E-11	2.02E-13	3.71E-13	3.48E-10
RURAL_OH	6.00E-11	5.26E-12	3.81E-14	6.98E-14	6.54E-11
SUBURBN_OH	6.70E-10	5.87E-11	4.25E-13	7.79E-13	7.30E-10
URBAN_OH	1.36E-09	1.19E-10	8.63E-13	1.58E-12	1.48E-09
RURAL_PA	3.55E-10	3.12E-11	2.25E-13	4.13E-13	3.87E-10
SUBURBN_PA	3.46E-09	3.04E-10	2.20E-12	4.03E-12	3.77E-09
URBAN_PA	6.98E-09	6.12E-10	4.42E-12	8.11E-12	7.60E-09
RURAL_UT	1.18E-10	1.04E-11	7.49E-14	1.37E-13	1.29E-10
SUBURBN_UT	9.77E-10	8.56E-11	6.19E-13	1.14E-12	1.06E-09
URBAN_UT	5.85E-09	5.13E-10	3.71E-12	6.80E-12	6.37E-09
RURAL_WY	1.75E-10	1.53E-11	1.11E-13	2.03E-13	1.91E-10
SUBURBN_WY	7.96E-10	6.98E-11	5.05E-13	9.25E-13	8.67E-10
URBAN_WY	1.14E-09	1.00E-10	7.24E-13	1.33E-12	1.24E-09
RURAL	1.09E-09	9.59E-11	6.93E-13	1.27E-12	1.19E-09
SUBURB	8.31E-09	7.29E-10	5.27E-12	9.67E-12	9.06E-09
URBAN	2.19E-08	1.92E-09	1.39E-11	2.55E-11	2.38E-08
TOTALS:	3.13E-08	2.74E-09	1.98E-11	3.64E-11	3.41E-08

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SOCIETAL INGESTION RISK - PERSON-SV

LINK	GONADS	EFFECTIVE
RURAL_AZ	1.33E-11	1.35E-11
RURAL_DE	8.47E-12	8.63E-12
RURAL_IL	8.53E-11	8.68E-11
RURAL_IN	6.62E-11	6.74E-11
RURAL_IA	9.49E-11	9.67E-11
RURAL_NE	4.48E-10	4.56E-10
RURAL_NV	1.22E-10	1.25E-10
RURAL_NJ	2.51E-11	2.55E-11
RURAL_OH	7.52E-11	7.66E-11
RURAL_PA	4.96E-10	5.05E-10
RURAL_UT	2.94E-10	3.00E-10
RURAL_WY	8.81E-10	8.97E-10
TOTAL	2.61E-09	2.66E-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	1.45E-11	2.46E-11	1.14E-11	1.45E-11
RURAL_DE	7.19E-12	7.34E-12	9.25E-12	1.57E-11	7.29E-12	9.24E-12
RURAL_IL	7.23E-11	7.38E-11	9.30E-11	1.58E-10	7.33E-11	9.29E-11
RURAL_IN	5.61E-11	5.73E-11	7.23E-11	1.22E-10	5.70E-11	7.22E-11
RURAL_IA	8.05E-11	8.22E-11	1.04E-10	1.75E-10	8.17E-11	1.04E-10
RURAL_NE	3.80E-10	3.88E-10	4.89E-10	8.28E-10	3.85E-10	4.88E-10
RURAL_NV	1.04E-10	1.06E-10	1.34E-10	2.26E-10	1.05E-10	1.33E-10
RURAL_NJ	2.12E-11	2.17E-11	2.73E-11	4.63E-11	2.16E-11	2.73E-11
RURAL_OH	6.38E-11	6.51E-11	8.21E-11	1.39E-10	6.47E-11	8.20E-11
RURAL_PA	4.20E-10	4.29E-10	5.41E-10	9.16E-10	4.26E-10	5.40E-10
RURAL_UT	2.50E-10	2.55E-10	3.21E-10	5.44E-10	2.53E-10	3.21E-10
RURAL_WY	7.47E-10	7.63E-10	9.61E-10	1.63E-09	7.58E-10	9.60E-10
TOTAL	2.21E-09	2.26E-09	2.85E-09	4.82E-09	2.24E-09	2.85E-09

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Calc. 2009-06944:Irradiated Fuel to Yucca Mt.: Fatalities

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

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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 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 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. 2009-06944: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	&& 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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Calc. 2009-06944: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 && LCFCON(1), LCFCON(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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Calc. 2009-06944:Irradiated Fuel to Yucca Mt.: Injuries

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=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=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

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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 1.0 0.0 5.2
  AM241 1810.0 Part
  AM242M 20.4 Part
  CM245 0.0 Part
  CM244 12500.0 Part
  CM243 57.6 Part
  CM242 60.8 Part
  CE144 13900.0 Part
  AM243 74.5 Part
  EU154 10300.0 Part
  EU155 2740.0 Part
  PM147 51700.0 Part
  PU238 9510.0 Part
  PU239 408.0 Part
  PU240 697.0 Part
  PU241 168000.0 Part
  PU242 0.0 Part
  SB125 3390.0 Part
  SR90 120000.0 Part
  Y90 120000.0 Part
  CS134 64100.0 Cs
  CS137 176000.0 Cs
  I129 0.0 Cs
  RU106 24600.0 Ru
  KR85 10900.0 Gas
  CO60 85.8 Cor
  NP239 74.5 Part
  H3GAS 649.0 Gas
  TC99 23.3 Part
  CD113M 49.8 Part
  TE125M 830.0 Part
  SM151 647.0 Part
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
```

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Calc. 2009-06944:Irradiated Fuel to Yucca Mt.: Injuries

```
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
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
```

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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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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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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	-
2	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	-
5	-	-	-	X	-	-	X	-	-	-	-	-	-	X	X	-	-	-	-
6	-	-	-	X	-	-	-	-	-	-	-	-	-	X	X	-	-	-	-
7	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-	-
8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
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_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

EXPECTED VALUES OF POPULATION RISK IN PERSON-SV

	GROUND	INHALED	RESUSPD	CLOUDSH	TOTAL
RURAL_AZ	1.72E-12	1.51E-13	1.09E-15	2.00E-15	1.88E-12
SUBURBN_AZ	4.69E-13	4.11E-14	2.97E-16	5.45E-16	5.11E-13
URBAN_AZ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RURAL_DE	2.51E-12	2.20E-13	1.59E-15	2.91E-15	2.73E-12
SUBURBN_DE	3.09E-10	2.71E-11	1.96E-13	3.59E-13	3.37E-10
URBAN_DE	1.74E-09	1.52E-10	1.10E-12	2.02E-12	1.89E-09
RURAL_IL	4.97E-11	4.36E-12	3.15E-14	5.78E-14	5.42E-11
SUBURBN_IL	4.57E-10	4.01E-11	2.90E-13	5.32E-13	4.98E-10
URBAN_IL	1.37E-09	1.20E-10	8.66E-13	1.59E-12	1.49E-09
RURAL_IN	5.34E-11	4.68E-12	3.38E-14	6.21E-14	5.82E-11
SUBURBN_IN	5.27E-10	4.63E-11	3.34E-13	6.13E-13	5.75E-10
URBAN_IN	1.26E-09	1.11E-10	8.00E-13	1.47E-12	1.37E-09
RURAL_IA	6.04E-11	5.30E-12	3.83E-14	7.02E-14	6.58E-11
SUBURBN_IA	2.50E-10	2.19E-11	1.58E-13	2.90E-13	2.72E-10
URBAN_IA	3.16E-10	2.77E-11	2.01E-13	3.68E-13	3.45E-10
RURAL_NE	1.81E-10	1.59E-11	1.15E-13	2.11E-13	1.98E-10
SUBURBN_NE	5.65E-10	4.95E-11	3.58E-13	6.57E-13	6.15E-10
URBAN_NE	1.36E-09	1.19E-10	8.62E-13	1.58E-12	1.48E-09
RURAL_NV	2.38E-11	2.09E-12	1.51E-14	2.77E-14	2.59E-11
SUBURBN_NV	8.14E-11	7.14E-12	5.16E-14	9.46E-14	8.87E-11
URBAN_NV	1.98E-10	1.74E-11	1.26E-13	2.31E-13	2.16E-10
RURAL_NJ	1.20E-11	1.05E-12	7.59E-15	1.39E-14	1.30E-11
SUBURBN_NJ	2.18E-10	1.91E-11	1.38E-13	2.53E-13	2.37E-10
URBAN_NJ	3.19E-10	2.80E-11	2.02E-13	3.71E-13	3.48E-10
RURAL_OH	6.00E-11	5.26E-12	3.81E-14	6.98E-14	6.54E-11
SUBURBN_OH	6.70E-10	5.87E-11	4.25E-13	7.79E-13	7.30E-10
URBAN_OH	1.36E-09	1.19E-10	8.63E-13	1.58E-12	1.48E-09
RURAL_PA	3.55E-10	3.12E-11	2.25E-13	4.13E-13	3.87E-10
SUBURBN_PA	3.46E-09	3.04E-10	2.20E-12	4.03E-12	3.77E-09
URBAN_PA	6.98E-09	6.12E-10	4.42E-12	8.11E-12	7.60E-09
RURAL_UT	1.18E-10	1.04E-11	7.49E-14	1.37E-13	1.29E-10
SUBURBN_UT	9.77E-10	8.56E-11	6.19E-13	1.14E-12	1.06E-09
URBAN_UT	5.85E-09	5.13E-10	3.71E-12	6.80E-12	6.37E-09
RURAL_WY	1.75E-10	1.53E-11	1.11E-13	2.03E-13	1.91E-10
SUBURBN_WY	7.96E-10	6.98E-11	5.05E-13	9.25E-13	8.67E-10
URBAN_WY	1.14E-09	1.00E-10	7.24E-13	1.33E-12	1.24E-09
RURAL	1.09E-09	9.59E-11	6.93E-13	1.27E-12	1.19E-09
SUBURB	8.31E-09	7.29E-10	5.27E-12	9.67E-12	9.06E-09
URBAN	2.19E-08	1.92E-09	1.39E-11	2.55E-11	2.38E-08
TOTALS:	3.13E-08	2.74E-09	1.98E-11	3.64E-11	3.41E-08

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SOCIETAL INGESTION RISK - PERSON-SV

LINK	GONADS	EFFECTIVE
RURAL_AZ	1.33E-11	1.35E-11
RURAL_DE	8.47E-12	8.63E-12
RURAL_IL	8.53E-11	8.68E-11
RURAL_IN	6.62E-11	6.74E-11
RURAL_IA	9.49E-11	9.67E-11
RURAL_NE	4.48E-10	4.56E-10
RURAL_NV	1.22E-10	1.25E-10
RURAL_NJ	2.51E-11	2.55E-11
RURAL_OH	7.52E-11	7.66E-11
RURAL_PA	4.96E-10	5.05E-10
RURAL_UT	2.94E-10	3.00E-10
RURAL_WY	8.81E-10	8.97E-10
TOTAL	2.61E-09	2.66E-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	1.45E-11	2.46E-11	1.14E-11	1.45E-11
RURAL_DE	7.19E-12	7.34E-12	9.25E-12	1.57E-11	7.29E-12	9.24E-12
RURAL_IL	7.23E-11	7.38E-11	9.30E-11	1.58E-10	7.33E-11	9.29E-11
RURAL_IN	5.61E-11	5.73E-11	7.23E-11	1.22E-10	5.70E-11	7.22E-11
RURAL_IA	8.05E-11	8.22E-11	1.04E-10	1.75E-10	8.17E-11	1.04E-10
RURAL_NE	3.80E-10	3.88E-10	4.89E-10	8.28E-10	3.85E-10	4.88E-10
RURAL_NV	1.04E-10	1.06E-10	1.34E-10	2.26E-10	1.05E-10	1.33E-10
RURAL_NJ	2.12E-11	2.17E-11	2.73E-11	4.63E-11	2.16E-11	2.73E-11
RURAL_OH	6.38E-11	6.51E-11	8.21E-11	1.39E-10	6.47E-11	8.20E-11
RURAL_PA	4.20E-10	4.29E-10	5.41E-10	9.16E-10	4.26E-10	5.40E-10
RURAL_UT	2.50E-10	2.55E-10	3.21E-10	5.44E-10	2.53E-10	3.21E-10
RURAL_WY	7.47E-10	7.63E-10	9.61E-10	1.63E-09	7.58E-10	9.60E-10
TOTAL	2.21E-09	2.26E-09	2.85E-09	4.82E-09	2.24E-09	2.85E-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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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-57
2	TRAGIS Output.....	7A-59
3	TRAGIS Generated Input for RADTRAN	7A-61
4	RADTRAN Input.....	7A-63
5	RADTRAN Fatalities Case Output	7A-79
6	RADTRAN Injuries Case Output.....	7A-93

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1 TRAGIS INPUT

The TRAGIS input screens are reproduced below.

WebTRAGIS Client Version: 4.6.2

Select Origin/Destination

Mode

☒ Highway ☐ Railroad ☐ Water ☐ InterModal

Origin

State	Node Name
MD	SALEM NW S49 LOCL
ME	SALEM NP
MI	SAYREVILLE W TNJTX9
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	BENNETTSVILLE E U15 S9
TX	BISHOPVILLE SW I20X115
UT	BLACKSBURG W I85X100

Selected Node Number

451115493

Route Type

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

Help **Client Software Parameters**

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
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)

30

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

0

☐ Include Nevada County Population Details

Other Constraints
☒ Prohibit use of roads that restrict Commercial Trucks
☒ Prohibit the use of ferries
☒ 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 or between Belways
☐ Prohibit the use of roads with Low 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	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

**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\$	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
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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

ST	MILES	0	>0.0	22.7	59.7	139	326	821	1861	3326	5815	
			-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	5.85
PERCENTAGES												
		7.31	13.07	15.37	12.95	13.28	14.59	10.31	6.27	4.14	1.86	0.85

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
```

**PSEG Site
ESP Application
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[VA]

Rural - KM= 114.1

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' application window. The title bar reads 'Radcat 2.3 Project Panthro - Calc. 2009-06944: Radwaste: PSEG ESP to Barnwell SC [unsaved]'. The menu bar includes 'File' and 'Edit'. A toolbar with various icons is located below the menu bar. A tabbed interface is present with tabs for 'Title', 'Package', 'Radionuclides', 'Vehicle', 'Link', 'Stop', 'Handling', 'Accident', and 'Parameters'. The 'Accident' tab is currently selected. Within this tab, there is a 'Title:' label followed by a text box containing 'Calc. 2009-06944: Radwaste: PSEG ESP to Barnwell SC'. Below this is a large 'Remarks' text area. At the bottom of the window, there are three main sections: 'Accident Options' on the left, 'Output Level' in the center, and 'Health Effects' on the right. The 'Accident Options' section contains three checked checkboxes: 'Incident Free', 'Accident', and 'SI Output'. The 'Output Level' section has four radio buttons, with '1' being the selected option. The 'Health Effects' section contains two radio buttons, with 'Rem/Person-rem' being the selected option. Above these three sections are two buttons: 'Add Remark' and 'Remove Remark'.

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

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
Part 3, Environmental Report**

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
	I131	Cs	3.38E04
	RB86	Cs	2.21E02
	RU103	Ru	3.12E01
	RU106	Ru	7.80E01

Add Library Radionuclide >

Modify User Defined Radionuclides

Add User Defined Radionuclide >

< Remove Radionuclide

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

Add Vehicle Remove Vehicle

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

Link

Link Name	Vehicle	Length (km)	Speed (km/h)	Population Density (persons/km ²)	Vehicle Density (vehicles/hr)	Persons per Vehicle	Accident Rate (accidents/veh-km)	Fatalities per Accident	Zon
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

Link

Link Name	Vehicle	Length (km)	Speed (km/h)	Population Density (persons/km ²)	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

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

Tabbed Interface: Title, Package, Radionuclides, Vehicle, Link, **Stop**, Handling, Accident, Parameters

Name	Vehicle	Min Distance (m)	Max Distance (m)	People or People/km ²	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

Add Stop Remove Stop

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

File Edit

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

Tabbed Interface: 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

**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

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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

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

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

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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

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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

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

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/km²

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 ²)	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 ² to residential population/km ²	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 ³ /sec)	3.30E-04
Cleanup Level (microcuries/m ²)	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 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 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. 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 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	&& 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	&& 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

**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

```

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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 0.0108 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 GROUND SHINE 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 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: 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	&& 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	&& 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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```
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 GROUND SHINE 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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Calc. 2009-06944: Radwaste: PSEG ESP to Barnwell SC: 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_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

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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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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-109
2	TRAGIS Output	7A-111
3	TRAGIS Generated Input for RADTRAN	7A-113
4	RADTRAN Input.....	7A-116
5	RADTRAN Fatalities Case Output	7A-121
6	RADTRAN Injuries Case Output	7A-129

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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: WA

Node Name
PWT AIRPORT
QUINCY S28 S281
RAYMOND U101S6
REDMOND SE S202S520
RENTON S I405X2
RENTON W I405I5
RICHLAND
RICHLAND N S240LR4S
RICHLAND NW S240LR10
RICHLAND SE I182X5
RITZVILLE I90X221
RITZVILLE SW I90X220
RIVERTON HGTS S518LOCL
RLD AIRPORT

Selected Node Number: 531100871

☐ Enter Intermediate Node

Destination

State: NJ

Node Name
S BRUNSWICK E TNJTX8A
S TOMS RIVER W TGSPX80
SADDLE BROOK I80X62
SADDLE BROOK NW TGSPX159
SALEM S45 S49
SALEM NW S49 LOCL
SALEM NP
SAYREVILLE W TNJTX9
SEASIDE HTS S35 S37
SEAVILLE U9 S50
SEAVILLE SE TGSPX20
SECAUCUS E I95EX16E
SEVEN STARS S U9 S70
SHARPTOWN NW U40 S48

Selected Node Number: 341108491

Route Type

☒ Commercial ☐ HRCQ

☐ Quickest ☐ Other ☐ HRCQ + Nevada

☐ Shortest ☐ WIPP

Calculate Route

Alternative Route Penalty

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

Link Penalty (1-100): 10

Calculate Alternative Route

Date/Time Options

☒ Use Current Date

☒ Use Current Time

Population Options

☐ 400m Buffer Zone

☒ 800m Buffer Zone

☐ 2500m Buffer Zone

Help | Client Software Parameters

**PSEG Site
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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														
<p>Driver Options</p> <p><input type="radio"/> One Driver <input checked="" type="radio"/> Two Drivers</p> <p>Highway Inspection</p> <p><input checked="" type="checkbox"/> Include time for inspections upon entry into state</p> <p>Enter est. average time to complete inspection per state. (in minutes) <input style="width: 50px;" type="text" value="30"/></p> <p>Toll Bias Factor</p> <p>Enter the toll bias factor. (0 - 1000) <input style="width: 50px;" type="text" value="0"/></p> <p><input type="checkbox"/> Include Nevada County Population Details</p>	<p>Other Constraints</p> <ul style="list-style-type: none"><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. <p>Road Lane Type Penalty</p> <p>Penalty Factor (0 - 100)</p> <table style="width: 100%;"><tbody><tr><td>Lane Type 1 - Limited Access Multilane</td><td><input style="width: 50px;" type="text" value="0"/></td></tr><tr><td>Lane Type 2 - Limited Access Single Lane</td><td><input style="width: 50px;" type="text" value="0"/></td></tr><tr><td>Lane Type 3 - Multilane Divided</td><td><input style="width: 50px;" type="text" value="0"/></td></tr><tr><td>Lane Type 4 - Multilane Undivided</td><td><input style="width: 50px;" type="text" value="0"/></td></tr><tr><td>Lane Type 5 - Principal Highway</td><td><input style="width: 50px;" type="text" value="0"/></td></tr><tr><td>Lane Type 6 - Through Highway</td><td><input style="width: 50px;" type="text" value="0"/></td></tr><tr><td>Lane Type 7 - Other</td><td><input style="width: 50px;" type="text" value="0"/></td></tr></tbody></table>	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"/>		
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"/>																

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

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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

**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=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
```

**PSEG Site
ESP Application
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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

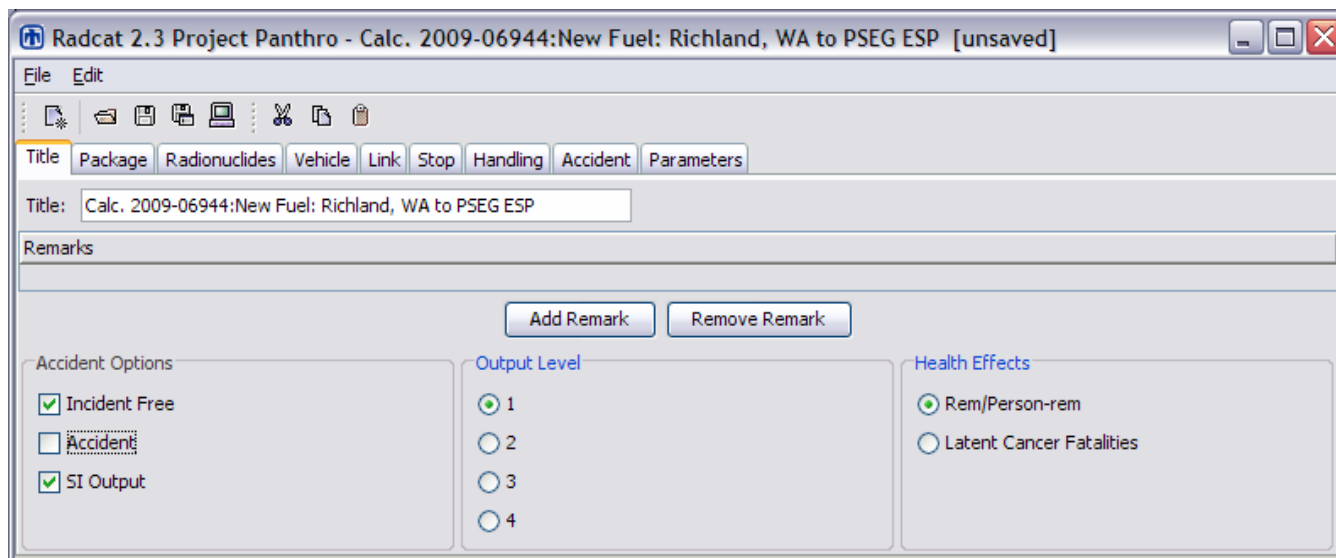
**PSEG Site
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[Total]
Rural - KM=3396.8
Suburban - KM= 905.4
Urban - KM= 95.3
Total - KM=4397.4
Rural Pop Density= 11.7
Suburban Pop Density= 305.4
Urban Pop Density=2294.9

**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

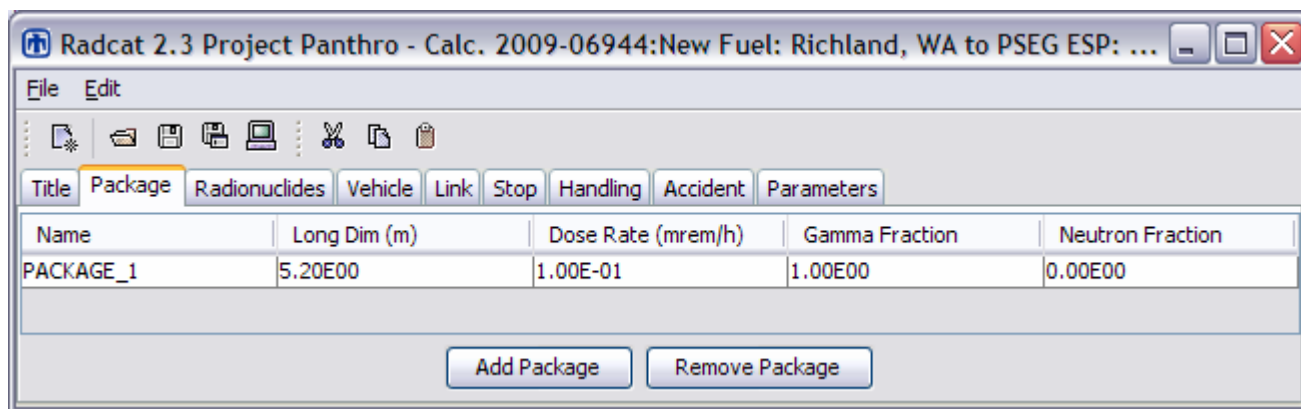
☐ 3

☐ 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 ²	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

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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 ² to residential population/km ²	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 ³ /sec)	3.30E-04
Cleanup Level (microcuries/m ²)	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 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 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. 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 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	&& 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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```
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
  PARM 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 0.0108 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

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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

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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

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

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
ESP Application
Part 3, Environmental Report**

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 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. 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 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	&& 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	&& 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

**PSEG Site
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Part 3, Environmental Report**

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

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

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

**PSEG Site
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Part 3, Environmental Report**

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

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

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

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

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

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: Injuries

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