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Chapter 15 Accident Analysis

15.1 Selection of Accidents

The radiological consequences of accidents are assessed to demonstrate that new units could be constructed and operated at the VCS site without undue risk to the health and safety of the public. To analyze the suitability of the VCS site, site-specific accident meteorology is used to evaluate the radiological consequences of design basis accidents (DBAs) associated with selected reactor designs. The assessment uses a robust and conservative set of surrogate DBAs that is representative of the range of reactor designs being considered for the VCS site. The DBAs include a spectrum of events, including those of relatively greater probability of occurrence as well as those that are less probable but have greater severity.

The set of accidents selected focuses on four light water reactor (LWR) designs: AP1000, APWR, ABWR, and ESBWR. Two versions of the ABWR (GE and Toshiba) are being considered for the VCS site, but the evaluation in this section is based upon the source term associated with the ABWR certified design. These four designs are standard designs that have recognized bases for postulated accident analyses. The accidents for the mPower are not as well defined as these other LWRs. As the design is standard LWR technology and, given its relatively small core thermal output, the accident consequences associated with the mPower reactor are considered to be bounded by those for the other four reactor types. If the mPower (or another reactor technology not previously evaluated) is selected for the VCS site, the COL application would verify that the accident doses are bounded by those provided in the ESP application or would provide a complete evaluation of accident radiological consequences compared with regulatory limits.

The following LWR accidents are identified in the SRP, NUREG-0800:

- SRP Section 15.1.5.A, Radiological Consequences of Main Steam Line Failures Outside Containment of a PWR
- SRP Section 15.2.8, Feedwater System Pipe Breaks Inside and Outside Containment (PWR)
- SRP Section 15.3.3, Reactor Coolant Pump Rotor Seizure (Locked Rotor Accident)
- SRP Section 15.3.4, Reactor Coolant Pump Shaft Break
- SRP Section 15.4.9, Spectrum of Rod Drop Accidents (BWR)
- SRP Section 15.6.2, Radiological Consequences of the Failure of Small Lines Carrying Primary Coolant Outside Containment
- SRP Section 15.6.3, Radiological Consequences of the Steam Generator Tube Failure

- SRP Section 15.6.5, Loss-of-Coolant Accident Resulting from Spectrum of Postulated Piping Breaks Within the Reactor Coolant Pressure Boundary
- SRP Section 15.7.4, Radiological Consequences of Fuel Handling Accidents

RG 1.183 ([Reference 15.5-1](#)) includes the following additional accidents:

- PWR Rod Ejection Accident (corresponding to SRP Section 15.4.8)
- BWR Main Steam Line Break (corresponding to SRP Section 15.6.4)

In addition, a cleanup water line break is evaluated for the ABWR and the ESBWR.

This set of accidents provides a reasonable basis for evaluating the suitability of the VCS site, and the associated radiological consequences from the above DBAs are analyzed as follows.

15.2 Evaluation Methodology

Doses for the representative DBAs are evaluated at the EAB and the LPZ. These doses must meet the site acceptance criteria in 10 CFR 52.17(a)(1). Although the emergency safety features are expected to prevent core damage and mitigate releases of radioactivity, the loss-of-coolant accidents (LOCAs) analyzed presume substantial core melt with the release of significant amounts of fission products. The postulated LOCAs are expected to more closely approach 10 CFR 52.17 limits than the other DBAs of greater probability of occurrence but lesser magnitude of activity releases. The calculated accident doses are compared to the acceptance criteria in RG 1.183 and NUREG-0800, to demonstrate that the consequences of the postulated accidents are acceptable.

The evaluations use short-term accident atmospheric dispersion factors (X/Qs). The X/Qs are calculated using the methodology of RG 1.145 ([Reference 15.5-2](#)) and site-specific meteorological data. As indicated in Section 2.3.4, the RG 1.145 methodology is implemented in the NRC-sponsored PAVAN computer program. This program computes X/Qs at the EAB and LPZ for each combination of wind speed and atmospheric stability for each of the 16 downwind direction sectors. Releases are assumed to be at ground level, and the shortest distances between the power block area and the offsite locations are selected to conservatively maximize the X/Q values. The following site-specific values from Section 2.3.4 are used in these evaluations, reflecting the larger of the overall site 5th percentile and sector-dependent 0.5th percentile, in accordance with RG 1.145:

- EAB, 0 to 2 hours: $2.66 \times 10^{-4} \text{ sec/m}^3$
- LPZ, 0 to 8 hours: $1.55 \times 10^{-5} \text{ sec/m}^3$
8 to 24 hours: $1.01 \times 10^{-5} \text{ sec/m}^3$

24 to 96 hours: 4.20×10^{-6} sec/m³

96 to 720 hours: 1.19×10^{-6} sec/m³

The accident dose calculations are performed using the activity releases for the following time intervals:

- EAB: 2-hour period yielding the maximum dose
- LPZ: 0 to 8 hours, 8 to 24 hours, 24 to 96 hours, and 96 to 720 hours

The accident doses are expressed as TEDE, consistent with 10 CFR 52.17. The TEDE consists of the sum of the committed effective dose equivalent (CEDE) from inhalation and either the deep dose equivalent (DDE) or the effective dose equivalent (EDE) from external exposure. The CEDE is determined using the dose conversion factors in Federal Guidance Report 11 ([Reference 15.5-3](#)), while the DDE and the EDE are based on dose conversion factors in Federal Guidance Report 12 ([Reference 15.5-4](#)).

15.3 Source Terms

Doses are calculated based on the time-dependent activities released to the environment during each DBA. The activities are based on the analyses used to support the reactor standard safety analysis reports. Different reactor technologies use different source terms and approaches in defining the activity releases. The ABWR source terms, methodologies, and assumptions are based on the guidance in the NUREG-0800 and Regulatory Guides 1.3 ([Reference 15.5-5](#)) and 1.25 ([Reference 15.5-6](#)). The AP1000, APWR, and ESBWR source terms, methodologies, and assumptions are based on the alternative source term guidance outlined in RG 1.183.

15.4 Radiological Consequences

For the accidents identified in [Section 15.1](#), site-specific doses are calculated by multiplying the design certification doses by the ratio of site X/Qs to design certification X/Qs. Using the EAB and LPZ site-specific X/Qs provided in [Section 15.2](#), with the X/Qs from the vendor design control documents ([References 15.5-7](#) through [15.5-10](#)), the ratios, presented in [Tables 15.1-1](#) through [15.1-4](#), are obtained.

Details about the methodology and assumptions pertaining to each of the accidents, such as activity release paths and the credited mitigation features, may be found in the design certification documents for each of the reactor technologies.

As the ABWR design certification document presents whole body and thyroid doses, an equivalent TEDE value is estimated by multiplying the thyroid dose by 0.03 and adding the product to the whole body dose, in accordance with RG 1.183.

A summary of the resulting accident doses is presented in [Table 15.1-5](#). This table also compares the environmental doses to the recommended limits in RG 1.183 and NUREG-0800 and shows that the evaluated dose consequences are within the recommended limits.

The TEDE dose limits in [Table 15.1-5](#) are taken from RG 1.183, Table 6, for all accidents except PWR Reactor Coolant Pump Shaft Break (SRP Section 15.3.4) and Radiological Consequences of the Failure of Small Lines Carrying Primary Coolant Outside Containment (SRP Section 15.6.2). For these two accidents, NUREG-0800 indicates that the dose limit is a “small fraction” or 10 percent of the 10 CFR 100 guideline of 25 rem, meaning a limit of 2.5 rem. No guidance is provided in RG 1.183 or NUREG-0800 for Feedwater Line Break; thus, the regulatory limits shown are based on similar accidents.

The doses summarized in [Table 15.1-5](#) are based on the time-dependent doses for each of the accidents, as shown in [Tables 15.1-6](#) through [15.1-70](#). In addition to doses, the latter tables also show the activities released to the environment. In these tables, the EAB dose for each accident is shown for the 2-hour period yielding the maximum dose. The LPZ dose is shown for the duration of the accident.

15.5 References

- 15.5-1 Regulatory Guide 1.183, *Alternative Radiological Source Terms for Evaluating Design Basis Accidents at Nuclear Power Reactors*, NRC, July 2000.
- 15.5-2 Regulatory Guide 1.145, *Atmospheric Dispersion Models for Potential Accident Consequence Assessments at Nuclear Power Plants*, Revision 1, NRC, November 1982.
- 15.5-3 Federal Guidance Report 11, *Limiting Values of Radionuclide Intake and Air Concentration and Dose Conversion Factors for Inhalation, Submersion, and Ingestion*, U. S. Environmental Protection Agency, EPA-520/1-88-020, 1988.
- 15.5-4 Federal Guidance Report 12, *External Exposure to Radionuclides in Air, Water, and Soil*, U. S. Environmental Protection Agency, EPA-402-R-93-081, 1993.
- 15.5-5 Regulatory Guide 1.3, *Assumptions Used for Evaluating the Potential Radiological Consequences of a Loss of Coolant Accident for Boiling Water Reactors*, Revision 2, NRC, June 1974.

- 15.5-6 Regulatory Guide 1.25 (Safety Guide 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*, NRC, March 1972.
- 15.5-7 AP1000 Document No. APP-GW-GL-700, *AP1000 Design Control Document*, Tier 2 Material, Westinghouse, Revision 17, 2008. |
- 15.5-8 Document MUAP-DC001, *APWR Design Control Document for the US-APWR*, Tier 2, Mitsubishi Heavy Industries, Ltd., Revision 2, 2009. |
- 15.5-9 *ABWR Standard Safety Analysis Report Design Control Document*, Tier 2, GE Nuclear Energy, Revision 4, 1997. |
- 15.5-10 Document 26A6642, *ESBWR Design Control Document*, Tier 2 Material, GE-Hitachi Nuclear Energy, Revision 6, 2009. |

Table 15.1-1
Design Certification X/Q Values and Ratios to Site X/Q Values for AP1000

Accident	Location	Release Time (hr)	X/Q (sec/m ³)		X/Q Ratio (Site/DCD)
			DCD	Site	
LOCA	EAB	0-2	5.1×10^{-4}	2.66×10^{-4}	5.22×10^{-1}
	LPZ	0-8	2.2×10^{-4}	1.55×10^{-5}	7.05×10^{-2}
		8-24	1.6×10^{-4}	1.01×10^{-5}	6.31×10^{-2}
		24-96	1.0×10^{-4}	4.20×10^{-6}	4.20×10^{-2}
		96-720	8.0×10^{-5}	1.19×10^{-6}	1.49×10^{-2}
Other	EAB	0-2	1.0×10^{-3}	2.66×10^{-4}	2.66×10^{-1}
	LPZ	0-8	5.0×10^{-4}	1.55×10^{-5}	3.10×10^{-2}
		8-24	3.0×10^{-4}	1.01×10^{-5}	3.37×10^{-2}
		24-96	1.5×10^{-4}	4.20×10^{-6}	2.80×10^{-2}
		96-720	8.0×10^{-5}	1.19×10^{-6}	1.49×10^{-2}

Reference: AP1000 DCD Rev. 17 (15.5-7)

Table 15.1-2
Design Certification X/Q Values and Ratios to Site X/Q Values for APWR

Location	Release Time (hr)	X/Q (sec/m ³)		X/Q Ratio (Site/DCD)
		DCD	Site	
EAB	0-2	5.0×10^{-4}	2.66×10^{-4}	5.32×10^{-1}
LPZ	0-8	2.1×10^{-4}	1.55×10^{-5}	7.38×10^{-2}
	8-24	1.3×10^{-4}	1.01×10^{-5}	7.77×10^{-2}
	24-96	6.9×10^{-5}	4.20×10^{-6}	6.09×10^{-2}
	96-720	2.8×10^{-5}	1.19×10^{-6}	4.25×10^{-2}

Reference: APWR DCD Rev. 2 (15.5-8)

**Table 15.1-3
 Design Certification X/Q Values and Ratios to Site X/Q Values for ABWR**

Accident	Location	Release Time (hr)	X/Q (sec/m ³)		X/Q Ratio (Site/DCD)
			DCD	Site	
Cleanup Water Line Break	EAB	0–2	2.29×10^{-2}	2.66×10^{-4}	1.16×10^{-2}
	LPZ	0–8	2.29×10^{-2}	1.55×10^{-5}	6.77×10^{-4}
LOCA	EAB	0–2	1.37×10^{-3}	2.66×10^{-4}	1.94×10^{-1}
	LPZ	0–8	1.56×10^{-4}	1.55×10^{-5}	9.94×10^{-2}
		8–24	9.61×10^{-5}	1.01×10^{-5}	1.05×10^{-1}
		24–96	3.36×10^{-5}	4.20×10^{-6}	1.25×10^{-1}
		96–720	7.42×10^{-6}	1.19×10^{-6}	1.60×10^{-1}
Other	EAB	0–2	1.37×10^{-3}	2.66×10^{-4}	1.94×10^{-1}
	LPZ	0–8	1.37×10^{-3}	1.55×10^{-5}	1.13×10^{-2}

Reference: ABWR DCD Rev. 4 (15.5-9)

Table 15.1-4
Design Certification X/Q Values and Ratios to Site X/Q Values for ESBWR

Accident	Location	Release Time (hr)	X/Q (sec/m ³)		X/Q Ratio (Site/DCD)
			DCD	Site	
LOCA	EAB	0–2	2.00×10^{-3}	2.66×10^{-4}	1.33×10^{-1}
	LPZ	0–8	1.90×10^{-4}	1.55×10^{-5}	8.16×10^{-2}
		8–24	1.40×10^{-4}	1.01×10^{-5}	7.21×10^{-2}
		24–96	7.50×10^{-5}	4.20×10^{-6}	5.60×10^{-2}
		96–720	3.00×10^{-5}	1.19×10^{-6}	3.97×10^{-2}
Small Break Outside Containment	EAB	0–2	2.00×10^{-3}	2.66×10^{-4}	1.33×10^{-1}
	LPZ	0–8	1.90×10^{-4}	1.55×10^{-5}	8.16×10^{-2}
		8–24	1.40×10^{-4}	1.01×10^{-5}	7.21×10^{-2}
		24–96	7.50×10^{-5}	4.20×10^{-6}	5.60×10^{-2}
		96–720	3.00×10^{-5}	1.19×10^{-6}	3.97×10^{-2}
Other	EAB	0–2	2.00×10^{-3}	2.66×10^{-4}	1.33×10^{-1}
	LPZ	0–8	1.90×10^{-4}	1.55×10^{-5}	8.16×10^{-2}

Reference: ESBWR DCD Rev. 6 (15.5-10)

Table 15.1-5 (Sheet 1 of 2)
Summary of Design Basis Accident Site Doses

SRP Section	Accident		Design	DCD Section	Site Dose (rem TEDE)		
					EAB	LPZ	Limit
15.1.5A	Steam System Piping Failure	Pre-Incident Iodine Spike	AP1000	15.1.5	2.7×10^{-1}	2.3×10^{-2}	25
			APWR	15.1.5	1.0×10^{-1}	8.0×10^{-3}	
		Accident-Initiated Iodine Spike	AP1000	15.1.5	2.9×10^{-1}	5.9×10^{-2}	2.5
			APWR	15.1.5	1.7×10^{-1}	2.1×10^{-2}	
15.3.3	Locked Rotor Accident	No Feedwater	AP1000	15.3.3	2.1×10^{-1}	1.2×10^{-2}	2.5
		Feedwater Available	AP1000	15.3.3	1.6×10^{-1}	2.3×10^{-2}	
	Locked Rotor Accident		APWR	15.3.3	2.6×10^{-1}	5.2×10^{-2}	
15.4.8	Rod Ejection Accident		AP1000	15.4.8	9.6×10^{-1}	1.6×10^{-1}	6.3
			APWR	15.4.8	2.7	3.2×10^{-1}	
15.6.2	Small Break Outside Containment		AP1000	15.6.2	5.6×10^{-1}	3.2×10^{-2}	2.5
			APWR	15.6.2	8.0×10^{-1}	4.4×10^{-2}	
			ABWR	15.6.2	4.6×10^{-2}	2.7×10^{-3}	
	Small Break Outside Cmt	Pre-Incident Iodine Spike	ESBWR	15.4.8	4.5×10^{-2}	8.2×10^{-3}	25
		Equilibrium Iodine Activity	ESBWR	15.4.8	1.3×10^{-2}	8.2×10^{-3}	2.5
15.6.3	Steam Generator Tube Rupture	Pre-Incident Iodine Spike	AP1000	15.6.3	5.9×10^{-1}	3.8×10^{-2}	25
			APWR	15.6.3	1.9	1.1×10^{-1}	
		Accident-Initiated Iodine Spike	AP1000	15.6.3	2.9×10^{-1}	2.5×10^{-2}	2.5
			APWR	15.6.3	5.1×10^{-1}	3.1×10^{-2}	
15.6.4	Main Steam Line Break	Pre-Incident Iodine Spike	ABWR	15.6.4	5.5×10^{-1}	3.2×10^{-2}	25
			ESBWR	15.4.5	3.5×10^{-1}	1.6×10^{-2}	
		Equilibrium Iodine Activity	ABWR	15.6.4	2.7×10^{-2}	1.6×10^{-3}	2.5
			ESBWR	15.4.5	2.7×10^{-2}	8.2×10^{-3}	
15.6.5	Loss-of-Coolant Accident		AP1000	15.6.5	1.3×10^1	1.6	25
			APWR	15.6.5	6.9	9.0×10^{-1}	
			ABWR	15.6.5	1.9	1.4	
			ESBWR	15.4.4	3.0	1.3	
15.7.4	Fuel Handling Accident		AP1000	15.7.4	1.4	8.0×10^{-2}	6.3
			APWR	15.7.4	1.8	1.0×10^{-1}	
			ABWR	15.7.4	6.7×10^{-1}	3.9×10^{-2}	
			ESBWR	15.4.1	5.5×10^{-1}	3.3×10^{-2}	

Table 15.1-5 (Sheet 2 of 2)
Summary of Design Basis Accident Site Doses

SRP Section	Accident		Design	DCD Section	Site Dose (rem TEDE)		
					EAB	LPZ	Limit
None	Feedwater Line Break	Pre-Incident Iodine Spike	ESBWR	15.4.7	2.4	1.4×10^{-1}	25
		Equilibrium Iodine Activity	ESBWR	15.4.7	1.5×10^{-1}	8.2×10^{-3}	2.5
None	Cleanup Water Line Break		ABWR	15.6.6	1.4×10^{-2}	8.0×10^{-4}	25
	Cleanup Water Line Break	Pre-Incident Iodine Spike	ESBWR	15.4.9	9.2×10^{-1}	5.7×10^{-2}	25
		Equilibrium Iodine Activity	ESBWR	15.4.9	5.3×10^{-2}	8.2×10^{-3}	2.5

Note: This table summarizes the doses from the tables that follow. For the ABWR, the whole body and thyroid doses within [Tables 15.1-44 to 15.1-53](#) are converted into TEDE values using weighting factors as indicated in [Section 15.4](#). For the designs being considered, there are no radiological consequences for the accidents described in SRP Sections 15.2.8, 15.3.4, and 15.4.9.

References: AP1000 DCD Rev. 17 (Reference 15.5-7)
 APWR DCD Rev. 2 (Reference 15.5-8)
 ABWR DCD Rev. 4 (Reference 15.5-9)
 ESBWR DCD Rev. 6 (Reference 15.5-10)

**Table 15.1-6
Activity Releases for AP1000 Main Steam System Piping Failure with Pre-Incident Iodine Spike**

Isotope	Activity Release (Ci)				
	0–2 hr	2–8 hr	8–24 hr	24–72 hr	Total
Kr-85m	6.86×10^{-2}	1.14×10^{-1}	6.80×10^{-2}	6.20×10^{-3}	2.57×10^{-1}
Kr-85	2.82×10^{-1}	8.47×10^{-1}	2.25	6.68	1.01×10^1
Kr-87	2.76×10^{-2}	1.34×10^{-2}	5.20×10^{-4}	0.00	4.15×10^{-2}
Kr-88	1.12×10^{-1}	1.37×10^{-1}	4.04×10^{-2}	8.00×10^{-4}	2.90×10^{-1}
Xe-131m	1.28×10^{-1}	3.79×10^{-1}	9.81×10^{-1}	2.70	4.19
Xe-133m	1.59×10^{-1}	4.51×10^{-1}	1.04	2.05	3.70
Xe-133	1.18×10^1	3.45×10^1	8.65×10^1	2.16×10^2	3.49×10^2
Xe-135m	3.04×10^{-3}	1.30×10^{-5}	0.00	0.00	3.05×10^{-3}
Xe-135	3.10×10^{-1}	6.90×10^{-1}	8.35×10^{-1}	3.39×10^{-1}	2.17
Xe-138	3.99×10^{-3}	1.10×10^{-5}	0.00	0.00	4.00×10^{-3}
I-130	3.59×10^{-1}	1.42×10^{-1}	2.09×10^{-1}	1.33×10^{-1}	8.43×10^{-1}
I-131	2.40×10^1	1.21×10^1	3.10×10^1	8.21×10^1	1.49×10^2
I-132	3.05×10^1	4.14	8.07×10^{-1}	6.00×10^{-3}	3.55×10^1
I-133	4.34×10^1	1.90×10^1	3.53×10^1	3.98×10^1	1.38×10^2
I-134	6.74	1.63×10^{-1}	1.40×10^{-3}	0.00	6.90
I-135	2.60×10^1	8.16	7.54	1.71	4.34×10^1
Cs-134	1.90×10^1	1.95×10^{-1}	5.19×10^{-1}	1.54	2.13×10^1
Cs-136	2.82×10^1	2.86×10^{-1}	7.42×10^{-1}	2.06	3.13×10^1
Cs-137	1.37×10^1	1.41×10^{-1}	3.74×10^{-1}	1.11	1.53×10^1
Cs-138	1.01×10^1	1.02×10^{-3}	0.00	0.00	1.01×10^1
Total	2.15×10^2	8.15×10^1	1.68×10^2	3.56×10^2	8.21×10^2

Note: Source terms are for the radiation dose values recorded in DCD Rev. 17 (Reference 15.5-7).

**Table 15.1-7
 Doses for AP1000 Main Steam System Piping Failure
 with Pre-Existing Iodine Spike**

Time (hr)	DCD Dose (rem TEDE)		X/Q Ratio	Site Dose (rem TEDE)	
	EAB	LPZ	Site to DCD	EAB	LPZ
0–2	1.00	—	2.66×10^{-1}	2.66×10^{-1}	—
0–8	—	5.81×10^{-1}	3.10×10^{-2}	—	1.80×10^{-2}
8–24	—	7.18×10^{-2}	3.37×10^{-2}	—	2.42×10^{-3}
24–96	—	1.08×10^{-1}	2.80×10^{-2}	—	3.02×10^{-3}
Total	1.00	7.61×10^{-1}	—	2.66×10^{-2}	2.35×10^{-2}
Limit	—	—	—	25	25

Note: Time-dependent LPZ doses and total LPZ and EAB doses correspond to the radiation doses in DCD Rev. 17 (Reference 15.5-7).

**Table 15.1-8
 Activity Releases for AP1000 Main Steam System Piping Failure Accident-Initiated Iodine Spike**

Isotope	Activity Release (Ci)				
	0–2 hr	2–8 hr	8–24 hr	24–72 hr	Total
Kr-85m	6.86×10^{-2}	1.14×10^{-1}	6.80×10^{-2}	6.20×10^{-3}	2.57×10^{-1}
Kr-85	2.82×10^{-1}	8.47×10^{-1}	2.25	6.68	1.01×10^1
Kr-87	2.76×10^{-2}	1.34×10^{-2}	5.20×10^{-4}	0.00	4.15×10^{-2}
Kr-88	1.12×10^{-1}	1.37×10^{-1}	4.04×10^{-2}	8.00×10^{-4}	2.90×10^{-1}
Xe-131m	1.28×10^{-1}	3.79×10^{-1}	9.81×10^{-1}	2.70	4.19
Xe-133m	1.59×10^{-1}	4.51×10^{-1}	1.04	2.05	3.70
Xe-133	1.18×10^1	3.45×10^1	8.65×10^1	2.16×10^2	3.49×10^2
Xe-135m	3.04×10^{-3}	1.30×10^{-5}	0.00	0.00	3.05×10^{-3}
Xe-135	3.10×10^{-1}	6.90×10^{-1}	8.35×10^{-1}	3.39×10^{-1}	2.17
Xe-138	3.99×10^{-3}	1.10×10^{-5}	0.00	0.00	4.00×10^{-3}
I-130	4.15×10^{-1}	9.95×10^{-1}	1.58	1.01	4.00
I-131	2.57×10^1	5.73×10^1	1.56×10^2	4.13×10^2	6.52×10^2
I-132	4.57×10^1	9.74×10^1	2.23×10^1	2.00×10^{-1}	1.66×10^2
I-133	4.85×10^1	1.14×10^2	2.27×10^2	2.55×10^2	6.45×10^2
I-134	1.33×10^1	1.86×10^1	2.60×10^{-1}	0.00	3.22×10^1
I-135	3.20×10^1	7.74×10^1	7.83×10^1	1.77×10^1	2.05×10^2
Cs-134	1.90×10^1	1.95×10^{-1}	5.19×10^{-1}	1.54	2.13×10^1
Cs-136	2.82×10^1	2.86×10^{-1}	7.42×10^{-1}	2.06	3.13×10^1
Cs-137	1.37×10^1	1.41×10^{-1}	3.74×10^{-1}	1.11	1.53×10^1
Cs-138	1.01×10^1	1.02×10^{-3}	0.00	0.00	1.01×10^1
Total	2.50×10^2	4.03×10^2	5.79×10^2	9.19×10^2	2.15×10^3

Note: Source terms are for the radiation dose values recorded in DCD Rev. 17 (Reference 15.5-7).

**Table 15.1-9
 Doses for AP1000 Steam System Piping Failure
 with Accident-Initiated Iodine Spike**

Time (hr)	DCD Dose (rem TEDE)		X/Q Ratio	Site Dose (rem TEDE)	
	EAB	LPZ	Site to DCD	EAB	LPZ
0–2	1.10	—	2.66×10^{-1}	2.93×10^{-1}	—
0–8	—	1.02	3.10×10^{-2}	—	3.16×10^{-2}
8–24	—	3.77×10^{-1}	3.37×10^{-2}	—	1.27×10^{-2}
24–96	—	5.36×10^{-1}	2.80×10^{-2}	—	1.50×10^{-2}
Total	1.10	1.93	—	2.93×10^{-1}	5.93×10^{-2}
Limit	—	—	—	2.5	2.5

Note: Time-dependent LPZ doses and total LPZ and EAB doses correspond to the radiation doses in DCD Rev. 17 (Reference 15.5-7).

**Table 15.1-10
 Activity Releases for AP1000 Locked Rotor Accident**

Isotope	Activity Release (Ci)			
	No Feedwater	With Feedwater		
	0–2 hr	0–6 hr	6–8 hr	Total
Kr-85m	8.16×10^1	2.38×10^2	4.12×10^1	2.79×10^2
Kr-85	7.58	3.03×10^1	1.01×10^1	4.04×10^1
Kr-87	1.20×10^2	2.07×10^2	5.40	2.12×10^2
Kr-88	2.08×10^2	5.21×10^2	6.04×10^1	5.81×10^2
Xe-131m	3.77	1.50×10^1	4.94	1.99×10^1
Xe-133m	2.02×10^1	7.85×10^1	2.48×10^1	1.03×10^2
Xe-133	6.66×10^2	2.63×10^3	8.57×10^2	3.49×10^3
Xe-135m	3.24×10^1	3.30×10^1	0.00	3.30×10^1
Xe-135	1.59×10^2	5.40×10^2	1.32×10^2	6.72×10^2
Xe-138	1.29×10^2	1.30×10^2	0.00	1.30×10^2
I-130	8.45×10^{-1}	8.81×10^{-1}	5.65×10^{-1}	1.45
I-131	3.77×10^1	4.60×10^1	3.46×10^1	8.06×10^1
I-132	2.79×10^1	1.43×10^1	3.95	1.83×10^1
I-133	4.86×10^1	5.33×10^1	3.64×10^1	8.97×10^1
I-134	2.88×10^1	5.53	2.09×10^{-1}	5.74
I-135	4.19×10^1	3.74×10^1	2.05×10^1	5.79×10^1
Cs-134	1.29	1.48	1.11	2.59
Cs-136	5.63×10^{-1}	5.17×10^{-1}	3.47×10^{-1}	8.64×10^{-1}
Cs-137	7.74×10^{-1}	8.71×10^{-1}	6.50×10^{-1}	1.52
Cs-138	6.08	2.95	1.13	4.08
Rb-86	1.33×10^{-2}	1.64×10^{-2}	1.27×10^{-2}	2.91×10^{-2}
Total	1.62×10^3	4.59×10^3	1.24×10^3	5.82×10^3

Note: Source terms are for the radiation dose values recorded in DCD Rev. 17 (Reference 15.5-7).

Table 15.1-11
Doses for AP1000 Locked Rotor Accident with No Feedwater

Time (hr)	DCD Dose (rem TEDE)		X/Q Ratio	Site Dose (rem TEDE)	
	EAB	LPZ	Site to DCD	EAB	LPZ
0–2	8.00×10^{-1}	—	2.66×10^{-1}	2.13×10^{-1}	—
0–8	—	3.89×10^{-1}	3.10×10^{-2}	—	1.21×10^{-2}
Total	8.00×10^{-1}	3.89×10^{-1}	—	2.13×10^{-1}	1.21×10^{-2}
Limit	—	—	—	2.5	2.5

Note: Time-dependent LPZ doses and total LPZ and EAB doses correspond to the radiation doses in DCD Rev. 17 (Reference 15.5-7).

Table 15.1-12
Doses for AP1000 Locked Rotor Accident with Feedwater Available

Time (hr)	DCD Dose (rem TEDE)		X/Q Ratio	Site Dose (rem TEDE)	
	EAB	LPZ	Site to DCD	EAB	LPZ
6–8 ^(a)	6.00×10^{-1}	—	2.66×10^{-1}	1.60×10^{-1}	—
0–8	—	7.52×10^{-1}	3.10×10^{-2}	—	2.33×10^{-2}
Total	6.00×10^{-1}	7.52×10^{-1}	—	1.60×10^{-1}	2.33×10^{-2}
Limit	—	—	—	2.5	2.5

(a) Worst case 2-hour period is 6–8 hours.

Note: Time-dependent LPZ doses and total LPZ and EAB doses correspond to the radiation doses in DCD Rev. 17 (Reference 15.5-7).

**Table 15.1-13
 Activity Releases for AP1000 Rod Ejection Accident**

Isotope	Activity Release (Ci)					
	0–2 hr	2–8 hr	8–24 hr	24–96 hr	96–720 hr	Total
Kr-85m	1.12 x 10 ²	6.48 x 10 ¹	3.87 x 10 ¹	1.80	0.00	2.17 x 10 ²
Kr-85	5.01	5.60	1.49 x 10 ¹	3.35 x 10 ¹	2.88 x 10 ²	3.47 x 10 ²
Kr-87	1.82 x 10 ²	2.60 x 10 ¹	1.03	0.00	0.00	2.09 x 10 ²
Kr-88	2.91 x 10 ²	1.18 x 10 ²	3.49 x 10 ¹	3.00 x 10 ⁻¹	0.00	4.44 x 10 ²
Xe-131m	4.94	5.46	1.42 x 10 ¹	2.86 x 10 ¹	1.16 x 10 ²	1.69 x 10 ²
Xe-133m	2.67 x 10 ¹	2.81 x 10 ¹	6.49 x 10 ¹	8.45 x 10 ¹	5.31 x 10 ¹	2.57 x 10 ²
Xe-133	8.79 x 10 ²	9.59 x 10 ²	2.40 x 10 ³	4.27 x 10 ³	8.44 x 10 ³	1.69 x 10 ⁴
Xe-135m	7.34 x 10 ¹	5.00 x 10 ⁻²	0.00	0.00	0.00	7.35 x 10 ¹
Xe-135	2.15 x 10 ²	1.72 x 10 ²	2.09 x 10 ²	4.34 x 10 ¹	2.00 x 10 ⁻¹	6.40 x 10 ²
Xe-138	2.99 x 10 ²	1.40 x 10 ⁻¹	0.00	0.00	0.00	2.99 x 10 ²
I-130	4.90	7.28	4.32	2.00 x 10 ⁻¹	0.00	1.67 x 10 ¹
I-131	1.36 x 10 ²	2.45 x 10 ²	2.31 x 10 ²	3.10 x 10 ¹	1.68 x 10 ¹	6.60 x 10 ²
I-132	1.53 x 10 ²	9.94 x 10 ¹	9.80	0.00	0.00	2.62 x 10 ²
I-133	2.72 x 10 ²	4.40 x 10 ²	3.18 x 10 ²	2.30 x 10 ¹	0.00	1.05 x 10 ³
I-134	1.66 x 10 ²	2.85 x 10 ¹	1.00 x 10 ⁻¹	0.00	0.00	1.95 x 10 ²
I-135	2.39 x 10 ²	2.97 x 10 ²	1.19 x 10 ²	2.40	0.00	6.57 x 10 ²
Cs-134	3.08 x 10 ¹	6.22 x 10 ¹	6.03 x 10 ¹	7.70	5.20	1.66 x 10 ²
Cs-136	8.79	1.75 x 10 ¹	1.67 x 10 ¹	2.05	6.50 x 10 ⁻¹	4.57 x 10 ¹
Cs-137	1.79 x 10 ¹	3.62 x 10 ¹	3.51 x 10 ¹	4.52	3.05	9.68 x 10 ¹
Cs-138	1.09 x 10 ²	7.00	0.00	0.00	0.00	1.16 x 10 ²
Rb-86	3.62 x 10 ⁻¹	7.27 x 10 ⁻¹	6.96 x 10 ⁻¹	8.40 x 10 ⁻²	3.70 x 10 ⁻²	1.91
Total	3.23 x 10³	2.62 x 10³	3.57 x 10³	4.53 x 10³	8.92 x 10³	2.29 x 10⁴

Note: Source terms are for the radiation dose values recorded in DCD Rev. 17 (Reference 15.5-7).

**Table 15.1-14
 Doses for AP1000 Rod Ejection Accident**

Time (hr)	DCD Dose (rem TEDE)		X/Q Ratio	Site Dose (rem TEDE)	
	EAB	LPZ	Site to DCD	EAB	LPZ
0–2	3.60	—	2.66×10^{-1}	9.58×10^{-1}	—
0–8	—	4.38	3.10×10^{-2}	—	1.36×10^{-1}
8–24	—	7.85×10^{-1}	3.37×10^{-2}	—	2.64×10^{-2}
24–96	—	6.34×10^{-2}	2.80×10^{-2}	—	1.78×10^{-3}
96–720	—	2.02×10^{-2}	1.49×10^{-2}	—	3.00×10^{-4}
Total	3.60	5.25	—	9.58×10^{-1}	1.64×10^{-1}
Limit	—	—	—	6.3	6.3

Note: Time-dependent LPZ doses and total LPZ and EAB doses correspond to the radiation doses in DCD Rev. 17
 (Reference 15.5-7).

Table 15.1-15
Activity Releases for AP1000 Small Break Outside Containment

Isotope	Activity Release (Ci)
	0–0.5 hr
Kr-85m	1.24 x 10 ¹
Kr-85	4.40 x 10 ¹
Kr-87	7.05
Kr-88	2.21 x 10 ¹
Xe-131m	1.99 x 10 ¹
Xe-133m	2.50 x 10 ¹
Xe-133	1.84 x 10 ³
Xe-135m	2.59
Xe-135	5.20 x 10 ¹
Xe-138	3.65
I-130	1.89
I-131	9.26 x 10 ¹
I-132	3.49 x 10 ²
I-133	2.01 x 10 ²
I-134	1.58 x 10 ²
I-135	1.68 x 10 ²
Cs-134	4.16
Cs-136	6.16
Cs-137	3.00
Cs-138	2.21
Rb-86	0.00
Total	3.01 x 10³

Note: Source terms are for the radiation dose values recorded in DCD Rev. 17 (Reference 15.5-7).

**Table 15.1-16
 Doses for AP1000 Small Break Outside Containment**

Time (hr)	DCD Dose (rem TEDE)		X/Q Ratio	Site Dose (rem TEDE)	
	EAB	LPZ	Site to DCD	EAB	LPZ
0-2	2.10	—	2.66×10^{-1}	5.59×10^{-1}	—
0-8	—	1.03	3.10×10^{-2}	—	3.19×10^{-2}
Total	2.10	1.03	—	5.59×10^{-1}	3.19×10^{-2}
Limit	—	—	—	2.5	2.5

Note: Time-dependent LPZ doses and total LPZ and EAB doses correspond to the radiation doses in DCD Rev. 17 (Reference 15.5-7).

Table 15.1-17
Activity Releases for AP1000 Steam Generator Tube Rupture with Pre-Incident Iodine Spike

Isotope	Activity Release (Ci)			
	0–2 hr	2–8 hr	8–14 hr	Total
Kr-85m	5.53×10^1	1.93×10^1	0.00	7.46×10^1
Kr-85	2.20×10^2	1.08×10^2	2.00×10^{-1}	3.28×10^2
Kr-87	2.39×10^1	3.61	0.00	2.75×10^1
Kr-88	9.22×10^1	2.65×10^1	0.00	1.19×10^2
Xe-131m	9.96×10^1	4.88×10^1	0.00	1.48×10^2
Xe-133m	1.24×10^2	5.91×10^1	1.00×10^{-1}	1.83×10^2
Xe-133	9.19×10^3	4.47×10^3	1.00×10^1	1.37×10^4
Xe-135m	3.44	6.00×10^{-3}	0.00	3.45
Xe-135	2.46×10^2	1.02×10^2	1.00×10^{-1}	3.48×10^2
Xe-138	4.56	5.00×10^{-3}	0.00	4.57
I-130	1.79	5.39×10^{-2}	2.67×10^{-1}	2.11
I-131	1.21×10^2	5.27	3.05×10^1	1.57×10^2
I-132	1.42×10^2	7.86×10^{-1}	1.91	1.45×10^2
I-133	2.16×10^2	7.63	4.06×10^1	2.64×10^2
I-134	2.74×10^1	1.06×10^{-2}	2.00×10^{-4}	2.74×10^1
I-135	1.27×10^2	2.70	1.17×10^1	1.41×10^2
Cs-134	1.63	6.10×10^{-2}	2.16×10^{-1}	1.91
Cs-136	2.42	8.80×10^{-2}	3.15×10^{-1}	2.82
Cs-137	1.17	4.40×10^{-2}	1.56×10^{-1}	1.37
Cs-138	5.64×10^{-1}	0.00	0.00	5.64×10^{-1}
Total	1.07×10^4	4.85×10^3	9.61×10^1	1.57×10^4

Note: Source terms are for the radiation dose values recorded in DCD Rev. 17 (Reference 15.5-7).

Table 15.1-18
Doses for AP1000 Steam Generator Tube Rupture with Pre-Incident Iodine Spike

Time (hr)	DCD Dose (rem TEDE)		X/Q Ratio	Site Dose (rem TEDE)	
	EAB	LPZ	Site to DCD	EAB	LPZ
0–2	2.20	—	2.66×10^{-1}	5.85×10^{-1}	—
0–8	—	1.16	3.10×10^{-2}	—	3.60×10^{-2}
8–24	—	7.20×10^{-2}	3.37×10^{-2}	—	2.42×10^{-3}
Total	2.20	1.23	—	5.85×10^{-1}	3.84×10^{-2}
Limit	—	—	—	25	25

Note: Time-dependent LPZ doses and total LPZ and EAB doses correspond to the radiation doses in DCD Rev. 17 (Reference 15.5-7).

Table 15.1-19
Activity Releases for AP1000 Steam Generator Tube Rupture with Accident Initiated Iodine Spike

Isotope	Activity Release (Ci)			
	0–2 hr	2–8 hr	8–14 hr	Total
Kr-85m	5.53×10^1	1.93×10^1	0.00	7.46×10^1
Kr-85	2.20×10^2	1.08×10^2	2.00×10^{-1}	3.28×10^2
Kr-87	2.39×10^1	3.61	0.00	2.75×10^1
Kr-88	9.22×10^1	2.65×10^1	0.00	1.19×10^2
Xe-131m	9.96×10^1	4.88×10^1	0.00	1.48×10^2
Xe-133m	1.24×10^2	5.91×10^1	1.00×10^{-1}	1.83×10^2
Xe-133	9.19×10^3	4.47×10^3	1.00×10^1	1.37×10^4
Xe-135m	3.44	6.00×10^{-3}	0.00	3.45
Xe-135	2.46×10^2	1.02×10^2	1.00×10^{-1}	3.48×10^2
Xe-138	4.56	5.00×10^{-3}	0.00	4.57
I-130	8.87×10^{-1}	1.62×10^{-1}	8.23×10^{-1}	1.87
I-131	4.36×10^1	1.14×10^1	6.76×10^1	1.23×10^2
I-132	1.47×10^2	4.89	1.29×10^1	1.65×10^2
I-133	9.33×10^1	1.99×10^1	1.08×10^2	2.21×10^2
I-134	5.59×10^1	6.06×10^{-2}	6.02×10^{-2}	5.60×10^1
I-135	7.61×10^1	9.89	4.38×10^1	1.30×10^2
Cs-134	1.63	6.10×10^{-2}	2.16×10^{-1}	1.91
Cs-136	2.42	8.80×10^{-2}	3.15×10^{-1}	2.82
Cs-137	1.17	4.40×10^{-2}	1.56×10^{-1}	1.37
Cs-138	5.64×10^{-1}	0.00	0.00	5.64×10^{-1}
Total	1.05×10^4	4.88×10^3	2.44×10^2	1.56×10^4

Note: Source terms are for the radiation dose values recorded in DCD Rev. 17 (Reference 15.5-7).

Table 15.1-20
Doses for AP1000 Steam Generator Tube Rupture with
Accident-Initiated Iodine Spike

Time (hr)	DCD Dose (rem TEDE)		X/Q Ratio	Site Dose (rem TEDE)	
	EAB	LPZ	Site to DCD	EAB	LPZ
0–2	1.10	—	2.66×10^{-1}	2.93×10^{-1}	—
0–8	—	6.10×10^{-1}	3.10×10^{-2}	—	1.89×10^{-2}
8–24	—	1.68×10^{-1}	3.37×10^{-2}	—	5.66×10^{-3}
Total	1.10	7.78×10^{-1}	—	2.93×10^{-1}	2.46×10^{-2}
Limit	—	—	—	2.5	2.5

Note: Time-dependent LPZ doses and total LPZ and EAB doses correspond to the radiation doses in DCD Rev. 17 (Reference 15.5-7).

Table 15.1-21 (Sheet 1 of 2)
Activity Releases for AP1000 Loss-of-Coolant Accident

Isotope	Activity Release (Ci)							
	1.4–3.4 hr	0–2 hr	2–8 hr	8–24 hr	24–72 hr	72–96 hr	96–720 hr	Total
I-130	5.64 x 10 ¹	3.24 x 10 ¹	7.85 x 10 ¹	6.21	5.11 x 10 ⁻¹	1.17 x 10 ⁻¹	6.00 x 10 ⁻³	1.18 x 10 ²
I-131	1.68 x 10 ³	9.19 x 10 ²	2.57 x 10 ³	2.56 x 10 ²	1.33 x 10 ²	5.84 x 10 ¹	5.79 x 10 ²	4.52 x 10 ³
I-132	1.23 x 10 ³	8.79 x 10 ²	1.26 x 10 ³	1.62 x 10 ¹	6.00 x 10 ⁻³	0	0	2.16 x 10 ³
I-133	3.23 x 10 ³	1.82 x 10 ³	4.72 x 10 ³	3.71 x 10 ²	7.41 x 10 ¹	9.90	7.80	7.00 x 10 ³
I-134	6.60 x 10 ²	7.09 x 10 ²	4.29 x 10 ²	3.07 x 10 ⁻²	0	0	0	1.14 x 10 ³
I-135	2.56 x 10 ³	1.54 x 10 ³	3.36 x 10 ³	1.56 x 10 ²	4.79	1.00 x 10 ⁻²	0	5.06 x 10 ³
Kr-85m	1.42 x 10 ³	6.32 x 10 ²	3.14 x 10 ³	1.87 x 10 ³	8.60 x 10 ¹	0	0	5.73 x 10 ³
Kr-85	8.31 x 10 ¹	3.22 x 10 ¹	2.65 x 10 ²	7.06 x 10 ²	1.06 x 10 ³	5.28 x 10 ²	1.36 x 10 ⁴	1.62 x 10 ⁴
Kr-87	1.10 x 10 ³	6.88 x 10 ²	1.26 x 10 ³	5.00 x 10 ¹	0	0	0	2.00 x 10 ³
Kr-88	3.11 x 10 ³	1.50 x 10 ³	5.76 x 10 ³	1.70 x 10 ³	1.70 x 10 ¹	0	0	8.98 x 10 ³
Xe-131m	8.26 x 10 ¹	3.21 x 10 ¹	2.62 x 10 ²	6.79 x 10 ²	9.42 x 10 ²	4.31 x 10 ²	5.57 x 10 ³	7.92 x 10 ³
Xe-133m	4.43 x 10 ²	1.74 x 10 ²	1.37 x 10 ³	3.15 x 10 ³	3.14 x 10 ³	9.65 x 10 ²	2.58 x 10 ³	1.14 x 10 ⁴
Xe-133	1.47 x 10 ⁴	5.71 x 10 ³	4.62 x 10 ⁴	1.16 x 10 ⁵	1.46 x 10 ⁵	5.97 x 10 ⁴	4.07 x 10 ⁵	7.81 x 10 ⁵
Xe-135m	1.06 x 10 ¹	3.33 x 10 ¹	2.62	0	0	0	0	3.59 x 10 ¹
Xe-135	3.15 x 10 ³	1.31 x 10 ³	8.33 x 10 ³	1.01 x 10 ⁴	2.06 x 10 ³	4.00 x 10 ¹	1.00 x 10 ¹	2.19 x 10 ⁴
Xe-138	3.11 x 10 ¹	1.14 x 10 ²	6.90	0	0	0	0	1.21 x 10 ²
Rb-86	3.04	1.72	4.60	2.80 x 10 ⁻¹	1.00 x 10 ⁻³	0	8.00 x 10 ⁻³	6.61
Cs-134	2.58 x 10 ²	1.46 x 10 ²	3.92 x 10 ²	2.40 x 10 ¹	1.00 x 10 ⁻¹	0	1.20	5.63 x 10 ²
Cs-136	7.33 x 10 ¹	4.14 x 10 ¹	1.11 x 10 ²	6.70	0	0	2.00 x 10 ⁻¹	1.59 x 10 ²
Cs-137	1.51 x 10 ²	8.49 x 10 ¹	2.28 x 10 ²	1.41 x 10 ¹	0	0	7.00 x 10 ⁻¹	3.28 x 10 ²
Cs-138	1.50 x 10 ²	2.60 x 10 ²	6.96 x 10 ¹	0	0	0	0	3.30 x 10 ²
Sb-127	2.42 x 10 ¹	1.14 x 10 ¹	3.67 x 10 ¹	2.14	1.00 x 10 ⁻²	0	1.00 x 10 ⁻²	5.03 x 10 ¹
Sb-129	5.10 x 10 ¹	2.71 x 10 ¹	6.23 x 10 ¹	1.48	0	0	0	9.09 x 10 ¹
Te-127m	3.15	1.47	4.83	2.95 x 10 ⁻¹	2.00 x 10 ⁻³	0	1.30 x 10 ⁻²	6.61
Te-127	2.05 x 10 ¹	1.02 x 10 ¹	2.81 x 10 ¹	1.11	0	0	0	3.94 x 10 ¹
Te-129m	1.07 x 10 ¹	5.01	1.64 x 10 ¹	1.00	1.00 x 10 ⁻²	0	3.00 x 10 ⁻²	2.25 x 10 ¹
Te-129	1.88 x 10 ¹	1.39 x 10 ¹	1.45 x 10 ¹	3.00 x 10 ⁻²	0	0	0	2.84 x 10 ¹
Te-131	3.17 x 10 ¹	1.51 x 10 ¹	4.69 x 10 ¹	2.51	0	0	1.00 x 10 ⁻²	6.45 x 10 ¹
Te-132	3.23 x 10 ²	1.52 x 10 ²	4.89 x 10 ²	2.84 x 10 ¹	1.00 x 10 ⁻¹	0	1.00 x 10 ⁻¹	6.70 x 10 ²
Sr-89	9.23 x 10 ¹	4.31 x 10 ¹	1.45 x 10 ²	5.40	1.00 x 10 ⁻¹	0	3.00 x 10 ⁻¹	1.94 x 10 ²
Sr-90	7.95	3.71	1.22 x 10 ¹	7.50 x 10 ⁻¹	0	0	4.00 x 10 ⁻²	1.67 x 10 ¹
Sr-91	9.68 x 10 ¹	4.79 x 10 ¹	1.33 x 10 ²	5.30	0	0	0	1.86 x 10 ²
Sr-92	6.83 x 10 ¹	3.91 x 10 ¹	7.40 x 10 ¹	1.00	0	0	0	1.14 x 10 ²
Ba-139	5.44 x 10 ¹	3.74 x 10 ¹	4.56 x 10 ¹	1.50 x 10 ⁻¹	0	0	0	8.32 x 10 ¹

Table 15.1-21 (Sheet 2 of 2)
Activity Releases for AP1000 Loss-of-Coolant Accident

Isotope	Activity Release (Ci)							
	1.4–3.4 hr	0–2 hr	2–8 hr	8–24 hr	24–72 hr	72–96 hr	96–720 hr	Total
Ba-140	1.63 x 10 ²	7.61 x 10 ¹	2.49 x 10 ²	1.51 x 10 ¹	0	0	4.00 x 10 ⁻¹	3.41 x 10 ²
Mo-99	2.15 x 10 ¹	1.01 x 10 ¹	3.24 x 10 ¹	1.86	1.00 x 10 ⁻²	0	0	4.44 x 10 ¹
Tc-99m	1.47 x 10 ¹	7.54	1.91 x 10 ¹	5.90 x 10 ⁻¹	0	0	0	2.72 x 10 ¹
Ru-103	1.73 x 10 ¹	8.08	2.65 x 10 ¹	1.62	0	1.00 x 10 ⁻²	6.00 x 10 ⁻²	3.63 x 10 ¹
Ru-105	8.18	4.33	1.00 x 10 ¹	2.40 x 10 ⁻¹	0	0	0	1.46 x 10 ¹
Ru-106	5.70	2.66	8.75	5.40 x 10 ⁻¹	0	0	3.00 x 10 ⁻²	1.20 x 10 ¹
Rh-105	1.03 x 10 ¹	4.88	1.53 x 10 ¹	8.30 x 10 ⁻¹	0	0	0	2.10 x 10 ¹
Ce-141	3.89	1.82	5.96	3.64 x 10 ⁻¹	1.00 x 10 ⁻³	1.00 x 10 ⁻³	1.20 x 10 ⁻²	8.16
Ce-143	3.46	1.64	5.14	2.78 x 10 ⁻¹	1.00 x 10 ⁻³	0	0	7.06
Ce-144	2.94	1.37	4.51	2.76 x 10 ⁻¹	1.00 x 10 ⁻³	1.00 x 10 ⁻³	1.30 x 10 ⁻²	6.17
Pu-238	9.16 x 10 ⁻³	4.28 x 10 ⁻³	1.41 x 10 ⁻²	8.60 x 10 ⁻⁴	0	0	4.00 x 10 ⁻⁵	1.93 x 10 ⁻²
Pu-239	8.06 x 10 ⁻⁴	3.76 x 10 ⁻⁴	1.24 x 10 ⁻³	7.60 x 10 ⁻⁵	0	1.00 x 10 ⁻⁶	3.00 x 10 ⁻⁶	1.70 x 10 ⁻³
Pu-240	1.18 x 10 ⁻³	5.52 x 10 ⁻⁴	1.81 x 10 ⁻³	1.11 x 10 ⁻⁴	1.00 x 10 ⁻⁶	0	5.00 x 10 ⁻⁶	2.48 x 10 ⁻³
Pu-241	2.65 x 10 ⁻¹	1.24 x 10 ⁻¹	4.08 x 10 ⁻¹	2.50 x 10 ⁻²	1.00 x 10 ⁻⁴	0	1.20 x 10 ⁻³	5.58 x 10 ⁻¹
Np-239	4.48 x 10 ¹	2.12 x 10 ¹	6.75 x 10 ¹	3.84	1.00 x 10 ⁻²	1.00 x 10 ⁻²	1.00 x 10 ⁻²	9.26 x 10 ¹
Y-90	8.08 x 10 ⁻²	3.81 x 10 ⁻²	1.22 x 10 ⁻¹	7.00 x 10 ⁻³	0	0	0	1.67 x 10 ⁻¹
Y-91	1.19	5.54 x 10 ⁻¹	1.82	1.11 x 10 ⁻¹	1.00 x 10 ⁻³	0	4.00 x 10 ⁻³	2.49
Y-92	7.89 x 10 ⁻¹	4.32 x 10 ⁻¹	9.19 x 10 ⁻¹	1.80 x 10 ⁻²	0	0	0	1.37
Y-93	1.21	6.00 x 10 ⁻¹	1.68	6.80 x 10 ⁻²	0	0	0	2.35
Nb-95	1.59	7.46 x 10 ⁻¹	2.44	1.49 x 10 ⁻¹	1.00 x 10 ⁻³	0	5.00 x 10 ⁻³	3.34
Zr-95	1.59	7.41 x 10 ⁻¹	2.43	1.49 x 10 ⁻¹	0	0	6.00 x 10 ⁻³	3.33
Zr-97	1.43	6.89 x 10 ⁻¹	2.05	9.80 x 10 ⁻²	0	0	0	2.84
La-140	1.67	7.92 x 10 ⁻¹	2.50	1.39 x 10 ⁻¹	0	0	0	3.43
La-141	1.03	5.54 x 10 ⁻¹	1.23	2.70 x 10 ⁻²	0	0	0	1.81
La-142	5.38 x 10 ⁻¹	3.57 x 10 ⁻¹	4.74 x 10 ⁻¹	2.00 x 10 ⁻³	0	0	0	8.33 x 10 ⁻¹
Nd-147	6.16 x 10 ⁻¹	2.89 x 10 ⁻¹	9.42 x 10 ⁻¹	5.70 x 10 ⁻²	0	0	1.00 x 10 ⁻³	1.29
Pr-143	1.39	6.50 x 10 ⁻¹	2.13	1.28 x 10 ⁻¹	1.00 x 10 ⁻³	0	3.00 x 10 ⁻³	2.91
Am-241	1.20 x 10 ⁻⁴	5.59 x 10 ⁻⁵	1.84 x 10 ⁻⁴	1.13 x 10 ⁻⁵	0	0	6.00 x 10 ⁻⁷	2.52 x 10 ⁻⁴
Cm-242	2.82 x 10 ⁻²	1.32 x 10 ⁻²	4.33 x 10 ⁻²	2.65 x 10 ⁻³	1.00 x 10 ⁻⁵	1.00 x 10 ⁻⁵	1.20 x 10 ⁻⁴	5.93 x 10 ⁻²
Cm-244	3.46 x 10 ⁻³	1.62 x 10 ⁻³	5.32 x 10 ⁻³	3.26 x 10 ⁻⁴	1.00 x 10 ⁻⁶	0	1.60 x 10 ⁻⁵	7.28 x 10 ⁻³
Total	3.53 x 10⁴	1.72 x 10⁴	8.14 x 10⁴	1.35 x 10⁵	1.54 x 10⁵	6.17 x 10⁴	4.29 x 10⁵	8.78 x 10⁵

Note: Source terms are for the radiation dose values recorded in DCD Rev. 17 (Reference 15.5-7).

**Table 15.1-22
 Doses for AP1000 Loss-of-Coolant Accident**

Time (hr)	DCD Dose (rem TEDE)		X/Q Ratio	Site Dose (rem TEDE)	
	EAB	LPZ	Site to DCD	EAB	LPZ
1.4–3.4 ^(a)	2.46×10^1	—	5.22×10^{-1}	1.28×10^1	—
0–8	—	2.17×10^1	7.05×10^{-2}	—	1.53
8–24	—	7.50×10^{-1}	6.31×10^{-2}	—	4.73×10^{-2}
24–96	—	2.93×10^{-1}	4.20×10^{-2}	—	1.23×10^{-2}
96–720	—	5.49×10^{-1}	1.49×10^{-2}	—	8.17×10^{-3}
Total	2.46×10^1	2.33×10^1	—	1.28×10^1	1.60
Limit	—	—	—	25	25

(a) Worst case 2-hour period is 1.4–3.4 hours.

Note: Time-dependent LPZ doses and total LPZ and EAB doses correspond to the radiation doses in DCD Rev. 17 (Reference 15.5-7).

Table 15.1-23
Activity Releases for AP1000 Fuel Handling Accident

Isotope	Activity Release (Ci), 0–2 hr
Kr-85m	8.40
Kr-85	1.10×10^3
Kr-88	3.00×10^{-1}
Xe-131m	5.52×10^2
Xe-133m	2.30×10^3
Xe-133	8.88×10^4
Xe-135m	1.02×10^2
Xe-135	5.68×10^3
I-130	7.00×10^{-1}
I-131	3.47×10^2
I-132	2.44×10^2
I-133	1.08×10^2
I-135	3.20
Total	9.92×10^4

Note: Source terms are for the radiation dose values recorded in DCD Rev. 17 (Reference 15.5-7).

Table 15.1-24
Doses for AP1000 Fuel Handling Accident

Time (hr)	DCD Dose (rem TEDE)		X/Q Ratio Site to DCD	Site Dose (rem TEDE)	
	EAB	LPZ		EAB	LPZ
0–2	5.20	—	2.66×10^{-1}	1.38	—
0–8	—	2.59	3.10×10^{-2}	—	8.03×10^{-2}
Total	5.20	2.59	—	1.38	8.03×10^{-2}
Limit	—	—	—	6.3	6.3

Note: Time-dependent LPZ doses and total LPZ and EAB doses correspond to the radiation doses in DCD Rev. 17 (Reference 15.5-7).

Table 15.1-25
Activity Releases for APWR Steam System Piping Failure
with Pre-Incident Iodine Spike

Isotope	Activity Release (Ci)		
	0–8 hr	8–24 hr	Total
Kr-85	3.21×10^1	2.40×10^1	5.61×10^1
Kr-85m	3.56×10^{-1}	8.77×10^{-2}	4.43×10^{-1}
Kr-87	9.12×10^{-2}	1.13×10^{-3}	9.23×10^{-2}
Kr-88	5.10×10^{-1}	6.46×10^{-2}	5.74×10^{-1}
Xe-133	1.07×10^2	7.75×10^1	1.85×10^2
Xe-135	4.38	3.39	7.78
I-131	1.72×10^1	7.25	2.44×10^1
I-132	6.18	1.66×10^{-1}	6.35
I-133	2.79×10^1	9.03	3.69×10^1
I-134	3.49	1.01×10^{-3}	3.49
I-135	1.62×10^1	2.73	1.89×10^1
Rb-86	8.64×10^{-2}	1.62×10^{-3}	8.80×10^{-2}
Cs-134	8.80	1.68×10^{-1}	8.97
Cs-136	2.32	4.33×10^{-2}	2.37
Cs-137	5.01	9.56×10^{-2}	5.11
Total	2.32×10^2	1.25×10^2	3.56×10^2

Reference: APWR DCD Rev. 2 (15.5-8)

Table 15.1-26
Doses for APWR Steam System Piping Failure with Pre-Incident Iodine Spike

Time (hr)	DCD Dose (rem TEDE)		X/Q Ratio	Site Dose (rem TEDE)	
	EAB	LPZ		EAB	LPZ
0–2	1.9×10^{-1}	—	5.32×10^{-1}	1.0×10^{-1}	—
0–8	—	1.0×10^{-1}	7.38×10^{-2}	—	7.4×10^{-3}
8–24	—	7.6×10^{-3}	7.77×10^{-2}	—	5.9×10^{-4}
Total	1.9×10^{-1}	1.1×10^{-1}	—	1.0×10^{-1}	8.0×10^{-3}
Limit	—	—	—	25	25

Note: Time-dependent LPZ doses and total LPZ and EAB doses correspond to the radiation doses in DCD Rev. 2 (Reference 15.5-8).

Table 15.1-27
Activity Releases for APWR Steam System Piping Failure Accident-Initiated Iodine Spike

Isotope	Activity Release (Ci)		
	0–8 hr	8–24 hr	Total
Kr-85	3.21×10^1	2.40×10^1	5.61×10^1
Kr-85m	3.56×10^{-1}	8.77×10^{-2}	4.43×10^{-1}
Kr-87	9.12×10^{-2}	1.13×10^{-3}	9.23×10^{-2}
Kr-88	5.10×10^{-1}	6.46×10^{-2}	5.74×10^{-1}
Xe-133	1.08×10^2	8.03×10^1	1.88×10^2
Xe-135	7.61	1.33×10^1	2.09×10^1
I-131	5.05×10^1	6.50×10^1	1.16×10^2
I-132	9.89	1.49	1.14×10^1
I-133	7.65×10^1	8.09×10^1	1.57×10^2
I-134	3.77	9.11×10^{-3}	3.78
I-135	3.77×10^1	2.45×10^1	6.21×10^1
Rb-86	8.64×10^{-2}	1.62×10^{-3}	8.80×10^{-2}
Cs-134	8.80	1.68×10^{-1}	8.97
Cs-136	2.32	4.33×10^{-2}	2.37
Cs-137	5.01	9.56×10^{-2}	5.11
Total	3.43×10^2	2.90×10^2	6.33×10^2

Reference: APWR DCD Rev. 2 (15.5-8)

Table 15.1-28
Doses for APWR Steam System Piping Failure with Accident-Initiated Iodine Spike

Time (hr)	DCD Dose (rem TEDE)		X/Q Ratio Site to DCD	Site Dose (rem TEDE)	
	EAB	LPZ		EAB	LPZ
0–2	3.2×10^{-1}	—	5.32×10^{-1}	1.7×10^{-1}	—
0–8	—	2.1×10^{-1}	7.38×10^{-2}	—	1.6×10^{-2}
8–24	—	6.5×10^{-2}	7.77×10^{-2}	—	5.1×10^{-3}
Total	3.2×10^{-1}	2.8×10^{-1}	—	1.7×10^{-1}	2.1×10^{-2}
Limit	—	—	—	2.5	2.5

Note: Time-dependent LPZ doses and total LPZ and EAB doses correspond to the radiation doses in DCD Rev. 2 (Reference 15.5-8).

**Table 15.1-29
 Activity Releases for APWR Locked Rotor Accident**

Isotope	Activity Release (Ci)		
	0–8 hr	8–24 hr	Total
Kr-85	1.12×10^2	8.40×10^1	1.96×10^2
Kr-85m	6.40×10^2	1.58×10^2	7.98×10^2
Kr-87	5.02×10^2	6.21	5.08×10^2
Kr-88	1.37×10^3	1.74×10^2	1.55×10^3
Xe-133	6.87×10^3	4.96×10^3	1.18×10^4
Xe-135	1.61×10^3	7.67×10^2	2.37×10^3
I-131	8.81×10^1	2.32×10^2	3.20×10^2
I-132	1.94×10^1	8.35	2.77×10^1
I-133	9.85×10^1	2.17×10^2	3.15×10^2
I-134	6.46	1.10×10^{-1}	6.57
I-135	6.38×10^1	9.16×10^1	1.55×10^2
Rb-86	3.23×10^{-2}	8.66×10^{-2}	1.19×10^{-1}
Cs-134	3.24	8.78	1.20×10^1
Cs-136	8.72×10^{-1}	2.33	3.21
Cs-137	1.84	5.00	6.84
Total	1.14×10^4	6.71×10^3	1.81×10^4

Reference: APWR DCD Rev. 2 (15.5-8)

**Table 15.1-30
 Doses for APWR Locked Rotor Accident**

Time (hr)	DCD Dose (rem TEDE)		X/Q Ratio	Site Dose (rem TEDE)	
	EAB	LPZ	Site to DCD	EAB	LPZ
10–12 ^(a)	4.9×10^{-1}	—	5.32×10^{-1}	2.6×10^{-1}	—
0–8	—	4.4×10^{-1}	7.38×10^{-2}	—	3.2×10^{-2}
8–24	—	2.5×10^{-1}	7.77×10^{-2}	—	1.9×10^{-2}
Total	4.9×10^{-1}	6.9×10^{-1}	—	2.6×10^{-1}	5.2×10^{-2}
Limit	—	—	—	2.5	2.5

(a) Worst case 2-hour period is 10–12 hours.

Note: Time-dependent LPZ doses and total LPZ and EAB doses correspond to the radiation doses in DCD Rev. 2 (Reference 15.5-8).

**Table 15.1-31
 Activity Releases for APWR Rod Ejection Accident**

Isotope	Activity Release (Ci)				
	0–8 hr	8–24 hr	24–96 hr	96–720 hr	Total
Kr-85	2.63×10^2	2.50×10^2	1.90×10^2	1.63×10^3	2.33×10^3
Kr-85m	3.59×10^3	9.58×10^2	9.86	0	4.56×10^3
Kr-87	2.81×10^3	3.50×10^1	0	0	2.85×10^3
Kr-88	7.70×10^3	1.02×10^3	2.05	0	8.72×10^3
Xe-133	3.81×10^4	3.46×10^4	2.11×10^4	4.22×10^4	1.36×10^5
Xe-135	9.31×10^3	5.32×10^3	5.40×10^2	2.81	1.52×10^4
I-131	5.82×10^2	7.17×10^2	2.58×10^2	7.79×10^2	2.34×10^3
I-132	4.62×10^2	3.93×10^1	1.40×10^{-2}	0	5.01×10^2
I-133	1.12×10^3	1.06×10^3	1.13×10^2	1.13×10^1	2.30×10^3
I-134	4.95×10^2	5.15×10^{-1}	0	0	4.95×10^2
I-135	8.75×10^2	4.39×10^2	6.60	4.00×10^{-3}	1.32×10^3
Rb-86	4.16×10^{-1}	9.65×10^{-2}	0	0	5.13×10^{-1}
Cs-134	4.15×10^1	9.79	1.01×10^{-3}	0	5.13×10^1
Cs-136	1.13×10^1	2.60	1.00×10^{-6}	0	1.39×10^1
Cs-137	2.36×10^1	5.57	0	0	2.92×10^1
Total	6.53×10^4	4.45×10^4	2.22×10^4	4.46×10^4	1.77×10^5

Reference: APWR DCD Rev. 2 (15.5-8)

**Table 15.1-32
 Doses for APWR Rod Ejection Accident**

Time (hr)	DCD Dose (rem TEDE)		X/Q Ratio	Site Dose (rem TEDE)	
	EAB	LPZ	Site to DCD	EAB	LPZ
0–2	5.1	—	5.32×10^{-1}	2.7	—
0–8	—	3.2	7.38×10^{-2}	—	2.4×10^{-1}
8–24	—	8.8×10^{-1}	7.77×10^{-2}	—	6.8×10^{-2}
24–96	—	1.6×10^{-1}	6.09×10^{-2}	—	9.7×10^{-3}
96–720	—	1.7×10^{-1}	4.25×10^{-2}	—	7.2×10^{-3}
Total	5.1	4.4	—	2.7	3.2×10^{-1}
Limit	—	—	—	6.3	6.3

Note: Time-dependent LPZ doses and total LPZ and EAB doses correspond to the radiation doses in DCD Rev. 2 (Reference 15.5-8).

Table 15.1-33
Activity Releases for APWR Small Break Outside Containment

Isotope	Activity Release (Ci) 0–8 hr
Kr-85	6.84×10^2
Kr-85m	1.25×10^1
Kr-87	7.05
Kr-88	2.26×10^1
Xe-133	2.32×10^3
Xe-135	7.70×10^1
I-131	1.72×10^2
I-132	7.98×10^1
I-133	2.93×10^2
I-134	4.33×10^1
I-135	1.85×10^2
Total	3.90×10^3

Reference: APWR DCD Rev. 2 (15.5-8)

Table 15.1-34
Doses for APWR Small Break Outside Containment

Time (hr)	DCD Dose (rem TEDE)		X/Q Ratio	Site Dose (rem TEDE)	
	EAB	LPZ		EAB	LPZ
0–2	1.5	—	5.32×10^{-1}	8.0×10^{-1}	—
0–8	—	6.0×10^{-1}	7.38×10^{-2}	—	4.4×10^{-2}
Total	1.5	6.0×10^{-1}	—	8.0×10^{-1}	4.4×10^{-2}
Limit	—	—	—	2.5	2.5

Note: Time-dependent LPZ doses and total LPZ and EAB doses correspond to the radiation doses in DCD Rev. 2 (Reference 15.5-8).

Table 15.1-35
Activity Releases for APWR Steam Generator Tube Rupture
with Pre-Incident Iodine Spike

Isotope	Activity Release (Ci)				
	0–8 hr	8–24 hr	24–96 hr	96–720 hr	Total
Kr-85	3.43×10^3	4.64×10^1	2.06×10^2	1.59×10^3	5.27×10^3
Kr-85m	6.17×10^1	9.70×10^{-2}	8.00×10^{-3}	0	6.18×10^1
Kr-87	3.40×10^1	0	0	0	3.40×10^1
Kr-88	1.11×10^2	6.00×10^{-2}	1.00×10^{-2}	0	1.11×10^2
Xe-133	1.16×10^4	1.44×10^2	5.06×10^2	9.44×10^2	1.32×10^4
Xe-135	3.75×10^2	2.18	6.70×10^{-1}	0	3.78×10^2
I-131	4.18×10^2	1.81	0	0	4.20×10^2
I-132	2.09×10^2	3.92×10^{-2}	0	0	2.09×10^2
I-133	7.16×10^2	2.24	0	0	7.18×10^2
I-134	1.28×10^2	6.00×10^{-5}	0	0	1.28×10^2
I-135	4.61×10^2	6.70×10^{-1}	0	0	4.62×10^2
Rb-86	4.54×10^{-3}	5.44×10^{-4}	0	0	5.09×10^{-3}
Cs-134	4.63×10^{-1}	5.63×10^{-2}	0	0	5.19×10^{-1}
Cs-136	1.22×10^{-1}	1.45×10^{-2}	0	0	1.37×10^{-1}
Cs-137	2.64×10^{-1}	3.21×10^{-2}	0	0	2.96×10^{-1}
Total	1.76×10^4	1.98×10^2	7.12×10^2	2.53×10^3	2.10×10^4

Reference: APWR DCD Rev. 2 (15.5-8)

Table 15.1-36
Doses for APWR Steam Generator Tube Rupture with Pre-Incident Iodine Spike

Time (hr)	DCD Dose (rem TEDE)		X/Q Ratio	Site Dose (rem TEDE)	
	EAB	LPZ	Site to DCD	EAB	LPZ
0–2	3.6	—	5.32×10^{-1}	1.9	—
0–8	—	1.5	7.38×10^{-2}	—	1.1×10^{-1}
8–24	—	2.0×10^{-3}	7.77×10^{-2}	—	1.6×10^{-4}
24–96	—	2.1×10^{-4}	6.09×10^{-2}	—	1.3×10^{-5}
96–720	—	1.7×10^{-4}	4.25×10^{-2}	—	7.2×10^{-6}
Total	3.6	1.5	—	1.9	1.1×10^{-1}
Limit	—	—	—	25	25

Note: Time-dependent LPZ doses and total LPZ and EAB doses correspond to the radiation doses in DCD Rev. 2 (Reference 15.5-8).

Table 15.1-37
Activity Releases for APWR Steam Generator Tube Rupture
with Accident-Initiated Iodine Spike

Isotope	Activity Release (Ci)				
	0–8 hr	8–24 hr	24–96 hr	96–720 hr	Total
Kr-85	3.43×10^3	4.64×10^1	2.06×10^2	1.59×10^3	5.27×10^3
Kr-85m	6.17×10^1	9.70×10^{-2}	8.00×10^{-3}	0	6.18×10^1
Kr-87	3.40×10^1	0	0	0	3.40×10^1
Kr-88	1.11×10^2	6.00×10^{-2}	1.00×10^{-2}	0	1.11×10^2
Xe-133	1.16×10^4	1.45×10^2	5.06×10^2	9.44×10^2	1.32×10^4
Xe-135	3.70×10^2	3.82	6.70×10^{-1}	0	3.74×10^2
I-131	1.10×10^2	1.03×10^1	0	0	1.20×10^2
I-132	5.24×10^1	2.12×10^{-1}	0	0	5.26×10^1
I-133	1.87×10^2	1.27×10^1	0	0	2.00×10^2
I-134	3.05×10^1	1.06×10^{-3}	0	0	3.05×10^1
I-135	1.19×10^2	3.74	0	0	1.23×10^2
Rb-86	4.54×10^{-3}	5.44×10^{-4}	0	0	5.09×10^{-3}
Cs-134	4.63×10^{-1}	5.63×10^{-2}	0	0	5.19×10^{-1}
Cs-136	1.22×10^{-1}	1.45×10^{-2}	0	0	1.37×10^{-1}
Cs-137	2.64×10^{-1}	3.21×10^{-2}	0	0	2.96×10^{-1}
Total	1.61×10^4	2.22×10^2	7.12×10^2	2.53×10^3	1.96×10^4

Reference: APWR DCD Rev. 2 (15.5-8)

Table 15.1-38
Doses for APWR Steam Generator Tube Rupture with Accident-Initiated Iodine Spike

Time (hr)	DCD Dose (rem TEDE)		X/Q Ratio	Site Dose (rem TEDE)	
	EAB	LPZ	Site to DCD	EAB	LPZ
0–2	9.6×10^{-1}	—	5.32×10^{-1}	5.1×10^{-1}	—
0–8	—	4.1×10^{-1}	7.38×10^{-2}	—	3.0×10^{-2}
8–24	—	1.0×10^{-2}	7.77×10^{-2}	—	7.8×10^{-4}
24–96	—	2.1×10^{-4}	6.09×10^{-2}	—	1.3×10^{-5}
96–720	—	1.7×10^{-4}	4.25×10^{-2}	—	7.2×10^{-6}
Total	9.6×10^{-1}	4.2×10^{-1}	—	5.1×10^{-1}	3.1×10^{-2}
Limit	—	—	—	2.5	2.5

Note: Time-dependent LPZ doses and total LPZ and EAB doses correspond to the radiation doses in DCD Rev. 2 (Reference 15.5-8).

Table 15.1-39 (Sheet 1 of 2)
Activity Release for APWR Loss-of-Coolant Accident

Isotope	Activity Release (Ci)				
	0–8 hr	8–24 hr	24–96 hr	96–720 hr	Total
Kr-85	7.75×10^2	1.74×10^3	3.92×10^3	3.35×10^4	3.99×10^4
Kr-85m	9.16×10^3	4.37×10^3	1.99×10^2	0	1.37×10^4
Kr-87	3.54×10^3	7.83×10^1	0	0	3.62×10^3
Kr-88	1.68×10^4	3.68×10^3	3.70×10^1	0	2.05×10^4
Xe-133	1.26×10^5	2.76×10^5	4.93×10^5	9.77×10^5	1.87×10^6
Xe-135	3.79×10^4	4.05×10^4	9.60×10^3	4.41×10^1	8.80×10^4
I-131	1.42×10^3	5.61×10^2	1.85×10^3	5.60×10^3	9.43×10^3
I-132	1.50×10^3	1.01×10^2	2.22×10^2	2.48×10^2	2.07×10^3
I-133	2.67×10^3	7.37×10^2	8.09×10^2	8.07×10^1	4.30×10^3
I-134	4.22×10^2	1.84×10^{-1}	0	0	4.22×10^2
I-135	1.95×10^3	2.44×10^2	4.67×10^1	1.20×10^{-1}	2.24×10^3
Rb-86	1.44	1.60×10^{-2}	0	0	1.45
Cs-134	1.44×10^2	1.62	0	0	1.46×10^2
Cs-136	3.90×10^1	4.31×10^{-1}	0	0	3.94×10^1
Cs-137	8.19×10^1	9.21×10^{-1}	1.00×10^{-3}	0	8.28×10^1
Sb-127	1.04×10^1	1.26×10^{-1}	1.00×10^{-5}	0	1.05×10^1
Sb-129	1.99×10^1	6.87×10^{-2}	0	0	2.00×10^1
Te-127	1.04×10^1	1.30×10^{-1}	0	0	1.05×10^1
Te-127m	1.39	1.80×10^{-2}	0	0	1.40
Te-129	2.30×10^1	1.12×10^{-1}	0	0	2.31×10^1
Te-129m	4.75	6.13×10^{-2}	0	0	4.81
Te-131m	1.36×10^1	1.44×10^{-1}	0	0	1.37×10^1
Te-132	1.41×10^2	1.71	1.00×10^{-4}	0	1.43×10^2
Sr-89	4.74×10^1	6.12×10^{-1}	0	0	4.80×10^1
Sr-90	3.93	5.10×10^{-2}	0	0	3.98
Sr-91	5.01×10^1	3.54×10^{-1}	1.00×10^{-3}	0	5.05×10^1
Sr-92	3.11×10^1	4.95×10^{-2}	0	0	3.11×10^1
Ba-139	1.96×10^1	5.04×10^{-3}	0	0	1.96×10^1
Ba-140	7.49×10^1	9.53×10^{-1}	0	0	7.59×10^1
Co-58	3.36×10^{-3}	4.50×10^{-8}	0	0	3.36×10^{-3}
Co-60	1.59×10^{-2}	2.00×10^{-4}	1.01×10^{-6}	0	1.61×10^{-2}
Mo-99	9.57	1.11×10^{-1}	1.00×10^{-4}	0	9.68
Tc-99m	8.50	1.04×10^{-1}	1.00×10^{-4}	0	8.60
Ru-103	7.62	9.83×10^{-2}	1.01×10^{-4}	0	7.72

Table 15.1-39 (Sheet 2 of 2)
Activity Release for APWR Loss-of-Coolant Accident

Isotope	Activity Release (Ci)				
	0–8 hr	8–24 hr	24–96 hr	96–720 hr	Total
Ru-105	3.14	1.12 x 10 ⁻²	0	0	3.15
Ru-106	2.67	3.46 x 10 ⁻²	0	0	2.70
Rh-105	4.61	5.41 x 10 ⁻²	0	0	4.67
Y-90	7.44 x 10 ⁻²	5.12 x 10 ⁻³	6.06 x 10 ⁻⁶	0	7.96 x 10 ⁻²
Y-91	6.00 x 10 ⁻¹	8.54 x 10 ⁻³	0	0	6.09 x 10 ⁻¹
Y-92	4.13	1.04 x 10 ⁻¹	0	0	4.24
Y-93	5.90 x 10 ⁻¹	4.32 x 10 ⁻³	0	0	5.94 x 10 ⁻¹
Zr-95	7.55 x 10 ⁻¹	9.76 x 10 ⁻³	0	0	7.65 x 10 ⁻¹
Zr-97	6.65 x 10 ⁻¹	6.12 x 10 ⁻³	0	0	6.71 x 10 ⁻¹
Nb-95	7.60 x 10 ⁻¹	9.85 x 10 ⁻³	1.01 x 10 ⁻⁵	0	7.69 x 10 ⁻¹
La-140	1.76	1.43 x 10 ⁻¹	2.02 x 10 ⁻⁴	0	1.90
La-141	4.25 x 10 ⁻¹	1.29 x 10 ⁻³	0	0	4.27 x 10 ⁻¹
La-142	2.01 x 10 ⁻¹	7.07 x 10 ⁻⁵	0	0	2.01 x 10 ⁻¹
Pr-143	6.74 x 10 ⁻¹	8.91 x 10 ⁻³	1.00 x 10 ⁻⁵	0	6.83 x 10 ⁻¹
Nd-147	2.80 x 10 ⁻¹	3.55 x 10 ⁻³	0	0	2.83 x 10 ⁻¹
Am-241	7.51 x 10 ⁻⁵	9.77 x 10 ⁻⁷	0	0	7.60 x 10 ⁻⁵
Cm-242	1.86 x 10 ⁻²	2.41 x 10 ⁻⁴	0	0	1.88 x 10 ⁻²
Cm-244	2.26 x 10 ⁻³	2.93 x 10 ⁻⁵	0	0	2.29 x 10 ⁻³
Ce-141	1.78	2.29 x 10 ⁻²	0	0	1.80
Ce-143	1.63	1.78 x 10 ⁻²	0	0	1.65
Ce-144	1.35	1.75 x 10 ⁻²	0	0	1.36
Np-239	1.85 x 10 ¹	2.16 x 10 ⁻¹	1.00 x 10 ⁻⁵	0	1.87 x 10 ¹
Pu-238	5.30 x 10 ⁻³	6.88 x 10 ⁻⁵	0	0	5.37 x 10 ⁻³
Pu-239	4.00 x 10 ⁻⁴	5.19 x 10 ⁻⁶	0	0	4.05 x 10 ⁻⁴
Pu-240	6.28 x 10 ⁻⁴	8.14 x 10 ⁻⁶	1.01 x 10 ⁻⁸	0	6.36 x 10 ⁻⁴
Pu-241	1.39 x 10 ⁻¹	1.81 x 10 ⁻³	0	0	1.41 x 10 ⁻¹
Total	2.03 x 10 ⁵	3.28 x 10 ⁵	5.09 x 10 ⁵	1.02 x 10 ⁶	2.06 x 10 ⁶

Reference: APWR DCD Rev. 2 (15.5-8)

Table 15.1-40
Doses for APWR Loss-of-Coolant Accident

Time (hr)	DCD Dose (rem TEDE)		X/Q Ratio	Site Dose (rem TEDE)	
	EAB	LPZ	Site to DCD	EAB	LPZ
0.5–2.5 ^(a)	1.3×10^1	—	5.32×10^{-1}	6.9	—
0–8	—	9.0	7.38×10^{-2}	—	6.6×10^{-1}
8–24	—	1.2	7.77×10^{-2}	—	9.3×10^{-2}
24–96	—	1.3	6.09×10^{-2}	—	7.9×10^{-2}
96–720	—	1.4	4.25×10^{-2}	—	6.0×10^{-2}
Total	1.3×10^1	1.3×10^1	—	6.9	9.0×10^{-1}
Limit	—	—	—	25	25

(a) Worst case 2-hour period is 0.5–2.5 hours.

Note: Time-dependent LPZ doses and total LPZ and EAB doses correspond to the radiation doses in DCD Rev. 2 (Reference 15.5-8).

Table 15.1-41
Activity Release for APWR Fuel Handling Accident

Isotope	Activity Release (Ci) 0–8 hr
Kr-85	1.20×10^3
Kr-85m	3.90×10^2
Kr-87	5.98×10^{-2}
Kr-88	1.25×10^2
Xe-133	9.90×10^4
Xe-135	2.21×10^4
I-131	3.67×10^2
I-132	2.75×10^2
I-133	2.31×10^2
I-134	2.71×10^{-6}
I-135	3.80×10^1
Total	1.24×10^5

Reference: APWR DCD Rev. 2 (15.5-8)

Table 15.1-42
Doses for APWR Fuel Handling Accident

Time (hr)	DCD Dose (rem TEDE)		X/Q Ratio	Site Dose (rem TEDE)	
	EAB	LPZ	Site to DCD	EAB	LPZ
0–2	3.3	—	5.32×10^{-1}	1.8	—
0–8	—	1.4	7.38×10^{-2}	—	1.0×10^{-1}
Total	3.3	1.4	—	1.8	1.0×10^{-1}
Limit	—	—	—	6.3	6.3

Note: Time-dependent LPZ doses and total LPZ and EAB doses correspond to the radiation doses in DCD Rev. 2 (Reference 15.5-8).

Table 15.1-43
Activity Releases for ABWR Main Steam Line Break

Isotope	Activity Release (MBq)	
	Equilibrium Activity	Pre-Incident Spike
I-131	7.29×10^4	1.46×10^6
I-132	7.10×10^5	1.42×10^7
I-133	5.00×10^5	9.99×10^6
I-134	1.40×10^6	2.79×10^7
I-135	7.29×10^5	1.46×10^7
Kr-83m	4.07×10^2	2.44×10^3
Kr-85m	7.18×10^2	4.29×10^3
Kr-85	2.26	1.36×10^1
Kr-87	2.44×10^3	1.47×10^4
Kr-88	2.46×10^3	1.48×10^4
Kr-89	9.88×10^3	5.92×10^4
Kr-90	2.55×10^3	1.55×10^4
Xe-131m	1.76	1.06×10^1
Xe-133m	3.39×10^1	2.04×10^2
Xe-133	9.47×10^2	5.70×10^3
Xe-135m	2.89×10^3	1.74×10^4
Xe-135	2.70×10^3	1.62×10^4
Xe-137	1.23×10^4	7.40×10^4
Xe-138	9.44×10^3	5.66×10^4
Xe-139	4.33×10^3	2.59×10^4

Reference: ABWR DCD Rev. 4 (15.5-9)

Table 15.1-44
Doses for ABWR Main Steam Line Break with Pre-Incident Iodine Spike

Location	Time (hr)	DCD Dose (Sv)		X/Q Ratio Site to DCD	Site Dose (rem)	
		W. Body	Thyroid		W. Body	Thyroid
EAB	0-2	1.3×10^{-2}	5.1×10^{-1}	1.94×10^{-1}	2.5×10^{-1}	9.9
LPZ	0-8	—	—	1.13×10^{-2}	1.5×10^{-2}	5.8×10^{-1}
Limit	—	—	—	—	25	300

Reference: ABWR DCD Rev. 4 (15.5-9)

Table 15.1-45
Doses for ABWR Main Steam Line Break with Equilibrium Iodine Activity

Location	Time (hr)	DCD Dose (Sv)		X/Q Ratio Site to DCD	Site Dose (rem)	
		W. Body	Thyroid		W. Body	Thyroid
EAB	0-2	6.2×10^{-4}	2.6×10^{-2}	1.94×10^{-1}	1.2×10^{-2}	5.0×10^{-1}
LPZ	0-8	—	—	1.13×10^{-2}	7.0×10^{-4}	2.9×10^{-2}
Limit	—	—	—	—	2.5	30

Reference: ABWR DCD Rev. 4 (15.5-9)

Table 15.1-46
Activity Releases for ABWR Small Break Outside Containment

Isotope	Activity Release (MBq)					
	1 min	10 min	1 hr	2 hr	4 hr	8 hr
I-131	6.36×10^{-1}	5.77×10^1	2.77×10^4	6.81×10^4	1.27×10^5	1.41×10^5
I-132	6.18	5.51×10^2	2.52×10^5	5.96×10^5	1.09×10^6	1.19×10^6
I-133	4.37	3.96×10^2	1.87×10^5	4.59×10^5	8.51×10^5	9.44×10^5
I-134	1.21×10^1	1.06×10^3	4.44×10^5	9.92×10^5	1.76×10^6	1.90×10^6
I-135	6.36	5.74×10^2	2.71×10^5	6.59×10^5	1.21×10^6	1.34×10^6

Reference: ABWR DCD Rev. 4 (15.5-9)

Table 15.1-47
Doses for ABWR Small Break Outside Containment

Location	Time (hr)	DCD Dose (Sv)		X/Q Ratio	Site Dose (rem)	
		W. Body	Thyroid	Site to DCD	W. Body	Thyroid
EAB	0-2	9.4×10^{-4}	4.8×10^{-2}	1.94×10^{-1}	1.8×10^{-2}	9.3×10^{-1}
LPZ	0-8	—	—	1.13×10^{-2}	1.1×10^{-2}	5.4×10^{-2}
Limit	—	—	—	—	2.5	30

Reference: ABWR DCD Rev. 4 (15.5-9)

Table 15.1-48 (Sheet 1 of 2)
Activity Releases for ABWR Loss-of-Coolant Accident

Isotope	Activity Release from Reactor Building (MBq)									
	1 min	10 min	1 hr	2 hr	4 hr	8 hr	12 hr	24 hr	96 hr	720 hr
I-131	2.9×10^4	2.6×10^6	9.6×10^6	9.6×10^6	1.0×10^7	1.3×10^7	1.7×10^7	3.6×10^7	1.9×10^8	6.7×10^8
I-132	4.1×10^4	3.7×10^6	1.3×10^7	1.3×10^7	1.4×10^7	1.4×10^7	1.5×10^7	1.5×10^7	1.5×10^7	1.5×10^7
I-133	5.9×10^4	5.6×10^6	2.0×10^7	2.0×10^7	2.1×10^7	2.6×10^7	3.3×10^7	5.6×10^7	1.2×10^8	1.3×10^8
I-134	6.7×10^4	5.6×10^6	1.9×10^7	1.9×10^7	1.9×10^7	1.9×10^7	1.9×10^7	1.9×10^7	1.9×10^7	1.9×10^7
I-135	5.6×10^4	5.2×10^6	1.9×10^7	1.9×10^7	2.0×10^7	2.3×10^7	2.6×10^7	3.1×10^7	3.5×10^7	3.5×10^7
Kr-83m	2.7×10^4	2.3×10^6	9.3×10^6	1.2×10^7	1.9×10^7	2.8×10^7	3.2×10^7	3.3×10^7	3.3×10^7	3.3×10^7
Kr-85	2.6×10^3	2.3×10^5	1.0×10^6	1.5×10^6	3.6×10^6	1.2×10^7	2.4×10^7	8.1×10^7	6.7×10^8	5.6×10^9
Kr-85m	5.6×10^4	5.2×10^6	2.1×10^7	3.1×10^7	5.9×10^7	1.3×10^8	1.9×10^8	2.7×10^8	2.9×10^8	2.9×10^8
Kr-87	1.1×10^5	9.3×10^6	3.6×10^7	4.4×10^7	6.3×10^7	7.8×10^7	8.1×10^7	8.1×10^7	8.1×10^7	8.1×10^7
Kr-88	1.6×10^5	1.4×10^7	5.6×10^7	7.8×10^7	1.4×10^8	2.5×10^8	3.1×10^8	3.6×10^8	3.7×10^8	3.7×10^8
Kr-89	1.7×10^5	4.8×10^6	6.7×10^6	6.7×10^6	6.7×10^6	6.7×10^6	6.7×10^6	6.7×10^6	6.7×10^6	6.7×10^6
Xe-131m	1.3×10^3	1.2×10^5	5.2×10^5	7.8×10^5	1.9×10^6	5.9×10^6	1.3×10^7	4.1×10^7	3.0×10^8	1.4×10^9
Xe-133	4.8×10^5	4.1×10^7	1.8×10^8	2.8×10^8	6.7×10^8	2.1×10^9	4.4×10^9	1.4×10^{10}	8.9×10^{10}	2.5×10^{11}
Xe-133m	2.0×10^4	1.8×10^6	7.4×10^6	1.1×10^7	2.7×10^7	8.5×10^7	1.7×10^8	5.2×10^8	2.6×10^9	4.1×10^9
Xe-135	5.9×10^4	5.6×10^6	2.3×10^7	3.4×10^7	7.4×10^7	1.9×10^8	3.3×10^8	6.7×10^8	1.0×10^9	1.0×10^9
Xe-135m	8.5×10^4	5.9×10^6	1.7×10^7	1.8×10^7	1.8×10^7	1.8×10^7	1.8×10^7	1.8×10^7	1.8×10^7	1.8×10^7
Xe-137	3.7×10^5	1.3×10^7	1.9×10^7	1.9×10^7	1.9×10^7	1.9×10^7	1.9×10^7	1.9×10^7	1.9×10^7	1.9×10^7
Xe-138	3.7×10^5	2.6×10^7	7.4×10^7	7.4×10^7	7.4×10^7	7.4×10^7	7.4×10^7	7.4×10^7	7.4×10^7	7.4×10^7

Table 15.1-48 (Sheet 2 of 2)
Activity Releases for ABWR Loss-of-Coolant Accident

Isotope	Activity Release from Condenser (MBq)									
	1 min	10 min	1 hr	2 hr	4 hr	8 hr	12 hr	24 hr	96 hr	720 hr
I-131	0	0	7.0×10^2	1.2×10^4	1.2×10^5	8.5×10^5	2.4×10^6	1.2×10^7	1.8×10^8	2.0×10^9
I-132	0	0	8.1×10^2	1.1×10^4	7.0×10^4	2.4×10^5	3.5×10^5	4.4×10^5	4.4×10^5	4.4×10^5
I-133	0	0	1.5×10^3	2.4×10^4	2.3×10^5	1.5×10^6	3.7×10^6	1.5×10^7	7.4×10^7	8.9×10^7
I-134	0	0	8.5×10^2	8.5×10^3	3.0×10^4	4.8×10^4	4.8×10^4	4.8×10^4	4.8×10^4	4.8×10^4
I-135	0	0	1.3×10^3	2.1×10^4	1.7×10^5	9.3×10^5	2.0×10^6	5.2×10^6	7.4×10^6	7.4×10^6
Kr-83m	0	0	5.9×10^3	7.8×10^4	4.4×10^5	1.3×10^6	1.7×10^6	1.9×10^6	1.9×10^6	1.9×10^6
Kr-85	0	0	7.4×10^2	1.3×10^4	1.3×10^5	9.3×10^5	2.6×10^6	1.3×10^7	2.3×10^8	5.9×10^9
Kr-85m	0	0	1.5×10^4	2.3×10^5	1.8×10^6	8.5×10^6	1.6×10^7	3.0×10^7	3.6×10^7	3.6×10^7
Kr-87	0	0	2.0×10^4	2.4×10^5	1.1×10^6	2.4×10^6	2.7×10^6	2.8×10^6	2.8×10^6	2.8×10^6
Kr-88	0	0	3.7×10^4	5.6×10^5	3.7×10^6	1.4×10^7	2.3×10^7	3.1×10^7	3.2×10^7	3.2×10^7
Kr-89	0	0	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1
Xe-131m	0	0	4.1×10^2	6.7×10^3	6.7×10^4	4.8×10^5	1.3×10^6	6.7×10^6	1.0×10^8	1.3×10^9
Xe-133	0	0	1.4×10^5	2.4×10^6	2.3×10^7	1.6×10^8	4.4×10^8	2.2×10^9	3.0×10^{10}	1.8×10^{11}
Xe-133m	0	0	5.6×10^3	1.0×10^5	9.3×10^5	6.7×10^6	1.8×10^7	8.1×10^7	8.1×10^8	2.0×10^9
Xe-135	0	0	1.7×10^4	2.7×10^5	2.4×10^6	1.4×10^7	3.3×10^7	9.6×10^7	2.0×10^8	2.0×10^8
Xe-135m	0	0	2.9×10^3	1.0×10^4	1.3×10^4	1.3×10^4	1.3×10^4	1.3×10^4	1.3×10^4	1.3×10^4
Xe-137	0	0	3.4×10^1	3.5×10^1	3.5×10^1	3.5×10^1	3.5×10^1	3.5×10^1	3.5×10^1	3.5×10^1
Xe-138	0	0	1.0×10^4	3.2×10^4	3.7×10^4	3.7×10^4	3.7×10^4	3.7×10^4	3.7×10^4	3.7×10^4

Reference: ABWR DCD Rev. 4 (15.5-9)

Table 15.1-49
Doses for ABWR Loss-of-Coolant Accident

Location	Time (hr)	DCD Dose (Sv)		X/Q Ratio	Site Dose (rem)	
		W. Body	Thyroid	Site to DCD	W. Body	Thyroid
EAB	0-2	4.1×10^{-2}	1.9	1.94×10^{-1}	8.0×10^{-1}	3.7×10^1
LPZ	0-8	1.0×10^{-2}	3.1×10^{-1}	9.94×10^{-2}	9.9×10^{-2}	3.1
	8-24	8.0×10^{-3}	2.0×10^{-1}	1.05×10^{-1}	8.4×10^{-2}	2.1
	24-96	1.1×10^{-2}	7.9×10^{-1}	1.25×10^{-1}	1.4×10^{-1}	9.9
	96-720	9.0×10^{-3}	1.1	1.60×10^{-1}	1.4×10^{-1}	1.8×10^1
	Total	3.8×10^{-2}	2.4	—	4.7×10^{-1}	3.3×10^1
Limit	—	—	—	—	25	300

Reference: ABWR DCD Rev. 4 (15.5-9)

Table 15.1-50
Activity Releases for ABWR Cleanup Water Line Break

Isotope	Activity Release (MBq)
I-131	8.1×10^4
I-132	1.9×10^5
I-133	2.3×10^5
I-134	3.2×10^5
I-135	2.5×10^5

Reference: ABWR DCD Rev. 4 (15.5-9)

Table 15.1-51
Doses for ABWR Cleanup Water Line Break

Location	Time (hr)	DCD Dose (Sv)		X/Q Ratio	Site Dose (rem)	
		W. Body	Thyroid	Site to DCD	W. Body	Thyroid
EAB	0-2	2.8×10^{-3}	3.0×10^{-1}	1.16×10^{-2}	3.3×10^{-3}	3.5×10^{-1}
LPZ	0-8	—	—	6.77×10^{-4}	1.9×10^{-4}	2.0×10^{-2}
Limit	—	—	—	—	25	300

Reference: ABWR DCD Rev. 4 (15.5-9)

**Table 15.1-52
 Activity Releases for ABWR Fuel Handling Accident**

Isotope	Activity Release (MBq)			
	1 min	10 min	1 hr	2 hr
I-131	2.85×10^5	2.56×10^6	4.55×10^6	4.55×10^6
I-132	3.67×10^5	3.22×10^6	5.62×10^6	5.62×10^6
I-133	2.95×10^5	2.64×10^6	4.70×10^6	4.70×10^6
I-134	1.60×10^{-2}	1.36×10^{-1}	2.28×10^{-1}	2.28×10^{-1}
I-135	4.85×10^4	4.29×10^5	7.62×10^5	7.62×10^5
Total	9.96×10^5	8.85×10^6	1.56×10^7	1.56×10^7
Kr-83m	1.52×10^4	1.32×10^5	2.33×10^5	2.38×10^5
Kr-85m	1.94×10^5	1.72×10^6	3.08×10^6	3.16×10^6
Kr-85	1.05×10^6	9.47×10^6	1.72×10^7	1.77×10^7
Kr-87	3.00×10^1	2.59×10^2	4.51×10^2	4.55×10^2
Kr-88	5.62×10^4	4.92×10^5	8.81×10^5	8.99×10^5
Kr-89	6.55×10^{-7}	2.77×10^{-6}	3.01×10^{-6}	3.01×10^{-6}
Xe-131m	1.84×10^5	1.65×10^6	3.00×10^6	3.09×10^6
Xe-133m	2.44×10^6	2.18×10^7	3.96×10^7	4.07×10^7
Xe-133	6.22×10^7	5.59×10^8	1.01×10^9	1.04×10^9
Xe-135m	7.25×10^5	5.44×10^6	8.18×10^6	8.18×10^6
Xe-135	1.42×10^7	1.27×10^8	2.29×10^8	2.36×10^8
Xe-137	1.45×10^{-6}	6.77×10^{-6}	7.66×10^{-6}	7.66×10^{-6}
Xe-138	1.46×10^{-6}	1.07×10^{-5}	1.59×10^{-5}	1.59×10^{-5}

Reference: ABWR DCD Rev. 4 (15.5-9)

**Table 15.1-53
 Doses for ABWR Fuel Handling Accident**

Location	Time (hr)	DCD Dose (Sv)		X/Q Ratio	Site Dose (rem)	
		W. Body	Thyroid		W. Body	Thyroid
EAB	0-2	1.2×10^{-2}	7.5×10^{-1}	1.94×10^{-1}	2.3×10^{-1}	1.5×10^1
LPZ	0-8	—	—	1.13×10^{-2}	1.4×10^{-2}	8.5×10^{-1}
Limit	—	—	—	—	6	75

Reference: ABWR DCD Rev. 4 (15.5-9)

Table 15.1-54
Activity Releases for ESBWR Main Steam Line Break

Isotope	Activity Release (Ci)	
	Equilibrium Iodine	Pre-Incident Iodine
Co-58	8.95×10^{-3}	8.95×10^{-3}
Co-60	1.79×10^{-2}	1.79×10^{-2}
Kr-85	9.48×10^{-4}	9.48×10^{-4}
Kr-85m	2.42×10^{-1}	2.42×10^{-1}
Kr-87	7.84×10^{-1}	7.84×10^{-1}
Kr-88	7.84×10^{-1}	7.84×10^{-1}
Sr-89	4.11×10^{-2}	4.11×10^{-2}
Sr-90	2.85×10^{-3}	2.85×10^{-3}
Sr-91	1.59	1.59
Sr-92	3.60	3.60
Y-90	2.85×10^{-3}	2.85×10^{-3}
Y-91	1.68×10^{-2}	1.68×10^{-2}
Y-92	2.18	2.18
Y-93	1.59	1.59
Zr-95	3.27×10^{-3}	3.27×10^{-3}
Nb-95	3.27×10^{-3}	3.27×10^{-3}
Mo-99	8.13×10^{-1}	8.13×10^{-1}
Tc-99m	8.13×10^{-1}	8.13×10^{-1}
Ru-103	8.21×10^{-3}	8.21×10^{-3}
Ru-106	1.26×10^{-3}	1.26×10^{-3}
Te-129m	1.68×10^{-2}	1.68×10^{-2}
Te-131m	4.02×10^{-2}	4.02×10^{-2}
Te-132	4.11×10^{-3}	4.11×10^{-3}
I-131	1.55	3.10×10^1
I-132	1.08×10^1	2.15×10^2
I-133	1.01×10^1	2.02×10^2
I-134	1.68×10^1	3.36×10^2
I-135	1.35×10^1	2.69×10^2
Xe-133	3.29×10^{-1}	3.29×10^{-1}
Xe-135	9.10×10^{-1}	9.10×10^{-1}
Cs-134	1.09×10^{-2}	1.09×10^{-2}
Cs-136	7.37×10^{-3}	7.37×10^{-3}
Cs-137	2.93×10^{-2}	2.93×10^{-2}
Ba-140	1.68×10^{-1}	1.68×10^{-1}
La-140	1.68×10^{-1}	1.68×10^{-1}
Ce-141	1.26×10^{-2}	1.26×10^{-2}
Ce-144	1.26×10^{-3}	1.26×10^{-3}
Np-239	3.27	3.27

Reference: ESBWR DCD Rev. 6 (15.5-10)

Table 15.1-55
Doses for ESBWR Main Steam Line Break with Pre-Incident Iodine Spike

Location	Time (hr)	DCD Dose (rem TEDE)	X/Q Ratio (Site to DCD)	Site Dose (rem TEDE)
EAB	0–2	2.6	1.33×10^{-1}	3.5×10^{-1}
LPZ	0–8	2.0×10^{-1}	8.16×10^{-2}	1.6×10^{-2}
Limit	—	—	—	25

Reference: ESBWR DCD Rev. 6 (15.5-10)

Table 15.1-56
Doses for ESBWR Main Steam Line Break with Equilibrium Iodine Activity

Location	Time (hr)	DCD Dose (rem TEDE)	X/Q Ratio (Site to DCD)	Site Dose (rem TEDE)
EAB	0–2	2.0×10^{-1}	1.33×10^{-1}	2.7×10^{-2}
LPZ	0–8	1.0×10^{-1}	8.16×10^{-2}	8.2×10^{-3}
Limit	—	—	—	2.5

Reference: ESBWR DCD Rev. 6 (15.5-10)

Table 15.1-57
Activity Releases from ESBWR Feedwater Line Break

Isotope	Activity Release (Ci)	
	Equilibrium Iodine	Pre-Incident Spike
I-131	1.08×10^1	2.16×10^2
I-132	7.50×10^1	1.50×10^3
I-133	7.03×10^1	1.41×10^3
I-134	1.17×10^2	2.34×10^3
I-135	9.37×10^1	1.87×10^3
Cs-134	7.75×10^{-2}	7.75×10^{-2}
Cs-136	5.25×10^{-2}	5.25×10^{-2}
Cs-137	2.09×10^{-1}	2.09×10^{-1}
Co-58	6.37×10^{-2}	6.37×10^{-2}
Co-60	1.27×10^{-1}	1.27×10^{-1}
Sr-89	2.92×10^{-1}	2.92×10^{-1}
Sr-90	2.03×10^{-2}	2.03×10^{-2}
Y-90	2.03×10^{-2}	2.03×10^{-2}
Sr-91	1.13×10^1	1.13×10^1
Sr-92	2.56×10^1	2.56×10^1
Y-91	1.19×10^{-1}	1.19×10^{-1}
Y-92	1.55×10^1	1.55×10^1
Y-93	1.13×10^1	1.13×10^1
Zr-95	2.33×10^{-2}	2.33×10^{-2}
Nb-95	2.33×10^{-2}	2.33×10^{-2}
Mo-99	5.78	5.78
Tc-99m	5.78	5.78
Ru-103	5.84×10^{-2}	5.84×10^{-2}
Ru-106	8.94×10^{-3}	8.94×10^{-3}
Te-129m	1.19×10^{-1}	1.19×10^{-1}
Te-131m	2.86×10^{-1}	2.86×10^{-1}
Te-132	2.92×10^{-2}	2.92×10^{-2}
Ba-140	1.19	1.19
La-140	1.19	1.19
Ce-141	8.94×10^{-2}	8.94×10^{-2}
Ce-144	8.94×10^{-3}	8.94×10^{-3}
Np-239	2.33×10^1	2.33×10^1

Reference: ESBWR DCD Rev. 6 (15.5-10)

Table 15.1-58
Doses for ESBWR Feedwater Line Break Line Break with Pre-Incident Iodine Spike

Location	Time (hr)	DCD Dose (rem TEDE)	X/Q Ratio (Site to DCD)	Site Dose (rem TEDE)
EAB	0–2	1.8×10^1	1.33×10^{-1}	2.4
LPZ	0–8	1.7	8.16×10^{-2}	1.4×10^{-1}
Limit	—	—	—	25

Reference: ESBWR DCD Rev. 6 (15.5-10)

Table 15.1-59
Doses for ESBWR Feedwater Line Break with Equilibrium Iodine Activity

Location	Time (hr)	DCD Dose (rem TEDE)	X/Q Ratio (Site to DCD)	Site Dose (rem TEDE)
EAB	0–2	1.1	1.33×10^{-1}	1.5×10^{-1}
LPZ	0–8	1.0×10^{-1}	8.16×10^{-2}	8.2×10^{-3}
Limit	—	—	—	2.5

Reference: ESBWR DCD Rev. 6 (15.5-10)

Table 15.1-60
Activity Releases for ESBWR Small Break Outside Containment
with Pre-Incident Iodine Spike

Isotope	Activity Release (Ci)				
	0.5 hr	1 hr	2 hr	4 hr	6 hr
Co-58	4.32 x 10 ⁻⁴	6.91 x 10 ⁻⁴	1.21 x 10 ⁻³	1.90 x 10 ⁻³	1.96 x 10 ⁻³
Co-60	8.64 x 10 ⁻⁴	1.38 x 10 ⁻³	2.42 x 10 ⁻³	3.81 x 10 ⁻³	3.93 x 10 ⁻³
Sr-89	1.98 x 10 ⁻³	3.17 x 10 ⁻³	5.55 x 10 ⁻³	8.74 x 10 ⁻³	9.02 x 10 ⁻³
Sr-90	1.38 x 10 ⁻⁴	2.20 x 10 ⁻⁴	3.85 x 10 ⁻⁴	6.06 x 10 ⁻⁴	6.26 x 10 ⁻⁴
Sr-91	7.69 x 10 ⁻²	1.23 x 10 ⁻¹	2.15 x 10 ⁻¹	3.39 x 10 ⁻¹	3.50 x 10 ⁻¹
Sr-92	1.74 x 10 ⁻¹	2.78 x 10 ⁻¹	4.87 x 10 ⁻¹	7.67 x 10 ⁻¹	7.91 x 10 ⁻¹
Y-90	1.38 x 10 ⁻⁴	2.20 x 10 ⁻⁴	3.85 x 10 ⁻⁴	6.06 x 10 ⁻⁴	6.26 x 10 ⁻⁴
Y-91	8.09 x 10 ⁻⁴	1.29 x 10 ⁻³	2.26 x 10 ⁻³	3.57 x 10 ⁻³	3.68 x 10 ⁻³
Y-92	1.05 x 10 ⁻¹	1.68 x 10 ⁻¹	2.94 x 10 ⁻¹	4.64 x 10 ⁻¹	4.78 x 10 ⁻¹
Y-93	7.69 x 10 ⁻²	1.23 x 10 ⁻¹	2.15 x 10 ⁻¹	3.39 x 10 ⁻¹	3.50 x 10 ⁻¹
Zr-95	1.58 x 10 ⁻⁴	2.52 x 10 ⁻⁴	4.42 x 10 ⁻⁴	6.95 x 10 ⁻⁴	7.18 x 10 ⁻⁴
Nb-95	1.58 x 10 ⁻⁴	2.52 x 10 ⁻⁴	4.42 x 10 ⁻⁴	6.95 x 10 ⁻⁴	7.18 x 10 ⁻⁴
Mo-99	3.93 x 10 ⁻²	6.28 x 10 ⁻²	1.10 x 10 ⁻¹	1.73 x 10 ⁻¹	1.78 x 10 ⁻¹
Tc-99m	3.93 x 10 ⁻²	6.28 x 10 ⁻²	1.10 x 10 ⁻¹	1.73 x 10 ⁻¹	1.78 x 10 ⁻¹
Ru-103	3.97 x 10 ⁻⁴	6.34 x 10 ⁻⁴	1.11 x 10 ⁻³	1.75 x 10 ⁻³	1.80 x 10 ⁻³
Ru-106	6.07 x 10 ⁻⁵	9.71 x 10 ⁻⁵	1.70 x 10 ⁻⁴	2.67 x 10 ⁻⁴	2.76 x 10 ⁻⁴
Te-129m	8.09 x 10 ⁻⁴	1.29 x 10 ⁻³	2.26 x 10 ⁻³	3.57 x 10 ⁻³	3.68 x 10 ⁻³
Te-131m	1.94 x 10 ⁻³	3.11 x 10 ⁻³	5.44 x 10 ⁻³	8.56 x 10 ⁻³	8.83 x 10 ⁻³
Te-132	1.98 x 10 ⁻⁴	3.17 x 10 ⁻⁴	5.55 x 10 ⁻⁴	8.74 x 10 ⁻⁴	9.02 x 10 ⁻⁴
I-131	1.46	2.34	4.09	6.44	6.65
I-132	1.02 x 10 ¹	1.63 x 10 ¹	2.85 x 10 ¹	4.48 x 10 ¹	4.63 x 10 ¹
I-133	9.54	1.53 x 10 ¹	2.67 x 10 ¹	4.20 x 10 ¹	4.34 x 10 ¹
I-134	1.59 x 10 ¹	2.54 x 10 ¹	4.45 x 10 ¹	7.01 x 10 ¹	7.23 x 10 ¹
I-135	1.27 x 10 ¹	2.03 x 10 ¹	3.56 x 10 ¹	5.60 x 10 ¹	5.78 x 10 ¹
Cs-134	5.26 x 10 ⁻⁴	8.41 x 10 ⁻⁴	1.47 x 10 ⁻³	2.32 x 10 ⁻³	2.39 x 10 ⁻³
Cs-136	3.56 x 10 ⁻⁴	5.70 x 10 ⁻⁴	9.96 x 10 ⁻⁴	1.57 x 10 ⁻³	1.62 x 10 ⁻³
Cs-137	1.42 x 10 ⁻³	2.27 x 10 ⁻³	3.96 x 10 ⁻³	6.24 x 10 ⁻³	6.44 x 10 ⁻³
Ba-140	8.09 x 10 ⁻³	1.29 x 10 ⁻²	2.26 x 10 ⁻²	3.57 x 10 ⁻²	3.68 x 10 ⁻²
La-140	8.09 x 10 ⁻³	1.29 x 10 ⁻²	2.26 x 10 ⁻²	3.57 x 10 ⁻²	3.68 x 10 ⁻²
Ce-141	6.07 x 10 ⁻⁴	9.71 x 10 ⁻⁴	1.70 x 10 ⁻³	2.67 x 10 ⁻³	2.76 x 10 ⁻³
Ce-144	6.07 x 10 ⁻⁵	9.71 x 10 ⁻⁵	1.70 x 10 ⁻⁴	2.67 x 10 ⁻⁴	2.76 x 10 ⁻⁴
Np-239	1.58 x 10 ⁻¹	2.52 x 10 ⁻¹	4.42 x 10 ⁻¹	6.95 x 10 ⁻¹	7.18 x 10 ⁻¹

Reference: ESBWR DCD Rev. 6 (15.5-10)

Table 15.1-61
Doses for ESBWR Small Break Outside Containment with Pre-Incident Iodine Spike

Location	Time (hr)	DCD Dose (rem TEDE)	X/Q Ratio (Site to DCD)	Site Dose (rem TEDE)
EAB	0–2	3.4×10^{-1}	1.33×10^{-1}	4.5×10^{-2}
LPZ	0–720	1.0×10^{-1}	8.16×10^{-2}	8.2×10^{-3}
Limit	—	—	—	25

Reference: ESBWR DCD Rev. 6 (15.5-10)

Note: Although the DCD indicates that the LPZ dose extends to 720 hr, it does not provide the dose as a function of time. The site LPZ dose is estimated by multiplying the total DCD dose by the maximum X/Q ratio from [Table 15.1-4](#).

Table 15.1-62
Activity Releases for ESBWR Small Break Outside Containment
with Pre-Incident Iodine Spike

Isotope	Activity Release (Ci)				
	0.5 hr	1 hr	2 hr	4 hr	6 hr
Co-58	4.32 x 10 ⁻⁴	6.91 x 10 ⁻⁴	1.21 x 10 ⁻³	1.90 x 10 ⁻³	1.96 x 10 ⁻³
Co-60	8.64 x 10 ⁻⁴	1.38 x 10 ⁻³	2.42 x 10 ⁻³	3.81 x 10 ⁻³	3.93 x 10 ⁻³
Sr-89	1.98 x 10 ⁻³	3.17 x 10 ⁻³	5.55 x 10 ⁻³	8.74 x 10 ⁻³	9.02 x 10 ⁻³
Sr-90	1.38 x 10 ⁻⁴	2.20 x 10 ⁻⁴	3.85 x 10 ⁻⁴	6.06 x 10 ⁻⁴	6.26 x 10 ⁻⁴
Sr-91	7.69 x 10 ⁻²	1.23 x 10 ⁻¹	2.15 x 10 ⁻¹	3.39 x 10 ⁻¹	3.50 x 10 ⁻¹
Sr-92	1.74 x 10 ⁻¹	2.78 x 10 ⁻¹	4.87 x 10 ⁻¹	7.67 x 10 ⁻¹	7.91 x 10 ⁻¹
Y-90	1.38 x 10 ⁻⁴	2.20 x 10 ⁻⁴	3.85 x 10 ⁻⁴	6.06 x 10 ⁻⁴	6.26 x 10 ⁻⁴
Y-91	8.09 x 10 ⁻⁴	1.29 x 10 ⁻³	2.26 x 10 ⁻³	3.57 x 10 ⁻³	3.68 x 10 ⁻³
Y-92	1.05 x 10 ⁻¹	1.68 x 10 ⁻¹	2.94 x 10 ⁻¹	4.64 x 10 ⁻¹	4.78 x 10 ⁻¹
Y-93	7.69 x 10 ⁻²	1.23 x 10 ⁻¹	2.15 x 10 ⁻¹	3.39 x 10 ⁻¹	3.50 x 10 ⁻¹
Zr-95	1.58 x 10 ⁻⁴	2.52 x 10 ⁻⁴	4.42 x 10 ⁻⁴	6.95 x 10 ⁻⁴	7.18 x 10 ⁻⁴
Nb-95	1.58 x 10 ⁻⁴	2.52 x 10 ⁻⁴	4.42 x 10 ⁻⁴	6.95 x 10 ⁻⁴	7.18 x 10 ⁻⁴
Mo-99	3.93 x 10 ⁻²	6.28 x 10 ⁻²	1.10 x 10 ⁻¹	1.73 x 10 ⁻¹	1.78 x 10 ⁻¹
Tc-99m	3.93 x 10 ⁻²	6.28 x 10 ⁻²	1.10 x 10 ⁻¹	1.73 x 10 ⁻¹	1.78 x 10 ⁻¹
Ru-103	3.97 x 10 ⁻⁴	6.34 x 10 ⁻⁴	1.11 x 10 ⁻³	1.75 x 10 ⁻³	1.80 x 10 ⁻³
Ru-106	6.07 x 10 ⁻⁵	9.71 x 10 ⁻⁵	1.70 x 10 ⁻⁴	2.67 x 10 ⁻⁴	2.76 x 10 ⁻⁴
Te-129m	8.09 x 10 ⁻⁴	1.29 x 10 ⁻³	2.26 x 10 ⁻³	3.57 x 10 ⁻³	3.68 x 10 ⁻³
Te-131m	1.94 x 10 ⁻³	3.11 x 10 ⁻³	5.44 x 10 ⁻³	8.56 x 10 ⁻³	8.83 x 10 ⁻³
Te-132	1.98 x 10 ⁻⁴	3.17 x 10 ⁻⁴	5.55 x 10 ⁻⁴	8.74 x 10 ⁻⁴	9.02 x 10 ⁻⁴
I-131	7.31 x 10 ⁻²	1.17 x 10 ⁻¹	2.05 x 10 ⁻¹	3.22 x 10 ⁻¹	3.33 x 10 ⁻¹
I-132	5.09 x 10 ⁻¹	8.14 x 10 ⁻¹	1.42	2.24	2.31
I-133	4.77 x 10 ⁻¹	7.63 x 10 ⁻¹	1.33	2.10	2.17
I-134	7.95 x 10 ⁻¹	1.27	2.22	3.50	3.61
I-135	6.36 x 10 ⁻¹	1.02	1.78	2.80	2.89
Cs-134	5.26 x 10 ⁻⁴	8.41 x 10 ⁻⁴	1.47 x 10 ⁻³	2.32 x 10 ⁻³	2.39 x 10 ⁻³
Cs-136	3.56 x 10 ⁻⁴	5.70 x 10 ⁻⁴	9.96 x 10 ⁻⁴	1.57 x 10 ⁻³	1.62 x 10 ⁻³
Cs-137	1.42 x 10 ⁻³	2.27 x 10 ⁻³	3.96 x 10 ⁻³	6.24 x 10 ⁻³	6.44 x 10 ⁻³
Ba-140	8.09 x 10 ⁻³	1.29 x 10 ⁻²	2.26 x 10 ⁻²	3.57 x 10 ⁻²	3.68 x 10 ⁻²
La-140	8.09 x 10 ⁻³	1.29 x 10 ⁻²	2.26 x 10 ⁻²	3.57 x 10 ⁻²	3.68 x 10 ⁻²
Ce-141	6.07 x 10 ⁻⁴	9.71 x 10 ⁻⁴	1.70 x 10 ⁻³	2.67 x 10 ⁻³	2.76 x 10 ⁻³
Ce-144	6.07 x 10 ⁻⁵	9.71 x 10 ⁻⁵	1.70 x 10 ⁻⁴	2.67 x 10 ⁻⁴	2.76 x 10 ⁻⁴
Np-239	1.58 x 10 ⁻¹	2.52 x 10 ⁻¹	4.42 x 10 ⁻¹	6.95 x 10 ⁻¹	7.18 x 10 ⁻¹

Reference: ESBWR DCD Rev. 6 (15.5-10)

Table 15.1-63
Doses for ESBWR Small Break Outside Containment with Equilibrium Iodine Activity

Location	Time (hr)	DCD Dose (rem TEDE)	X/Q Ratio (Site to DCD)	Site Dose (rem TEDE)
EAB	0–2	1.0×10^{-1}	1.33×10^{-1}	1.3×10^{-2}
LPZ	0–720	1.0×10^{-1}	8.16×10^{-2}	8.2×10^{-3}
Limit	—	—	—	2.5

Reference: ESBWR DCD Rev. 6 (15.5-10)

Note: Although the DCD indicates that the LPZ dose extends to 720 hr, it does not provide the dose as a function of time. The site LPZ dose is estimated by multiplying the total DCD dose by the maximum X/Q ratio from [Table 15.1-4](#).

Table 15.1-64
Activity Releases for ESBWR Cleanup Water Line Break

Isotope	Activity Release (Ci)	
	Equilibrium Iodine	Pre-Incident Spike
I-131	4.10	8.21 x 10 ¹
I-132	2.85 x 10 ¹	5.71 x 10 ²
I-133	2.68 x 10 ¹	5.35 x 10 ²
I-134	4.46 x 10 ¹	8.92 x 10 ²
I-135	3.57 x 10 ¹	7.14 x 10 ²
Cs-134	2.95 x 10 ⁻²	2.95 x 10 ⁻²
Cs-136	2.00 x 10 ⁻²	2.00 x 10 ⁻²
Cs-137	7.95 x 10 ⁻²	7.95 x 10 ⁻²
Co-58	2.42 x 10 ⁻²	2.42 x 10 ⁻²
Co-60	4.85 x 10 ⁻²	4.85 x 10 ⁻²
Sr-89	1.11 x 10 ⁻¹	1.11 x 10 ⁻¹
Sr-90	7.72 x 10 ⁻³	7.72 x 10 ⁻³
Y-90	7.72 x 10 ⁻³	7.72 x 10 ⁻³
Sr-91	4.31	4.31
Sr-92	9.76	9.76
Y-91	4.54 x 10 ⁻²	4.54 x 10 ⁻²
Y-92	5.90	5.90
Y-93	4.31	4.31
Zr-95	8.86 x 10 ⁻³	8.86 x 10 ⁻³
Nb-95	8.86 x 10 ⁻³	8.86 x 10 ⁻³
Mo-99	2.20	2.20
Tc-99m	2.20	2.20
Ru-103	2.23 x 10 ⁻²	2.23 x 10 ⁻²
Ru-106	3.41 x 10 ⁻³	3.41 x 10 ⁻³
Te-129m	4.54 x 10 ⁻²	4.54 x 10 ⁻²
Te-131m	1.09 x 10 ⁻¹	1.09 x 10 ⁻¹
Te-132	1.11 x 10 ⁻²	1.11 x 10 ⁻²
Ba-140	4.54 x 10 ⁻¹	4.54 x 10 ⁻¹
La-140	4.54 x 10 ⁻¹	4.54 x 10 ⁻¹
Ce141	3.41 x 10 ⁻²	3.41 x 10 ⁻²
Ce-144	3.41 x 10 ⁻³	3.41 x 10 ⁻³
Np-239	8.86	8.86

Reference: ESBWR DCD Rev. 6 (15.5-10)

Table 15.1-65
Doses for ESBWR Cleanup Water Line Break with Pre-Incident Iodine Spike

Location	Time (hr)	DCD Dose (rem TEDE)	X/Q Ratio (Site to DCD)	Site Dose (rem TEDE)
EAB	0–2	6.9	1.33×10^{-1}	9.2×10^{-1}
LPZ	0–8	7.0×10^{-1}	8.16×10^{-2}	5.7×10^{-2}
Limit	—	—	—	25

Reference: ESBWR DCD Rev. 6 (15.5-10)

Table 15.1-66
Doses for ESBWR Cleanup Water Line Break with Equilibrium Iodine Activity

Location	Time (hr)	DCD Dose (rem TEDE)	X/Q Ratio (Site to DCD)	Site Dose (rem TEDE)
EAB	0–2	4.0×10^{-1}	1.33×10^{-1}	5.3×10^{-2}
LPZ	0–8	1.0×10^{-1}	8.16×10^{-2}	8.2×10^{-3}
Limit	—	—	—	2.5

Reference: ESBWR DCD Rev. 6 (15.5-10)

Table 15.1-67 (Sheet 1 of 2)
Integrated Activity Releases for ESBWR Loss-of-Coolant Accident

Isotope	Activity Release (Ci)								
	0.5 hr	2 hr	8 hr	12 hr	24 hr	72 hr	96 hr	168 hr	720 hr
Co-58	0	8.0×10^{-3}	6.7×10^{-2}	1.0×10^{-1}	1.8×10^{-1}	3.0×10^{-1}	3.3×10^{-1}	4.0×10^{-1}	7.6×10^{-1}
Co-60	0	1.9×10^{-2}	1.6×10^{-1}	2.4×10^{-1}	4.2×10^{-1}	7.2×10^{-1}	7.9×10^{-1}	9.5×10^{-1}	2.0
Kr-85	1.7×10^{-1}	1.5×10^1	3.6×10^2	8.0×10^2	2.9×10^3	1.8×10^4	2.7×10^4	5.9×10^4	3.5×10^5
Kr-85m	3.2	2.3×10^2	3.1×10^3	5.0×10^3	7.5×10^3	8.2×10^3	8.2×10^3	8.2×10^3	8.2×10^3
Kr-87	5.2	2.4×10^2	1.1×10^3	1.2×10^3	1.2×10^3	1.2×10^3	1.2×10^3	1.2×10^3	1.2×10^3
Kr-88	8.3	5.4×10^2	5.5×10^3	7.5×10^3	9.1×10^3	9.2×10^3	9.2×10^3	9.2×10^3	9.2×10^3
Rb-86	1.3×10^{-2}	2.8×10^{-1}	2.1	3.1	5.3	8.9	9.7	1.1×10^1	1.8×10^1
Sr-89	0	8.9	7.4×10^1	1.1×10^2	2.0×10^2	3.4×10^2	3.7×10^2	4.4×10^2	8.2×10^2
Sr-90	0	1.0	8.4	1.3×10^1	2.2×10^1	3.8×10^1	4.2×10^1	5.1×10^1	1.1×10^2
Sr-91	0	1.0×10^1	6.8×10^1	9.1×10^1	1.2×10^2	1.3×10^2	1.3×10^2	1.3×10^2	1.3×10^2
Sr-92	0	8.3	3.6×10^1	4.0×10^1	4.1×10^1	4.2×10^1	4.2×10^1	4.2×10^1	4.2×10^1
Y-90	0	1.6×10^{-2}	3.8×10^{-1}	8.0×10^{-1}	2.5	8.4	1.1×10^1	1.7×10^1	7.0×10^1
Y-91	0	1.2×10^{-1}	1.0	1.5	2.8	5.1	5.6	6.8	1.3×10^1
Y-92	0	9.7×10^{-1}	1.9×10^1	2.8×10^1	3.6×10^1	3.7×10^1	3.7×10^1	3.7×10^1	3.7×10^1
Y-93	0	1.3×10^{-1}	8.7×10^{-1}	1.2	1.6	1.7	1.7	1.7	1.7
Zr-95	0	1.7×10^{-1}	1.4	2.1	3.7	6.4	7.0	8.4	1.6×10^1
Zr-97	0	1.6×10^{-1}	1.2	1.7	2.5	3.1	3.1	3.1	3.1
Nb-95	0	1.7×10^{-1}	1.4	2.1	3.8	6.5	7.1	8.6	1.7×10^1
Mo-99	0	2.2	1.8×10^1	2.6×10^1	4.4×10^1	6.7×10^1	7.1×10^1	7.6×10^1	8.0×10^1
Tc-99m	0	2.0	1.7×10^1	2.5×10^1	4.2×10^1	6.6×10^1	7.0×10^1	7.5×10^1	7.9×10^1
Ru-103	0	1.8	1.5×10^1	2.3×10^1	4.0×10^1	6.9×10^1	7.5×10^1	8.9×10^1	1.6×10^2
Ru-105	0	1.0	5.4	6.6	7.4	7.5	7.5	7.5	7.5
Ru-106	0	6.9×10^{-1}	5.8	8.7	1.5×10^1	2.6×10^1	2.9×10^1	3.5×10^1	7.1×10^1
Rh-105	0	1.1	9.4	1.4×10^1	2.3×10^1	3.2×10^1	3.3×10^1	3.4×10^1	3.4×10^1
Sb-127	0	2.5	2.0×10^1	3.0×10^1	5.2×10^1	8.2×10^1	8.7×10^1	9.5×10^1	1.0×10^2
Sb-129	0	6.0	3.2×10^1	3.9×10^1	4.3×10^1	4.4×10^1	4.4×10^1	4.4×10^1	4.4×10^1
Te-127	0	2.5	2.1×10^1	3.1×10^1	5.4×10^1	8.7×10^1	9.3×10^1	1.0×10^2	1.3×10^2
Te-127m	0	3.4×10^{-1}	2.8	4.3	7.6	1.3×10^1	1.4×10^1	1.7×10^1	3.5×10^1
Te-129	0	6.6	4.0×10^1	5.0×10^1	6.5×10^1	8.1×10^1	8.4×10^1	9.1×10^1	1.3×10^2
Te-129m	0	1.1	9.3	1.4×10^1	2.5×10^1	4.2×10^1	4.6×10^1	5.5×10^1	9.7×10^1
Te-131m	0	3.3	2.6×10^1	3.7×10^1	5.9×10^1	8.0×10^1	8.2×10^1	8.4×10^1	8.4×10^1
Te-132	0	3.3×10^1	2.7×10^2	4.0×10^2	6.7×10^2	1.0×10^3	1.1×10^3	1.2×10^3	1.3×10^3
I-131	5.8	1.5×10^2	1.1×10^3	1.6×10^3	2.8×10^3	5.1×10^3	5.7×10^3	7.1×10^3	1.1×10^4
I-132	8.0	1.9×10^2	8.5×10^2	1.0×10^3	1.4×10^3	1.8×10^3	1.9×10^3	2.1×10^3	2.2×10^3

Table 15.1-67 (Sheet 2 of 2)
Integrated Activity Releases for ESBWR Loss-of-Coolant Accident

Isotope	Activity Release (Ci)								
	0.5 hr	2 hr	8 hr	12 hr	24 hr	72 hr	96 hr	168 hr	720 hr
I-133	1.2 x 10 ¹	2.8 x 10 ²	1.9 x 10 ³	2.7 x 10 ³	4.2 x 10 ³	5.5 x 10 ³	5.6 x 10 ³	5.7 x 10 ³	5.7 x 10 ³
I-134	9.9	1.1 x 10 ²	2.0 x 10 ²	2.1 x 10 ²	2.1 x 10 ²	2.1 x 10 ²	2.1 x 10 ²	2.1 x 10 ²	2.1 x 10 ²
I-135	1.1 x 10 ¹	2.4 x 10 ²	1.3 x 10 ³	1.7 x 10 ³	2.1 x 10 ³	2.2 x 10 ³	2.2 x 10 ³	2.2 x 10 ³	2.2 x 10 ³
Xe-133	2.6 x 10 ¹	2.2 x 10 ³	5.2 x 10 ⁴	1.2 x 10 ⁵	4.0 x 10 ⁵	2.1 x 10 ⁶	2.9 x 10 ⁶	5.2 x 10 ⁶	1.1 x 10 ⁷
Xe-135	9.4	8.2 x 10 ²	1.6 x 10 ⁴	3.0 x 10 ⁴	6.5 x 10 ⁴	1.0 x 10 ⁵	1.0 x 10 ⁵	1.0 x 10 ⁵	1.0 x 10 ⁵
Cs-134	1.2	2.7 x 10 ¹	2.0 x 10 ²	2.9 x 10 ²	5.1 x 10 ²	8.7 x 10 ²	9.6 x 10 ²	1.1 x 10 ³	2.3 x 10 ³
Cs-136	4.1 x 10 ⁻¹	8.7	6.3 x 10 ¹	9.4 x 10 ¹	1.6 x 10 ²	2.7 x 10 ²	2.9 x 10 ²	3.4 x 10 ²	5.0 x 10 ²
Cs-137	7.9 x 10 ⁻¹	1.7 x 10 ¹	1.2 x 10 ²	1.9 x 10 ²	3.3 x 10 ²	5.6 x 10 ²	6.1 x 10 ²	7.3 x 10 ²	1.5 x 10 ³
Ba-139	0	8.2	2.3 x 10 ¹	2.3 x 10 ¹	2.3 x 10 ¹	2.3 x 10 ¹	2.3 x 10 ¹	2.3 x 10 ¹	2.3 x 10 ¹
Ba-140	0	1.6 x 10 ¹	1.4 x 10 ²	2.1 x 10 ²	3.6 x 10 ²	6.0 x 10 ²	6.5 x 10 ²	7.6 x 10 ²	1.1 x 10 ³
La-140	0	3.2 x 10 ⁻¹	8.8	1.9 x 10 ¹	5.9 x 10 ¹	1.9 x 10 ²	2.3 x 10 ²	3.3 x 10 ²	7.4 x 10 ²
La-141	0	1.2 x 10 ⁻¹	6.2 x 10 ⁻¹	7.4 x 10 ⁻¹	8.1 x 10 ⁻¹	8.2 x 10 ⁻¹	8.2 x 10 ⁻¹	8.2 x 10 ⁻¹	8.2 x 10 ⁻¹
La-142	0	7.8 x 10 ⁻²	2.3 x 10 ⁻¹	2.4 x 10 ⁻¹	2.4 x 10 ⁻¹	2.4 x 10 ⁻¹	2.4 x 10 ⁻¹	2.4 x 10 ⁻¹	2.4 x 10 ⁻¹
Ce-141	0	3.9 x 10 ⁻¹	3.3	4.9	8.6	1.5 x 10 ¹	1.6 x 10 ¹	1.9 x 10 ¹	3.4 x 10 ¹
Ce-143	0	3.5 x 10 ⁻¹	2.8	4.0	6.4	8.9	9.1	9.3	9.4
Ce-144	0	3.2 x 10 ⁻¹	2.7	4.0	7.2	1.2 x 10 ¹	1.4 x 10 ¹	1.6 x 10 ¹	3.3 x 10 ¹
Pr-143	0	1.4 x 10 ⁻¹	1.2	1.8	3.2	5.6	6.1	7.3	1.1 x 10 ¹
Nd-147	0	6.3 x 10 ⁻²	5.2 x 10 ⁻¹	7.8 x 10 ⁻¹	1.4	2.3	2.4	2.8	4.0
Np-239	0	4.6	3.7 x 10 ¹	5.4 x 10 ¹	9.1 x 10 ¹	1.4 x 10 ²	1.4 x 10 ²	1.5 x 10 ²	1.6 x 10 ²
Pu-238	0	9.6 x 10 ⁻⁴	8.0 x 10 ⁻³	1.2 x 10 ⁻²	2.1 x 10 ⁻²	3.7 x 10 ⁻²	4.0 x 10 ⁻²	4.9 x 10 ⁻²	1.0 x 10 ⁻¹
Pu-239	0	1.1 x 10 ⁻⁴	8.9 x 10 ⁻⁴	1.3 x 10 ⁻³	2.4 x 10 ⁻³	4.1 x 10 ⁻³	4.5 x 10 ⁻³	5.4 x 10 ⁻³	1.1 x 10 ⁻²
Pu-240	0	1.4 x 10 ⁻⁴	1.2 x 10 ⁻³	1.7 x 10 ⁻³	3.1 x 10 ⁻³	5.3 x 10 ⁻³	5.8 x 10 ⁻³	7.0 x 10 ⁻³	1.5 x 10 ⁻²
Pu-241	0	4.4 x 10 ⁻²	3.7 x 10 ⁻¹	5.6 x 10 ⁻¹	9.8 x 10 ⁻¹	1.7	1.9	2.2	4.6
Am-241	0	2.1 x 10 ⁻⁵	1.8 x 10 ⁻⁴	2.7 x 10 ⁻⁴	4.7 x 10 ⁻⁴	8.2 x 10 ⁻⁴	9.1 x 10 ⁻⁴	1.1 x 10 ⁻³	2.4 x 10 ⁻³
Cm-242	0	5.0 x 10 ⁻³	4.2 x 10 ⁻²	6.3 x 10 ⁻²	1.1 x 10 ⁻¹	1.9 x 10 ⁻¹	2.1 x 10 ⁻¹	2.5 x 10 ⁻¹	5.1 x 10 ⁻¹
Cm-244	0	2.6 x 10 ⁻⁴	2.2 x 10 ⁻³	3.3 x 10 ⁻³	5.8 x 10 ⁻³	1.0 x 10 ⁻²	1.1 x 10 ⁻²	1.3 x 10 ⁻²	2.8 x 10 ⁻²

Reference: ESBWR DCD Rev. 6 (15.5-10)

Table 15.1-68
Doses for ESBWR Loss-of-Coolant Accident

Location	Time (hr)	DCD Dose (rem TEDE)	X/Q Ratio (Site to DCD)	Site Dose (rem TEDE)
EAB	2.3–4.3 ^(a)	2.24×10^1	1.33×10^{-1}	2.98
LPZ	0–8	6.93	8.16×10^{-2}	5.65×10^{-1}
	8–24	4.54	7.21×10^{-2}	3.28×10^{-1}
	24–96	4.72	5.60×10^{-2}	2.64×10^{-1}
	96–720	4.56	3.97×10^{-2}	1.81×10^{-1}
	Total	2.08×10^1	—	1.34
Limit	—	—	—	25

(a) Worst case 2-hour period is 2.3–4.3 hours.

Note: Time-dependent LPZ doses and total LPZ and EAB doses correspond to the radiation doses in DCD Rev. 6 (Reference 15.5-10).

Table 15.1-69
Activity Releases for ESBWR Fuel Handling Accident

Isotope	Activity Release (Ci), 0–2 hr
I-131	1.37×10^2
I-132	7.01×10^{-2}
I-133	8.21×10^1
I-134	5.24×10^{-7}
I-135	1.28×10^1
Kr-85m	9.96×10^1
Kr-85	4.98×10^2
Kr-87	1.07×10^{-2}
Kr-88	2.85×10^1
Xe-133	3.23×10^4
Xe-135	2.01×10^3

Reference: ESBWR DCD Rev. 6 (15.5-10)

Table 15.1-70
Doses for ESBWR Fuel Handling Accident

Location	Time (hr)	DCD Dose (rem TEDE)	X/Q Ratio (Site to DCD)	Site Dose (rem TEDE)
EAB	0–2	4.1	1.33×10^{-1}	5.5×10^{-1}
LPZ	0–8	4.0×10^{-1}	8.16×10^{-2}	3.3×10^{-2}
Limit	—	—	—	6.3

Reference: ESBWR DCD Rev. 6 (15.5-10)