D-1.4.2 Advanced Test Reactor Canal Area

D-1.4.2.1 Radiological Hazardous Material

D-1.4.2.1.1 Properties. The properties for the ATR canal area radiological hazardous material are listed in Table D-19.

Table D-19. Radiological properties for the Advanced Test Reactor canal area.

Physical form	Each ATR fuel element is made up of 19 curved plates covered by an aluminum alloy cladding. The fission products are contained within the fuel matrix in the form of gases, volatile, semi-volatile, or particulate materials. Electromagnetic gamma radiation from activated internal core components.
Particle size	Respirable.
Flammability	Nonflammable.
Reactivity	Not reactive.
Density	N/A.
Special firefighting concerns	None.
Health concerns	Potential acute and latent health effects (cancer or genetic effects) caused by inhalation or ingestion of the fission products.

D-1.4.2.1.2 Conditions of Storage and Use. The ATR canal is used for storing irradiated ATR spent nuclear fuel during a cooldown period before being sent to an irradiated fuel storage facility. The canal is also used to store activated internal components removed from the ATR during reactor outages to refurbish and refuel the reactor.

The ATR core, after operating at 250 mW for 60 days, contains 3.01E+8 Ci of noble gases and volatile fission products. About 8.91E+7 Ci of those fission products are the primary contributors to dose. Multiple core quantities of spent nuclear fuel may be in storage at any given time. Table D-20 provides the fission product MAR.

Table D-20. Material-at-risk for the Advanced Test Reactor canal area.

Isotope	Quantity (Ci)
Kr-85m	2.56E+06
Kr-88	7.32E+06
Xe-133	1.36E+07
Xe-133m	4.11E+05
Cs-134	3.76E+04
Cs-137	4.85E+04
Te-127m	1.36E+04
Te-129m	1.52E+05
Te-132	7.90E+06

Table D-20. (continued).

Isotope	Quantity (Ci)
I-131	5.98E+06
I-132	9.06E+06
I-133	1.38E+07
I-134	1.54E+07
I-135	1.28E+07

Under normal operating conditions, the primary barrier is the fuel element cladding.

The secondary barrier is the canal water.

The emergency fire water supply system for canal make-up water is one of the engineering controls and safety systems.[3]

ATR is operated at 200 mW, which is lower than the maximum 250-mW authorized power level.

The following are some of the instruments or indicators used in the EALs:

- Canal water level alarm system
- Continuous air monitors (CAMs) and remote area monitors (RAMs).

D-1.4.2.1.3 Barrier and Failure Mode Analyses. For the purposes of barrier and failure mode analyses, the accident scenarios are related to the airborne release of radiological material (fission products). The accident scenario types are based on information obtained from SAR-153, Chapter 15. The results of the barrier and failure mode analyses are detailed in the following subsection; Table D-21 summarizes the results. SAR-153 served as the principal references in developing the scenarios.

Table D-21. Radiological failure modes and barriers for the Advanced Test Reactor canal area.

Scenario Release Designator	Material	Primary Barrier	Failure Modes and Causes	Possible Initiating Events and Scenarios	Release From Primary Barrier	Other Barriers and Their Effects
ATRPDS-7	Radioactive fission products	Fuel cladding	Loss of coolant water due to breach of canal wall or floor from dropped cask, falling crane, or seismic event	Dropped cask, falling overhead crane, or seismic event	100% fuel melt	Essentially none, as canal is outside ATR confinement
ATRDLEXP-1	Direct gamma radiation	Experiment transfer shield	Uncoupling of experiment from transfer shield assembly	Failure of coupling mechanism or mishandling	100% gamma radiation	Essentially none
ATRCIC-1	Direct gamma radiation	Transfer shield	Uncoupling of core internal part or equipment from the transfer shield assembly	Failure of coupling mechanism or mishandling	100% gamma radiation	Essentially none

D-1.4.2.1.4 Scenario Bases and Analytical Assumptions

1. Scenario ATRPDS-7, Advanced Test Reactor Canal Drain

Detailed Scenario Description Loss of coolant water due to breach of canal wall or floor due to dropped cask, dropped resin block, falling crane, or seismic event.

Material-at-Risk See Table D-20.

Release Characteristics ATR is assumed to have operated at 250 mW for 60 days, which provides the maximum fission product inventory within the 40 fuel elements that have been removed from the ATR core and placed in the canal for a cooldown period. Irradiated experiments and ATR core internal components contain activation products, which create very high gamma radiation exposure rates (i.e., 1.0E+6 R/hr on contact). The release is assumed to be at ground level and takes place over a 2.5-hour time period.

Airborne Release Fraction 1.00E+0 for noble gases, 1.00E+0 for iodine, 1.00E+0 for cesium, and 1.00E+0 for tellurium (SAR-153, Table 15.12-6, p. 15.12-23 of 15.12-34).

Respirable Fraction 1.0E+0.

Damage Ratio 1.0E+0.

Leak Path Factor 1.0E+0 (factored into SAR-153, Table 15.12-6).

Adjustment Factor N/A (release duration is less than 4 hours).

Source Term The ST shown in Table D-22 was developed according to the following equation:
ST = (MAR × DR × LPF × ARF × RF) × AF.

Modeling Software and Inputs RSAC, Version 6.2. Ground-level release.

Table D-22. Source term for scenario release designator ATRPDS-7.

Nuclide	MAR (Ci)	DR	LPF × RF	ARF	AF[a]	ST (Ci)
Kr-85m	2.56E+06	1.00E+0	1.00E+0	1.00E+0	1.00E+0	2.56E+06
Kr-88	7.32E+06	1.00E+0	1.00E+0	1.00E+0	1.00E+0	7.32E+06
Xe-133	1.36E+07	1.00E+0	1.00E+0	1.00E+0	1.00E+0	1.36E+07
Xe-133m	4.11E+05	1.00E+0	1.00E+0	1.00E+0	1.00E+0	4.11E+05
Cs-134	3.76E+04	1.00E+0	1.00E+0	1.00E+0	1.00E+0	3.76E+04
Cs-137	4.85E+04	1.00E+0	1.00E+0	1.00E+0	1.00E+0	4.85E+04
Te-127m	1.36E+04	1.00E+0	1.00E+0	1.00E+0	1.00E+0	1.36E+04
Te-129m	1.52E+05	1.00E+0	1.00E+0	1.00E+0	1.00E+0	1.52E+05

Table D-22. (continued).

Nuclide	MAR (Ci)	DR	LPF × RF	ARF	AF[a]	ST (Ci)
Te-132	7.90E+06	1.00E+0	1.00E+0	1.00E+0	1.00E+0	7.90E+06
I-131	5.98E+06	1.00E+0	1.00E+0	1.00E+0	1.00E+0	5.98E+06
I-132	9.06E+06	1.00E+0	1.00E+0	1.00E+0	1.00E+0	9.06E+06
I-133	1.38E+07	1.00E+0	1.00E+0	1.00E+0	1.00E+0	1.38E+07
I-134	1.54E+07	1.00E+0	1.00E+0	1.00E+0	1.00E+0	1.54E+07
I-135	1.28E+07	1.00E+0	1.00E+0	1.00E+0	1.00E+0	1.28E+07

a. No adjustment, as the release is assumed to occur over a 2.5-hour time period.

2. Scenario ATRDLEXP-1 and ATRCIC-1, High Gamma Radiation Exposure Rates

Detailed Scenario Description Operational error results in dropped loop experiment or core internal change-out irradiated materials outside of shielded container.

Material-at-Risk Electromagnetic gamma radiation.

Release Characteristics Irradiated experiments and ATR core internal components contain activation products, which create very high gamma radiation exposure rates (i.e., 1.0E+6 R/hr on contact).

Airborne Release Fraction N/A.

Respirable Fraction N/A.

Damage Ratio N/A.

Leak Path Factor N/A.

Adjustment Factor N/A.

Source Term The exposure rate ST is shown in Table D-23.

Modeling Software and Inputs Inverse square law used to calculate exposure rates at a distance.

Table D-23. Advanced Test Reactor dropped loop experiment exposure rates by distance (Scenario ATRDLEXP-1) and Advanced Test Reactor dropped core internal change-out irradiated parts or equipment (Scenario ATRCIC-1).

Distance (m)	Exposure Rate (R/hr)
30	516
68[a]	100
100	46.5
124[b]	30.2
485[c]	1.97
815[d]	7.00E−1
2,865[e]	5.66E−02

a. Threshold for early lethality equivalent.
b. Closest ATR facility boundary.
c. ATR staging area in parking lot.
d. PA distance.
e. Idaho Nuclear Technology and Engineering Center (INTEC).

D-1.4.3 Advanced Test Reactor Critical Facility

D-1.4.3.1 Radiological Hazardous Material

D-1.4.3.1.1 Properties. The properties for the ATRC Facility radiological hazardous material are listed in Table D-24.

Table D-24. Radiological properties for the Advanced Test Reactor Critical Facility.

Physical form	Each ATR fuel element is made up of 19 curved plates covered by an aluminum alloy cladding. The fission products are contained within the fuel matrix in the form of gases, volatile, semi-volatile, or particulate materials. Electromagnetic gamma radiation from activated internal core components.
Particle size	Respirable.
Flammability	Nonflammable.
Reactivity	Not reactive.
Density	N/A.
Special firefighting concerns	None.
Health concerns	Potential acute and latent health effects (cancer or genetic effects) caused by inhalation or ingestion of the fission products.

D-1.4.3.1.2 Conditions of Storage and Use. The ATRC Facility is located in the ATR canal. The ATRC Facility contains 40 low-power irradiated fuel elements. The ATR canal water provides cooling for the ATRC Facility. Non-fuel fissile material is stored in locked cabinets located on the ATRC Facility main floor. Those cabinets are considered a mass criticality storage (MCA) area. Table D-25 provides a listing of the fissile materials and their location.

Table D-25. Advanced Test Reactor Critical Facility bay nominal fissile material inventory.[6]

Fuel Category	Area/Room	Rack, Cabinet, or Core	Fissile Mass (U-235 or Equivalent) (g)
40 fuel elements – U-235	TRA-670/ATRC Facility bay	Canal storage grid or core	1,075 ± 10 g each
Fuel plate bundle	TRA-670/ATRC Facility bay	ATRC Facility storage cabinet or core when assembled	Less than or equal to 1,075 ± 10 g each
Odd lot	TRA-670/ATRC Facility bay	ATRC Facility storage cabinet	Less than or equal to 700 g each
Test train	TRA-670/ATRC Facility bay	ATRC Facility storage cabinet or core	Less than or equal to 365 g each

The primary source of radioactive inventory is the fuel material and fission products within the ATRC Facility fuel element cladding, which is assumed equivalent to reactor operation at 5 kW for 7 days, followed by zero power for 23.4 days, in a cycle that is repeated for 60 years. This power history provides a bounding inventory for all foreseeable operations. The inventory of gaseous and volatile radionuclides is 6.28E+3 Ci and 1.77E+3 Ci contribute the majority of dose. Table D-26 provides the radiological MAR.

Table D-26. Material-at-risk for the Advanced Test Reactor Critical Facility [Engineering Design File (EDF) TRA-ATR-1729[7]].

Isotope	Quantity (Ci)
Kr-85m	5.35E+01
Kr-88	1.11E+02
Xe-133	3.10E+02
Xe-133m	9.41E+00
Cs-134	8.12E−01
Cs-137	1.06E+00
Te-127m	2.68E−01
Te-129m	2.72E+00
Te-132	1.77E+02
I-131	1.16E+02
I-132	1.76E+02
I-133	2.68E+02
I-134	2.98E+02
I-135	2.50E+02

Under normal operating conditions, the primary barrier is the fuel element cladding.

The secondary barrier is the ATR canal water.

The emergency fire water supply system for canal make-up water is one of the engineering controls and safety systems.[6]

The MCA is limited to a maximum of 650 g of fissile material.

The following are some of the instruments or indicators used in the EALs:

- Canal water level alarm system
- CAMs and RAMs
- Log count rate alarm.

D-1.4.3.1.3 Barrier and Failure Mode Analyses. For the purposes of barrier and failure mode analyses, the accident scenarios are related to the airborne release of radiological material (fission products). The accident scenario types are based on information obtained from SAR-192,[6] Chapters 8 and 10. The results of the barrier and failure mode analyses are detailed in the following subsection; Table D-27 summarizes the results. SAR-192 served as the principal references in developing the scenarios.

D-1.4.3.1.4 Scenario Bases and Analytical Assumptions

1. Scenario ATRCCD-1, Advanced Test Reactor Critical Facility Fuel Handling Accident

Detailed Scenario Description	Control bridge drops onto the ATRC Facility reactor core causing mechanical damage to fuel cladding.
Material-at-Risk	See Table D-26.
Release Characteristics	100% fuel cladding damage occurs releasing gaseous and volatile radionuclides to a depth of one-grain thickness. The release is at ground level and it is assumed to last for 4 hours.
Airborne Release Fraction	2.36E−2 for noble gases, 2.36E−2 for iodine, 2.36E−2 for cesium, and 2.36E−2 for tellurium (based on cladding damage of one-grain thickness[8]).
Respirable Fraction	1.0E+0 (assumption based on information in SAR-192).
Damage Ratio	1.0E+0 (assumes fuel cladding damage).
Leak Path Factor	1.0E+0 (release is direct to the ATRC Facility main floor, which is outside of the confinement).
Adjustment Factor	1.0 (adjusts ST to represent the first 4 hours of a 4-hour release period).
Source Term	The ST shown in Table D-28 was developed according to the following equation: ST = (MAR × DR × LPF × ARF × RF) × AF.
Modeling Software and Inputs	RSAC, Version 6.2. Ground-level release.

Table D-27. Radiological failure modes and barriers for the Advanced Test Reactor Critical Facility.

Scenario Release Designator	Material	Primary Barrier	Failure Modes and Causes	Possible Initiating Events and Scenarios	Release from Primary Barrier	Other Barriers and Their Effects
ATRCCD-1	Radioactive fission products	Fuel cladding	Mechanical damage to fuel cladding	Fuel handling accident, control bridge drops onto ATRC Facility reactor core	Release fraction of 2.36E−2 derived from a one-grain thickness fuel damage depth and 100% cladding damage	Essentially none, as ATRC Facility is outside ATR confinement
ATRCFM-1	Radioactive fission products	Fuel cladding	Unknown, requires multiple system failures at maximum operating power leading to fuel melt and fuel cladding breach	A major reactivity control system failure, reactor shutdown system failure, and safety rod drive system failure to insert safety rods	100% fuel melt	Essentially none, as ATRC Facility is outside ATR confinement
ATRCCRIT	Prompt neutron pulse and radioactive fission products	Physical and administrative controls on fuel storage and fuel cladding	Fuel mishandling event, which positions seven or more fuel element in a critical configuration at bottom of ATRC Facility canal	Mechanical system failure while moving fuel elements or failure to implement technical specification requirements causes criticality to occur	1E+18 fission products and 20-minute halogen in–growth	Essentially none, as ATRC Facility is outside ATR confinement

Table D-28. Source term for scenario release designator ATRCCD-1.

Nuclide	MAR (Ci)	DR	LPF × RF	ARF	AF[a]	ST (Ci)
Kr-85m	5.35E+01	1.00E+0	1.00E+0	2.36E−2	1.00E+0	1.26E+0
Kr-88	1.11E+02	1.00E+0	1.00E+0	2.36E−2	1.00E+0	2.62E+0
Xe-133	3.10E+02	1.00E+0	1.00E+0	2.36E−2	1.00E+0	7.32E+0
Xe-133m	9.41E+00	1.00E+0	1.00E+0	2.36E−2	1.00E+0	2.22E−1
Cs-134	8.12E−01	1.00E+0	1.00E+0	2.36E−2	1.00E+0	1.92E−2
Cs-137	1.06E+00	1.00E+0	1.00E+0	2.36E−2	1.00E+0	2.50E−2
Te-127m	2.68E−01	1.00E+0	1.00E+0	2.36E−2	1.00E+0	6.32E−3
Te-129m	2.72E+00	1.00E+0	1.00E+0	2.36E−2	1.00E+0	6.42E−2
Te-132	1.77E+02	1.00E+0	1.00E+0	2.36E−2	1.00E+0	4.18E+0
I-131	1.16E+02	1.00E+0	1.00E+0	2.36E−2	1.00E+0	2.74E+0
I-132	1.76E+02	1.00E+0	1.00E+0	2.36E−2	1.00E+0	4.15E+0
I-133	2.68E+02	1.00E+0	1.00E+0	2.36E−2	1.00E+0	6.32E+0
I-134	2.98E+02	1.00E+0	1.00E+0	2.36E−2	1.00E+0	7.03E+0
I-135	2.50E+02	1.00E+0	1.00E+0	2.36E−2	1.00E+0	5.90E+0

[a] No adjustment, as the release is assumed to occur over a 4-hour time period.

2. Scenario ATRCFM-1, Advanced Test Reactor Critical Facility Severe Reactor Accident

Detailed Scenario Description Multiple system failures such as a major reactivity control system failure, reactor shutdown system failure, and safety rod drive system failure to insert safety rods cause 100% fuel melting.

Material-at-Risk See Table D-26. The gaseous and volatile fission and activation product inventory at ATRC Facility scram following reactor operation at 5 kW for 7 days, followed by zero power for 23.4 days, in a cycle that is repeated for 60 years is 6.28E+03 Ci.

Release Characteristics 100% fuel melt. The ATRC Facility is outside of the ATR confinement. The release is at ground level and it is assumed to last for 4 hours.

Airborne Release Fraction 1.00E+0 for noble gases, 2.50E−1 for iodine, 5.00E−1 for cesium, and 3.00E−1 for tellurium (based on EDF TRA-ATRC-1755[9]).

Respirable Fraction 1.0E+0 (assumption based on information SAR-192).

Damage Ratio 1.0E+0 (assumes fuel cladding damage).

Leak Path Factor 1.0E+0 (release is direct to the ATRC Facility main floor, which is outside of the confinement).

Adjustment Factor 1.0 (adjusts ST to represent the first 4 hours of a 4-hour release period).

Source Term The ST shown in Table D-29 was developed according to the following equation:
ST = (MAR × DR × LPF × ARF × RF) × AF.

Modeling Software and Inputs RSAC, Version 6.2. Ground-level release.

Table D-29. Source term for scenario release designator ATRCFM-1.

Nuclide	MAR (Ci)	DR	LPF × RF	ARF	AF[a]	ST (Ci)
Kr-85m	5.35E+01	1.00E+0	1.00E+0	1.00E+0	1.00E+0	5.35E+1
Kr-88	1.11E+02	1.00E+0	1.00E+0	1.00E+0	1.00E+0	1.11E+2
Xe-133	3.10E+02	1.00E+0	1.00E+0	1.00E+0	1.00E+0	3.10E+2
Xe-133m	9.41E+00	1.00E+0	1.00E+0	1.00E+0	1.00E+0	9.41E+0
Cs-134	8.12E−01	1.00E+0	1.00E+0	5.00E−1	1.00E+0	4.06E−1
Cs-137	1.06E+00	1.00E+0	1.00E+0	5.00E−1	1.00E+0	5.30E−1
Te-127m	2.68E−01	1.00E+0	1.00E+0	3.00E−1	1.00E+0	8.04E−2
Te-129m	2.72E+00	1.00E+0	1.00E+0	3.00E−1	1.00E+0	8.16E−1
Te-132	1.77E+02	1.00E+0	1.00E+0	3.00E−1	1.00E+0	5.31E+1
I-131	1.16E+02	1.00E+0	1.00E+0	2.50E−1	1.00E+0	2.90E+1
I-132	1.76E+02	1.00E+0	1.00E+0	2.50E−1	1.00E+0	4.40E+1
I-133	2.68E+02	1.00E+0	1.00E+0	2.50E−1	1.00E+0	6.70E+1
I-134	2.98E+02	1.00E+0	1.00E+0	2.50E−1	1.00E+0	7.45E+1
I-135	2.50E+02	1.00E+0	1.00E+0	2.50E−1	1.00E+0	6.25E+1

a. No adjustment, as the release is assumed to occur over a 4-hour time period.

3. Scenario ATRCCRIT, Advanced Test Reactor Critical Facility Criticality

Detailed Scenario Description Fuel mishandling event, which positions seven or more fuel element in a critical configuration at bottom of the ATRC Facility canal or operator error resulting in over batching in the MCA outside of the ATRC Facility canal.

Material-at-Risk See Table D-25 (assumes 1E+18 fissions during criticality). In addition to the criticality, there will be a release of pre-existing fission products.

Release Characteristics Following an unplanned criticality, it is assumed that the fission products produced due to in-growth during the 20-minute period after the initiating criticality events are released to the atmosphere. The ATRC Facility is outside of the ATR confinement and the release is at ground level.

Airborne Release Fraction 1.00E+0 for noble gases, 2.50E−1 for iodine, 5.00E−1 for cesium, and 3.00E−1 for tellurium (based on EDF TRA-ATRC-1755).

Respirable Fraction 1.00E+0 (assumption based on information in SAR-192).

Damage Ratio 1.00E−1 (assumes 10% fuel cladding damage).

Leak Path Factor 5.5E−1 (EPA 550-B-99-009,[10] Appendix D, Section D.1.2).

Source Term The ST shown in Table D-30 was developed according to the following equation: ST = MAR × F × LPF × ARF × RF.

Modeling Software and Inputs RSAC, Version 6.2. Ground-level release.

Table D-30. Source term for scenario release designator ATRCCRIT.

Nuclide	MAR (Ci)	DR	LPF × RF	ARF	AF[a]	ST (Ci)
Kr-85m	5.35E+01	1.00E−1	1.00E+0	1.00E+0	1.00E+0	5.35E+0
Kr-88	1.11E+02	1.00E−1	1.00E+0	1.00E+0	1.00E+0	1.11E+1
Xe-133	3.10E+02	1.00E−1	1.00E+0	1.00E+0	1.00E+0	3.10E+1
Xe-133m	9.41E+00	1.00E−1	1.00E+0	1.00E+0	1.00E+0	9.41E−1
Cs-134	8.12E−01	1.00E−1	1.00E+0	5.00E−1	1.00E+0	4.06E−2
Cs-137	1.06E+00	1.00E−1	1.00E+0	5.00E−1	1.00E+0	5.30E−2
Te-127m	2.68E−01	1.00E−1	1.00E+0	3.00E−1	1.00E+0	8.04E−3
Te-129m	2.72E+00	1.00E−1	1.00E+0	3.00E−1	1.00E+0	8.16E−2
Te-132	1.77E+02	1.00E−1	1.00E+0	3.00E−1	1.00E+0	5.31E+0
I-131	1.16E+02	1.00E−1	1.00E+0	2.50E−1	1.00E+0	2.90E+0
I-132	1.76E+02	1.00E−1	1.00E+0	2.50E−1	1.00E+0	4.40E+0
I-133	2.68E+02	1.00E−1	1.00E+0	2.50E−1	1.00E+0	6.70E+0
I-134	2.98E+02	1.00E−1	1.00E+0	2.50E−1	1.00E+0	7.45E+0
I-135	2.50E+02	1.00E−1	1.00E+0	2.50E−1	1.00E+0	6.25E+0

a. No adjustment, as the release is assumed to occur over a 4-hour time period.

D-1.5 Evaluation Results

D-1.5.1 Radiological Hazardous Material Release Results

Radiological hazardous material release results for 95% worst-case and 50% typical weather conditions as described in the main document are presented in Tables D-31 through D-34.

Table D-31. Advanced Test Reactor 4- and 48-hour and Advanced Test Reactor Critical Facility radiological material release scenario calculation results (total effective dose equivalent) for 95% worst-case meteorology.

Scenario Release Designator	Short Description	Downwind TEDE[a] Estimates for 95% Worst-Case Meteorology (rem)					Protective Action Distance (m)	Threshold for Early Lethality Distance (m)	Emergency Class
		30 m	100 m	Facility Boundary (124 m)	INTEC/ ICDF[a] Boundary (2,865 m)	Site Boundary (10,855 m)			
ATRPDS-1	Loss of primary coolant due to LPBO from failure of pressurizing system with no low-pressure coolant injection	5.02+3 (4 hr)	5.02E+2 (4 hr)	4.93E+2 (4 hr)	2.19E+0 (4 hr)	2.23E−1 (4 hr)	4,300 (4 hr)	400 (4 hr)	Site area emergency (SAE) (release less than or equal to 4 hours; potential for ingestion advisories)
		6.02E+4 (48 hr)	6.02E+3 (48 hr)	5.92E+3 (48 hr)	2.62E+1 (48 hr)	2.68E+0 (48 hr)	54,000 (48 hr)	1,800 (48 hr)	General emergency (GE) (release greater than 4 hours; potential for ingestion advisories)

Table D-31. (continued).

Scenario Release Designator	Short Description	Downwind TEDE[a] Estimates for 95% Worst-Case Meteorology (rem)					Protective Action Distance (m)	Threshold for Early Lethality Distance (m)	Emergency Class
		30 m	100 m	Facility Boundary (124 m)	INTEC/ ICDF[a] Boundary (2,865 m)	Site Boundary (10,855 m)			
ATRPDS-2	Loss of primary coolant due to HPBO from failure of emergency PCPs and failure to depressurize PCS	2.39E+4 (4 hr)	2.39E+3 (4 hr)	2.35E+3 (4 hr)	9.74E+0 (4 hr)	9.98E−1 (4 hr)	10,800[b] (4 hr)	1,200 (4 hr)	SAE (release less than or equal to 4 hours; potential for ingestion advisories)
		2.87E+5 (48 hr)	2.87E+4 (48 hr)	2.82E+4 (48 hr)	1.17E+2 (48 hr)	1.20E+1 (48 hr)	35,000 (48 hr)	3,100 (48 hr)	GE (release greater than 4 hours; potential for ingestion advisories)

Table D-31. (continued).

Scenario Release Designator	Short Description	Downwind TEDE[a] Estimates for 95% Worst-Case Meteorology (rem)					Protective Action Distance (m)	Threshold for Early Lethality Distance (m)	Emergency Class
		30 m	100 m	Facility Boundary (124 m)	INTEC/ ICDF[a] Boundary (2,865 m)	Site Boundary (10,855 m)			
ATRPDS-3	Loss of primary coolant due to small break (3 in. diameter) in coolant inlet piping and failure of low-pressure injection system	4.20E+4 (4 hr)	4.20E+3 (4 hr)	4.13E+3 (4 hr)	1.69E+1 (4 hr)	1.73E+0 (4 hr)	14,000[c] (4 hr)	1,500 (4 hr)	SAE (release less than or equal to 4 hours; potential for ingestion advisories)
		5.10E+5 (48 hr)	5.10E+4 (48 hr)	5.02E+4 (48 hr)	1.99E+2 (48 hr)	2.00E+1 (48 hr)	48,000 (48 hr)	4,150 (48 hr)	GE (release greater than 4 hours; potential for ingestion advisories)

Table D-31. (continued).

Scenario Release Designator	Short Description	Downwind TEDE[a] Estimates for 95% Worst-Case Meteorology (rem)					Protective Action Distance (m)	Threshold for Early Lethality Distance (m)	Emergency Class
		30 m	100 m	Facility Boundary (124 m)	INTEC/ ICDF[a] Boundary (2,865 m)	Site Boundary (10,855 m)			
ATRPDS-3M	Loss of primary coolant due to large break in outlet coolant piping, resulting in core flow stagnation	1.19E+4 (4 hr)	1.19E+3 (4 hr)	1.17E+3 (4 hr)	4.87E+0 (4 hr)	4.88E−1 (4 hr)	6,700 (4 hr)	810 (4 hr)	SAE (release less than or equal to 4 hours; potential for ingestion advisories)
		7.14E+4 (24 hr)	7.14E+3 (48 hr)	7.02E+3 (24 hr)	2.92E+1 (24 hr)	2.93E+0 (24 hr)	15,000 (24 hr)	1,810 (24 hr)	GE (release greater than 4 hours; potential for ingestion advisories)

Table D-31. (continued).

Scenario Release Designator	Short Description	Downwind TEDE[a] Estimates for 95% Worst-Case Meteorology (rem)					Protective Action Distance (m)	Threshold for Early Lethality Distance (m)	Emergency Class
		30 m	100 m	Facility Boundary (124 m)	INTEC/ ICDF[a] Boundary (2,865 m)	Site Boundary (10,855 m)			
ATRPDS-4	Anticipated transient without scram (loss of ATR control, which may result in loss of coolant)	5.02+3 (4 hr)	5.02E+2 (4 hr)	4.93E+2 (4 hr)	2.19E+0 (4 hr)	2.23E−1 (4 hr)	4,300 (4 hr)	400 (4 hr)	SAE (release less than or equal to 4 hours; potential for ingestion advisories)
		6.02E+4 (48 hr)	6.02E+3 (48 hr)	5.92E+3 (48 hr)	2.63E+1 (48 hr)	2.68E+0 (48 hr)	54,000 (48 hr)	1,800 (48 hr)	GE (release greater than 4 hours; potential for ingestion advisories)

Table D-31. (continued).

Scenario Release Designator	Short Description	Downwind TEDE[a] Estimates for 95% Worst-Case Meteorology (rem)					Protective Action Distance (m)	Threshold for Early Lethality Distance (m)	Emergency Class
		30 m	100 m	Facility Boundary (124 m)	INTEC/ ICDF[a] Boundary (2,865 m)	Site Boundary (10,855 m)			
ATRPDS-5	A perched fuel element drops into core after criticality is achieved, causing very large and rapid reactivity insertion that causes vessel movement and rupture of piping leading to loss of coolant	4.20E+4 (4 hr)	4.20E+3 (4 hr)	4.13E+3 (4 hr)	1.69E+1 (4 hr)	1.73E+0 (4 hr)	14,000 (4 hr)	1,500 (4 hr))	SAE (release less than or equal to 4 hours; potential for ingestion advisories)
		5.10E+5 (48 hr)	5.10E+4 (48 hr)	5.02E+4 (48 hr)	1.99E+2 (48 hr)	2.00E+1 (48 hr)	48,000 (48 hr)	4,150 (48 hr	GE (release greater than 4 hours; potential for ingestion advisories)

Table D-31. (continued).

Scenario Release Designator	Short Description	Downwind TEDE[a] Estimates for 95% Worst-Case Meteorology (rem)					Protective Action Distance (m)	Threshold for Early Lethality Distance (m)	Emergency Class
		30 m	100 m	Facility Boundary (124 m)	INTEC/ ICDF[a] Boundary (2,865 m)	Site Boundary (10,855 m)			
ATRPDS-5M	A sudden rupture of experiment loop pressure tube ruptures insulating gas envelope tube in core region of ATR flux trap; fuel melt due to extremely rapid, positive ramp insertion of reactivity in ATR core from voiding in a high positive reactivity worth experiment flux trap	8.41E+2 (4 hr)	8.41E+1 (4 hr)	8.27E+1 (4 hr)	3.39E−1 (4 hr)	3.46E−2 (4 hr)	2,130 (4 hr)	90 (4 hr)	SAE [based on thyroid committed dose equivalent (CDE) release less than or equal to 4 hours; potential for ingestion advisories]
		1.01E+4 (48 hr)	1.01E+3 (48 hr)	9.92E+2 (48 hr)	4.07E+0 (48 hr)	4.15E−1 (48 hr)	6,100 (48 hr)	700 (48 hr)	GE (release greater than 4 hours; potential for ingestion advisories)