4.3.5.4.9 *Public and Occupational Health and Safety*

This section describes the radiological and hazardous chemical releases and their associated impacts resulting from either normal operation or accidents involved with the evolutionary LWRs. The section first describes the impacts from normal reactor operation at each potential site followed by a description of impacts from reactor accidents. The impacts associated with the ultimate disposal of the spent fuel in a HLW repository are presented separately in technical documents that specifically address repository operations.

Summaries of the radiological impacts to the public associated with normal operation during the assumed 17-year campaign time are presented in Tables 4.3.5.4.9–1 and 4.3.5.4.9–2 for a single large and small evolutionary LWRs, respectively. Summaries of radiological impacts to workers are given in Tables 4.3.5.4.9–3 and 4.3.5.4.9–4 for large and small evolutionary LWRs, respectively. Impacts from hazardous chemicals to these same groups are given in Table 4.3.5.4.9–5. Summaries of impacts associated with postulated accidents are given in Table 4.3.5.4.9–6 through Table 4.3.5.4.9–11. Detailed results are presented in Appendix M.

Normal Operation. There would be no radiological releases associated with the construction of an evolutionary LWR at any of the sites analyzed. Construction worker exposures to material potentially contaminated with radioactivity (for example, from construction activities involved with existing contaminated soil) would be limited to assure that doses are maintained as low as reasonably achievable. Toward this end, construction workers would be monitored as appropriate. Limited hazardous chemical releases are anticipated as a result of construction activities. However, concentrations would be within the regulated exposure limits. During normal operation, there would be both radiological and hazardous chemical releases to the environment and also direct in-plant exposures. The resulting doses and potential health effects to the public and workers at each site are described below.

Radiological Impacts. Radiological impacts to the average and maximally exposed members of the public resulting from the normal operation of the large and small evolutionary LWRs at each of the sites are presented in Tables 4.3.5.4.9–1 and 4.3.5.4.9–2, respectively. The impacts from all site operations, including the evolutionary LWR, are also given in these tables. To put operational doses into perspective, comparisons with doses from natural background radiation are included in the tables.

The dose to the maximally exposed member of the public from annual large evolutionary LWR operation would range from 0.034 mrem at the NTS site to 4.8 mrem at the ORR site. From 17 years of operation, the corresponding risks of fatal cancer to this individual would range from 2.9×10^{-7} to 4.1×10^{-5}. The impacts to the average individual would be less. As a result of annual operations, the population dose would range from 0.032 person-rem at NTS to 32 person-rem at SRS. The corresponding numbers of fatal cancers in these populations from 17 years of operation would range from 2.7×10^{-4} to 0.27.

The doses to the maximally exposed member of the public from annual total site operations, including the large evolutionary LWR, are all within the radiological limits specified in NESHAPS (40 CFR 61, Subpart H) and DOE Order 5400.5, and would range from 0.035 mrem at NTS to 6.7 mrem at the ORR site. From 17 years of operation, the corresponding risks of fatal cancers to this individual would range from 3.0×10^{-7} to 5.7×10^{-5}. The impacts to the average individual would be less. This activity would be included in a program to ensure that doses to the public are as ALARA. As a result of annual total site operations, the population doses would be within the limit in proposed 10 CFR 834 and would range from 0.036 person-rem at the NTS site to 76 person-rem at the SRS site. The corresponding numbers of fatal cancers in these populations from 17 years of operation would range from 3.0×10^{-4} to 0.65.

The dose to the maximally exposed member of the public from annual small evolutionary LWR operation would range from 0.025 mrem at NTS to 2.8 mrem at the ORR site. From 17 years of operation, the corresponding risks of fatal cancer to this individual would range from 2.1×10^{-7} to 2.4×10^{-5}. The impacts to the average

Table 4.3.5.4.9–1. Potential Radiological Impacts to the Public During Normal Operation of the Large Evolutionary Light Water Reactor

	Hanford		NTS		INEL		Pantex		ORR		SRS	
Receptor	**Reactor**	**Total Site[a]**	**Reactor**	**Total Site[a]**	**Reactor**	**Total Site[a]**	**Reactor**	**Total Site[a]**	**Reactor**	**Total Site[a]**	**Reactor**	**Total Site[a]**
Annual Dose to the Maximally Exposed Individual Member of the Public[b]												
Atmospheric release pathway (mrem)	0.33	0.33	0.034	0.035	0.046	0.053	1.5	1.5	4.8	5.0	0.26	0.61
Drinking water pathway (mrem)	0	0	0	0	0	0	0	0	1.0×10^{-3}	0.10	4.3×10^{-4}	0.081
Total liquid release pathway (mrem)	0.014	0.015	0	0	0	0	0	0	0.060	1.8	0.015	0.39
Atmospheric and liquid release pathways combined (mrem)	0.34	0.35	0.034	0.035	0.046	0.053	1.5	1.5	4.9	6.7	0.27	1.0
Percent of natural background[c]	0.11	0.12	0.011	0.011	0.014	0.016	0.45	0.45	1.6	2.3	0.092	0.34
17-year fatal cancer risk	2.9×10^{-6}	2.9×10^{-6}	2.9×10^{-7}	3.0×10^{-7}	3.9×10^{-7}	4.5×10^{-7}	1.3×10^{-5}	1.3×10^{-5}	4.1×10^{-5}	5.7×10^{-5}	2.3×10^{-6}	8.5×10^{-6}
Annual Population Dose Within 80 Kilometers[d]												
Atmospheric release pathway (person-rem)	30	30	0.032	0.036	9.6	12.0	8.9	8.9	5.1	34	32	72
Total liquid release pathway (person-rem)	1.5	2.6	0	0	0	0	0	0	0.078	4.8	0.096	3.7
Atmospheric and liquid release pathways combined (person-rem)	32	33	0.032	0.036	9.6	12.0	8.9	8.9	5.2	39	32	76
Percent of natural background[c]	0.017	0.018	3.5×10^{-4}	3.9×10^{-4}	0.011	0.013	7.6×10^{-3}	7.6×10^{-3}	1.4×10^{-3}	0.010	0.012	0.029
17-year fatal cancers	0.27	0.28	2.7×10^{-4}	3.0×10^{-4}	0.082	0.10	0.076	0.076	0.044	0.33	0.27	0.65

Table 4.3.5.4.9–1. Potential Radiological Impacts to the Public During Normal Operation of the Large Evolutionary Light Water Reactor—Continued

Receptor	Hanford		NTS		INEL		Pantex		ORR		SRS	
	Reactor	Total Site[a]	Reactor	Total Site[a]	Reactor	Total Site[a]	Reactor	Total Site[a]	Reactor	Total Site[a]	Reactor	Total Site[a]
Annual Dose to the Average Individual Within 80 Kilometer[e]												
Atmospheric and liquid release pathways combined (mrem)	0.052	0.053	1.1×10^{-3}	1.2×10^{-3}	0.036	0.045	0.025	0.025	4.0×10^{-3}	0.030	0.036	0.085
17-year fatal cancer risk	4.4×10^{-7}	4.5×10^{-7}	9.3×10^{-9}	1.0×10^{-8}	3.0×10^{-7}	3.8×10^{-7}	2.2×10^{-7}	2.2×10^{-7}	3.4×10^{-8}	2.6×10^{-7}	3.0×10^{-7}	7.2×10^{-7}

[a] Includes impacts from No Action facilities (refer to Sections 4.2.1.9 through 4.2.6.9). The location of the MEI may be different under No Action than for operation of the reactor. Therefore, the impacts may not be directly additive.

[b] The applicable radiological limits for an individual member of the public from site operations are 10 mrem per year from the air pathways, as required by NESHAPS (40 CFR 61, Subpart H) under the CAA; 4 mrem per year from the drinking water pathway, as required by the SDWA; and 100 mrem per year from all pathways combined. Refer to DOE Order 5400.5.

[c] The annual natural background radiation level at Hanford is 300 mrem for the average individual; the population within 80 km receives 186,400 person-rem; at NTS is 313 mrem for the average individual; the population within 80 km receives 9,190 person-rem; at INEL is 338 mrem for the average individual; the population within 80 km receives 90,800 person-rem; at Pantex is 334 mrem for the average individual; the population within 80 km receives 116,900 person-rem; at ORR is 295 mrem for the average individual; the population within 80 km receives 379,000 person-rem; at SRS is 298 mrem for the average individual; the population within 80 km receives 266,000 person-rem.

[d] For DOE activities, proposed 10 CFR 834 (see 58 FR 16268) would generally limit the potential annual population dose to 100 person-rem from all pathways combined, and would require an ALARA program.

[Text deleted.]

[e] Obtained by dividing the population dose by the number of people projected to be living within 80 km of the site (621,000 at Hanford; 29,400 at NTS; 269,000 at INEL; 350,000 at Pantex; 1,285,000 at ORR; and 893,000 at SRS).

Source: Section M.2.

Table 4.3.5.4.9–2. Potential Radiological Impacts to the Public During Normal Operation of the Small Evolutionary Light Water Reactor

Receptor	Hanford		NTS		INEL		Pantex		ORR		SRS	
	Reactor	Total Site[a]	Reactor	Total Site[a]	Reactor	Total Site[a]	Reactor	Total Site[a]	Reactor	Total Site[a]	Reactor	Total Site[a]
Annual Dose to the Maximally Exposed Individual Member of the Public[b]												
Atmospheric release pathway (mrem)	0.23	0.23	0.025	0.026	0.033	0.041	1.0	1.0	2.3	2.5	0.16	0.54
Drinking water pathway (mrem)	0	0	0	0	0	0	0	0	0.011	0.11	4.9×10^{-3}	0.086
Total liquid release pathway (mrem)	0.024	0.025	0	0	0	0	0	0	0.47	2.2	0.067	0.44
Atmospheric and liquid release pathways combined (mrem)	0.25	0.26	0.025	0.026	0.033	0.041	1.0	1.0	2.8	4.7	0.23	0.98
Percent of natural background[c]	0.085	0.085	8.0×10^{-3}	8.4×10^{-3}	9.8×10^{-3}	0.012	0.30	0.30	0.94	1.6	0.076	0.33
17-year fatal cancer risk	2.1×10^{-6}	2.2×10^{-6}	2.1×10^{-7}	2.2×10^{-7}	2.8×10^{-7}	3.5×10^{-7}	8.5×10^{-6}	8.5×10^{-6}	2.4×10^{-5}	4.0×10^{-5}	1.9×10^{-6}	8.3×10^{-6}
Annual Population Dose Within 80 Kilometers[d]												
Atmospheric release pathway (person-rem)	20	20	0.022	0.026	6.9	9.3	7.4	7.4	2.8	32	24	64
Total liquid release pathway (person-rem)	2.6	3.7	0	0	0	0	0	0	0.50	5.2	0.39	4.0
Atmospheric and liquid release pathways combined (person-rem)	23	24	0.022	0.026	6.9	9.3	7.4	7.4	3.3	37	24	68
Percent of natural background[c]	0.012	0.013	2.4×10^{-4}	2.8×10^{-4}	7.6×10^{-3}	0.010	6.3×10^{-3}	6.3×10^{-3}	8.7×10^{-4}	9.8×10^{-3}	9.2×10^{-3}	0.026
17-year fatal cancers	0.19	0.20	1.9×10^{-4}	2.2×10^{-4}	0.059	0.079	0.063	0.063	0.028	0.32	0.21	0.58

Table 4.3.5.4.9–2. Potential Radiological Impacts to the Public During Normal Operation of the Small Evolutionary Light Water Reactor—Continued

Receptor	Hanford		NTS		INEL		Pantex		ORR		SRS	
	Reactor	Total Site[a]	Reactor	Total Site[a]	Reactor	Total Site[a]	Reactor	Total Site[a]	Reactor	Total Site[a]	Reactor	Total Site[a]
Annual Dose to the Average Individual Within 80 Kilometers[e]												
Atmospheric and liquid release pathways combined (mrem)	0.037	0.039	7.5×10^{-4}	8.8×10^{-4}	0.026	0.035	0.021	0.021	2.6×10^{-3}	0.029	0.027	0.076
17-year fatal risk	3.1×10^{-7}	3.3×10^{-7}	6.4×10^{-9}	7.5×10^{-9}	2.2×10^{-7}	2.9×10^{-7}	1.8×10^{-7}	1.8×10^{-7}	2.2×10^{-8}	2.4×10^{-7}	2.3×10^{-7}	6.5×10^{-7}

[a] Includes impacts from No Action facilities (refer to Sections 4.2.1.9 through 4.2.6.9).

[b] The applicable radiological limits for an individual member of the public from site operations are 10 mrem per year from the air pathways, as required by NESHAPS (40 CFR 61, Subpart H) under the CAA; 4 mrem per year from the drinking water pathway, as required by the SDWA; and 100 mrem per year from all pathways combined. Refer to DOE Order 5400.5.

[c] The annual natural background radiation level at Hanford is 300 mrem for the average individual; the population within 80 km receives 186,400 person-rem; at NTS is 313 mrem for the average individual; the population within 80 km receives 9,190 person-rem; at INEL is 338 mrem for the average individual; the population within 80 km receives 90,800 person-rem; at Pantex is 334 mrem for the average individual; the population within 80 km receives 116,900 person-rem; at ORR is 295 mrem for the average individual; the population within 80 km receives 379,000 person-rem; at SRS is 298 mrem for the average individual; the population within 80 km receives 266,000 person-rem.

[d] For DOE activities, proposed 10 CFR 834 (see 58 FR 16268) would generally limit the potential annual population dose to 100 person-rem from all pathways combined, and would require an ALARA program.

[Text deleted.]

[e] Obtained by dividing the population dose by the number of people projected to be living within 80 km of the site (621,000 at Hanford; 29,400 at NTS; 269,000 at INEL; 350,000 at Pantex; 1,285,000 at ORR; and 893,000 at SRS).

Source: Section M.2.

individual would be less. The population dose would range from 0.022 person-rem at NTS to 24 person-rem at SRS. The corresponding numbers of fatal cancers in these populations from 17 years of operation would range from 1.9×10^{-4} to 0.21.

The doses to the maximally exposed member of the public from annual total site operations, including the small evolutionary LWR, are also all within radiological limits and would range from 0.026 mrem at the NTS site to 4.7 mrem at the ORR site. From 17 years of operation, the corresponding risks of fatal cancers to this individual would range from 2.2×10^{-7} to 4.0×10^{-5}. The impacts to the average individual would be less. As a result of annual total site operations, the population doses are also within the proposed reporting limit, and would range from 0.026 person-rem at NTS to 68 person-rem at SRS. The corresponding numbers of fatal cancers in these populations from 17 years of operation would range from 2.2×10^{-4} to 0.58.

Doses to onsite workers from normal operations are given in Tables 4.3.5.4.9–3 and 4.3.5.4.9–4 for the large and small evolutionary LWRs, respectively. Included are involved workers directly associated with the evolutionary LWR, workers who are not involved with the reactor and the entire workforce at each site. All doses fall within regulatory limits.

For the large evolutionary LWR alternative, the annual dose to reactor workers is site-independent and would be 810 mrem to the average worker associated with the evolutionary LWR and 170 person-rem to entire evolutionary LWR workforce. The annual average dose to the noninvolved worker would range from 2.6 mrem at ORR to 32 mrem at SRS. The annual total dose to all noninvolved workers would range from 3.0 person-rem at the NTS site to 250 person-rem at the Hanford site. The annual dose to the total site workforces would range from 173 person-rem at the NTS site to 420 person-rem at the Hanford site.

For the small evolutionary LWR alternative, the annual incremental dose to reactor workers is site-independent and would be 800 mrem to the average worker associated with the evolutionary LWR and 100 person-rem to entire evolutionary LWR workforce. The annual average dose to the noninvolved worker would range from 2.6 mrem at ORR to 32 mrem at SRS. The annual total dose to all noninvolved workers would range from 3.0 person-rem at NTS to 250 person-rem at Hanford. The annual dose to the total site workforces would range from 103 person-rem at NTS to 350 person-rem at Hanford.

The risks and numbers of fatal cancers among the different workers from 17 years of operation are included in Tables 4.3.5.4.9–3 and 4.3.5.4.9–4 for the large and small evolutionary LWRs, respectively. Dose to individual workers would be kept low by instituting badged monitoring and ALARA programs and also worker rotations. As a result of the implementation of these mitigation measures, the actual number of fatal cancers calculated would be lower for the operation of this facility.

Hazardous Chemical Impacts. The hazardous chemical impacts to the public resulting from normal operation of the large and small evolutionary LWR facilities at each of several sites are presented in Table 4.3.5.4.9–5. Included is the impact due only to operation of the evolutionary LWR facilities and the site's total hazardous chemical impact. The total site impacts are provided to demonstrate the estimated level of health effects expected and the risk of cancer due to the total chemical exposures on each site. All supporting impact analyses are provided in Section M.3.

For the large or small evolutionary LWR facilities, exposure data are identical and the HIs to the MEIs range from 2.8×10^{-8} at NTS to 1.1×10^{-6} at ORR and Pantex. The incremental cancer risk from hazardous chemicals to the MEI is 0 at all sites. The HI to the onsite worker ranges from 7.8×10^{-6} at Pantex to 1.6×10^{-5} at the Hanford, INEL, and ORR sites and the cancer risk to the onsite worker is zero (because no carcinogens are released from hazardous chemicals) at all sites.

Table 4.3.5.4.9–3. Potential Radiological Impacts to Workers During Normal Operation of the Large Evolutionary Light Water Reactor

Receptor	Hanford	NTS	INEL	Pantex	ORR	SRS
Involved Workforce[a]						
Average worker dose (mrem/yr)[b]	810	810	810	810	810	810
17-year fatal cancer risk	5.5×10^{-3}	5.5×10^{-3}	5.5×10^{-3}	5.5×10^{-3}	5.5×10^{-3}	5.5×10^{-3}
Total dose (person-rem/yr)	170	170	170	170	170	170
17-year fatal cancers	1.2	1.2	1.2	1.2	1.2	1.2
Noninvolved Workforce[c]						
Average worker dose (mrem/yr)[b]	27	5.0	30	10	2.6	32
17-year fatal cancer risk	1.8×10^{-4}	3.4×10^{-5}	2.0×10^{-4}	6.8×10^{-5}	1.8×10^{-5}	2.2×10^{-4}
Total dose (person-rem/yr)	250	3.0	220	14	44	226
17-year fatal cancers	1.7	0.020	1.5	0.095	0.30	1.5
Total Site Workforce[d]						
Dose (person-rem/yr)	420	173	390	184	214	396
17-year fatal cancers	2.9	1.2	2.7	1.3	1.5	2.7

[a] The involved worker is a worker associated with operations of the proposed action.

[b] The radiological limit for an individual worker is 5,000 mrem/year (10 CFR 835). However, DOE has also established an administrative control level of 2,000 mrem per year (DOE 1992t); the sites must make reasonable attempts to maintain worker doses below this level.

[c] The noninvolved worker is a worker onsite but not associated with operations of the proposed action. The noninvolved workforce is equivalent to the No Action workforce.

[d] The impact to the total workforce is the summation of the involved worker impact and the noninvolved worker impact.

[Text deleted.]

Source: Section M.2.

Table 4.3.5.4.9–4. Potential Radiological Impacts to Workers During Normal Operation of the Small Evolutionary Light Water Reactor

Receptor	Hanford	NTS	INEL	Pantex	ORR	SRS
Involved Workforce[a]						
Average worker dose (mrem/yr)[b]	800	800	800	800	800	800
17-year fatal cancer risk	5.4×10^{-3}	5.4×10^{-3}	5.4×10^{-3}	5.4×10^{-3}	5.4×10^{-3}	5.4×10^{-3}
Total dose (person-rem/yr)	100	100	100	100	100	100
17-year fatal cancers	0.68	0.68	0.68	0.68	0.68	0.68
Noninvolved Workforce[c]						
Average worker dose (mrem/yr)[b]	27	5.0	30	10	2.6	32
17-year fatal cancer risk	1.8×10^{-4}	3.4×10^{-5}	2.0×10^{-4}	6.8×10^{-5}	1.8×10^{-5}	2.2×10^{-4}
Total dose (person-rem/yr)	250	3.0	220	14	44	226
17-year fatal cancers	1.7	0.020	1.5	0.095	0.30	1.5
Total Site Workforce[d]						
Dose (person-rem/yr)	350	103	320	114	144	326
17-year fatal cancers	2.4	0.70	2.2	0.78	0.98	2.2

[a] The involved worker is a worker associated with operations of the proposed action.

[b] The radiological limit for an individual worker is 5,000 mrem/year (10 CFR 835). However, DOE has also established an administrative control level of 2,000 mrem per year (DOE 1992t); the sites must make reasonable attempts to maintain worker doses below this level.

[c] The noninvolved worker is a worker onsite but not associated with operations of the proposed action. The noninvolved workforce is equivalent to the No Action workforce.

[d] The impact to the total workforce is the summation of the involved worker impact and the noninvolved worker impact.

[Text deleted.]

Source: Section M.2.

Table 4.3.5.4.9–5. Potential Hazardous Chemical Impacts to the Public and Workers During Normal Operation of the Large or Small Evolutionary Light Water Reactor

	Hanford		NTS		INEL		Pantex		ORR		SRS	
Receptor	Facility[a]	Total Site[b]	Facility[a]	Total Site[b]	Facility[a]	Total Site[b]	Facility[a]	Total Site[b]	Facility[a]	Total Site[b]	Facility[a]	Total Site[b]
Maximally Exposed Individual (Public)												
Hazard index[c]	1.9×10^{-7}	6.2×10^{-5}	2.8×10^{-8}	2.8×10^{-8}	4.1×10^{-7}	0.015	1.1×10^{-6}	5.7×10^{-3}	1.1×10^{-6}	0.040	5.2×10^{-8}	5.2×10^{-3}
Cancer risk[d]	0	0	0	0	0	0.036	0	1.1×10^{-8}	0	0	0	1.3×10^{-7}
Worker Onsite												
Hazard index[e]	1.6×10^{-5}	4.0×10^{-3}	8.0×10^{-6}	8.0×10^{-6}	1.6×10^{-5}	0.22	7.8×10^{-6}	6.1×10^{-3}	1.6×10^{-5}	0.15	1.4×10^{-5}	1.2
Cancer risk[f]	0	0	0	0	0	7.7×10^{-4}	0	4.5×10^{-7}	0	0	0	1.9×10^{-4}

[a] Facility=Contribution from the proposed new facility operation only.

[b] Total=Includes the contributions from the No Action and the proposed new facility operation.

[c] Hazard Index for MEI=sum of individual Hazard Quotients (noncancer health effects) for MEI.

[d] Cancer Risk for MEI=(emissions concentrations) x (0.286 [converts concentrations to doses]) x (Slope Factor).

[e] Hazard Index for workers=sum of individual Hazard Quotients (noncancer health effects) for workers.

[f] Cancer Risk for workers=(emissions for 8-hr) x (0.286 [converts concentrations to doses]) x (0.237 [fraction of year exposed]) x (0.571 [fraction of lifetime working]) x (Slope Factor).

Note: Where there are no known carcinogens among the hazardous chemicals emitted, there are no slope factors; therefore, the calculated cancer risk value is 0.

Source: Section M.3, Large Evolutionary LWRs: Tables M.3.4–68 through M.3.4–73 and Small Evolutionary LWRs: Tables M.3.4–74 through M.3.4–79.

Facility Accidents. A set of potential accidents for evolutionary light water reactors for which there may be releases of radioactivity that may impact noninvolved onsite workers and the offsite population has been postulated. The accident consequences and risks to a worker located 1,000 m (3,280 ft) from the accident release point, the maximum offsite individual located at the site boundary, and the population located within 80 km of the accident release point are summarized in Tables 4.3.5.4.9–6 through 4.3.5.4.9–11 for the candidate sites (Hanford, NTS, INEL, Pantex, ORR, and SRS). In the event that the site boundary is less than 1,000 m (3,280 ft) from the accident release point, the worker is placed at the site boundary. For the set of accidents analyzed, the maximum number of cancer fatalities in the population within 80 km (50 mi) would be 22.0 at ORR for the large break loss of coolant and loss of core cooling accident scenario with a probability of 2.1×10^{-8} per year. The corresponding 17 year facility lifetime risk from the same accident scenario for the population, maximum offsite individual, and worker at 665 m (2,200 ft) would be 7.9×10^{-6}, 2.6×10^{-8}, and 2.1×10^{-8}, respectively. Appendix M.5 presents summary descriptions of the accident scenarios identified in Tables 4.3.5.4.9–6 through 4.3.5.4.9–11.

[Text deleted.] The location of workstations, number of workers, personnel protective features, engineered safety features, and other design details affect the extent of worker exposures to accidents. Certain accidents such as fires and explosions could cause fatalities to workers close to the accident. Prior to construction and operation of a new facility, DOE Orders require detailed safety analyses to assure that facility designs and operating procedures limit the number of workers in hazardous areas and minimize risk of injury or fatality in the event of an accident.

Aircraft Crash. The probability of an aircraft crash into a new disposition facility at Pantex will depend upon its specific location relative to the airport and airplane traffic patterns. In the future, there is the possibility that air traffic patterns may change and cause a change in the probability of a crash into a specific facility. [Text deleted.] A discussion of aircraft crash accidents for this PEIS is contained in Appendix R.

Table 4.3.5.4.9–6. Evolutionary Light Water Reactor Accident Impacts at Hanford Site

	Worker at 1,000 m		Maximum Offsite Individual		Population to 80 km		
Accident Description	**Risk of Latent Cancer/Prompt Fatality (per 17 yr)[a]**	**Probability of Latent Cancer/ Prompt Fatality[b]**	**Risk of Latent Cancer/ Prompt Fatality (per 17 yr)[a]**	**Probability of Latent Cancer/ Prompt Fatality[b]**	**Risk of Latent Cancer/Prompt Fatalities (per 17 yr)[a]**	**Number of Latent Cancer/ Prompt Fatalities[c]**	**Accident Frequency (per yr)**
Failure of small primary coolant line outside containment	3.8×10^{-8}/ 0	2.2×10^{-6}/ 0	4.8×10^{-9}/ 0	2.8×10^{-7}/ 0	8.9×10^{-7}/ 0	5.2×10^{-5}/ 0	1.0×10^{-3}
Scram system piping break outside containment	4.2×10^{-9}/ 0	2.5×10^{-5}/ 0	5.3×10^{-10}/ 0	3.1×10^{-6}/ 0	9.4×10^{-8}/ 0	5.5×10^{-4}/ 0	1.0×10^{-5}
Cleanup water line break outside containment	1.1×10^{-10}/ 0	6.7×10^{-7}/ 0	1.4×10^{-11}/ 0	8.4×10^{-8}/ 0	3.1×10^{-9}/ 0	1.8×10^{-5}/ 0	1.0×10^{-5}
Fuel handling	4.8×10^{-9}/ 0	2.8×10^{-5}/ 0	7.3×10^{-10}/ 0	4.3×10^{-6}/ 0	1.7×10^{-7}/ 0	1.0×10^{-3}/ 0	1.0×10^{-5}
Anticipated transient with scram and loss of core cooling	4.7×10^{-8}/ 0	0.021/ 0	5.9×10^{-9}/ 0	2.7×10^{-3}/ 0	1.8×10^{-6}/ 0	0.82/ 0	1.7×10^{-7}
Large break loss of coolant accident and loss of core cooling	3.2×10^{-8}/ 1.4×10^{-7}	0.089/ 0.040	2.9×10^{-8}/ 3.5×10^{-9}	0.082/ 9.7×10^{-3}	2.1×10^{-6}/ 0	5.9/ 0	2.1×10^{-8}
Expected risk[d]	1.3×10^{-7}/ 1.4×10^{-7}	–	4.1×10^{-8}/ 3.5×10^{-9}	–	5.1×10^{-6}/ 0	–	–

[a] The risk values are calculated by multiplying the probability of cancer fatality (for the worker at 1,000 m or the maximum offsite individual) or the number of cancer fatalities (for the population to 80 km) by the accident frequency and the number of year of operation.

[b] Increase likelihood (or probability) of cancer or prompt fatality to a hypothetical individual (a single onsite worker at a distance of 1,000 m or the site boundary, whichever is smaller, or to a hypothetical individual in the offsite population located at the site boundary) if exposed to the indicated dose. The value assumes the accident has occurred.

[c] Estimated number of cancer fatalities in the entire offsite population out to a distance of 80 km if exposed to the indicated dose. The value assumes the accident has occurred.

[d] Expected risk is the sum of the risks over the lifetime of the facility.

Note: All values are mean values. Advanced BWR data was used as surrogate data for the evolutionary LWR.

Source: Calculated using the source terms in Tables M.5.3.8.1–1 and M.5.3.8.1–2 and the MACCS computer code.

Table 4.3.5.4.9–7. Evolutionary Light Water Reactor Accident Impacts at Nevada Test Site

	Worker at 1,000 m		Maximum Offsite Individual		Population to 80 km		
Accident Description	**Risk of Latent Cancer/Prompt Fatality (per 17 yr)[a]**	**Probability of Latent Cancer/ Prompt Fatality[b]**	**Risk of Latent Cancer/Prompt Fatality (per 17 yr)[a]**	**Probability of Latent Cancer/ Prompt Fatality[b]**	**Risk of Latent Cancer/Prompt Fatalities (per 17 yr)[a]**	**Number of Latent Cancer/ Prompt Fatalities[c]**	**Accident Frequency (per yr)**
Failure of small primary coolant line outside containment	2.7×10^{-8}/ 0	1.6×10^{-6}/ 0	7.0×10^{-10}/ 0	4.1×10^{-8} 0	2.7×10^{-8}/ 0	1.6×10^{-6}/ 0	1.0×10^{-3}
Scram system piping break outside containment	2.9×10^{-9}/ 0	1.7×10^{-5}/ 0	7.7×10^{-11}/ 0	4.5×10^{-7}/ 0	2.8×10^{-9}/ 0	1.7×10^{-5}/ 0	1.0×10^{-5}
Cleanup water line break outside containment	7.9×10^{-11}/ 0	4.6×10^{-7}/ 0	2.1×10^{-12}/ 0	1.2×10^{-8}/ 0	9.6×10^{-11}/ 0	5.6×10^{-7}/ 0	1.0×10^{-5}
Fuel handling	3.3×10^{-9}/ 0	1.9×10^{-5}/ 0	1.3×10^{-10}/ 0	7.6×10^{-7}/ 0	4.3×10^{-9}/ 0	2.6×10^{-5}/ 0	1.0×10^{-5}
Anticipated transient with scram and loss of core cooling	3.0×10^{-8}/ 0	0.014/ 0	1.1×10^{-9}/ 0	5.0×10^{-4}/ 0	5.6×10^{-8}/ 0	0.026/ 0	1.3×10^{-7}
Large break loss of coolant accident and loss of core cooling	3.1×10^{-8}/ 8.9×10^{-8}	0.087/ 0.25	5.4×10^{-9}/ 8.4×10^{-11}	0.015/ 2.4×10^{-4}	2.1×10^{-8}/ 0	0.059/ 0	2.1×10^{-8}
Expected risk[d]	9.4×10^{-8}/ 8.9×10^{-8}	– –	7.4×10^{-9}/ 8.4×10^{-11}	– –	1.1×10^{-7}/ 0	–	–

[a] The risk values are calculated by multiplying the probability of cancer fatality (for the worker at 1,000 m or the maximum offsite individual) or the number of cancer fatalities (for the population to 80 km) by the accident frequency and the number of year of operation.

[b] Increase likelihood (or probability) of cancer or prompt fatality to a hypothetical individual (a single onsite worker at a distance of 1,000 m or the site boundary, whichever is smaller, or to a hypothetical individual in the offsite population located at the site boundary) if exposed to the indicated dose. The value assumes the accident has occurred.

[c] Estimated number of cancer fatalities in the entire offsite population out to a distance of 80 km if exposed to the indicated dose. The value assumes the accident has occurred.

[d] Expected risk is the sum of the risks over the lifetime of the facility.

Note: All values are mean values. Advanced BWR data was used as surrogate data for the evolutionary LWR.

Source: Calculated using the source terms in Tables M.5.3.8.1–1 and M.5.3.8.1–2 and the MACCS computer code.

Table 4.3.5.4.9–8. Evolutionary Light Water Reactor Accident Impacts at Idaho National Engineering Laboratory

	Worker at 1,000 m		Maximum Offsite Individual		Population to 80 km		
Accident Description	**Risk of Latent Cancer/Prompt Fatality (per 17 yr)[a]**	**Probability of Latent Cancer/ Prompt Fatality[b]**	**Risk of Latent Cancer/Prompt Fatality (per 17 yr)[a]**	**Probability of Latent Cancer/ Prompt Fatality[b]**	**Risk of Latent Cancer/Prompt Fatalities (per 17 yr)[a]**	**Number of Latent Cancer/ Prompt Fatalities[c]**	**Accident Frequency (per yr)**
Failure of small primary coolant line outside containment	3.8×10^{-8}/ 0	2.2×10^{-6}/ 0	4.3×10^{-10}/ 0	2.5×10^{-8}/ 0	3.7×10^{-7}/ 0	2.2×10^{-5}/ 0	1.0×10^{-3}
Scram system piping break outside containment	4.1×10^{-9}/ 0	2.4×10^{-5}/ 0	4.6×10^{-11}/ 0	2.7×10^{-7}/ 0	3.8×10^{-8}/ 0	2.3×10^{-4}/ 0	1.0×10^{-5}
Cleanup water line break outside containment	1.1×10^{-10}/ 0	6.6×10^{-7}/ 0	1.3×10^{-12}/ 0	7.6×10^{-9}/ 0	1.3×10^{-9}/ 0	7.6×10^{-6}/ 0	1.0×10^{-5}
Fuel handling	4.7×10^{-9}/ 0	2.7×10^{-5}/ 0	8.7×10^{-11}/ 0	5.1×10^{-7}/ 0	5.5×10^{-8}/ 0	3.3×10^{-4}/ 0	1.0×10^{-5}
Anticipated transient with scram and loss of core cooling	4.4×10^{-8}/ 0	0.020/ 0	7.3×10^{-10}/ 0	3.3×10^{-4}/ 0	7.6×10^{-7}/ 0	0.34/ 0	1.3×10^{-7}
Large break loss of coolant accident and loss of core cooling	2.5×10^{-8}/ 1.3×10^{-7}	0.071/ 0.36	3.7×10^{-9}/ 0	0.010/ 0	2.0×10^{-7}/ 0	0.57/ 0	2.1×10^{-8}
Expected risk[d]	1.2×10^{-7}/ 1.3×10^{-7}	–	5.0×10^{-9}/ 0	–	1.4×10^{-6}/ 0	–	–

[a] The risk values are calculated by multiplying the probability of cancer fatality (for the worker at 1,000 m or the maximum offsite individual) or the number of cancer fatalities (for the population to 80 km) by the accident frequency and the number of year of operation.

[b] Increase likelihood (or probability) of cancer or prompt fatality to a hypothetical individual (a single onsite worker at a distance of 1,000 m or the site boundary, whichever is smaller, or to a hypothetical individual in the offsite population located at the site boundary) if exposed to the indicated dose. The value assumes the accident has occurred.

[c] Estimated number of cancer fatalities in the entire offsite population out to a distance of 80 km if exposed to the indicated dose. The value assumes the accident has occurred.

[d] Expected risk is the sum of the risks over the lifetime of the facility.

Note: All values are mean values. Advanced BWR data was used as surrogate data for the evolutionary LWR.

Source: Calculated using the source terms in Tables M.5.3.8.1–1 and M.5.3.8.1–2 and the MACCS computer code.

Table 4.3.5.4.9–9. Evolutionary Light Water Reactor Accident Impacts at Pantex Plant

	Worker at 1,000 m		Maximum Offsite Individual		Population to 80 km		
Accident Description	**Risk of Latent Cancer/Prompt Fatality (per 17 yr)[a]**	**Probability of Latent Cancer/ Prompt Fatality[b]**	**Risk of Latent Cancer/Prompt Fatality (per 17 yr)[a]**	**Probability of Latent Cancer/ Prompt Fatality[b]**	**Risk of Latent Cancer/Prompt Fatalities (per 17 yr)[a]**	**Number of Latent Cancer/ Prompt Fatalities[c]**	**Accident Frequency (per yr)**
Failure of small primary coolant line outside containment	1.5×10^{-8}/ 0	8.8×10^{-7}/ 0	1.3×10^{-8}/ 0	7.9×10^{-7}/ 0	5.4×10^{-7}/ 0	3.2×10^{-5}/ 0	1.0×10^{-3}
Scram system piping break outside containment	1.6×10^{-9}/ 0	9.7×10^{-6}/ 0	1.5×10^{-9}/ 0	8.7×10^{-6}/ 0	5.7×10^{-8}/ 0	3.4×10^{-4}/ 0	1.0×10^{-5}
Cleanup water line break outside containment	4.5×10^{-11}/ 0	2.6×10^{-7}/ 0	4.0×10^{-11}/ 0	2.3×10^{-7}/ 0	1.8×10^{-9}/ 0	1.1×10^{-5}/ 0	1.0×10^{-5}
Fuel handling	1.9×10^{-9}/ 0	1.1×10^{-5}/ 0	1.7×10^{-9}/ 0	9.9×10^{-6}/ 0	8.3×10^{-8}/ 0	4.9×10^{-4}/ 0	1.0×10^{-5}
Anticipated transient with scram and loss of core cooling	1.6×10^{-8}/ 0	7.2×10^{-3}/ 0	1.4×10^{-8}/ 0	6.5×10^{-3}/ 0	9.0×10^{-7}/ 0	0.41/ 0	1.3×10^{-7}
Large break loss of coolant accident and loss of core cooling	3.4×10^{-8}/ 2.9×10^{-8}	0.095/ 0.080	3.6×10^{-8}/ 1.7×10^{-8}	0.10/ 0.047	8.4×10^{-7}/ 0	2.3/ 0	2.1×10^{-8}
Expected risk[d]	6.8×10^{-8}/ 2.9×10^{-8}	–	6.7×10^{-8}/ 1.7×10^{-8}	–	2.4×10^{-6}/ 0	–	–

[a] The risk values are calculated by multiplying the probability of cancer fatality (for the worker at 1,000 m or the maximum offsite individual) or the number of cancer fatalities (for the population to 80 km) by the accident frequency and the number of year of operation.

[b] Increase likelihood (or probability) of cancer or prompt fatality to a hypothetical individual (a single onsite worker at a distance of 1,000 m or the site boundary, whichever is smaller, or to a hypothetical individual in the offsite population located at the site boundary) if exposed to the indicated dose. The value assumes the accident has occurred.

[c] Estimated number of cancer fatalities in the entire offsite population out to a distance of 80 km if exposed to the indicated dose. The value assumes the accident has occurred.

[d] Expected risk is the sum of the risks over the lifetime of the facility.

Note: All values are mean values. Advanced BWR data was used as surrogate data for the evolutionary LWR.

Source: Calculated using the source terms in Tables M.5.3.8.1–1 and M.5.3.8.1–2 and the MACCS computer code.

Table 4.3.5.4.9–10. Evolutionary Light Water Reactor Accident Impacts at Oak Ridge Reservation

	Worker at 665 m		Maximum Offsite Individual		Population to 80 km		
Accident Description	**Risk of Latent Cancer/Prompt Fatality (per 17 yr)[a]**	**Probability of Latent Cancer/ Prompt Fatality[b]**	**Risk of Latent Cancer/Prompt Fatality (per 17 yr)[a]**	**Probability of Latent Cancer/ Prompt Fatality[b]**	**Risk of Latent Cancer/Prompt Fatalities (per 17 yr)[a]**	**Number of Latent Cancer/ Prompt Fatalities[c]**	**Accident Frequency (per yr)**
Failure of small primary coolant line outside containment	4.7×10^{-8}/ 0	2.8×10^{-6}/ 0	5.9×10^{-8}/ 0	3.5×10^{-6}/ 0	3.7×10^{-6}/ 0	2.2×10^{-4}/ 0	1.0×10^{-3}
Scram system piping break outside containment	5.2×10^{-9}/ 0	3.0×10^{-5}/ 0	6.4×10^{-9}/ 0	3.8×10^{-5}/ 0	3.9×10^{-7}/ 0	2.3×10^{-3}/ 0	1.0×10^{-5}
Cleanup water line break outside containment	1.4×10^{-10}/ 0	8.3×10^{-7}/ 0	1.8×10^{-10}/ 0	1.0×10^{-6}/ 0	1.3×10^{-8}/ 0	7.4×10^{-5}/ 0	1.0×10^{-5}
Fuel handling	5.8×10^{-9}/ 0	3.4×10^{-5}/ 0	7.3×10^{-9}/ 0	4.3×10^{-5}/ 0	6.6×10^{-7}/ 0	3.9×10^{-3}/ 0	1.0×10^{-5}
Anticipated transient with scram and loss of core cooling	6.1×10^{-8}/ 0	0.028/ 0	7.7×10^{-8}/ 0	0.035 0	6.9×10^{-6}/ 0	3.1/ 0	1.3×10^{-7}
Large break loss of coolant accident and loss of core cooling	2.1×10^{-8}/ 2.0×10^{-7}	0.058/ 0.56	2.6×10^{-8}/ 2.0×10^{-7}	0.073/ 0.56	7.9×10^{-6}/ 0	22/ 0	2.1×10^{-8}
Expected risk[d]	1.4×10^{-7}/ 2.0×10^{-7}	–	1.8×10^{-7}/ 2.0×10^{-7}	–	2.0×10^{-5}/ 0	–	–

[a] The risk values are calculated by multiplying the probability of cancer fatality (for the worker at 665 m or the maximum offsite individual) or the number of cancer fatalities (for the population to 80 km) by the accident frequency and the number of year of operation.

[b] Increase likelihood (or probability) of cancer or prompt fatality to a hypothetical individual (a single onsite worker at a distance of 1,000 m or the site boundary [665 m for the facility at ORR], whichever is smaller, or to a hypothetical individual in the offsite population located at the site boundary) if exposed to the indicated dose. The value assumes the accident has occurred.

[c] Estimated number of cancer fatalities in the entire offsite population out to a distance of 80 km if exposed to the indicated dose. The value assumes the accident has occurred.

[d] Expected risk is the sum of the risks over the lifetime of the facility.

Note: All values are mean values. Advanced BWR data was used as surrogate data for the evolutionary LWR.

Source: Calculated using the source terms in Tables M.5.3.8.1–1 and M.5.3.8.1–2 and the MACCS computer code.

Table 4.3.5.4.9–11. Evolutionary Light Water Reactor Accident Impacts at Savannah River Site

	Worker at 1,000 m		Maximum Offsite Individual		Population to 80 km		
Accident Description	Risk of Latent Cancer/Prompt Fatality (per 17 yr)[a]	Probability of Latent Cancer/ Prompt Fatality[b]	Risk of Latent Cancer/Prompt Fatality (per 17 yr)[a]	Probability of Latent Cancer/ Prompt Fatality[b]	Risk of Latent Cancer/Prompt Fatality (per 17 yr)[a]	Number of Latent Cancer/ Prompt Fatalities[c]	Accident Frequency (per yr)
Failure of small primary coolant line outside containment	2.4×10^{-8}/ 0	1.4×10^{-6}/ 0	3.5×10^{-10}/ 0	2.1×10^{-8}/ 0	1.3×10^{-6}/ 0	7.5×10^{-5}/ 0	1.0×10^{-3}
Scram system piping break outside containment	2.6×10^{-9}/ 0	1.6×10^{-5}/ 0	3.8×10^{-11}/ 0	2.3×10^{-7}/ 0	1.3×10^{-7}/ 0	7.9×10^{-4}/ 0	1.0×10^{-5}
Cleanup water line break outside containment	7.2×10^{-11}/ 0	4.2×10^{-7}/ 0	1.1×10^{-12}/ 0	6.3×10^{-9}/ 0	4.5×10^{-9}/ 0	2.6×10^{-5}/ 0	1.0×10^{-5}
Fuel handling	3.0×10^{-9}/ 0	1.8×10^{-5}/ 0	6.6×10^{-11}/ 0	3.9×10^{-7}/ 0	2.1×10^{-7}/ 0	1.3×10^{-3}/ 0	1.0×10^{-5}
Anticipated transient with scram and loss of core cooling	3.0×10^{-8}/ 0	0.013/ 0	5.8×10^{-10}/ 0	2.6×10^{-4}/ 0	2.5×10^{-6}/ 0	1.1/ 0	1.3×10^{-7}
Large break loss of coolant accident and loss of core cooling	3.4×10^{-8}/ 7.4×10^{-8}	0.096/ 0.21	1.7×10^{-9}/ 0	4.9×10^{-3}/ 0	1.5×10^{-6}/ 0	4.3/ 0	2.1×10^{-8}
Expected risk[d]	9.3×10^{-8}/ 7.4×10^{-8}	–	2.8×10^{-9}/ 0	–	5.7×10^{-6}/ 0	–	–

[a] The risk values are calculated by multiplying the probability of cancer fatality (for the worker at 1,000 m or the maximum offsite individual) or the number of cancer fatalities (for the population to 80 km) by the accident frequency and the number of year of operation.

[b] Increase likelihood (or probability) of cancer or prompt fatality to a hypothetical individual (a single onsite worker at a distance of 1,000 m or the site boundary, whichever is smaller, or to a hypothetical individual in the offsite population located at the site boundary) if exposed to the indicated dose. The value assumes the accident has occurred.

[c] Estimated number of cancer fatalities in the entire offsite population out to a distance of 80 km if exposed to the indicated dose. The value assumes the accident has occurred.

[d] Expected risk is the sum of the risks over the lifetime of the facility.

Note: All values are mean values. Advanced BWR data was used as surrogate data for the evolutionary LWR.

Source: Calculated using the source terms in Tables M.5.3.8.1–1 and M.5.3.8.1–2 and the MACCS computer code.