M.2.6 RADIOLOGICAL IMPACTS AT IDAHO NATIONAL ENGINEERING LABORATORY

This section presents the radiological impacts of various storage and disposition alternatives at INEL. Section M.2.6.1 presents the radiological releases and resulting impacts from facilities associated with No Action. Section M.2.6.2 presents the radiological releases and resulting impacts from the various alternatives.

For purposes of radiological impact modelling, INEL was divided into nine separate areas which would release radioactivity in 2005. All release points in each area were aggregated into a single release point. Table M.2.6–1 presents the characteristics of each of the release points including location, release height, and minimum distance to and annual average dispersion to the site boundary in each of the 16 directions. In order to calculate the maximum site boundary dose (that is, the dose ultimately incurred to the site MEI), the dose from each release point to the "maximum receptor" (that is, potential MEI) associated with each of the other release points has been calculated. For further clarification on the definition of the "maximum receptor" refer to Section M.2.2.2. For example, the dose resulting from releases from the Test Reactor Area, Argonne National Laboratory-West (ANL-W), Waste Experimental Reduction Facility/Power Burst Facility Area, and the other storage and disposition alternatives, has been determined for the maximum receptor from the Central Facilities Area. Figure M.2.6–1 illustrates the location of each maximum receptor in relation to each release point. The maximum site boundary dose (that is, the dose ultimately incurred to the site MEI) is then determined by the maximum dose to one of these maximum receptors. Table M.2.6–2 presents the direction, distance, and atmospheric dispersion from each release point to each of the maximum receptors. Annual radiological releases were assumed to remain constant during the full operational period.

The population and food stuffs distributions centered on each release area are provided in a Health Risk Data report, October 1996. The joint frequency distribution used for the dose assessment was based on the meteorological measurements for the year 1986 from the GRID III tower at the 10-m (33-ft) height and is contained in the Health Risk Data report.

Doses given in this section are associated with 1 year of operation because regulatory standards are given as annual limits. The health effects are presented on an annual basis in the tables, and for the projected operational period in the text. Tables M.2.6–3 and M.2.6–4 include the radiological impact to the public from atmospheric releases for No Action and the storage and disposition alternatives.

Table M.2.6–1. Release Point Characteristics, Direction, Distance, and Chi/Q at the Idaho National Engineering Laboratory Boundary

Release Point[a]	SMC		TAN		TRA		ICPP		LWR Site	
Latitude	43°51'27.741"		43°50'56.339"		43°35'8.244"		43°34'16.091"		43°34'42.623"	
Longitude	-112°43'47.366"		-112°42'14.153"		-112°57'46.840"		-112°56'4.083"		-112°52'5.376"	
Release Height	Ground Level		51.4 m		76.2 m		76.2 m		Ground Level	
	Distance and Atmospheric Dispersion at Site Boundary									
Direction	**Distance (m)**	**Chi/Q (s/m^3)**	**Distance (m)**	**Chi/Q (s/m^3)**	**Distance (m)**	**Chi/Q (s/m^3)**	**Distance (m)**	**Chi/Q (s/m^3)**	**Distance (m)**	**Chi/Q (s/m^3)**
N	18,016	$1.6x10^{-8}$	18,938	$5.2x10^{-9}$	19,099	$3.3x10^{-9}$	20,722	$3.1x10^{-9}$	22,328	$1.2x10^{-8}$
NNE	16,399	$3.7x10^{-8}$	12,650	$1.8x10^{-8}$	21,737	$6.8x10^{-9}$	24,282	$6.0x10^{-9}$	44,886	$9.8x10^{-9}$
NE	13,055	$1.2x10^{-7}$	12,336	$4.4x10^{-8}$	42,901	$7.3x10^{-9}$	42,405	$7.4x10^{-9}$	37,705	$2.9x10^{-8}$
ENE	12,005	$9.9x10^{-8}$	9,884	$3.4x10^{-8}$	41,932	$4.6x10^{-9}$	39,577	$4.9x10^{-9}$	34,098	$2.5x10^{-8}$
E	11,726	$4.0x10^{-8}$	9,685	$1.3x10^{-8}$	26,374	$2.9x10^{-9}$	23,863	$3.2x10^{-9}$	19,377	$2.0x10^{-8}$
ESE	16,180	$1.2x10^{-8}$	15,770	$3.9x10^{-9}$	26,409	$1.4x10^{-9}$	24,074	$1.5x10^{-9}$	18,696	$1.0x10^{-8}$
SE	26,221	$3.3x10^{-9}$	23,757	$1.3x10^{-9}$	19,093	$1.0x10^{-9}$	16,409	$1.2x10^{-9}$	18,261	$5.2x10^{-9}$
SSE	35,151	$3.2x10^{-9}$	33,821	$1.2x10^{-9}$	15,967	$1.6x10^{-9}$	14,337	$1.7x10^{-9}$	14,690	$1.0x10^{-8}$
S	35,319	$9.6x10^{-9}$	33,731	$3.8x10^{-9}$	15,538	$5.2x10^{-9}$	13,952	$5.8x10^{-9}$	14,635	$3.1x10^{-8}$
SSW	46,586	$9.7x10^{-9}$	44,899	$4.5x10^{-9}$	15,753	$1.0x10^{-8}$	14,144	$1.1x10^{-8}$	15,028	$4.3x10^{-8}$
SW	30,060	$1.8x10^{-8}$	34,045	$7.6x10^{-9}$	18,299	$1.2x10^{-8}$	16,442	$1.3x10^{-8}$	17,459	$3.7x10^{-8}$
WSW	12,107	$2.4x10^{-8}$	14,260	$6.8x10^{-9}$	18,988	$3.3x10^{-9}$	21,409	$2.9x10^{-9}$	25,439	$8.9x10^{-9}$
W	11,779	$3.4x10^{-8}$	13,873	$9.9x10^{-9}$	17,014	$5.2x10^{-9}$	20,752	$4.2x10^{-9}$	24,305	$1.3x10^{-8}$
WNW	9,215	$1.4x10^{-8}$	11,510	$3.5x10^{-9}$	12,184	$2.2x10^{-9}$	14,992	$1.8x10^{-9}$	17,919	$5.7x10^{-9}$
NW	10,005	$2.0x10^{-8}$	12,462	$4.4x10^{-9}$	11,503	$2.9x10^{-9}$	14,283	$2.3x10^{-9}$	17,908	$9.2x10^{-9}$
NNW	14,481	$1.3x10^{-8}$	18,035	$3.4x10^{-9}$	12,204	$3.4x10^{-9}$	15,365	$2.7x10^{-9}$	20,732	$8.2x10^{-9}$

Table M.2.6–1. Release Point Characteristics, Direction, Distance, and Chi/Q at the Idaho National Engineering Laboratory Boundary —Continued

Release Point[a]	WERF		CFA		RWMC		ANL-W	
Latitude	43°33'3.443"		43°32'4.386"		43°29'58.551"		43°35'41.733"	
Longitude	-112°51'31.071"		-112°56'10.073"		-113°2'13.843"		-112°39'18.744"	
Release Height	24.4 m		Ground Level		Ground Level		42.7 m	
Distance and Atmospheric Dispersion at Site Boundary								
Direction	**Distance (m)**	**Chi/Q (s/m^3)**	**Distance (m)**	**Chi/Q (s/m^3)**	**Distance (m)**	**Chi/Q (s/m^3)**	**Distance (m)**	**Chi/Q (s/m^3)**
N	25,458	$6.7x10^{-9}$	24,783	$1.1x10^{-8}$	17,201	$1.7x10^{-8}$	32,639	$8.3x10^{-9}$
NNE	41,139	$7.5x10^{-9}$	40,101	$1.1x10^{-8}$	29,087	$1.7x10^{-8}$	24,645	$1.4x10^{-8}$
NE	39,204	$1.9x10^{-8}$	45,052	$2.3x10^{-8}$	53,829	$1.8x10^{-8}$	19,642	$1.6x10^{-8}$
ENE	32,888	$1.6x10^{-8}$	39,302	$2.0x10^{-8}$	47,686	$1.6x10^{-8}$	16,056	$1.5x10^{-8}$
E	17,582	$1.4x10^{-8}$	23,842	$1.5x10^{-8}$	32,039	$1.0x10^{-8}$	14,469	$9.4x10^{-9}$
ESE	17,857	$6.7x10^{-9}$	18,765	$1.0x10^{-8}$	11,265	$2.0x10^{-8}$	9,005	$1.5x10^{-8}$
SE	14,508	$4.5x10^{-9}$	11,856	$9.4x10^{-9}$	7,293	$1.9x10^{-8}$	5,862	$2.6x10^{-8}$
SSE	11,541	$8.4x10^{-9}$	10,161	$1.7x10^{-8}$	6,090	$3.5x10^{-8}$	5,518	$5.5x10^{-8}$
S	11,539	$2.6x10^{-8}$	9,886	$5.3x10^{-8}$	5,924	$1.1x10^{-7}$	5,571	$7.3x10^{-8}$
SSW	11,937	$3.8x10^{-8}$	10,021	$7.5x10^{-8}$	6,003	$1.6x10^{-7}$	17,065	$2.5x10^{-8}$
SW	13,872	$3.4x10^{-8}$	11,653	$6.4x10^{-8}$	6,992	$1.3x10^{-7}$	19,886	$2.1x10^{-8}$
WSW	20,227	$7.9x10^{-9}$	16,966	$1.5x10^{-8}$	10,193	$3.0x10^{-8}$	28,926	$1.1x10^{-8}$
W	26,937	$7.5x10^{-9}$	20,726	$1.6x10^{-8}$	12,661	$3.1x10^{-8}$	35,298	$6.1x10^{-9}$
WNW	21,124	$3.1x10^{-9}$	19,192	$5.2x10^{-9}$	12,803	$8.9x10^{-9}$	32,525	$5.0x10^{-9}$
NW	20,318	$4.9x10^{-9}$	17,203	$9.7x10^{-9}$	14,757	$1.2x10^{-8}$	27,828	$6.4x10^{-9}$
NNW	23,853	$4.4x10^{-9}$	17,397	$1.0x10^{-8}$	16,111	$1.1x10^{-8}$	31,167	$8.5x10^{-9}$

[a] See Figure M.2.6–1 for location of release points.

Note: TAN=Test Area North; TRA=Test Reactor Area; WERF=Waste Experimental Reduction Area.

Source: HNUS 1996a.

Table M.2.6–2. Direction, Distance, and Meteorological Dispersion to Various Maximum Individual Receptors at the Idaho National Engineering Laboratory Site Boundary

Maximum Receptor For	Direction	Distance (m)	Atmospheric Dispersion Chi/Q (s/m^3)
Release Point: SMC			
SMC and TAN	NE	14,481	1.1×10^{-7}
TRA	SSW	53,888	8.1×10^{-9}
ICPP	SSW	52,249	8.4×10^{-9}
LWR Site	SSW	47,838	9.4×10^{-9}
WERF	SSW	47,497	9.5×10^{-9}
CFA	SSW	49,319	9.0×10^{-9}
RWMC	SSW	52,487	8.3×10^{-9}
ANL-W	S	35,376	9.6×10^{-9}
Release Point: TAN			
SMC and TAN	NE	12,337	4.4×10^{-8}
TRA	SW	54,224	4.4×10^{-9}
ICPP	SSW	52,464	3.8×10^{-9}
LWR Site	SSW	47,566	4.2×10^{-9}
WERF	SSW	47,165	4.3×10^{-9}
CFA	SSW	49,252	4.1×10^{-9}
RWMC	SSW	52,722	3.8×10^{-9}
ANL-W	S	34,503	3.7×10^{-9}
Release Point: TRA			
SMC and TAN	NE	48,269	6.4×10^{-9}
TRA	SW	18,299	1.2×10^{-8}
ICPP	SSW	16,796	9.4×10^{-9}
LWR Site	SSE	16,393	1.5×10^{-9}
WERF	SSE	16,850	1.5×10^{-9}
CFA	S	15,549	5.2×10^{-9}
RWMC	SSW	16,992	9.3×10^{-9}
ANL-W	E	16,415	2.9×10^{-9}
Release Point: ICPP			
SMC and TAN	NE	48,292	6.4×10^{-9}
TRA	SW	18,395	1.2×10^{-8}
ICPP	SW	16,443	1.3×10^{-8}
LWR Site	S	14,251	5.7×10^{-9}
WERF	SSE	14,570	1.7×10^{-9}
CFA	S	14,059	5.8×10^{-9}
RWMC	SW	16,712	1.3×10^{-8}
ANL-W	E	23,906	3.2×10^{-9}
Release Point: LWR Site			
SMC and TAN	NNE	44,887	9.8×10^{-9}
TRA	SW	22,811	2.6×10^{-8}
ICPP	SW	20,426	3.0×10^{-8}
LWR Site	SSW	15,029	4.3×10^{-8}
WERF	S	14,873	3.0×10^{-8}

Table M.2.6–2. Direction, Distance, and Meteorological Dispersion to Various Maximum Individual Receptors at the Idaho National Engineering Laboratory Site Boundary—Continued

Maximum Receptor For	Direction	Distance (m)	Atmospheric Dispersion Chi/Q (s/m^3)
CFA	SSW	16,430	$3.8x10^{-8}$
RWMC	SW	20,771	$2.9x10^{-8}$
ANL-W	ESE	18,736	$1.0x10^{-8}$
Release Point: WERF			
SMC and TAN	NNE	47,288	$6.3x10^{-9}$
TRA	WSW	21,626	$7.3x10^{-9}$
ICPP	SW	18,954	$2.3x10^{-8}$
LWR Site	SSW	12,217	$3.6x10^{-8}$
WERF	SSW	11,938	$3.8x10^{-8}$
CFA	SW	14,170	$3.3x10^{-8}$
RWMC	SW	19,347	$2.2x10^{-8}$
ANL-W	E	17,626	$1.4x10^{-8}$
Release Point: CFA			
SMC and TAN	NNE	51,824	$8.2x10^{-9}$
TRA	SW	15,468	$4.3x10^{-8}$
ICPP	SW	13,109	$5.4x10^{-8}$
LWR Site	SSE	10,331	$1.6x10^{-8}$
WERF	SSE	10,777	$1.5x10^{-8}$
CFA	SSW	10,021	$7.5x10^{-8}$
RWMC	SW	13,442	$5.2x10^{-8}$
ANL-W	E	23,916	$1.5x10^{-8}$
Release Point: RWMC			
SMC and TAN	NE	59,528	$1.6x10^{-8}$
TRA	SW	7,019	$1.3x10^{-7}$
ICPP	S	5,943	$1.1x10^{-7}$
LWR Site	ESE	12,605	$1.7x10^{-8}$
WERF	ESE	13,761	$1.5x10^{-8}$
CFA	SE	8,791	$1.4x10^{-8}$
RWMC	SSW	6,004	$1.6x10^{-7}$
ANL-W	E	32,468	$1.0x10^{-8}$
Release Point: ANL-W			
SMC and TAN	N	38,094	$6.8x10^{-9}$
TRA	WSW	38,408	$7.9x10^{-9}$
ICPP	WSW	35,484	$8.7x10^{-9}$
LWR Site	SW	25,870	$1.5x10^{-8}$
WERF	SW	24,903	$1.5x10^{-8}$
CFA	WSW	29,537	$1.1x10^{-8}$
RWMC	WSW	35,923	$8.6x10^{-9}$
ANL-W	S	5,572	$7.3x10^{-8}$

Note: WERF=Waste Experimental Reduction Facility; TAN=Test Area North; TRA=Test Reactor Area.
Source: HNUS 1996a.

Table M.2.6–3. Doses and Resulting Health Effects to the Maximally Exposed Individual at Idaho National Engineering Laboratory From Atmospheric Releases Associated With Annual Normal Operation

Alternative/Facility	Dose by Pathway (mrem)				Committed Effective Dose Equivalent (mrem)	Percent of Background[a]	Estimated 1-Year Fatal Cancer Risk
	Inhalation	Ingestion	Plume Immersion	Ground Shine			
No Action (Total Site)	2.8×10^{-4}	1.5×10^{-2}	2.2×10^{-3}	2.9×10^{-5}	1.8×10^{-2}[b]	5.2×10^{-3}	8.9×10^{-9}
Upgrade Storage	5.1×10^{-7}	8.8×10^{-10}	1.9×10^{-16}	4.0×10^{-13}	5.1×10^{-7}	1.5×10^{-7}	2.6×10^{-13}
Consolidated Storage Facility	1.6×10^{-6}	2.8×10^{-9}	6.1×10^{-16}	1.3×10^{-12}	1.6×10^{-6}	4.7×10^{-7}	8.0×10^{-13}
Collocated Storage Facility	1.6×10^{-6}	2.8×10^{-9}	6.5×10^{-16}	1.9×10^{-12}	1.6×10^{-6}	4.7×10^{-7}	8.0×10^{-13}
Pit Disassembly/ Conversion Facility	1.8×10^{-4}	4.0×10^{-6}	1.1×10^{-12}	1.6×10^{-9}	1.8×10^{-4}	5.3×10^{-5}	9.0×10^{-11}
Pu Conversion Facility	1.2×10^{-4}	2.2×10^{-7}	5.0×10^{-14}	1.0×10^{-10}	1.2×10^{-4}	3.6×10^{-5}	6.0×10^{-11}
MOX Fuel Fabrication Facility	8.8×10^{-5}	1.5×10^{-7}	3.3×10^{-14}	1.6×10^{-10}	8.8×10^{-5}	2.6×10^{-5}	4.4×10^{-11}
Ceramic Immobilization Facility (Immobilized Disposition)	2.0×10^{-8}	3.6×10^{-11}	8.1×10^{-18}	1.6×10^{-14}	2.0×10^{-8}	5.9×10^{-9}	1.0×10^{-14}
Deep Borehole Complex (Direct Disposition)	3.3×10^{-9}	4.9×10^{-11}	1.3×10^{-17}	1.9×10^{-14}	3.4×10^{-9}	1.0×10^{-9}	1.7×10^{-15}
Deep Borehole Complex (Immobilized Disposition)	4.1×10^{-9}	7.2×10^{-11}	1.9×10^{-17}	2.9×10^{-14}	4.2×10^{-9}	1.2×10^{-9}	2.1×10^{-15}
Vitrification Facility	8.2×10^{-6}	5.5×10^{-7}	1.6×10^{-10}	9.0×10^{-8}	8.9×10^{-6}	2.6×10^{-6}	4.4×10^{-12}
Ceramic Immobilization Facility (Ceramic Immobilization)	2.3×10^{-8}	1.1×10^{-7}	3.2×10^{-11}	1.7×10^{-8}	1.5×10^{-7}	4.4×10^{-8}	7.5×10^{-14}
Advanced Boiling Water Reactor	1.2×10^{-3}	6.2×10^{-2}	1.3×10^{-2}	1.4×10^{-3}	7.8×10^{-2}	2.3×10^{-2}	3.9×10^{-8}
CE System 80+ Reactor	1.9×10^{-3}	3.6×10^{-2}	7.2×10^{-4}	3.0×10^{-4}	3.8×10^{-2}	1.1×10^{-2}	1.9×10^{-8}
[Text deleted.]							
AP600 Reactor	1.0×10^{-3}	2.9×10^{-2}	2.2×10^{-3}	4.5×10^{-4}	3.3×10^{-2}	9.8×10^{-3}	1.7×10^{-8}
RESAR-90 Reactor	1.6×10^{-3}	4.3×10^{-2}	9.0×10^{-4}	3.8×10^{-4}	4.6×10^{-2}	1.4×10^{-2}	2.3×10^{-8}

[a] Average individual annual natural background radiation is equal to 338 mrem.

[b] The storage facility contributes 1.4×10^{-5} mrem/year.

[Text deleted.]

Source: HNUS 1996a.

Table M.2.6–4. Doses and Resulting Health Effects to the Population Within 80 Kilometers of Idaho National Engineering Laboratory From Atmospheric Releases Associated With Normal Operation in 2030

Alternative/Facility	Dose by Pathway (person-rem)				Committed Effective Dose Equivalent (person-rem)	Percent of Background[a]	Estimated 1-Year Fatal Cancers
	Inhalation	Ingestion	Plume Immersion	Ground Shine			
No Action (Total Site)	2.9×10^{-3}	2.4	2.1×10^{-2}	3.0×10^{-4}	2.4[b]	2.7×10^{-3}	1.2×10^{-3}
Upgrade Storage	3.1×10^{-6}	1.5×10^{-7}	1.2×10^{-15}	2.5×10^{-12}	3.2×10^{-6}	3.5×10^{-9}	1.6×10^{-9}
Consolidated Storage Facility	1.7×10^{-5}	9.1×10^{-7}	6.5×10^{-15}	1.4×10^{-11}	1.8×10^{-5}	2.0×10^{-8}	9.0×10^{-9}
Collocated Storage Facilities	1.7×10^{-5}	9.2×10^{-7}	6.9×10^{-15}	2.1×10^{-11}	1.8×10^{-5}	2.0×10^{-8}	9.0×10^{-9}
Pit Disassembly/ Conversion Facility	1.9×10^{-3}	1.3×10^{-3}	1.1×10^{-11}	1.6×10^{-8}	3.2×10^{-3}	3.5×10^{-6}	1.6×10^{-6}
Pu Conversion Facility	8.6×10^{-4}	3.1×10^{-4}	1.9×10^{-12}	3.1×10^{-9}	1.2×10^{-3}	1.3×10^{-6}	6.0×10^{-7}
MOX Fuel Fabrication Facility	9.2×10^{-4}	4.9×10^{-5}	3.5×10^{-13}	1.7×10^{-9}	9.7×10^{-4}	1.1×10^{-6}	4.9×10^{-7}
Ceramic Immobilization Facility (Immobilized Disposition)	2.2×10^{-7}	1.2×10^{-8}	8.4×10^{-17}	1.7×10^{-13}	2.3×10^{-7}	2.5×10^{-10}	1.2×10^{-10}
Deep Borehole Complex (Direct Disposition)	3.5×10^{-8}	1.6×10^{-8}	1.3×10^{-16}	2.0×10^{-13}	5.1×10^{-8}	5.6×10^{-11}	2.6×10^{-11}
Deep Borehole Complex (Immobilized Disposition)	4.4×10^{-8}	2.3×10^{-8}	2.0×10^{-16}	3.0×10^{-13}	6.7×10^{-8}	7.4×10^{-11}	3.4×10^{-11}
Vitrification Facility	8.6×10^{-5}	7.1×10^{-5}	1.7×10^{-9}	9.0×10^{-7}	1.6×10^{-4}	1.8×10^{-7}	8.0×10^{-8}
Ceramic Immobilization Facility (Ceramic Immobilization)	2.4×10^{-7}	1.3×10^{-5}	3.3×10^{-10}	1.9×10^{-7}	1.4×10^{-5}	1.5×10^{-8}	7.0×10^{-9}
Advanced Boiling Water Reactor	1.0×10^{-2}	13	7.6×10^{-2}	1.2×10^{-2}	14	1.5×10^{-2}	6.8×10^{-3}
CE System 80+ Reactor	2.1×10^{-2}	8.6	5.4×10^{-3}	3.4×10^{-3}	8.6	9.5×10^{-3}	4.3×10^{-3}
[Text deleted.]							
AP600 Reactor	1.1×10^{-2}	6.9	1.9×10^{-2}	5.1×10^{-3}	6.9	7.6×10^{-3}	3.5×10^{-3}
RESAR-90 Reactor	1.8×10^{-2}	9.6	8.2×10^{-3}	4.3×10^{-3}	9.6	1.1×10^{-2}	4.8×10^{-3}

[a] Total dose to the population within 80 km from natural background radiation in the year 2030 is equal to 90,800 person-rem.

[b] The storage facility contributes 7.6x10-5 person-rem/year.

[Text deleted.]

Source: HNUS 1996a.

M.2.6.1 No Action

Atmospheric Releases and Resulting Impacts to the Public. For No Action, eight of the nine areas have radioactive releases to the atmosphere from normal operation. Table M.2.6.1–1 presents the estimated annual atmospheric radioactive releases.

Tables M.2.6–3 and M.2.6–4 include the radiological impacts to the MEI and to the offsite population within 80 km (50 mi), respectively. The maximally exposed individual would receive an annual dose of 0.018 mrem. An estimated fatal cancer risk of 4.4×10^{-7} would result from 50 years of operation. The population within 80 km (50 mi) would receive a dose of 2.4 person-rem in 2030 (mid-life of operation). An estimated 0.061 fatal cancers could result from 50 years of operation.

Liquid Releases and Resulting Impacts to the Public. There are no radioactive liquid releases to the offsite environment associated with No Action. Therefore, there are no resulting impacts.

Worker Doses and Health Effects. Based on measured values during the time period of 1989 to 1992 (*Twenty-Second Annual Report Radiation Exposures for DOE and DOE Contractor Employees–1989* [DOE/EH-0286P] and subsequent yearly data reports), the annual average radiation dose to a badged worker at INEL was calculated to be 30 mrem. It is projected that in 2005 and beyond, there would be 7,337 badged workers involved in No Action activities at INEL. The annual average radiation dose to these workers is assumed to remain at 30 mrem; the annual total radiation dose among all these workers would then equal 220 person-rem. From 50 years of operation, an estimated fatal cancer risk of 6.0×10^{-4} would result to the average worker and 4.4 fatal cancers could result among all workers.

Table M.2.6.1–1. Annual Atmospheric Radioactive Releases From Normal Operation of No Action at Idaho National Engineering Laboratory (curies)

	SMC	TAN		TRA		ICPP		WERF		CFA	RWMC	ANL-W[a]	
Isotope	All Releases	Monitored/ Non-monitored	Diffuse Area	Monitored/ Non-monitored	Diffuse Area	Monitored/ Non-monitored	Diffuse Area	Monitored/ Non-monitored	Diffuse Area	All Releases	All Releases	Monitored/ Non-monitored	Diffuse Area
Ag-110m	0	0	0	0	0	5.1×10^{-12}	0	0	0	0	0	0	0
Am-241	0	0	0	0	5.8×10^{-7}	2.4×10^{-11}	2.2×10^{-9}	0	0	0	2.0×10^{-6}	0	0
Am-243	0	0	0	0	0	2.4×10^{-13}	0	0	0	0	0	0	0
Ar-41	0	0	0	1.3×10^{3}	0	0	0	0	0	0	0	17	0
Ba-139	0	0	0	5.4×10^{-2}	0	0	0	0	0	0	0	0	0
Ba-140	0	0	0	6.2×10^{-6}	0	0	0	0	0	0	0	2.7×10^{-3}	0
C-14	0	0	0	0	0	9.6×10^{-3}	0	0	0	0	0	0	0
Cd-113m	0	0	0	0	0	8.6×10^{-14}	0	0	0	0	0	0	0
Ce-141	0	0	0	0	0	2.5×10^{-12}	0	0	0	0	0	0	0
Ce-144	0	0	0	0	0	3.8×10^{-6}	9.2×10^{-9}	0	0	0	0	0	0
Cm-244	0	0	0	0	3.0×10^{-5}	0	0	0	0	0	0	0	0
Co-57	0	0	0	0	0	7.8×10^{-8}	0	0	0	0	0	0	0
Co-58	0	0	0	8.0×10^{-7}	0	2.4×10^{-7}	0	0	0	0	0	8.8×10^{-6}	0
Co-60	0	3.5×10^{-7}	5.7×10^{-7}	2.4×10^{-4}	3.8×10^{-4}	9.6×10^{-6}	4.5×10^{-9}	0	2.3×10^{-6}	2.0×10^{-6}	7.8×10^{-10}	1.6×10^{-5}	0
Cr-51	0	0	0	3.8×10^{-3}	7.1×10^{-7}	5.6×10^{-15}	0	0	0	0	0	0	0
Cs-134	0	0	2.9×10^{-10}	0	5.0×10^{-7}	8.8×10^{-5}	2.6×10^{-8}	0	5.6×10^{-7}	5.6×10^{-8}	0	1.5×10^{-4}	0
Cs-137	0	1.3×10^{-6}	2.7×10^{-6}	6.1×10^{-6}	8.7×10^{-4}	8.1×10^{-3}	7.6×10^{-6}	0	4.7×10^{-5}	9.0×10^{-5}	1.4×10^{-5}	8.2×10^{-4}	0
Cs-138	0	0	0	0.69	0	0	0	0	0	0	0	0	0
Eu-152	0	0	0	0	7.9×10^{-7}	8.7×10^{-5}	1.1×10^{-6}	0	0	4.7×10^{-8}	0	0	0
Eu-154	0	0	4.1×10^{-10}	0	3.7×10^{-7}	6.0×10^{-5}	0	0	0	9.1×10^{-8}	0	1.6×10^{-5}	0
Eu-155	0	0	0	0	7.1×10^{-8}	8.7×10^{-6}	0	0	0	2.2×10^{-8}	0	9.3×10^{-4}	0
Fe-55	0	0	0	0	0	4.5×10^{-9}	0	0	0	0	0	0	0
Hg-203	0	0	0	8.8×10^{-5}	0	0	0	0	0	4.7×10^{-9}	0	0	0
H-3	0	0	0	11	120	67	8.9×10^{-9}	0	0	4.4	0	34	7.9×10^{-2}
I-129	0	0	0	0	0	9.8×10^{-2}	3.8×10^{-8}	0	0	0	0	0	0
I-131	0	0	0	1.1×10^{-4}	0	0	0	0	0	0	0	0	0
I-132	0	0	0	1.1×10^{-3}	0	0	0	0	0	0	0	0	0
I-133	0	0	0	4.3×10^{-4}	0	0	0	0	0	0	0	0	0

Table M.2.6.1–1. Annual Atmospheric Radioactive Releases From Normal Operation of No Action at Idaho National Engineering Laboratory (curies)—Continued

	SMC	TAN		TRA		ICPP		WERF		CFA	RWMC	ANL-W[a]	
Isotope	All Releases	Monitored/ Non-monitored	Diffuse Area	Monitored/ Non-monitored	Diffuse Area	Monitored/ Non-monitored	Diffuse Area	Monitored/ Non-monitored	Diffuse Area	All Releases	All Releases	Monitored/ Non-monitored	Diffuse Area
Kr-85	0	0	0	0	0	0	0	0	0	0	0	70	0
Kr-85m	0	0	0	8.0	0	0	0	0	0	0	0	44	0
Kr-87	0	0	0	25	0	0	0	0	0	0	0	38	0
Kr-88	0	0	0	24	0	0	0	0	0	0	0	55	0
La-140	0	0	0	1.2×10^{-4}	0	0	0	0	0	0	0	1.5×10^{-5}	0
Mn-54	0	0	0	0	0	5.2×10^{-11}	0	0	0	0	0	5.0×10^{-5}	0
Na-22	0	0	0	0	0	0	0	0	0	0	0	3.8×10^{-5}	0
Na-24	0	0	0	5.2×10^{-3}	0	0	0	0	0	0	0	1.0×10^{-7}	0
Nb-94	0	0	0	0	0	1.1×10^{-15}	0	0	0	0	0	0	0
Nb-95	0	0	0	0	0	4.8×10^{-7}	3.1×10^{-8}	0	0	0	0	0	0
Nb-95m	0	0	0	0	0	3.4×10^{-15}	0	0	0	0	0	0	0
Ni-63	0	0	0	0	0	4.3×10^{-15}	0	0	0	0	0	0	0
Np-239	0	0	0	0	0	3.8×10^{-16}	1.6×10^{-8}	0	0	0	0	0	0
Pa-234	2.2×10^{-8}	0	0	0	0	2.3×10^{-15}	0	0	0	0	0	0	0
Pm-147	0	0	0	0	0	2.5×10^{-6}	0	0	0	0	0	0	0
Pr-144	0	0	0	0	0	4.5×10^{-6}	0	0	0	0	0	0	0
Pr-144m	0	0	0	0	0	2.6×10^{-9}	0	0	0	0	0	0	0
Pu-238	0	0	2.1×10^{-9}	0	8.2×10^{-7}	8.5×10^{-8}	1.7×10^{-8}	0	1.4×10^{-10}	0	0	0	0
Pu-239	0	6.2×10^{-8}	0	8.1×10^{-7}	3.1×10^{-6}	1.4×10^{-6}	0	8.5×10^{-8}	1.9×10^{-10}	1.8×10^{-7}	1.2×10^{-6}	1.6×10^{-6}	0
Pu-240	0	0	1.9×10^{-9}	0	0	2.3×10^{-7}	0	0	0	0	0	0	0
Pu-241	0	0	0	0	0	5.1×10^{-6}	0	0	0	0	0	0	0
Rb-88	0	0	0	0.52	0	0	0	0	0	0	0	1.3×10^{-3}	0
Rb-89	0	0	0	0.73	0	0	0	0	0	0	0	0	0
Ru-106	0	0	0	0	0	1.0×10^{-3}	7.2×10^{-8}	0	0	0	0	0	0
Sb-125	0	0	0	0	0	9.8×10^{-5}	2.4×10^{-7}	0	0	2.8×10^{-8}	0	0	0
Sn-199m	0	0	0	0	0	2.4×10^{-8}	0.0	0	0	0	0	0	0
Sr-90	0	2.9×10^{-7}	1.9×10^{-7}	3.6×10^{-4}	8.6×10^{-5}	1.4×10^{-3}	9.5×10^{-9}	4.1×10^{-8}	6.8×10^{-6}	7.8×10^{-7}	3.0×10^{-8}	2.6×10^{-3}	0
Tc-99m	0	0	0	2.2×10^{-3}	0	2.2×10^{-13}	0	0	0	0	0	0	0

Table M.2.6.1–1. Annual Atmospheric Radioactive Releases From Normal Operation of No Action at Idaho National Engineering Laboratory (curies)—Continued

	SMC	TAN		TRA		ICPP		WERF		CFA	RWMC	ANL-W[a]	
Isotope	All Releases	Monitored/ Non-monitored	Diffuse Area	Monitored/ Non-monitored	Diffuse Area	Monitored/ Non-monitored	Diffuse Area	Monitored/ Non-monitored	Diffuse Area	All Releases	All Releases	Monitored/ Non-monitored	Diffuse Area
Th-228	0	0	0	0	2.0×10^{-7}	0	0	0	0	0	0	0	0
Th-230	0	0	0	0	1.0×10^{-7}	0	0	0	0	0	0	0	0
Th-231	0	0	0	0	0	5.6×10^{-12}	0	0	0	0	0	0	0
Th-232	0	0	0	0	9.5×10^{-9}	0.0	0	0	0	0	0	0	0
Th-234	7.7×10^{-6}	0	0	0	0	7.8×10^{-13}	0	0	0	0	0	0	0
U-232	0	0	0	0	1.7×10^{-7}	0.0	0	0	0	0	0	0	0
U-233	0	0	0	0	0	1.2×10^{-14}	0	0	0	0	0	0	0
U-234	1.0×10^{-6}	0	5.0×10^{-8}	0	1.9×10^{-5}	1.4×10^{-6}	2.4×10^{-8}	0	2.4×10^{-8}	0	0	0	0
U-235	0	0	1.8×10^{-9}	0	0	5.8×10^{-8}	0	0	1.2×10^{-7}	1.4×10^{-10}	9.5×10^{-9}	3.7×10^{-9}	0
U-238	7.7×10^{-6}	0	3.8×10^{-8}	0	1.2×10^{-5}	4.8×10^{-9}	0	0	6.1×10^{-9}	0	0	5.3×10^{-10}	0
Xe-133	0	0	0	4.2	0	2.7×10^{-9}	0	0	0	0	0	490	0
Xe-135	0	0	0	28	0	0	0	0	0	0	0	310	0
Xe-135m	0	0	0	14	0	0	0	0	0	0	0	11	0
Xe-138	0	0	0	71	0	0	0	0	0	0	0	22	0
Y-90	0	0	0	0.0	0	2.9×10^{-4}	9.5×10^{-9}	0	0	0	0	0	0
Y-91m	0	0	0	1.6×10^{-3}	0	1.7×10^{-10}	0	0	0	0	0	0	0
Zn-65	0	0	0	5.7×10^{-8}	5.7×10^{-8}	0	0	4.8×10^{-7}	0	0	0	0	0
Zr-93	0	0	0	0.0	0.0	2.2×10^{-15}	0	0	0	0	0	0	0
Zr-95	0	0	0	0.0	0.0	4.1×10^{-6}	0	0	0	0	0	0	0

[a] ANL-W reported that releases from the no action storage are not measurable. For calculation purposes, it was assumed that all the Pu released from ANL-W in 1993 was released from Pu storage. This is very conservative since EBR-II, a Pu-fueled reactor, was in operation in 1993. In October 1995, the EBR-II was defueled and is no longer in operation.

Note: TAN=Test Area North; TRA=Test Reactor Area; WERF=Waste Experimental Reduction Facility.

Source: IN DOE 1994c.

M.2.6.2 Storage and Disposition

Radioactive Releases and Resulting Impacts to the Public. For the storage and disposition alternatives, the impacts from the No Action facilities need to be added to the changes in impacts from the storage or disposition facilities to determine the impacts from total site operation. For example, to determine the radiological impact for the addition of an AP600 reactor at INEL, the doses from No Action facilities have to be summed with the AP600 reactor doses. Estimated annual atmospheric radioactive releases from the facilities associated with the various alternative actions are given in Section M.2.3. Tables M.2.6–3 and M.2.6–4 include the radiological impacts by alternative facility. There are no radioactive liquid releases to the offsite environment associated with any alternative action.

The annual incremental doses associated with the different alternative facilities range from 3.4×10^{-9} to 0.078 mrem to the MEI and from 5.1×10^{-8} to 9.6 person-rem to the 80-km (50-mi) population in 2030. The associated health effects from annual operations are included in both tables.

Worker Doses and Health Effects. For the storage and disposition alternatives, the impacts from the No Action facilities need to be added to the incremental impacts from the storage or disposition facilities to determine the impacts from total site operations (refer to the worker discussion under No Action, above, and to Table M.2.3.2–1).