5.3.8 HEALTH AND SAFETY

This section describes potential health and safety impacts to INEEL workers and the offsite public from implementation of the facility disposition alternatives described in Chapter 3.

5.3.8.1 Short-Term Impacts

Short-term activities toward facility disposition could result in health impacts to INEEL workers and the public. DOE is considering two categories of disposition of HLW ***management*** facilities. The first involves disposition of new facilities required to support the waste processing alternatives. The second category involves the existing HLW ***management*** facilities as grouped in Table 3-***3*** in Chapter 3. The sections below provide DOE's estimates of radiological and nonradiological health and safety impacts for these facilities.

Impacts from Disposition of New Facilities Associated with Waste Processing Alternatives

Tables 5.3-***9*** through 5.3-1***1*** present potential health and safety impacts to involved workers from radiological and nonradiological sources by facility or group of facilities for new facilities associated with the waste processing alternatives.

Table 5.3-***9*** presents radiological impacts in terms of collective dose to workers and the resultant estimated number of latent cancer fatalities for the entire period of disposition. DOE bases dose estimates on the projected number of workers for each option and historic INEEL operations dose-per-worker data. No disposition activities would be associated with the No Action Alternative. ***The highest average collective dose would occur for the Hot Isostatic Pressed Waste Option and the Vitrification with Calcine Separations Option with 290 person-rem and would result in 0.12 latent cancer fatality under this option.***

Table 5.3-***10*** provides a summary of annual radiation dose and health impacts associated with airborne radionuclide emissions. These values are based on the doses for closing each new facility presented in Section 5.3.4. Dose impacts are presented for the maximally exposed offsite and onsite individuals and the population within 50 miles of ***INTEC***. The estimated increase in the number of latent cancer fatalities is presented for the collective population. ***The annual radiation doses to the maximally exposed individuals, noninvolved worker as well as to the population for all of the options are at very low levels. The maximum number of latent cancer fatalities is associated with the Vitrification with Calcine Separations Option and is much less than one (1.1×10⁻¹¹).***

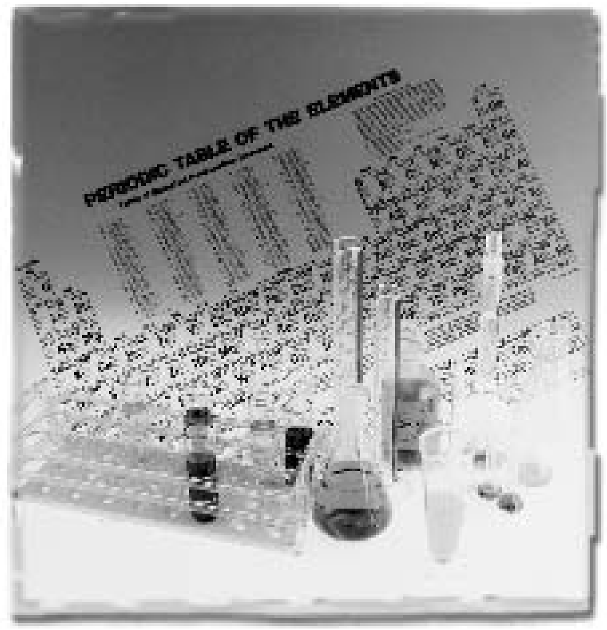

Table 5.3-1***1*** provides estimates of occupational safety impacts for workers involved with disposition activities. Impacts are presented in terms of the number of lost workdays and total recordable cases on an annual and total disposition period basis. A lost workday is the number of lost workdays beyond the onset of injury or illness. A total recordable case is a recordable case that includes work-related death, illness, or injury that resulted in loss of consciousness, restriction of work or motion, transfer to another job, or required medical attention beyond first aid. DOE estimated the lost workdays and total recordable cases for each option based on the projected number of workers and the five-year average lost workdays and total recordable cases rates from INEEL construction workforce data from ***1996*** to ***2000*** (***DOE 2001***).

Table 5.3-9. Estimated radiological impacts to involved workers during disposition activities for new facilities.[a,b,c]

Project Number	Description	***Radiation*** workers/ year	***Disposition*** time (years)	Total workers	***Collective*** dose (person-rem)	Estimated increase in latent cancer fatalities
			Continued Current Operations Alternative			
P1A	Calcine SBW including NWCF Upgrades[d]	37	2	74	19	***7.4×10^{-3}***
P1A	Calcine SBW including NWCF Upgrades[e]	31	2	62	16	***6.2×10^{-3}***
P1B	NGLW and Tank Farm Heel Waste Management	36	1	36	9	***3.6×10^{-3}***
Totals				***170***	***43***	***0.017***
			Full Separations Option			
P9A	Full Separations	100	3	***310***	77	***0.031***
P9B	Vitrification Plant	45	3	140	34	***0.014***
P9C	Class A Grout Plant	74	***2.5***	***190***	***46***	***0.019***
P18	New Analytical Laboratory	30	2	60	15	***6.0×10^{-3}***
P24	***Vitrified Product Interim Storage***	***3***	***1.8***	***5.4***	***1.4***	***5.4×10^{-4}***
P27	Class A Grout Disposal in a New Low-Activity Waste Disposal Facility	88	2	180	44	***0.018***
P35D	Class A Grout Packaging and Shipping to a New Low-Activity Waste Disposal Facility	20	2	40	10	***4.0×10^{-3}***
P59A	Calcine Retrieval and Transport	100	***1***	100	26	0.010
P118	Separations Organic Incinerator	2	2	4	1.0	***4.0×10^{-4}***
P133	***Waste Treatment Pilot Plant***	***25***	***2***	***50***	***13***	***5.0×10^{-3}***
Totals				***1.1×10^{3}***	***270***	***0.11***
			Planning Basis Option			
P1A	Calcine SBW including NWCF Upgrades[d]	37	2	74	19	***7.4×10^{-3}***
P1A	Calcine SBW including NWCF Upgrades[e]	31	2	62	16	***6.2×10^{-3}***
P1B	NGLW and Tank Farm Heel Waste Management	36	1	36	9	***3.6×10^{-3}***
P18	New Analytical Laboratory	30	2	60	15	***6.0×10^{-3}***
P23A	Full Separations	100	3	310	77	***0.031***
P23B	Vitrification Plant	49	2.8	***140***	34	***0.014***
P23C	Class A Grout Plant	67	2.8	***190***	***47***	***0.019***
P24	***Vitrified Product Interim Storage***	***3***	***1.8***	***5.4***	***1.4***	***5.4×10^{-4}***
P35E	***Class A Grout Packaging and Shipping for Offsite Disposal***	***20***	***2***	***40***	***10***	4.0×10^{-3}
P59A	Calcine Retrieval and Transport	100	1	100	26	0.010
P118	Separations Organic Incinerator	2	2	4	1	***4.0×10^{-4}***
P133	***Waste Treatment Pilot Plant***	***25***	***2***	***50***	***13***	***5.0×10^{-3}***
Totals				***1.1×10^{3}***	***270***	***0.11***

Table 5.3-9. Estimated radiological impacts to involved workers during disposition activities for new facilities[a,b,c] (continued).

Project Number	Descrition	***Radiation*** workers/ year	***Disposition*** time (years)	Total workers	***Collective*** dose (person-rem)	Estimated increase in latent cancer fatalities
Transuranic Separations Option						
P18	New Analytical Laboratory	30	2	60	15	***6.0×10^{-3}***
P27	Class A Grout Disposal in a New Low-Activity Waste Disposal Facility	***49***	2	***98***	***25***	***9.8×10^{-3}***
P49A	Transuranic/Class C Separations	81	3	240	61	***0.024***
P49C	Class C Grout Plant	64	2	130	32	***0.013***
P49D	Class C Grout Packaging and Shipping to a New Low-Activity Waste Disposal Facility	41	2	82	21	***8.2×10^{-3}***
P59A	Calcine Retrieval and Transport	100	1	100	26	0.010
P118	Separations Organic Incinerator	2	2	4	1	4.0×10^{-4}
P133	***Waste Treatment Pilot Plant***	***25***	***2***	***50***	***13***	***5.0×10^{-3}***
Totals				***770***	***190***	***0.077***
Hot Isostatic Pressed Waste Option						
P1A	Calcine SBW including NWCF Upgrades[d]	37	2	74	*19*	***7.4×10^{-3}***
P1A	Calcine SBW including NWCF Upgrades[e]	31	2	62	*16*	***6.2×10^{-3}***
P1B	NGLW and Tank Farm Heel Waste Management	36	1	36	9	***3.6×10^{-3}***
P18	New Analytical Laboratory	30	2	60	15	***6.0×10^{-3}***
P59A	Calcine Retrieval and Transport	100	1	100	26	0.010
P71	Mixing and Hot Isostatic Pressing	150	5	730	***180***	***0.073***
P72	Interim Storage of Hot Isostatic Pressed Waste	16	3	48	12	***4.8×10^{-3}***
P133	***Waste Treatment Pilot Plant***	***25***	***2***	***50***	***13***	***5.0×10^{-3}***
Totals				***1.2×10^{3}***	***290***	***0.12***
Direct Cement Waste Option						
P1A	Calcine SBW including NWCF Upgrades[d]	37	2	74	19	***7.4×10^{-3}***
P1A	Calcine SBW including NWCF Upgrades[e]	31	2	62	16	***6.2×10^{-3}***
P1B	NGLW and Tank Farm Heel Waste Management	36	1	36	9	***3.6×10^{-3}***
P18	New Analytical Laboratory	30	2	60	15	***6.0×10^{-3}***
P59A	Calcine Retrieval and Transport	100	1	100	26	0.010
P80	Direct Cement Process	120	3	360	91	0.036
P81	Unseparated Cementitious HLW Interim Storage	***88***	***1***	***88***	***22***	***8.8×10^{-3}***
P133	***Waste Treatment Pilot Plant***	***25***	***2***	***50***	***13***	***5.0×10^{-3}***
Totals				***840***	***210***	***0.084***

Table 5.3-9. Estimated radiological impacts to involved workers during disposition activities for new facilities [a,b,c] (continued).

Project Number	Descrition	Radiation workers/ year	Disposition time (years)	Total workers	Collective dose (person-rem)	Estimated increase in latent cancer fatalities
			Early Vitrification Option			
P18	New Analytical Laboratory	30	2	60	15	6.0×10^{-3}
P59A	Calcine Retrieval and Transport	100	1	100	26	0.010
P61	Vitrified Product Interim Storage	25	3	75	19	7.5×10^{-3}
P88	Early Vitrification Facility	78	5	390	98	0.039
P133	Waste Treatment Pilot Plant	25	2	50	13	5.0×10^{-3}
Totals				680	170	0.068
			Steam Reforming Option			
P13	New Storage Tanks	19	2	38	10	3.8×10^{-3}
P35E	Class A Grout Packaging and Loading for Offsite Disposal	20	2	40	10	4.0×10^{-3}
P59A	Calcine Retrieval and Transport	100	1	100	26	0.010
P117A	Calcine Packaging and Loading	33	3	99	25	9.9×10^{-3}
P2001	NGLW Grout Facility	9	1	9	2	9.0×10^{-4}
P2002A	Steam Reforming Facility	45	1	45	11	4.5×10^{-3}
Totals				330	83	0.033
			Minimum INEEL Processing Alternative			
P18	New Analytical Laboratory	30	2	60	15	6.0×10^{-3}
P24	Vitrified Product Interim Storage	3	1.8	5.4	1.4	5.4×10^{-4}
P27	Class A Grout Disposal in a New Low-Activity Waste Disposal Facility	88	2	180	44	0.018
P59A	Calcine Retrieval and Transport	100	1	100	26	0.010
P111	SBW & NGLW Treatment with CsIX to CH TRU Grout & LLW Grout	59	1	59	15	5.9×10^{-3}
P117A	Calcine Packaging and Loading	33	3	99	25	9.9×10^{-3}
P133	Waste Treatment Pilot Plant	25	2	50	13	5.0×10^{-3}
Totals				550	140	0.055
			Vitrification without Calcine Separations Option			
P13	New Storage Tanks	15	2	30	7.5	3.0×10^{-3}
P18	New Analytical laboratory	30	2	60	15	6.0×10^{-3}
P59A	Calcine Retrieval and Transport	100	1	100	26	0.010
P61	Vitrified Product Interim Storage	25	3	75	19	7.5×10^{-3}
P88	Vitrification with MACT	78	5	390	98	0.039
P133	Waste Treatment Pilot Plant	25	2	50	13	5.0×10^{-3}
Totals				710	180	0.071

Table 5.3-*9*. Estimated radiological impacts to involved workers during disposition activities for new facilities[a,b,c] (continued).

Project number	Description	***Radiation*** workers/ year	***Disposition*** time (years)	Total workers	***Collective*** dose (person-rem)	Estimated increase in latent cancer fatalities
			Vitrification with Calcine Separations Option			
P9A	***Full Separations***	***100***	***3***	***310***	***77***	***0.031***
P9C	***Grout Plant***	***74***	***2.5***	***190***	***46***	***0.019***
P13	***New Storage Tanks***	***15***	***2***	***30***	***7.5***	***3.0×10^{-3}***
P18	***New Analytical Laboratory***	***30***	***2***	***60***	***15***	***6.0×10^{-3}***
P24	***Vitrified Product Interim Storage***	***3***	***1.8***	***5.4***	***1.4***	***5.4×10^{-4}***
P35E	***Grout Packaging and Loading for Offsite Disposal***	***20***	***2***	***40***	***10***	***4.0×10^{-3}***
P59A	***Calcine Retrieval and Transport***	***100***	***1***	***100***	***26***	***0.010***
P88	***Vitrification with MACT***	***78***	***5***	***390***	***98***	***0.039***
P133	***Waste Treatment Pilot Plant***	***25***	***2***	***50***	***13***	***5.0×10^{-3}***
Totals				***1.2×10^{3}***	***290***	***0.12***

a. ***Source: Data from Project Data Sheets in Appendix C.6.***

b. ***Only includes projects with potential for radiation exposure during disposition.***

c. ***The EIS analyzes treatment of post-2005 newly generated liquid waste as mixed transuranic waste/SBW for comparability of impacts between alternatives. The newly generated liquid waste could be treated in the same facility as the mixed transuranic waste/SBW or DOE could construct a separate facility to grout the newly generated liquid waste.***

d. For the New Waste Calcining Facility MACT Facility.

e. For the liquid waste storage tank.

CH TRU = contact-handled transuranic waste; CsIX = cesium ion exchange; LLW = low-level waste; MACT = maximum achievable control technology; NGLW = newly generated liquid waste; TRU = transuranic.

As shown in Table 5.3-11, the highest number of lost workdays and total recordable cases over the entire disposition period would occur under the Hot Isostatic Pressed Waste and Vitrification with Calcine Separations Options. DOE estimates 610 lost workdays and 79 total recordable cases for these options. The ***Full Separations***, ***Planning Basis***, Early Vitrification, ***and Vitrification without Calcine Separations Options*** would have a similar number of lost workdays and total recordable cases occurrences with all other options resulting in lesser impacts for the entire disposition period of activity.

Impacts from Disposition of Existing Facilities Associated with HLW Management

Tables 5.3-1*2* through 5.3-1*5* present potential health and safety impacts from closure of existing HLW ***management*** facilities by alternative. These facilities would be closed as specified in Table 3-***3***.

Table 5.3-1*2* provides radiological impacts in terms of collective dose to workers and the resultant estimated number of LCFs for the entire disposition period of activity. As expected, the collective worker dose is highest for the Tank Farm Clean Closure Alternative due to the extensive decontamination efforts required for removing contaminated materials in order to reduce radioactivity to minimum detectable levels. Tank Farm Clean Closure would involve the largest number of workers and a longer duration of dispositioning activities for any of the Tank Farm options and therefore would result in a larger collective dose. DOE ***estimated*** the annual collective and total collective worker doses to be ***70*** and ***1,900*** person-rem, respectively. The total collective worker dose for the Clean Closure alternative would result in an estimated ***0.76*** latent cancer fatality. The estimated total collective worker doses for all other Tank Farm closure options, ***as well as closure of the*** bin sets and related facilities, and other new facilities associated with HLW management are much lower and would result in less than 1 latent cancer fatality for each option.

Table 5.3-*10*. Summary of radiation dose impacts associated with airborne radionuclide emissions from disposition of facilities associated with waste processing alternatives.

Receptor	No Action Alternative	Continued Current Operations Alternative	Separations Alternative			Non-Separations Alternative				Minimum INEEL Processing Alternative	***Direct Vitrification Alternative***	
			Full Separations Option[a]	Planning Basis Option	Transuranic Separations Option[b]	Hot Isostatic Pressed Waste Option	Direct Cement Waste Option	Early Vitrification Option	***Steam Reforming Option***		***Vitrification without Calcine Separations Option***	***Vitrification with Calcine Separations Option***
Annual dose to maximally exposed offsite individual (millirem per year)[c]	-	1.1×10^{-10}	3.3×10^{-10}	***3.9×10^{-10}***	4.7×10^{-10}	1.8×10^{-10}	1.3×10^{-10}	1.4×10^{-10}	***2.4×10^{-10}***	***5.6×10^{-10}***	***2.1×10^{-10}***	***3.0×10^{-10}***
Integrated dose to maximally exposed offsite individual (millirem)[d]	-	***2.2×10^{-10}***	***7.7×10^{-10}***	***9.9×10^{-10}***	***9.4×10^{-10}***	***5.4×10^{-10}***	***2.2×10^{-10}***	***4.0×10^{-10}***	***3.9×10^{-10}***	***1.3×10^{-9}***	***5.4×10^{-10}***	***7.8×10^{-10}***
Estimated increase in probability of latent cancer fatality for the maximally exposed offsite individual	-	***1.1×10^{-16}***	***3.9×10^{-16}***	***5.0×10^{-16}***	***4.7×10^{-16}***	***2.7×10^{-16}***	***1.1×10^{-16}***	***2.0×10^{-16}***	***2.0×10^{-16}***	***6.5×10^{-16}***	***2.7×10^{-16}***	***3.9×10^{-16}***
Annual dose to noninvolved worker (millirem per year)[e]	-	2.0×10^{-11}	6.0×10^{-11}	***7.0×10^{-11}***	1.4×10^{-10}	3.7×10^{-11}	2.1×10^{-11}	2.8×10^{-11}	***4.3×10^{-11}***	***1.6×10^{-10}***	***4.3×10^{-11}***	***6.0×10^{-11}***
Integrated dose to noninvolved worker (millirem)[d]	-	***4.0×10^{-11}***	***1.4×10^{-10}***	***1.8×10^{-10}***	***2.8×10^{-10}***	***1.1×10^{-10}***	***3.7×10^{-11}***	***8.1×10^{-11}***	***7.0×10^{-11}***	***3.8×10^{-10}***	***1.1×10^{-10}***	***1.6×10^{-10}***
Estimated increase in probability of latent cancer fatality for the noninvolved worker	-	***1.6×10^{-17}***	***5.6×10^{-17}***	***7.2×10^{-17}***	***1.1×10^{-16}***	***4.4×10^{-17}***	***1.5×10^{-17}***	***3.2×10^{-17}***	***2.8×10^{-17}***	***1.5×10^{-16}***	***4.4×10^{-17}***	***6.4×10^{-17}***
Annual collective dose to population within 50 miles of INTEC (person-rem per year)[f]	-	***4.0×10^{-9}***	***1.2×10^{-8}***	***1.4×10^{-8}***	***1.3×10^{-8}***	***5.7×10^{-9}***	***4.5×10^{-9}***	***4.6×10^{-9}***	***8.8×10^{-9}***	***1.6×10^{-8}***	***7.0×10^{-9}***	***9.9×10^{-9}***
Integrated collective dose to population (person-rem)[d]	-	***7.9×10^{-9}***	***2.8×10^{-8}***	***3.6×10^{-8}***	***2.6×10^{-8}***	***1.7×10^{-8}***	***7.7×10^{-9}***	***1.3×10^{-8}***	***1.4×10^{-8}***	***3.6×10^{-8}***	***1.8×10^{-8}***	***2.5×10^{-8}***
Estimated increase in number of latent cancer fatalities in population	-	***4.0×10^{-12}***	***1.4×10^{-11}***	***1.8×10^{-11}***	***1.3×10^{-11}***	***8.5×10^{-12}***	***3.9×10^{-12}***	***6.5×10^{-12}***	***7.0×10^{-12}***	***1.8×10^{-11}***	***9.0×10^{-12}***	***1.3×10^{-11}***

a. Impacts do not include disposal of low-level waste Class A type Grout in Tank Farm and bin sets, which is presented in Section 5.3.4, Table 5.3-6.
b. Impacts do not include disposal of low-level waste Class C type Grout in Tank Farm and bin sets, which is presented in Section 5.3.4, Table 5.3-6.
c. Doses are maximum values over any single year in which facility disposition occurs.
d. The annual average project doses were multiplied by the project duration and summed for all projects to determine the integrated doses and health effects.
e. Location of highest onsite dose is Central Facilities Area.
f. Population dose assumes a growth rate of 6 percent per decade between 2000 and 2035.

Table 5.3-11. Estimated worker injury impacts during disposition activities of new facilities at INEEL by alternative.[a]

Project number	Description	Total number of workers per year	Disposition time (years)	Total number of workers	Total lost workdays[b]	Total recordable cases[c]
	Continued Current Operations Alternative					
P1A	Calcine SBW including NWCF Upgrades[d]	58	2	120	33	4.3
P1A	Calcine SBW including NWCF Upgrades[e]	42	2	84	24	3.1
P1B	NGLW and Tank Farm Heel Waste Management	48	1	48	14	1.8
Totals				250	70	9.2
	Full Separations Option					
P9A	Full Separations	220	3	670	190	25
P9B	Vitrification Plant	72	3	220	61	8.0
P9C	Class A Grout Plant	120	2.5	300	85	11
P18	New Analytical Laboratory	88	2	180	50	6.5
P24	Vitrified Product Interim Storage	31	1.8	56	16	2.1
P25A	Packaging and Loading Vitrified HLW at INTEC for Shipment to a Geologic Repository	2.1	0.25	0.53	0.15	0.019
P27	Class A Grout Disposal in a New Low-Activity Waste Disposal Facility	140	2	270	77	10
P35D	Class A Grout Packaging and Shipping to a New Low-Activity Waste Disposal Facility	30	2	60	17	2.2
P59A	Calcine Retrieval and Transport	160	1	160	45	5.9
P118	Separations Organic Incinerator	2	2	4	1.1	0.15
P133	Waste Treatment Pilot Plant	45	2	90	26	3.3
Totals				2.0×10^3	570	74
	Planning Basis Option					
P1A	Calcine SBW including NWCF Upgrades[d]	58	2	120	33	4.3
P1A	Calcine SBW including NWCF Upgrades[e]	42	2	84	24	3.1
P1B	NGLW and Tank Farm Heel Waste Management	48	1	48	14	1.8
P18	New Analytical Laboratory	88	2	180	50	6.5
P23A	Full Separations	220	3	660	190	24
P23B	Vitrification Plant	72	2.8	200	57	7.5
P23C	Class A Grout Plant	120	2.8	340	95	12
P24	Vitrified Product Interim Storage	31	1.8	56	16	2.1
P25A	Packaging and Loading Vitrified HLW at INTEC for Shipment to a Geologic Repository	2.1	0.25	0.53	0.15	0.019
P35E	Class A Grout Packaging and Loading for Offsite Disposal	30	2	60	17	2.2
P59A	Calcine Retrieval and Transport	160	1	160	45	5.9
P118	Separations Organic Incinerator	2	2	4	1.1	0.15
P133	Waste Treatment Pilot Plant	45	2	90	26	3.3
Totals				2.0×10^3	570	74

Table 5.3-11. Estimated worker injury impacts during disposition activities of new facilities at INEEL by alternative [a] (continued).

Project number	Description	Total number of workers per year	Disposition time (years)	Total number of workers	Total lost workdays[b]	Total recordable cases[c]
	Transuranic Separations Option					
P18	New Analytical Laboratory	88	2	180	50	6.5
P27	Class A Grout Disposal in a New Low-Activity Waste Disposal Facility	140	2	270	77	10
P39A	Packaging and Loading TRU at INTEC for Shipment to the Waste Isolation Pilot Plant	7	1.5	11	3.0	0.39
P49A	Transuranic/Class C Separations	150	3	450	130	17
P49C	Class C Grout Plant	93	2	190	53	6.9
P49D	Class C Grout Packaging and Shipping to a New Low-Activity Waste Disposal Facility	57	2	110	32	4.2
P59A	Calcine Retrieval and Transport	160	1	160	45	5.9
P118	Separations Organic Incinerator	2	2	4	1.1	0.15
P133	Waste Treatment Pilot Plant	45	2	90	26	3.3
Totals				1.5×10^3	420	54
	Hot Isostatic Pressed Waste Option					
P1A	Calcine SBW including NWCF Upgrades[d]	58	2	120	33	4.3
P1A	Calcine SBW including NWCF Upgrades[e]	42	2	84	24	3.1
P1B	NGLW and Tank Farm Heel Waste Management	48	1	48	14	1.8
P18	New Analytical Laboratory	88	2	180	50	6.5
P59A	Calcine Retrieval and Transport	160	1	160	45	5.9
P71	Mixing and Hot Isostatic Pressing	200	5	1.0×10^3	280	37
P72	Interim Storage of Hot Isostatic Pressed Waste	150	3	450	130	17
P73A	Packaging and Loading Hot Isostatic Pressed Waste at INTEC for Shipment to a Geologic Repository	7	1	7	2.0	0.26
P133	Waste Treatment Pilot Plant	45	2	90	26	3.3
Totals				2.1×10^3	610	79
	Direct Cement Waste Option					
P1A	Calcine SBW including NWCF Upgrades[d]	58	2	120	33	4.2
P1A	Calcine SBW including NWCF Upgrades[e]	42	2	84	24	3.1
P1B	NGLW and Tank Farm Heel Waste Management	48	1	48	14	1.8
P18	New Analytical Laboratory	88	2	180	50	6.5
P59A	Calcine Retrieval and Transport	160	1	160	45	5.9
P80	Direct Cement Process	160	3	480	140	11
P81	Unseparated Cementitious HLW Interim Storage	290	1	290	82	11
P83A	Packaging and Loading Cementitious Waste at INTEC for Shipment to a Geologic Repository	7	1	7	2.0	0.26
P133	Waste Treatment Pilot Plant	45	2	90	26	3.3
Totals				1.4×10^3	410	54

Table 5.3-11. Estimated worker injury impacts during disposition activities of new facilities at INEEL by alternative [a] (continued).

Project number	Description	Total number of workers per year	Disposition time (years)	Total number of workers	Total lost workdays[b]	Total recordable cases[c]
	Early Vitrification Option					
P18	New Analytical Laboratory	88	2	180	50	6.5
P59A	Calcine Retrieval and Transport	160	1	160	45	5.9
P61	Unseparated Vitrified Product Interim Storage	250	3	750	210	28
P62A	Packaging and Loading Vitrified HLW at INTEC for Shipment to a Geologic Repository	10	3	30	8.5	1.1
P90A	Packaging and Loading Vitrified SBW at INTEC for Shipment to Waste Isolation Pilot Plant	7	1.5	11	3.0	0.39
P88	Early Vitrification Facility	120	5	590	170	22
P133	Waste Treatment Pilot Plant	45	2	90	26	3.3
Totals				1.8×10^3	510	67
	Steam Reforming Option					
P13	New Storage Tanks	19	2	38	11	1.4
P35E	Class A Grout Packaging and Loading for Offsite Disposal	30	2	60	17	2.2
P59A	Calcine Retrieval and Transport	160	1	160	45	5.9
P117A	Calcine Packaging and Loading	52	3	160	44	5.8
P2001	NGLW Grout Facility	16	1	16	4.5	0.59
P2002A	Steam Reforming Facility	72	1	72	20	2.7
Totals				500	140	19
	Minimum INEEL Processing Alternative					
P18	New Analytical Laboratory	88	2	180	50	6.5
P24	Vitrified Product Interim Storage	31	1.8	56	16	2.1
P25A	Packaging and Loading Vitrified HLW at INTEC for Shipment to a Geologic Repository	2.1	0.25	0.53	0.15	0.19
P27	Class A Grout Disposal in a New Low-Activity Waste Disposal Facility	140	2	270	77	10
P59A	Calcine Retrieval and Transport	160	1	160	45	5.9
P111	SBW & NGLW Treatment with CsIX to CH TRU Grout & LLW Grout	100	1	100	28	3.7
P112A	Packaging and Loading Contact Handled TRU for Shipment to WIPP	7	4.5	32	8.9	1.2
P117A	Calcine Packaging and Loading	110	3	330	94	12
P133	Waste Treatment Pilot Plant	45	2	90	26	3.3
Totals				1.2×10^3	350	45

Table 5.3-11. Estimated worker injury impacts during disposition activities of new facilities at INEEL by alternative [a] (continued).

Project number	Description	Total number of workers per year	Disposition time (years)	Total number of workers	Total lost workdays[b]	Total recordable cases[c]
Vitrification without Calcine Separations Option						
P13	New Storage Tanks	19	2	38	11	1.4
P18	New Analytical Laboratory	88	2	180	50	6.5
P59A	Calcine Retrieval and Transport	160	1	160	45	5.9
P61	Vitrified HLW Interim Storage	250	3	750	210	28
P62A	Packaging and Loading Vitrified HLW at INTEC for Shipment to a Geologic Repository	10	3	30	8.5	1.1
P88	Vitrification with MACT	120	5	590	170	22
P133	Waste Treatment Pilot Plant	45	2	90	26	3.3
Totals				1.8×10^3	520	68
Vitrification with Calcine Separations Option						
P9A	Full Separations	220	3	670	190	25
P9C	Grout Plant	120	2.5	300	85	11
P13	New Storage Tanks	19	2	38	11	1.4
P18	New Analytical Laboratory	88	2	180	50	6.5
P24	Vitrified Product Interim Storage	31	1.8	56	16	2.1
P25A	Packaging and Loading Vitrified HLW for Shipment to a Geologic Repository	2.1	0.25	0.53	0.15	0.019
P35E	Grout Packaging and Loading for Offsite Disposal	30	2	60	17	2.2
P59A	Calcine Retrieval and Transport	160	1	160	45	5.9
P88	Vitrification Facility with MACT	120	5	590	170	22
P133	Waste Treatment Pilot Plant	45	2	90	26	3.3
Totals				2.1×10^3	610	79

a. The EIS analyzes treatment of post-2005 newly generated liquid waste as mixed transuranic waste/SBW for comparability of impacts between alternatives. The newly generated liquid waste could be treated in the same facility as the mixed transuranic waste/SBW or DOE could construct a separate facility to grout the newly generated liquid waste.

b. The number of workdays beyond the day of injury or onset of illness the employee was away from work or limited to restricted work activity because of an occupational injury or illness.

c. A recordable case includes work-related death, illness, or injury which resulted in loss of consciousness, restriction of work or motion, transfer to another job, or required medical treatment beyond first aid.

d. For the New Waste Calcining Facility with Maximum Achievable Control Technology upgrades.

e. For the liquid waste storage tank.

CH TRU = contact-handled transuranic waste; CsIX = cesium ion exchange; FUETAP = formed under elevated temperature and pressure; HLW = high-level waste; LLW = low-level waste; MACT = maximum achievable control technology; NGLW = newly generated liquid waste; TRU = transuranic waste; WIPP = Waste Isolation Pilot Plant.

Table 5.3-*12*. Estimated radiological health impacts from disposition activities for existing facilities (annual and total dose).[a]

Facility description	Annual average number of workers	Annual collective worker dose (person-rem)	Total collective dose for disposition period (person-rem)	Estimated LCFs from total collective dose (person-rem)
Tank Farm				
Clean Closure	280	***70***	***1,900***	***0.76***
Performance-Based Closure	***20***	***5.0***	***110***	***0.042***
Closure to Landfill Standards	***12***	***3.0***	***51***	***0.020***
Performance-Based Closure with Class A Grout Disposal	***11***	***2.8***	***66***	***0.026***
Performance-Based Closure with Class C Grout Disposal	***11***	***2.8***	***66***	***0.026***
Tank Farm related facilities	***1***	***0.25***	***1.5***	***6.0×10^{-4}***
Bin Sets				
Clean Closure	58	***15***	***380***	***0.15***
Performance-Based Closure	***55***	***14***	***290***	***0.12***
Closure to Landfill Standards	27	***6.8***	***140***	***0.057***
Performance-Based Closure with Class A Grout Disposal	***47***	***12***	***200***	***0.080***
Performance-Based Closure with Class C Grout Disposal	***47***	***12***	***200***	***0.080***
Bin Sets related facilities	***<1***	***<0.25***	***<1.5***	***$<6.0\times10^{-4}$***
PEWE and related facilities	***39***	***9.8***	***54***	***0.021***
Fuel Processing Building and related facilities				
Performance-Based Closure	25	6.3	63	0.025
Closure to Landfill Standards	20	5.0	50	0.020
FAST/FAST Stack	34	***8.5***	***51***	0.020
Transport Lines Group	***1***	***0.25***	***0. 25***	***1.0×10^{-4}***
New Waste Calcining Facility				
Performance-Based Closure	35	8.8	***26***	***0.011***
Closure to Landfill Standards	32	8.0	***24***	***9.6×10^{-3}***
Remote Analytical Laboratory	***4***	***1.0***	***3.0***	***1.2×10^{-3}***

a. Source: Data from Project Data Sheets in Appendix C.6.
FAST = Fluorinel and Storage Facility; LCF = latent cancer fatality; PEWE = Process Equipment Waste Evaporator.

Table 5.3-1***3*** provides a summary of annual radiation dose and health impacts associated with airborne radionuclide emissions from the Tank Farm and bin sets under alternative closure scenarios. Dose impacts are presented for the maximally exposed offsite and onsite individuals and the population within 50 miles of ***INTEC***. The highest radiation dose impacts are associated with the Bin Set Closure to Landfill Standards Alternative. However, these doses are still significantly less than the applicable standard for annual exposure. The maximum collective population dose of ***6.1×10^{-8}*** person-rem for the Bin Set Closure to Landfill Standards Alternative results in an increase in the number of latent cancer fatalities of ***3.1×10^{-11}***. All other radiation dose impacts are lower.

Table 5.3-1***4*** provides a summary of annual radiation dose and health impacts from radionuclide emissions from the ***disposition of*** other existing facilities associated with HLW ***management***. Dose impacts are presented for the maximally exposed offsite and onsite individuals and the population within 50 miles of ***INTEC***. All of the dose impacts are negligible with the highest collective population dose and increase in number of latent cancer fatalities being estimated for the Fuel Processing Building and Related Facilities.

Table 5.3-*13*. Summary of radiation dose impacts associated with airborne radionuclide emissions from disposition of the Tank Farm and bin sets under alternative closure scenarios.

Case	Applicable standard	Maximum annual radiation dose[a]			
		Clean closure	Performance-based closure	Closure to landfill standards	Performance-based closure with Class A or C grout disposal[b]
Tank Farm					
Dose to maximally exposed offsite individual (millirem per year)	10[c]	1.2×10^{-9}	***1.5×10^{-10}***	***1.1×10^{-9}***	1.5×10^{-10}
Estimated annual increase in probability of LCF to the maximally exposed offsite individual	NA[d]	6.0×10^{-16}	***7.5×10^{-17}***	***5.5×10^{-16}***	7.5×10^{-17}
Dose to noninvolved worker (millirem per year)[e]	5.0×10^{3}[f]	1.2×10^{-9}	***1.5×10^{-10}***	***1.1×10^{-9}***	1.5×10^{-10}
Estimated annual increase in probability of LCF to the noninvolved work	NA	4.8×10^{-16}	***6.0×10^{-17}***	***4.4×10^{-16}***	6.0×10^{-17}
Collective dose to population within 50 miles of INTEC (person-rem per year)[g]	NA	***3.7×10^{-8}***	***4.6×10^{-9}***	***3.4×10^{-8}***	***4.7×10^{-9}***
Estimated annual increase in number of latent cancer fatalities to population	NA	***1.9×10^{-11}***	***2.3×10^{-12}***	***1.7×10^{-11}***	***2.4×10^{-12}***
Bin sets					
Dose to maximally exposed offsite individual (millirem per year)	10[c]	1.0×10^{-10}	1.3×10^{-10}	9.2×10^{-10}	1.3×10^{-10}
Estimated annual increase in probability of LCF to the maximally exposed offsite individual	NA	5.0×10^{-17}	6.5×10^{-17}	4.6×10^{-16}	6.5×10^{-17}
Dose to noninvolved worker (millirem per year)[e]	5.0×10^{3}[f]	2.3×10^{-11}	3.0×10^{-11}	2.2×10^{-10}	3.0×10^{-11}
Estimated annual increase in probability of LCF to the noninvolved work	NA	9.2×10^{-18}	1.2×10^{-17}	8.8×10^{-17}	1.2×10^{-17}
Collective dose to population within 50 miles of INTEC (person-rem per year)[g]	NA	***6.6×10^{-9}***	***8.6×10^{-9}***	***6.1×10^{-8}***	***8.6×10^{-9}***
Estimated annual increase in number of latent cancer fatalities to population	NA	***3.3×10^{-12}***	***4.3×10^{-12}***	***3.1×10^{-11}***	***4.3×10^{-12}***

a. Doses are maximum values over any single year during which decontamination and decommissioning occur.
b. Radiation dose impacts for Class A and Class C type grouting disposal techniques are the same since analyses indicate that the primary exposure results from the cleaning portion of the operation rather than the filling.
c. EPA dose limit specified in 40 CFR 61.92; applies to effective dose equivalent from air releases only.
d. NA = not applicable.
e. Location of highest onsite dose is Central Facilities Area.
f. Occupational dose limit per 10 CFR 835.202; applies to sum of doses from all exposure pathways.
g. Applies to future projected population of about ***242,000*** people.

Table 5.3-*14*. Summary of radiation dose impacts associated with airborne radionuclide emissions from disposition of other existing facilities associated with HLW management.

		Maximum annual radiation dose[a]						
Case	Applicable standard	Tank Farm related facilities	Bin set related facilities	Process Equipment Waste Evaporator & related facilities	Fuel processing building & related facilities	FAST and related facilities	New Waste Calcining Facility	Remote Analytical Laboratory
Dose to maximally exposed offsite individual (millirem per year)	10[b]	***8.1×10^{-11}***	***6.7×10^{-11}***	1.2×10^{-10}	2.4×10^{-10}	8.1×10^{-11}	4.5×10^{-11}	4.1×10^{-11}
Estimated annual increase in probability of LCF to the maximally exposed offsite individual	NA[c]	***4.1×10^{-17}***	***3.4×10^{-17}***	6.0×10^{-17}	1.2×10^{-16}	4.1×10^{-17}	2.3×10^{-17}	2.1×10^{-17}
Dose to noninvolved worker (millirem per year)[d]	5.0×10^{3}[e]	***8.1×10^{-11}***	***1.6×10^{-11}***	1.2×10^{-10}	2.4×10^{-10}	8.1×10^{-11}	1.0×10^{-11}	4.1×10^{-11}
Estimated annual increase in probability of LCF to the noninvolved worker	NA	***3.2×10^{-17}***	***6.4×10^{-18}***	4.8×10^{-17}	9.6×10^{-17}	3.2×10^{-17}	4.0×10^{-18}	1.6×10^{-17}
Collective dose to population within 50 miles of INTEC (person-rem per year)[f]	NA[f]	***2.5×10^{-9}***	***4.4×10^{-9}***	***3.7×10^{-9}***	***7.4×10^{-9}***	***2.5×10^{-9}***	***3.0×10^{-9}***	***1.2×10^{-9}***
Estimated annual increase in number of LCFs to population	NA	***1.3×10^{-12}***	***2.2×10^{-12}***	***1.9×10^{-12}***	***3.7×10^{-12}***	***1.3×10^{-12}***	***1.5×10^{-12}***	***6.0×10^{-13}***

a. Doses are maximum values over any single year during which decontamination and decommissioning occurs.

b. EPA dose limit specified in 40 CFR 61.92; applies to effective dose equivalent from air releases only.

c. NA = not applicable.

d. Location of highest onsite dose is Central Facilities Area.

e. Occupational dose limit per 10 CFR 835.202; applies to sum of doses from all exposure pathways.

f. Applies to future projected population of about ***242,000*** people.

FAST = Fluorinel and Storage Facility.

Source: Data from Project Data Sheets in Appendix C.6.

Table 5.3-1***5*** provides estimates of occupational safety impacts for workers involved with dispositioning activities. DOE estimated the lost workdays and total recordable cases for each option based on the projected number of workers and the 5-year average lost workdays and total recordable cases rates from INEEL construction ***and operations*** data from ***1996*** to ***2000*** (***DOE 2001***).

As shown in Table 5.3-1***5***, DOE expects the highest number of lost workdays and total recordable cases to occur for the Tank Farm Clean Closure Alternative due to the larger number of workers and duration of disposition activities associated with that option. DOE ***estimated*** the annual and total lost workdays to be ***80*** days and ***2,100*** days, respectively. The annual and total recordable cases are ***estimated*** to be ***10*** cases and ***280*** cases, respectively. As shown in Table 5.3-1***5***, worker occupational health and safety impacts for all other alternatives would be much lower.

Table 5.3-*15*. Estimated worker injury impacts from disposition activities for existing facilities.

Facility description	Annual average number of workers	Annual lost workdays[a]	Annual total recordable cases[b]	Total lost workdays	Total recordable cases
Tank Farm					
Clean Closure	280	***80***	***10***	***2.1×10^3***	***280***
Performance-Based Closure	***20***	***5.7***	***0.74***	***120***	***16***
Closure to Landfill Standards	***12***	***3.4***	***0.44***	***58***	***7.5***
Performance-Based Closure with Class A Grout Disposal	***11***	***3.1***	***0.41***	***75***	***9.8***
Performance-Based Closure with Class C Grout Disposal	***11***	***3.1***	***0.41***	***75***	***9.8***
Tank Farm related facilities	***1***	***0.28***	***0.037***	***1.7***	***0.22***
Bin Sets					
Clean Closure	58	***16***	***2.1***	***430***	***56***
Performance-Based Closure	55	***16***	2.0	***330***	***43***
Closure to Landfill Standards	27	***7.7***	1.0	***160***	***21***
Performance-Based Closure with Class A Grout Disposal	***47***	***13***	***1.7***	***230***	***30***
Performance-Based Closure with Class C Grout Disposal	***47***	***13***	***1.7***	***230***	***30***
Bin Sets related Facilities	***<1***	***<0. 28***	***<0.037***	***<1.7***	***<0.22***
PEWE and related facilities	***51***	***14***	***1.9***	***87***	***11***
Fuel Processing Building and related Facilities					
Performance-Based Closure	40	***11***	***1.5***	***110***	15
Closure to Landfill Standards	32	***9.1***	***1.2***	***91***	12
FAST/FAST Stack	54	***15***	2.0	***92***	12
Transport Lines Group	***3***	***0.85***	***0.11***	***0.85***	***0.11***
New Waste Calcining Facility					
Performance-Based Closure	47	***13***	***1.7***	***40***	***5.2***
Closure to Landfill Standards	44	***12***	***1.6***	***37***	***4.9***
Remote Analytical Laboratory	7	2.0	***0.26***	***6.0***	***0.78***

a. Lost workdays - the number of workdays beyond the onset of injury or illness.
b. Total recordable case - a recordable case includes work-related death, illness, or injury which resulted in loss of consciousness, restriction of work or motion, transfer to another job, or required medical attention beyond first aid.
FAST = Fluorinel and Storage Facility; LCF = latent cancer fatalities; PEWE = Process Equipment Waste Evaporator.
Source: Data from Project Data Sheets in Appendix C.6.

5.3.8.2 Long-Term Impacts

In addition to the short term impacts evaluated in Section 5.3.8.1, DOE has also estimated the potential long-term impacts that may occur as a result of facility disposition activities. Because the residual contamination that could be released to the environment is underground, the primary means by which contamination could reach receptors is through leaching into the soil surrounding the facilities and eventually into ***the*** aquifer near the facilities.

DOE evaluated the potential for other ***dispersion mechanisms*** but has concluded that they are not likely except for the bin sets under the No Action Alternative, for which DOE has postulated a potential air release as discussed in Appendix C.9. For the No Action Alternative for other facilities, the residual contamination would be sufficiently far underground and enclosed within the facilities to preclude access by burrowing animals or weathering. The Performance-Based Closure, Closure to Landfill Standards, and variations of those alternatives involve placement of a cementitous grout material in the facilities, which would further preclude ***weathering or*** access by burrowing animals.

DOE evaluated the potential impacts over the 10,000-year period following facility disposition. This timeframe is consistent with the period of analysis for long-term impacts in other DOE EISs. It also represents the longest time period for the performance standards in applicable regulations and DOE Orders governing facility disposition activities. This analysis involved calculating the peak concentration of contaminants in the aquifer and then estimating the impact to an individual who drills a well into the contaminated material ***as well as calculating radiation dose to individuals who could be in proximity to radioactivity in closed HLW management facilities.***

For radiological constituents, DOE calculated the radiation dose and estimated the corresponding number of latent cancer fatalities that could result from the radiation exposure. For nonradiological constituents, the cancer risk (for carcinogens) or the hazard quotient (for noncarcinogens) was calculated. A summary of radiation dose is presented for each receptor and facility disposition scenario in Table 5.3-1***6. The results represent doses over the entire period of exposure for each receptor that would occur during peak years of exposure (peak groundwater concentration or highest external dose rates, depending on receptor).***

Doses to the maximally exposed resident are highest under the bin set - No Action scenario. For this receptor, doses from the groundwater pathway are primarily due to iodine-129 and technetium-99 intake via groundwater and food product ingestion. Intruder and ***future industrial*** worker doses result mainly from external exposure to radionuclides in closed facilities. For intruders, the dose would be highest under the alternative involving disposal of Class C-type grout in the Tank Farm, while for ***the future industrial*** worker it would be very low in all cases but highest under the ***bin set -*** No Action scenario. The magnitude of these external dose estimates is highly influenced by the proximity to the Tank Farm. Under the conditions assumed here, the maximum intruder dose is estimated at about $\boldsymbol{2.5\times10^5}$ millirem ***under the Tank Farm - Performance-based Closure with Class C Grout Disposal scenario.***

Nonradiological risks are reported both for cancer and noncancer health effects. Cancer risk is reported in terms of probability of individual excess cancer resulting from lifetime exposure. In the cases assessed here, cancer risk results only from inhalation of cadmium entrained in fugitive dust. For all receptors and scenarios, cancer risk from cadmium exposure is very low (less than one in a trillion).

Noncancer effects are reported in terms of a health hazard quotient, which is the ratio of the contaminants of potential concern intake to the applicable inhalation or oral reference dose. A hazard quotient of greater than one indicates that the intake is higher than the reference value. Noncancer risk is incurred from intake of cadmium via ingestion, inhalation and dermal absorption, and fluorides and nitrates via ingestion and dermal absorption. Noncancer risk would be higher for some receptors and scenarios. ***The highest values result from cadmium intake by the maximally exposed resident under the bin sets - No Action scenario and the scenarios involving disposal of Class A or C-type***

Table 5.3-16. Lifetime radiation dose (millirem) by receptor and facility disposition scenario.

Facility	Maximally exposed resident	Future industrial worker	Intruder	Recreational user
No Action				
Tank Farm	84	4.4	5.1×10^{4}	0.64
Bin sets	490	25	2.3×10^{-4}	3.7
Performance-Based Closure or Closure to Landfill Standards				
Tank Farm	4.4	0.36	1.9×10^{4}	0.057
Bin sets	1.3	0.070	6.6×10^{-9}	0.010
New Waste Calcining Facility	0.034	1.7×10^{-3}	9.1×10^{-11}[a]	2.4×10^{-4}
Process Equipment Waste Evaporator	0.036	1.8×10^{-3}	9.6×10^{-11}[a]	2.6×10^{-4}
Performance-Based Closure with Class A Grout Disposal				
Tank Farm[b]	5.0	0.44	2.0×10^{4}	0.070
Bin sets[b]	2.2	0.19	6.7×10^{-9}	0.030
Performance-Based Closure with Class C Grout Disposal				
Tank Farm[c]	4.6	0.38	2.5×10^{5}	0.061
Bin sets[c]	2.1	0.16	2.4×10^{-7}	0.025
Class A or C Grout Disposal in a New Low-Activity Waste Disposal Facility				
Class A disposal facility	6.9	0.95	2.8×10^{-6}	0.16
Class C disposal facility	5.8	0.72	4.4×10^{-3}	0.12

a. Direct radiation dose to intruder from exposure to residual activity in closed New Waste Calcining Facility and Process Equipment Waste Evaporator was not assessed. Doses shown for these facilities are from groundwater pathway.

b. Includes residual contamination plus Class A-type grout.

c. Includes residual contamination plus Class C-type grout.

grout in a Low-Activity Waste Disposal Facility. The health hazard quotient is slightly below one for the bin sets - No Action and Class A Grout Disposal in a new Low-Activity Waste Disposal Facility scenarios (0.81 and 0.96, respectively), and slightly above one (1.1) for the Class C Grout Disposal in a new Low-Activity Waste Disposal Facility scenario. The effect of concern for fluoride intake is objectionable dental fluorosis, which is considered more of a cosmetic effect than an adverse health effect (EPA 1998). Table 5.3-17 presents a summary of noncancer hazard quotients for intakes of fluoride, nitrate, and cadmium.

Additional details on the modeling methodology used by DOE is included in Appendix C.9 of this EIS.

5.3.9 ENVIRONMENTAL JUSTICE

As discussed in Section 5.2.11, Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, directs each Federal agency to "make…achieving environmental justice part of its mission" and to identify and address "…disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority and low-income populations." The Council on Environmental Quality, which oversees the Federal government's compliance with Executive Order 12898 and the National Environmental Policy Act, subsequently developed guidelines to assist Federal agencies in incorporating the goals of Executive Order