Appendix C.3
Health and Safety

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C.3.1 INTRODUCTION

Health and safety impacts to workers and the public can arise from various work-related activities associated with waste processing and facility disposition. Health impacts that were evaluated in this environmental impact statement (EIS) include those resulting from radiological and non-radiological activities and have been presented for the following three types of impacts:

- Radiological health impacts were evaluated for all radiological workers involved with waste processing and facility disposition based on the likelihood of developing a latent cancer fatality (LCF) from worker exposure to radiological air and surface contaminants. Radiological health impacts from facility emissions were also evaluated for the general public, maximally exposed individual, and noninvolved worker.

- Non-radiological health impacts were presented in terms of the hazard quotient for each type of carcinogenic and noncarcinogenic toxic air pollutant for all workers involved with waste processing and facility disposition activities and the public using estimated site boundary pollutant concentration levels.

- Occupational health and safety impacts were evaluated for all workers involved with waste processing and facility disposition activities based on historical injury and illness data at the Idaho National Engineering and Environmental Laboratory (INEEL).

These health impacts and the methodologies and results used to obtain them are presented in Sections 5.2.10 and 5.3.8 of this EIS. ***Groundwater impacts are not part of this appendix. They are addressed in Section 5.3.8.2 and Appendix C.9 of this EIS.***

C.3.2 RADIOLOGICAL HEALTH IMPACTS

For calculating worker radiological health impacts, Project Data Summaries and supporting Engineering Design Files (see Appendix C.6) were used as sources of information on the number of radiological workers and estimated average radiation dose per worker, and duration of each project within a specific option or alternative. Data were then used to determine the annual average collective dose (person-rem), the total project phase collective worker dose (person-rem), and the estimated increase in the number of LCFs from the total collective worker dose. The LCF value is calculated by multiplying the total collective worker dose by the appropriate dose-to-risk conversion factor based on the 1993 *Limitations of Exposure to Ionizing Radiation* (NCRP 1993). These risk factors are 0.0005 and 0.0004 LCFs per person-rem of radiation exposure to the general public and worker population, respectively. The factor for the population is slightly higher due to the presence of infants and children, ***who*** are more sensitive to radiation than the adult worker population. Data on worker radiological health impacts are presented separately for construction, operations, and disposition activities.

Radiological health impacts from facility emissions are presented for the maximally exposed offsite individual, the maximally exposed onsite worker, and the general public. Estimates of radiological dose are presented in Sections 5.2.6 and 5.3.4. These doses are then integrated for the duration of the project phase for each category above. LCF estimates are calculated for the population based on the total collective dose.

C.3.2.1 Waste Processing

Table C.3-1 provides radiological dose and LCFs during construction activities by project. Data are presented in terms of annual and integrated impacts to involved workers.

Table C.3-2 provides radiological dose and LCFs during operations activities by project. Data are presented in terms of annual and integrated impacts to involved workers.

Table C.3-1. Estimated radiological impacts during construction activities to involved workers by project.

Project	Description	Radiation workers/ year[a]	Construction time[a] (years)	Total workers	Collective dose[b] (person-rem)	Estimated increase in latent cancer fatalities[c]
			No Action Alternative			
P1E	Bin Set 1 Calcine Transfer	21	7	150	37	0.015
Totals				150	37	0.015
			Continued Current Operations Alternative			
P1A	Calcine SBW including New Waste Calcining Facility Upgrades	48	5	240	60	0.024
P1E	Bin Set 1 Calcine Transfer	21	7	150	37	0.015
Totals				390	97	0.039
			Full Separations Option			
P59A	Calcine Retrieval and Transport	90	6	540	140	0.054
P27	Class A Grout Disposal in a Low-Activity Waste Disposal Facility	6	24.75	150	37	0.015
Totals				690	170	0.069
			Planning Basis Option			
P1A	Calcine SBW including New Waste Calcining Facility Upgrades	48	5	240	60	0.024
P59A	Calcine Retrieval and Transport	90	6	540	140	0.054
Totals				780	200	0.078
			Transuranic Separations Option			
P59A	Calcine Retrieval and Transport	90	6	540	140	0.054
P27	Class C Grout Disposal in a Low-Activity Waste Disposal Facility	6	24.75	150	37	0.015
Totals				690	170	0.069
			Hot Isostatic Pressed Waste Option			
P1A	Calcine SBW including New Waste Calcining Facility Upgrades	48	5	240	60	0.024
P59A	Calcine Retrieval and Transport	90	6	540	140	0.054
Totals				780	200	0.078
			Direct Cement Waste Option			
P1A	Calcine SBW including New Waste Calcining Facility Upgrades	48	5	240	60	0.024
P59A	Calcine Retrieval and Transport	90	6	540	140	0.054
Totals				780	200	0.078
			Early Vitrification Option			
P59A	Calcine Retrieval and Transport	90	6	540	140	0.054
Totals				540	140	0.054
			Steam Reforming Option			
P59A	*Calcine Retrieval and Transport*	*90*	*6*	*540*	*140*	*0.054*
Totals				*540*	*140*	*0.054*
			Minimum INEEL Processing Alternative			
P27	Class A Grout Disposal in a Low-Activity Waste Disposal Facility	6	24.75	150	37	0.015
P59A	Calcine Retrieval and Transport	90	6	540	140	0.054
Totals				690	170	0.069
			Vitrification without Calcine Separations Option			
P59A	*Calcine Retrieval and Transport*	*90*	*6*	*540*	*140*	*0.054*
Totals				*540*	*140*	*0.054*
			Vitrification with Calcine Separations Option			
P59A	*Calcine Retrieval and Transport*	*90*	*6*	*540*	*140*	*0.054*
Totals				*540*	*140*	*0.054*

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

b. Based on INEEL statistics for construction workers of 0.25 rem per year.

c. Represents the number of latent cancer fatalities in addition to the baseline national cancer mortality rate. See text box, "Assessment of the Health Effects of Ionizing Radiation" in Section 5.2.9.

Table C.3-2. Estimated radiological impacts during operations to involved workers by project.

Project	Description	***Radiation*** workers/ year	Processing times (years)	***Total*** workers	Collective dose (person-rem)	Estimated increases in latent cancer fatalities
			No Action Alternative			
P1D	No Action Alternative	42	***36***	***1.5×10^{3}***	***290***	***0.11***
P1E	Bin Set 1 Calcine Transfer	17	***1***	***17***	***3.2***	***1.3×10^{-3}***
P18MC	Remote Analytical Laboratory Operations	***10***	29	***290***	***55***	***0.022***
Totals				***1.8×10^{3}***	***350***	***0.14***
			Continued Current Operations Alternative			
P1A	Calcine SBW including New Waste Calcining Facility Upgrades	96	6	580	110	***0.044***
P1B	Newly-Generated Liquid Waste and Tank Farm Heel Waste Management	60	21	1.3×10^{3}	240	***0.096***
P1E	Bin Set 1 Calcine Transfer	17	1	17	3.2	***1.3×10^{-3}***
P18MC	Remote Analytical Laboratory Operations	***10***	29	***290***	***55***	***0.022***
Totals				***2.1×10^{3}***	***410***	***0.16***
			Full Separations Option			
P9A	Full Separations	30	21	630	120	***0.048***
P9B	Vitrification Plant	40	***20***	***800***	***150***	***0.061***
P9C	Class A Grout Plant	16	21	340	64	***0.026***
P18	New Analytical Laboratory	***30***	***21***	***630***	***120***	***0.048***
P24	Vitrified Product Interim Storage	5	***20***	***100***	***19***	***7.6×10^{-3}***
P25A	Packaging and Loading Vitrified HLW at INTEC for Shipment to a Geologic Repository	6	20	120	23	***9.1×10^{-3}***
P59A	Calcine Retrieval and Transport	10	***20***	***200***	***38***	***0.015***
P118	Separations Organic Incinerator	***8.5***	21	***180***	***34***	***0.014***
P27	Class A Grout Disposal in a Low-Activity Waste Disposal Facility	2.5	21	53	10	***4.0×10^{-3}***
P35D	Class A Grout Packaging and Shipping to a Low-Activity Waste Disposal Facility	8	21	170	32	***0.013***
P133	***Waste Treatment Pilot Plant***	***33***	***27***	***890***	***170***	***0.068***
Totals				***4.1×10^{3}***	***780***	***0.31***

Table C.3-2. Estimated radiological impacts during operations to involved workers by project (continued).

Project	Description	***Radiation*** workers/ year	Processing times (years)	***Total*** workers	Collective dose (person-rem)	Estimated increases in latent cancer fatalities
			Planning Basis Option			
P1A	Calcine SBW including New Waste Calcining Facility Upgrades	96	6	580	110	***0.044***
P1B	Newly Generated Liquid Waste and Tank Farm Heel Waste Management	60	21	1.3×10^3	240	***0.096***
P59A	Calcine Retrieval and Transport	10	***16***	***160***	***30***	***0.012***
P23A	Full Separations	30	16	480	91	***0.036***
P23B	Vitrification Plant	40	15	600	110	***0.046***
P23C	Class A Grout Plant	16	16	260	49	***0.019***
P24	Interim Storage of Vitrified Waste	5	***20***	***100***	***19***	$***7.6\times10^{-3}***$
P25A	Packaging and Loading Vitrified HLW at INTEC for Shipment to a Geologic Repository	6	20	120	23	$***9.1\times10^{-3}***$
P18	New Analytical Laboratory	***30***	***21***	***630***	***120***	***0.048***
P118	Separations Organic Incinerator	***8.5***	16	***140***	***26***	***0.010***
P35***E***	Class A Grout Packaging and ***Loading for Offsite Disposal***	***8***	***16***	***130***	***24***	$***9.7\times10^{-3}***$
P133	***Waste Treatment Pilot Plant***	***33***	***21***	***690***	***130***	***0.053***
Totals				$***5.1\times10^3***$	***980***	***0.39***
			Transuranic Separations Option			
P18	New Analytical Laboratory	***30***	***21***	***630***	***120***	***0.048***
P39A	Shipping Transuranic Waste from INTEC to the Waste Isolation Pilot Plant	2.5	***21***	***53***	***10***	$***4.0\times10^{-3}***$
P49A	Transuranic/Class C Separations	50	21	1.1×10^3	200	0.080
P49C	Class C Grout Plant	16	21	340	64	***0.026***
P59A	Calcine Retrieval and Transport	10	21	210	40	***0.016***
P118	Separations Organic Incinerator	***8.5***	21	***180***	***34***	***0.014***
P27	Class A Grout Disposal in a Low-Activity Waste Disposal Facility	2.5	21	53	10	$***4.0\times10^{-3}***$
P49D	Class C Grout Packaging and Shipping to a Low-Activity Waste Disposal Facility	8.5	21	180	34	***0.014***
P133	***Waste Treatment Pilot Plant***	***33***	***27***	***890***	***170***	***0.068***
Totals				$***3.6\times10^3***$	***680***	***0.27***

Table C.3-2. Estimated radiological impacts during operations to involved workers by project (continued).

Project	Description	***Radiation*** workers/ year	Processing times (years)	***Total*** workers	Collective dose (person-rem)	Estimated increases in latent cancer fatalities
	Hot Isostatic Pressed Waste Option					
P1A	Calcine SBW including New Waste Calcining Facility Upgrades	96	6	580	110	***0.044***
P1B	Newly-Generated Liquid Waste and Tank Farm Heel Waste Management	60	21	1.3×10^3	240	***0.096***
P18	New Analytical Laboratory	***30***	***21***	***630***	***120***	***0.048***
P59A	Calcine Retrieval and Transport	10	21	210	40	***0.016***
P71	Mixing and Hot Isostatic Pressing	22	21	460	88	***0.035***
P72	Interim Storage of Hot Isostatic Pressed Waste	2.5	***21***	***53***	***10***	$***4.0\times10^{-3}***$
P73A	Packaging and Loading Hot Isostatic Pressed Waste at INTEC for Shipment to a Geologic Repository	2.5	20	50	9.5	$***3.8\times10^{-3}***$
P133	***Waste Treatment Pilot Plant***	***33***	***27***	***890***	***170***	***0.068***
Totals				$***4.1\times10^3***$	***790***	***0.31***
	Direct Cement Waste Option					
P1A	Calcine SBW including New Waste Calcining Facility Upgrades	96	6	580	110	***0.044***
P1B	Newly-Generated Liquid Waste and Tank Farm Heel Waste Management	60	21	1.3×10^3	240	***0.096***
P18	New Analytical Laboratory	***30***	***21***	***630***	***120***	***0.048***
P59A	Calcine Retrieval and Transport	10	21	210	40	***0.016***
P80	Direct Cement Process	93	21	2.0×10^3	370	0.15
P81	Unseparated Cementitious HLW Interim Storage	4.5	***21***	***95***	***18***	$***7.2\times10^{-3}***$
P83A	Packaging and Loading Cementitious Waste at INTEC for Shipment to a Geologic Repository	2.5	20	50	9.5	$***3.8\times10^{-3}***$
P133	***Waste Treatment Pilot Plant***	***33***	***27***	***890***	***170***	***0.068***
Totals				$***5.7\times10^3***$	$***1.1\times10^3***$	***0.43***

Table C.3-2. Estimated radiological impacts during operations to involved workers by project (continued).

Project	Description	***Radiation*** workers/ year	Processing times (years)	***Total*** workers	Collective dose (person-rem)	Estimated increases in latent cancer fatalities
			Early Vitrification Option			
P1C	Process Equipment Waste Evaporator and Liquid Effluent Treatment and Disposal	28	36	1.0×10^{3}	190	***0.077***
P18	New Analytical Laboratory	***30***	***21***	***630***	***120***	***0.048***
P59A	Calcine Retrieval and Transport	10	21	210	40	***0.016***
P61	Vitrified HLW Interim Storage	4.5	***21***	***95***	***18***	7.2×10^{-3}
P62A	Packaging and Loading Vitrified HLW at INTEC for Shipment to a Geologic Repository	2.5	20	50	9.5	3.8×10^{-3}
P88	Early Vitrification with Maximum Achievable Control Technology	39	21	820	160	***0.062***
P90A	Packaging and Loading Vitrified SBW at INTEC for Shipment to the Waste Isolation Pilot Plant	2.5	***20***	***50***	***9.5***	3.8×10^{-3}
P133	***Waste Treatment Pilot Plant***	***33***	***27***	***890***	***170***	***0.068***
Totals				3.8×10^{3}	***710***	***0.29***
			Steam Reforming Option			
P1C	***Process Equipment Waste Evaporator and Liquid Effluent Treatment and Disposal Facility***	***28***	***36***	1.0×10^{3}	***190***	***0.077***
P18MC	***Remote Analytical Laboratory Operation***	***10***	***29***	***290***	***55***	***0.022***
P59A	***Calcine Retrieval and Transport***	***10***	***20***	***200***	***38***	***0.015***
P117A	***Calcine Packaging and Loading to Hanford***	***44***	***24.25***	1.1×10^{3}	***200***	***0.081***
P2001	***NGLW Grout Facility***	***22***	***22.25***	***490***	***93***	***0.037***
P35E	***Grout Packaging and Loading for Offsite Disposal***	***8***	***22.25***	***180***	***34***	***0.014***
P2002A	***Steam Reforming***	***40***	***2***	***80***	***15***	6.1×10^{-3}
Totals				3.3×10^{3}	***630***	***0.25***

Table C.3-2. Estimated radiological impacts during operations to involved workers by project (continued).

Project	Description	***Radiation*** workers/ year	Processing times (years)	***Total*** workers	Collective dose (person-rem)	Estimated increases in latent cancer fatalities
	Minimum INEEL Processing Alternative					
P1C	Process Equipment Waste Evaporator and Liquid Effluent Treatment and Disposal	28	26	730	140	***0.055***
P18	New Analytical Laboratory	***30***	***21***	***630***	***120***	***0.048***
P24	Interim Storage of Vitrified Waste	5	***20***	***100***	***19***	7.6×10^{-3}
P25A	Packaging and Loading Vitrified HLW at INTEC for Shipment to a Geologic Repository	6	20	120	23	9.1×10^{-3}
P27	Class A Grout Disposal in a Low-Activity Waste Disposal Facility	2.5	21	53	10	4.0×10^{-3}
P111	SBW and Newly-Generated Liquid Waste Treatment with Cesium Ion Exchange to Contact-Handled Transuranic Grout and Low-Level Waste Grout	33	***17***	***560***	***110***	***0.043***
P112A	Packaging and Loading Contact-Handled Transuranic (from SBW and Newly-Generated Liquid Waste Cesium Ion Exchange Grout Treatment) for Shipment to WIPP	2.5	***17***	***43***	***8.1***	3.2×10^{-3}
P59A	Calcine Retrieval and Transport	10	***15***	***150***	***29***	***0.011***
P117A	Calcine Packaging and Loading to Hanford	44	***15***	***660***	***130***	0.050
P133	***Waste Treatment Pilot Plant***	***33***	***17***	***560***	***110***	***0.043***
Totals				3.6×10^{3}	***690***	***0.27***

Table C.3-2. Estimated radiological impacts during operations to involved workers by project (continued).

Project	Description	*Radiation* workers/ year	Processing times (years)	*Total* workers	Collective dose (person-rem)	Estimated increases in latent cancer fatalities
	Vitrification without Calcine Separations Option					
P1C	***Process Equipment Waste Evaporator and Liquid Effluent Treatment and Disposal Facility***	***28***	***36***	***1.0×10^{3}***	***190***	***0.077***
P18	***New Analytical Laboratory***	***30***	***21***	***630***	***120***	***0.048***
P59A	***Calcine Retrieval and Transport***	***10***	***13.25***	***130***	***25***	***0.010***
P61	***Vitrified HLW Interim Storage***	***4.5***	***22.25***	***100***	***19***	***7.6×10^{-3}***
P62A	***Packaging and Loading Vitrified HLW for Shipment to NGR***	***2.5***	***20***	***50***	***10***	***3.8×10^{-3}***
P88	***Vitrification with Maximum Achievable Control Technology***	***39***	***13.25***	***520***	***98***	***0.039***
P133	***Waste Treatment Pilot Plant***	***33***	***6***	***200***	***38***	***0.015***
Totals				***2.6×10^{3}***	***500***	***0.20***
	Vitrification with Calcine Separations Option					
P1C	***Process Equipment Waste Evaporator and Liquid Effluent Treatment and Disposal Facility***	***28***	***36***	***1.0×10^{3}***	***190***	***0.077***
P9A	***Full Separations***	***30***	***13.25***	***400***	***76***	***0.030***
P9C	***Grout Plant***	***16***	***13.25***	***210***	***40***	***0.016***
P18	***New Analytical Laboratory***	***30***	***21***	***630***	***120***	***0.048***
P24	***Vitrified Product Interim Storage***	***5***	***20***	***100***	***19***	***7.6×10^{-3}***
P25A	***Packaging and Loading Vitrified HLW for Shipment to NGR***	***6***	***20***	***120***	***23***	***9.1×10^{-3}***
P35E	***Grout Packaging and Loading for Offsite Disposal***	***8***	***13.25***	***110***	***20***	***8.1×10^{-3}***
P59A	***Calcine Retrieval and Transport***	***10***	***13.25***	***130***	***25***	***0.010***
P88	***Vitrification with Maximum Achievable Control Technology***	***39***	***13.25***	***520***	***98***	***0.039***
P133	***Waste Treatment Pilot Plant***	***33***	***6***	***200***	***38***	***0.015***
Totals				***3.4×10^{3}***	***650***	***0.26***

a. Project data from project data sheets are divided into two phases.

Radiological impacts from facility airborne emissions to the maximally exposed onsite and offsite individuals and general population within 50 miles of ***INTEC*** is based on worker and radiological dose data presented in Appendix C.2, Table C.2-***10***. Collective population ***dose*** from Table C.2-***10*** was multiplied by the dose-to-risk conversion factor of ***0.0005 LCFs per person-rem of radiation exposure to the general public*** to determine LCFs in Section 5.2.10.

C.3.2.2 Facility Disposition

Section C.3.4.2 discusses radiological impacts for the involved workers by project for the existing facilities during facility disposition activities.

C.3.3 NONRADIOLOGICAL HEALTH IMPACTS

For nonradiological health impacts from atmospheric releases, DOE used toxic air pollutant emissions data for each project under an alternative to estimate air concentrations at the INEEL site boundary. For the evaluation of occupational health effects, the modeled chemical concentration is compared with the applicable occupational standard that provides levels at which no adverse effects are expected, yielding a

hazard quotient. The hazard quotient is a ratio between the calculated concentration in air and the applicable standard. For noncarcinogenic toxic air pollutants, if the hazard quotient is less than 1, then no adverse health effects would be expected. If the hazard quotient is greater than 1, additional investigation would be warranted. For carcinogenic toxic air pollutants, risks are estimated as the incremental probability of an individual developing cancer over a lifetime as a result of exposure to the potential carcinogen.

Section 5.2.10 presents the waste processing options with the maximum carcinogenic and noncarcinogenic pollutant maximum concentrations based on data from Appendix C.2, Table C.2-***14***. Table C.2-***14*** provides maximum pollutant concentrations by each of the projects within the waste processing options.

C.3.4 OCCUPATIONAL HEALTH AND SAFETY IMPACTS

Estimates of occupational illness and injury rates for workers involved with the waste processing alternatives are provided in terms of lost workdays and total recordable cases that would occur during a peak employment year and for the entire period of construction and operations for each of the alternatives. The lost workday values represent 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. The total recordable cases include work-related death, illness, or injury that resulted in loss of consciousness, restriction of work or motion, transfer to another job, or required medical treatment beyond first aid.

Historical total recordable cases and lost workday rates were obtained from the Computerized Accident/Incident Reporting System (CAIRS) database (***DOE 2001***) for ***INEEL*** construction and operations activities over a 5-year period ***from 1996-2000. Based on the available data, DOE concluded that the overall INEEL rates were representative of both construction and operations. These rates are 28.4 percent for lost workdays and 3.7 percent for total recordable cases. DOE lost workdays and total recordable cases rates have been trending downward. For example, in 2001, the INEEL rates were 15.4 percent and 2.3 percent for lost workdays and total recordable cases, respectively, compared to 23.0 and 2.3 percent for overall DOE rates.***

Section 5.2.10 provides estimates of annual and cumulative lost workdays and total recordable cases by alternative during construction and operations for the waste processing alternatives.

The following information is in support of the worker safety information provided in Section 5.2.10 and 5.3.8 for waste processing and facility disposition respectively:

C.3.4.1 Waste Processing

Tables C.3-3 and C.3-4 provide the number of peak-year and total workers and the lost workdays and total recordable cases by project during construction.

Tables C.3-5 and C.3-6 provide the number of peak-year and total workers and the lost workdays and total recordable cases by project during operations.

C.3.4.2 Facility Disposition

Table C.3-7 provides peak-year employment and worker safety data ***for disposition of new facilities*** by alternative. ***Alternative*** specific employment numbers are provided in Appendix C.1.

Table C.3-8 contains estimated radiological impacts and occupational worker data for ***disposition of*** existing facilities by project.

Table C.3-9 contains estimated radiological impacts to involved workers during disposition of new facilities.

Table C.3-10 contains estimated worker injury impacts during disposition activities of new facilities.

Table C.3-3. Worker safety during construction - peak year employment levels.

Project	Number of workers[a]	Lost workdays/year	Total recordable cases/year
No Action Alternative	21	***6.0***	***0.78***
Continued Current Operations Alternative	89	***25***	***3.3***
Separations Alternative			
Full Separations Option	850	***240***	32
Planning Basis Option	870	***250***	***32***
Transuranic Separations Option	680	***190***	***25***
Non-Separations Alternative			
Hot Isostatic Pressed Waste Option	360	***100***	***13***
Direct Cement Waste Option	400	***110***	15
Early Vitrification Option	330	***93***	***12***
Steam Reforming Option	***550***	***160***	***20***
Minimum INEEL Processing Alternative	200	***56***	***7.3***
Direct Vitrification Alternative			
Vitrification without Calcine Separations Option	***350***	***100***	***13***
Vitrification with Calcine Separations Option	***670***	***190***	***25***

a. For peak year employment levels, see Appendix C.1.

Table C.3-4. Estimated worker injury impacts during construction activities of new facilities at INEEL by alternative.

Project	Description	Average number workers/year	LWD[a] per year	TRC[b] per year	Construction time (years)	Total LWD	Total TRC
			No Action Alternative				
P1E	Bin Set 1 Calcine Transfer	21	6.0	0.78	5	30	3.9
			Continued Current Operations Alternative				
P1A	Calcine SBW including New Waste Calcining Facility Upgrades	48	14	1.8	4	55	7.1
P1B	Newly-Generated Liquid Waste and Tank Farm Heel Waste Management	20	5.7	0.74	4	23	3.0
P1E	Bin Set 1 Calcine Transfer	21	6.0	0.78	5	30	3.9
Totals						110	14
			Full Separations Option				
P9A	Full Separations	300	85	11	5	430	56
P9B	Vitrification Plant	280	80	10	5	400	52
P9C	Class A Grout Plant	160	45	5.9	2	91	12
P18	New Analytical Laboratory	59	17	2.2	2	34	4.4
P24	Interim Storage of Vitrified Waste	110	31	4.1	3.8	120	15
P27	Class A Grout Disposal in a New Low-Activity Waste Disposal Facility	78	22	2.9	7	160	20
P35D	Class A Grout Packaging and Shipping to a Low-Activity Waste Disposal Facility	22	6.2	0.81	4.2	26	3.4
P59A	Calcine Retrieval and Transport	100	28	3.7	5	140	19
P118	Separations Organic Incinerator	10	2.8	0.37	3.3	9.4	1.2
P133	Waste Treatment Pilot Plant	63	18	2.3	4	72	9.3
Totals						1.5×10^3	190
			Planning Basis Option				
P1A	Calcine SBW including New Waste Calcining Facility Upgrades	48	14	1.8	4	55	7.1
P1B	Newly-Generated Liquid Waste and Tank Farm Heel Waste Management	20	5.7	0.74	4	23	3.0
P59A	Calcine Retrieval and Transport	100	28	3.7	5	140	19
P23A	Full Separations	300	85	11	5	430	56
P23B	Vitrification Plant	280	80	10	5	400	52
P23C	Class A Grout Plant	160	45	5.9	5	230	30
P24	Interim Storage of Vitrified Waste	110	31	4.1	3.75	120	15

Table C.3-4. Estimated worker injury impacts during construction activities of new facilities at INEEL by alternative (continued).

Project	Description	Average number workers/year	LWD[a] per year	TRC[b] per year	Construction time (years)	Total LWD	Total TRC
			Planning Basis Option (continued)				
P18	New Analytical Laboratory	59	17	2.2	2	34	4.4
P118	Separations Organic Incinerator	10	2.8	0.37	3.3	9.4	1.2
P35E	Grout Packaging and Loading for Offsite Disposal	22	6.2	0.81	4	25	3.3
P133	Waste Treatment Pilot Plant	63	18	2.3	4	72	9.3
Totals						1.5×10^3	200
			Transuranic Separations Option				
P18	New Analytical Laboratory	59	17	2.2	2	34	4.4
P27	Class A Grout Disposal in a Low-Activity Waste Disposal Facility	78	22	2.9	7	160	20
P49A	Transuranic Waste /Class C Separations	300	85	11	5	430	56
P49C	Class C Grout Plant	200	57	7.4	5	280	37
P49D	Class C Grout Packaging and Shipping to a Low-Activity Waste Disposal Facility	22	6.2	0.81	4.2	26	3.4
P59A	Calcine Retrieval and Transport	100	28	3.7	5	140	19
P118	Separations Organic Incinerator	10	2.8	0.37	3.3	9.4	1.2
P133	Waste Treatment Pilot Plant	63	18	2.3	4	72	9.3
Totals						1.1×10^3	150
			Hot Isostatic Pressed Waste Option				
P1A	Calcine SBW including New Waste Calcining Facility Upgrades	48	14	1.8	4	55	7.1
P1B	Newly-Generated Liquid Waste and Tank Farm Heel Waste Management	20	5.7	0.74	4	23	3.0
P18	New Analytical Laboratory	59	17	2.2	2	34	4.4
P59A	Calcine Retrieval and Transport	100	28	3.7	5	140	19

Table C.3-4. Estimated worker injury impacts during construction activities of new facilities at INEEL by alternative (continued).

Project	Description	Average number workers/year	LWD[a] per year	TRC[b] per year	Construction time (years)	Total LWD	Total TRC
			Hot Isostatic Pressed Waste Option (continued)				
P71	Mixing and Hot Isostatic Pressing	100	28	3.7	4	110	15
P72	Interim Storage of Hot Isostatic Pressed Waste	92	26	3.4	3	78	10
P133	Waste Treatment Pilot Plant	63	18	2.3	4	72	9.3
Totals						520	67
			Direct Cement Waste Option				
P1A	Calcine SBW including New Waste Calcining Facility Upgrades	48	14	1.8	4	55	7.1
P1B	Newly-Generated Liquid Waste and Tank Farm Heel Waste Management	20	5.7	0.74	4	23	3.0
P18	New Analytical Laboratory	59	17	2.2	2	34	4.4
P59A	Calcine Retrieval and Transport	100	28	3.7	5	140	19
P80	Direct Cement Process	130	37	4.8	4	150	19
P81	Unseparated Cementitious Waste Interim Storage	134	38	5.0	4	150	20
P133	Waste Treatment Pilot Plant	63	18	2.3	4	72	9.3
Total						620	81
			Early Vitrification Option				
P18	New Analytical Laboratory	59	17	2.2	2	34	4.4
P59A	Calcine Retrieval and Transport	100	28	3.7	5	140	19
P61	Vitrified HLW Interim Storage	110	31	4.1	4	130	16
P88	Early Vitrification Facility with Maximum Achievable Control Technology	110	31	4.1	5	160	20
P133	Waste Treatment Pilot Plant	63	18	2.3	4	72	9.3
Totals						530	69

Table C.3-4. Estimated worker injury impacts during construction activities of new facilities at INEEL by alternative (continued).

Project	Description	Average number workers/year	LWD[a] per year	TRC[b] per year	Construction time (years)	Total LWD	Total TRC
			Steam Reforming Option				
P13	New Storage Tanks	49	14	1.8	2.5	35	4.5
P59A	Calcine Retrieval and Transport	100	28	3.7	5	140	19
P117A	Calcine Packaging and Loading	78	22	2.9	4	89	12
P2001	NGLW Grout Facility	50	14	1.9	4	57	7.4
P35E	Grout Packaging and Loading for Offsite Disposal	22	6.2	0.81	4	25	3.3
P2002A	Steam Reforming	295	84	11	5	420	55
Totals						770	100
			Minimum INEEL Processing Alternative				
P18	New Analytical Laboratory	59	17	2.2	2	34	4.4
P24	Interim Storage of Vitrified Waste	110	31	4.1	3.8	120	15
P27	Class A Grout Disposal in a Low-Activity Waste Disposal Facility	78	22	2.9	7	160	20
P59A	Calcine Retrieval and Transport	100	28	3.7	5	140	19
P111	SBW and Newly-Generated Liquid Waste Treatment with Cesium Ion Exchange to Contact-Handled Transuranic Grout and Low-Level Waste Grout	20	5.7	0.74	3	17	2.2
P117A	Calcine Packaging and Loading to Hanford	78	22	2.9	4	89	12
P133	Waste Treatment Pilot Plant	63	18	2.3	4	72	9.3
Totals						620	81

Table C.3-4. Estimated worker injury impacts during construction activities of new facilities at INEEL by alternative (continued).

Project	Description	Average number workers/year	LWD[a] per year	TRC[b] per year	Construction time (years)	Total LWD	Total TRC
		Vitrification without Calcine Separations Option					
P13	New Storage Tanks	49	14	1.8	2.5	35	4.5
P18	New Analytical Laboratory	59	17	2.2	4	67	8.7
P59A	Calcine Retrieval and Transport	100	28	3.7	5	140	19
P61	Vitrified HLW Interim Storage	110	31	4.1	4	130	16
P88	Vitrification with Maximum Achievable Control Technology	120	34	4.4	8	270	36
P133	Waste Treatment Pilot Plant	63	18	2.3	4	72	9.3
Totals						710	93
		Vitrification with Calcine Separations Option					
P9A	Full Separations	300	85	11	5	430	56
P9C	Grout Plant	160	45	5.9	2	91	12
P13	New Storage Tanks	49	14	1.8	2.5	35	4.5
P18	New Analytical Laboratory	59	17	2.2	4	67	8.7
P24	Vitrified Product Interim Storage	110	31	4.1	3.8	120	15
P35E	Grout Packaging and Loading for Offsite Disposal	22	6.2	0.81	4	25	3.3
P59A	Calcine Retrieval and Transport	100	28	3.7	5	140	19
P88	Vitrification with Maximum Achievable Control Technology	120	34	4.4	8	270	36
P133	Waste Treatment Pilot Plant	63	18	2.3	6	110	14
Totals						1.3×10^3	170

a. LWD = lost workday. The number of workdays beyond the day of injury or onset of illness that the employee was away from work or limited to restricted work activity because of an occupational injury or illness.

b. TRC = 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 treatment beyond first aid.

Table C.3-5. Worker safety during operations - peak year employment levels.

Project	Number of workers[a]	Lost workdays/year	Total recordable cases/year
No Action Alternative	***73***	***21***	***2.7***
Continued Current Operations Alternative	280	***79***	***10***
Separations Alternative			
Full Separations Option	440	***130***	***16***
Planning Basis Option	***480***	***140***	***18***
Transuranic Separations Option	320	***90***	***12***
Non-Separations Alternative			
Hot Isostatic Pressed Waste Option	460	***130***	***17***
Direct Cement Waste Option	530	***150***	***19***
Early Vitrification Option	330	***93***	***12***
Steam Reforming Option	***170***	***49***	***6.4***
Minimum INEEL Processing Alternative	330	***93***	***12***
Direct Vitrification Alternative			
Vitrification without Calcine Separations Option	***310***	***87***	***11***
Vitrification with Calcine Separations Option	***440***	***130***	***16***

a. For peak year employment levels, see Appendix C.1.

Table C.3-6. Estimated worker injury impacts during operations activities of new facilities at INEEL by alternative.

Project	Description	Average number workers/year	LWD[a] per year	TRC[b] per year	Processing time (years)	Total LWD	Total TRC
			No Action Alternative				
P1D	No Action Alternative	62	18	2.3	17	300	39
P1E	Bin Set 1 Calcine Transfer	18	5.1	0.67	17	87	11
P4	Long-Term Storage of Calcine in Bin Sets	3	0.85	0.11	36	31	4.0
P18MC	Remote Analytical Laboratory Operations	52	15	1.9	29	430	56
Totals						850	110
			Continued Current Operations Alternative				
P1A	Calcine SBW including New Waste Calcining Facility Upgrades	150	43	5.6	6	260	33
P1B	Newly-Generated Liquid Waste and Tank Farm Heel Waste Management	76	22	2.8	5	110	14
P1B(II)[c]	Newly-Generated Liquid Waste and Tank Farm Heel Waste Management	56	16	2.1	14	220	29
P1E	Bin Set 1 Calcine Transfer	18	5.1	0.67	17	87	11
P4	Long-Term Storage of Calcine in Bin Sets	3	0.85	0.11	36	31	4.0
P18MC	Remote Analytical Laboratory Operations	52	15	1.9	29	430	56
Totals						1.1×10^3	150
			Full Separations Option				
P9A	Full Separations	120	34	4.4	21	720	93
P9B	Vitrification Plant	90	26	3.3	18	460	60
P9C	Class A Grout Plant	38	11	1.4	21	230	30
P18	New Analytical Laboratory	100	28	3.7	34	970	130
P24	Interim Storage of Vitrified Waste	6.5	1.8	0.24	36	67	8.7
P25A	Packaging and Loading Vitrified HLW at INTEC for Shipment to a Geologic Repository	7	2.0	0.26	20	40	5.2
P59A	Calcine Retrieval and Transport	11	3.1	0.41	20	63	8.1
P118	Separations Organic Incinerator	8.5	2.4	0.31	21	51	6.6
P27	Class A Grout Disposal in a Low-Activity Waste Disposal Facility	17	4.8	0.63	21	100	13
P35D	Class A Grout Packaging and Shipping to a Low-Activity Waste Disposal Facility	9.5	2.7	0.35	21	57	7.4
P133	Waste Treatment Pilot Plant	39	11	1.4	27	300	39
Totals						3.0×10^3	400

Table C.3-6. Estimated worker injury impacts during operations activities of new facilities at INEEL by alternative (continued).

Project	Description	Average number workers/year	LWD[a] per year	TRC[b] per year	Processing time (years)	Total LWD	Total TRC
			Planning Basis Option				
P1A	Calcine SBW including New Waste Calcining Facility Upgrades	150	43	5.6	6	260	33
P1B	Newly-Generated Liquid Waste and Tank Farm Heel Waste Management	130	37	4.8	21	780	100
P59A	Calcine Retrieval and Transport	11	3.1	0.41	16	50	6.5
P23A	Full Separations	120	34	4.4	16	550	71
P23B	Vitrification Plant	90	26	3.3	15	380	50
P23C	Class A Grout Plant	38	11	1.4	16	170	23
P24	Interim Storage of Vitrified Waste	6.5	1.8	0.24	36	66	8.7
P25A	Packaging and Loading Vitrified HLW at INTEC for Shipment to a Geologic Repository	7	2.0	0.26	20	40	5.2
P18	New Analytical Laboratory	100	28	3.7	34	970	130
P118	Separations Organic Incinerator	8.5	2.4	0.31	21	51	6.6
P35E	Grout Packaging and Loading for Offsite Disposal	8.5	2.4	0.31	23	56	7.2
P133	Waste Treatment Pilot Plant	39	11	1.4	27	300	39
Totals						3.7×10^3	480
			Transuranic Separations Option				
P18	New Analytical Laboratory	100	28	3.7	34	970	130
P27	Class A Grout Disposal in a Low-Activity Waste Disposal Facility	17	4.8	0.63	21	100	13
P39A	Packaging and Loading Transuranic Waste at INTEC for Shipment to the Waste Isolation Pilot Plant	6.5	1.8	0.24	19	35	4.6

Table C.3-6. Estimated worker injury impacts during operations activities of new facilities at INEEL by alternative (continued).

Project	Description	Average number workers/year	LWD[a] per year	TRC[b] per year	Processing time (years)	Total LWD	Total TRC
			Transuranic Separations Option (continued)				
P49A	Transuranic Waste/Class A Separations	84	24	3.1	21	500	65
P49C	Class C Grout Plant	40	11	1.5	21	240	31
P49D	Class C Grout Packaging and Shipping to a Low-Activity Waste Disposal Facility	8.5	2.4	0.31	21	51	6.6
P59A	Calcine Retrieval and Transport	11	3.1	0.41	21	66	8.5
P118	Separations Organic Incinerator	8.5	2.4	0.31	21	51	6.6
P133	Waste Treatment Pilot Plant	39	11	1.4	27	300	39
Totals						2.3×10^3	300
			Hot Isostatic Pressed Waste Option				
P1A	Calcine SBW including New Waste Calcining Facility Upgrades	150	43	5.6	6	260	33
P1B	Newly-Generated Liquid Waste and Tank Farm Heel Waste Management	76	22	2.8	5	110	14
P1B(II)[c]	Newly-Generated Liquid Waste and Tank Farm Heel Waste Management	56	16	2.1	14	220	29
P18	New Analytical Laboratory	100	28	3.7	34	970	130
P59A	Calcine Retrieval and Transport	11	3.1	0.41	21	66	8.5
P71	Mixing and Isostatic Pressing	78	22	2.9	21	470	61
P72	Interim Storage Isostatic Pressed Waste	6.5	1.8	0.24	36	67	8.7
P73A	Packaging and Loading Hot Isostatic Pressed Waste at INTEC for Shipment to a Geologic Repository	6.5	1.8	0.24	20	37	4.8
P133	Waste Treatment Pilot Plant	39	11	1.4	27	300	39
Totals						2.5×10^3	320

Table C.3-6. Estimated worker injury impacts during operations activities of new facilities at INEEL by alternative (continued).

Project	Description	Average number workers/year	LWD[a] per year	TRC[b] per year	Processing time (years)	Total LWD	Total TRC
			Direct Cement Waste Option				
P1A	Calcine SBW including New Waste Calcining Facility Upgrades	150	43	5.6	6	260	33
P1B	Newly-Generated Liquid Waste and Tank Farm Heel Waste Management	76	22	2.8	5	110	14
P1B(II)[c]	Newly-Generated Liquid Waste and Tank Farm Heel Waste Management	56	16	2.1	14	220	29
P18	New Analytical Laboratory	100	28	3.7	34	970	130
P59A	Calcine Retrieval and Transport	11	3.1	0.41	21	66	8.5
P80	Direct Cement Process	140	40	5.2	21	840	110
P81	Unseparated Cementitious HLW Interim Storage	6.5	1.8	0.24	34	63	8.2
P83A	Packaging & Loading Cementitious Waste at INTEC for Shipment to a Geologic Repository	11	3.1	0.41	20	62	8.1
P133	Waste Treatment Pilot Plant	39	11	1.4	27	300	39
Totals						2.9×10^3	380
			Early Vitrification Option				
P1C	Process Equipment Waste Evaporator and Liquid Effluent Treatment and Disposal Facility	28	8.0	1.0	36	290	37
P18	New Analytical Laboratory	100	28	3.7	34	970	130
P59A	Calcine Retrieval and Transport	11	3.1	0.41	21	66	8.5
P61	Vitrified HLW Interim Storage	6.5	1.8	0.24	36	67	8.7
P62A	Packaging and Loading of Vitrified HLW at INTEC for Shipment to a Geologic Repository	6.5	1.8	0.24	20	37	4.8
P88	Early Vitrification with Maximum Achievable Control Technology	130	37	4.8	21	780	100
P90A	Packaging and Loading Vitrified SBW at INTEC for Shipment to the Waste Isolation Pilot Plant	6.5	1.8	0.24	18	33	4.3
P133	Waste Treatment Pilot Plant	39	11	1.4	27	300	39
Totals						2.5×10^3	330

Table C.3-6. Estimated worker injury impacts during operations activities of new facilities at INEEL by alternative (continued).

Project	Description	Average number workers/year	LWD[a] per year	TRC[b] per year	Processing time (years)	Total LWD	Total TRC
			Steam Reforming Option				
P1C	Process Equipment Waste Evaporator and Liquid Effluent Treatment and Disposal Facility	28	8.0	1.0	36	290	37
P18MC	Remote Analytical Laboratory Operations	52	15	1.9	29	430	56
P59A	Calcine Retrieval and Transport	11	3.1	0.41	20	63	8.1
P117A	Calcine Packaging and Loading	48	14	1.8	25	340	44
P2001	NGLW Grout Facility	25	7.1	0.93	23	160	21
P35E	Grout Packaging and Loading for Offsite Disposal	8.5	2.4	0.31	23	56	7.2
P2002A	Steam Reforming	46	13	1.7	2	26	3.4
Totals						1.4×10^3	180
			Minimum INEEL Processing Alternative				
P1C	Process Equipment Waste Evaporator and Liquid Effluent Treatment and Disposal Facility	28	8.0	1.0	26	210	27
P18	New Analytical Laboratory	100	28	3.7	34	970	130
P24	Interim Storage of Vitrified Waste	6.5	1.8	0.24	36	67	8.7
P25A	Packaging and Loading Vitrified HLW at INTEC for Shipment to a Geologic Repository	6	1.7	0.22	20	34	4.4
P27	Class A Grout Disposal in a Low-Activity Waste Disposal Facility	17	4.8	0.63	21	100	13
P59A	Calcine Retrieval and Transport	11	3.1	0.41	15	47	6.1
P111A	SBW and Newly-Generated Liquid Waste Treatment with Cesium Ion Exchange to Contact-Handled Transuranic Grout and Low-Level Waste Grout	33	9.4	1.2	5	47	6.1

Table C.3-6. Estimated worker injury impacts during operations activities of new facilities at INEEL by alternative (continued).

Project	Description	Average number workers/year	LWD[a] per year	TRC[b] per year	Processing time (years)	Total LWD	Total TRC
			Minimum INEEL Processing Alternative (continued)				
P112A	Packaging and Loading Contact-Handled Transuranic Waste for Shipment to WIPP	18	5.1	0.67	15	77	10
P117A	Packaging and Loading Calcine to Hanford	48	14	1.8	15	200	27
P133	Waste Treatment Pilot Plant	39	11	1.4	27	300	39
Totals						2.0×10^3	270
			Vitrification without Calcine Separations Option				
P1C	Process Equipment Waste Evaporator and Liquid Effluent Treatment and Disposal Facility	28	8.0	1.0	35	280	36
P18	New Analytical Laboratory	110	31	4.1	21	660	86
P59A	Calcine Retrieval and Transport	11	3.1	0.41	13	41	5.3
P61	Vitrified HLW Interim Storage	6.5	1.8	0.24	22	41	5.3
P62A	Packaging and Loading Vitrified HLW at INTEC for Shipment to a Geologic Repository	6.5	1.8	0.24	20	37	4.8
P88	Vitrification with Maximum Achievable Control Technology	130	37	4.8	22	810	110
P133	Waste Treatment Pilot Plant	39	11	1.4	6	67	8.7
Totals						1.9×10^3	250

Table C.3-6. Estimated worker injury impacts during operations activities of new facilities at INEEL by alternative (continued).

Project	Description	Average number workers/year	LWD[a] per year	TRC[b] per year	Processing time (years)	Total LWD	Total TRC
			Vitrification with Calcine Separations Option				
P1C	Process Equipment Waste Evaporator and Liquid Effluent Treatment and Disposal Facility	28	8.0	1.0	35	280	36
P9A	Full Separations	120	34	4.4	13	440	58
P9C	Grout Plant	38	11	1.4	13	140	18
P18	New Analytical Laboratory	110	31	4.1	21	660	86
P24	Vitrified Product Interim Storage	6.5	1.8	0.24	22	41	5.3
P25A	Packaging and Loading Vitrified HLW at INTEC for Shipment to a Geologic Repository	7	2.0	0.26	20	40	5.2
P35E	Grout Packaging and Loading for Offsite Disposal	8.5	2.4	0.31	13	31	4.1
P59A	Calcine Retrieval and Transport	11	3.1	0.41	6.0	19	2.4
P88	Vitrification with Maximum Achievable Control Technology	130	37	4.8	22	810	110
P133	Waste Treatment Pilot Plant	39	11	1.4	6	67	8.7
Totals						2.5×10^3	330

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

b. TRC = 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 treatment beyond first aid.

c. Project data from project data sheets are divided into two phases.

Table C.3-7. Estimated worker injury impacts during disposition activities of new facilities at INEEL by alternative.

Project	Dispositioning peak year employment levels		
	Number of workers[a]	Lost workdays/year	Total recordable cases/year
No Action Alternative	***0***	***0***	***0***
Continued Current Operations Alternative	***58***	***16***	***2.1***
Separations Alternative			
Full Separations Option	790	***220***	***29***
Planning Basis Option	***660***	***190***	***24***
Transuranic Separations Option	730	***210***	***27***
Non-Separations Alternative			
Hot Isostatic Pressed Waste Option	450	***130***	17
Direct Cement Waste Option	420	***120***	***15***
Early Vitrification Option	320	***91***	12
Steam Reforming Option	***280***	***79***	***10***
Minimum INEEL Processing Alternative	320	***92***	12
Direct Vitrification Alternative			
Vitrification without Calcine Separations Option	***340***	***97***	***13***
Vitrification with Calcine Separations Option	***710***	***200***	***26***

a. For peak year employment levels, see Appendix C.1.

Table C.3-8. Estimated radiological impacts for *disposition of* existing facilities by project.

Project	Radiological workers per year [a]	Annual collective dose (person-rem) [b]	Number of years	Total collective dose (person-rem)	*Increase in latent cancer fatalities*
Tank Farm					
Clean Closure	280	*70*	27	*1.9×10^{3}*	*0.76*
Performance-Based Closure	*20*	*5.0*	*21*	*110*	*0.042*
Closure to Landfill Standards	12	*3.0*	*17*	*51*	*0.020*
Performance-Based Closure with Class A Fill	*11*	*2.8*	*24*	*66*	*0.026*
Performance-Based Closure with Class C Fill	*11*	*2.8*	*24*	*66*	*0.026*
Tank Farm related facilities					
CPP-619	*0*	*0*	6	*0*	*0*
CPP-628	*0*	*0*	6	*0*	*0*
CPP-638	*0*	*0*	2	*0*	*0*
CPP-712	*0*	*0*	6	*0*	*0*
CPP-717	*1*	*0.25*	6	*1.5*	*6.0×10^{-4}*
Total				*1.5*	*6.0×10^{-4}*
Bin sets					
Clean Closure	58	*15*	*26*	*380*	*0.15*
Performance-Based Closure	*55*	*14*	*21*	*290*	*0.12*
Closure to Landfill Standards	27	*6.8*	21	*140*	*0.057*
Performance-Based Closure with Class A Fill	*47*	*12*	*17*	*200*	*0.080*
Performance-Based Closure with Class C Fill	*47*	*12*	*17*	*200*	*0.080*
Bin sets related facilities					
CPP-639	*0*	*0*	6	*0*	*0*
CPP-646	*0*	*0*	6	*0*	*0*
CPP-647	*0*	*0*	6	*0*	*0*
CPP-658	*0*	*0*	6	*0*	*0*
CPP-671	*0*	*0*	6	*0*	*0*
CPP-673	*0*	*0*	6	*0*	*0*
Total				*1.5* [c]	*6.0×10^{-4}* [c]

Table C.3-8. Estimated radiological impacts for *disposition of* existing facilities by project (continued).

Project	Radiological workers per year [a]	Annual collective dose (person-rem) [b]	Number of years	Total collective dose (person-rem)	*Increase in latent cancer fatalities*
Process Equipment Waste Evaporator and related facilities					
CPP-604	***25***	***6.3***	6	***38***	***0.015***
CPP-605	***1***	***0.25***	6	***1.5***	***6.0×10^{-4}***
CPP-641	***0***	***0***	***2***	***0***	***0***
CPP-649	1	0.25	6	1.5	***6.0×10^{-4}***
CPP-708	6	1.5	6	9.0	***3.6×10^{-3}***
CPP-756	***1***	***0.25***	6	***1.5***	***6.0×10^{-4}***
CPP-1618	***1***	***0.25***	6	***1.5***	***6.0×10^{-4}***
PEWE Condensate Lines	***2***	***0.50***	***1***	***0.5***	***2.0×10^{-4}***
PEWE Condensate Lines and Cell Floor Drain Lines	***2***	***0.50***	***1***	***0.5***	***2.0×10^{-4}***
Total				***54***	***0.021***
Fuel Processing Building and related facilities – Performance-Based Closure					
CPP-601	13	3.3	10	***33***	***0.013***
CPP-627	6	1.5	10	15	***6.0×10^{-3}***
CPP-640	6	1.5	10	15	***6.0×10^{-3}***
Total				***63***	***0.025***
Fuel Processing Building and related facilities – Closure to Landfill Standards					
CPP-601	10	2.5	10	***25***	***0.010***
CPP-627	***5***	1.3	10	***13***	***5.0×10^{-3}***
CPP-640	***5***	1.3	10	13	***5.0×10^{-3}***
Total				***50***	***0.020***
FAST and related facilities					
CPP-666	34	***8.5***	6	***51***	***0.020***
CPP-767	***34***	***8.5***	***6***	***51***	***0.020***
Total				***51*** [d]	***0.020*** [d]

Table C.3-8. Estimated radiological impacts for *disposition of* existing facilities by project (continued).

Project	Radiological workers per year [a]	Annual collective dose (person-rem) [b]	Number of years	Total collective dose (person-rem)	*Increase in latent cancer fatalities*
Transport Lines Group					
Process Offgas Lines	***1***	***0.25***	***1***	***0.25***	***1.0×10^{-4}***
High-Level Liquid (Raffinate) Lines	***0***	***0***	***1***	***0***	***0***
Process (Dissolver) Transport Lines	***0***	***0***	***1***	***0***	***0***
Calcine Solids Transport Lines	***0***	***0***	***1***	***0***	***0***
Total				***0.25***	***1.0×10^{-4}***
Other HLW facilities					
CPP-659					
Performance-Based Closure	35	8.8	***3***	***26***	***0.011***
Closure to Landfill Standards	32	8.0	***3***	***24***	***9.6×10^{-3}***
CPP-684	4	1.0	***3***	***3.0***	***1.2×10^{-3}***
Total				***29*** [e]	***0.012*** [e]

a. Workers per year of zero occurs when the annual average is much less than one or the workers are accounted for elsewhere.

b. Based on 250 millirem per worker per year.

c. Total is calculated assuming one worker over six years.

d. Disposition of FAST facilities would be accomplished by one project using 34 workers over 6 years. These buildings are listed separately because CPP-666 is Performance-Based Closure and CPP-707 is Clean Closure.

e. Total represents maximum option for CPP-659.

Table C.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 C.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	9.0	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 C.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	0.010
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	0.010
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 C.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.

Table C.3-10. 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 C.3-10. 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 C.3-10. 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 C.3-10. 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 process; 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.

Appendix C.3 References

DOE (Department of Energy), 2001, Occupational Injury and Property Damage Summary, January-December 2001, available online http://tis-hq.eh.doe.gov/cairs/cairs/summary/oipds014/sum.html, accessed April 17, 2002.

NCRP (National Council on Radiation Protection and Measurements), 1993, *Limitations of Exposure to Ionizing Radiation*, Report Number 116, Washington, D.C.