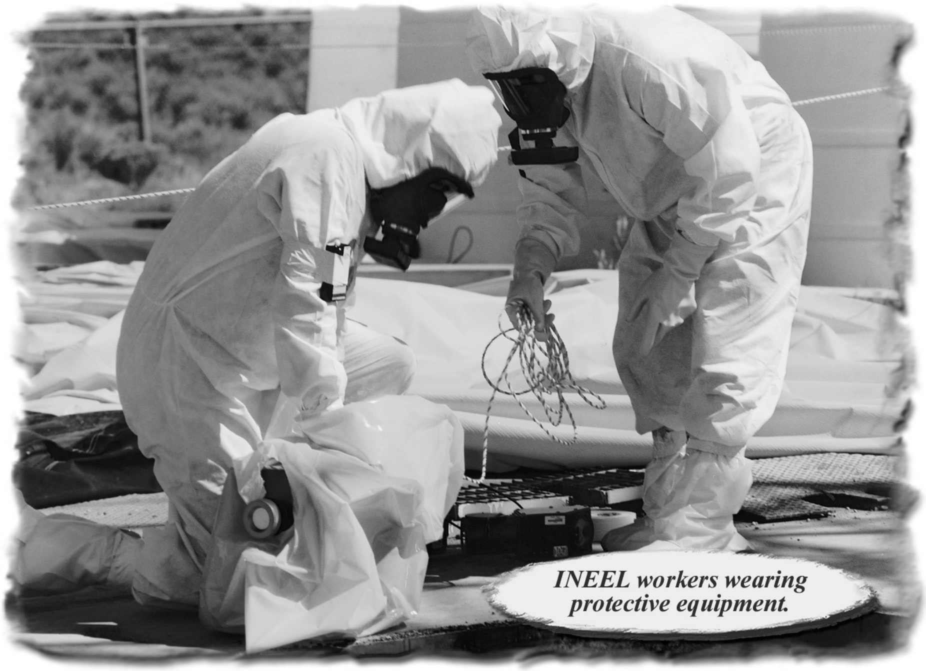

INEEL workers wearing protective equipment.

5.2.10 HEALTH AND SAFETY

This section presents potential health and safety impacts to INEEL workers and the offsite public from implementing the waste processing alternatives described in Chapter 3. The estimates of health impacts are based on projected radioactive and nonradioactive releases to the environment and radiation exposure to facility workers. As discussed in Section 5.2.7, releases to surface water would be minimal and would not be expected to result in adverse health impacts. This section also summarizes worker illness, injury, and fatality incidence rates based on historical INEEL occupational safety data.

Because the Minimum INEEL Processing ***Alternative*** would involve shipment of mixed HLW to the Hanford Site for processing, this section briefly describes potential health and safety impacts to workers and the offsite public from treating INEEL waste at the Hanford Site. A more detailed discussion of health and safety impacts from treating INEEL waste at the Hanford Site is presented in Appendix C.8.

5.2.10.1 Methodology

DOE used data on airborne emissions of radioactive materials (Section 5.2.6) to calculate radiation dose to the noninvolved worker and maximally exposed offsite individual and the collective dose to the population residing within 50 miles of INTEC. The radiation dose values for the various alternatives were then multiplied by the dose-to-risk conversion factors, which are based on the 1993 *Limitations of Exposure to Ionizing Radiation* (NCRP 1993). DOE has adopted these risk factors of 0.0005 and 0.0004 latent cancer fatality (LCF) for each person-rem of radiation exposure to the general public and worker population, respectively, for doses less than 20 rem. 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.

DOE used radiation dose information provided in the project data sheets (see Appendix C.6) for projects comprising each option to estimate the potential health effects to involved workers (i.e., workers performing construction and operations under each alternative) from construction and operations activities. Radiation dose was calculated as annual average and total campaign dose summed for the projects to estimate health effects by option.

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 was compared with the applicable occupational standard which 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.

5.2.10.2 Radiological and Nonradiological Construction Impacts

Under all alternatives there would be some amount of radiation exposure to construction workers. Construction workers involved in upgrade and expansion of HLW facilities would be exposed to low levels of radioactive contamination. For more information on specific projects for each alternative, see Appendix C.6.

Table 5.2-1***9*** provides summaries of the number of involved workers, total collective dose, and estimated increase in number of LCFs for the total construction phase for each alternative. Most of the waste processing alternatives result in similar levels of total collective worker dose ranging from ***37*** to ***200*** person-rem. The highest collective dose of ***200*** person-rem occurs under ***the*** Planning Basis, ***Hot Isostatic Pressed Waste and Direct Cement Waste Options***. The corresponding increase in number of latent cancer fatalities for any of these options would be ***0.078***.

Nonradiological emissions associated with construction activities would result primarily from the disturbance of land, which generates fugitive dust, and from the combustion of fossil fuels in construction equipment. As stated in Section 5.2.6, dust generation would be mitigated by the application of water, use of soil additives, and possibly administrative controls. Emissions of criteria pollutants from construction equipment may also cause localized impacts to air quality. Construction-related impacts to workers from criteria pollutant emissions are expected to fall within applicable standards (see Section 5.2.6).

5.2.10.3 Radiological and Nonradiological Operational Impacts

Radiological Air Emissions - As stated in Section 5.2.6, Air Resources, waste processing and related activities at INTEC would result in releases of radionuclides to the atmosphere. No future discharge of radioactive liquid effluents that would result in offsite radiation doses would occur under any of the alternatives (see Section 5.2.7). Therefore, DOE only calculated potential health effects from airborne releases of radioactivity.

Table 5.2-***20*** provides summaries of radiation doses and health impacts from atmospheric emissions from the waste processing options. Health effects are presented for (a) the maximally exposed individual at an offsite location; (b) noninvolved onsite workers at the INEEL areas of highest predicted radioactivity level; and (c) the offsite population (adjusted for future growth) within a 50-mile radius of the INTEC. The annual doses represent the maximum value predicted over any one year the waste processing occurs. Doses over periods which involve only interim storage of waste would be much less. The annual average project doses were multiplied by the project duration and summed for all projects within a given option to determine the integrated dose and resultant health effects for each option. Modeling indicated that the dose due to ground contamination did not contribute significantly to the total dose for the primary nuclides and pathways of concern.

In all cases for air emissions, the dose to the maximally exposed offsite individual is a small fraction of that received from natural background sources and is well below the EPA airborne emissions dose limit of 10 millirem per year (40 CFR 61.92). The highest annual dose of 1.8×10^{-3} millirem to the maximally exposed offsite individual would occur from the Planning Basis and Hot Isostatic Pressed Waste Options. This estimated annual maximally exposed offsite individual dose is slightly higher than the esti-

- New Information -

Table 5.2-19. Estimated radiological impacts to involved workers by alternative during construction activities.

			Separations Alternative			Non-Separations Alternative				Minimum INEEL Processing Alternative		Direct Vitrification Alternative	
Receptor	No Action Alternative	Continued Current Operations Alternative	Full Separations Option	Planning Basis Option	Transuranic Separations Option	Hot Isostatic Pressed Waste Option	Direct Cement Waste Option	Early Vitrification Option	Steam Reforming Option	At INEEL	At Hanford[a]	Vitrification without Calcine Separations Option	Vitrification with Calcine Separations Option
Number of involved worker - years	150	390	690	780	690	780	780	540	540	690	NA[b]	540	540
Total construction phase worker dose (person-rem)[c]	37	97	170	200	170	200	200	140	140	170	NA[b]	140	140
Total increase in number of latent cancer fatalities	0.015	0.039	0.069	0.078	0.069	0.078	0.078	0.054	0.054	0.069	NA[b]	0.054	0.054

a. Construction activities associated with this alternative would consist of building three canister storage buildings and a calcine dissolution facility. As shown in Appendix C.8, Sections C.8.5.1 and C.8.5.2, there would be no radiological dose associated with construction of these facilities.

b. NA = Not applicable

c. Total construction phase dose is based on the average annual dose for each project that comprises each alternative multiplied by the duration for each project and then summed for each alternative.

Table 5.2-20. Estimated public and occupational radiological impacts from atmospheric emissions.

			Separations Alternative			Non-Separations Alternative				Minimum INEEL Processing Alternative		***Direct Vitrification Alternative***	
Receptor	No Action Alternative	Continued Current Operations Alternative	Full Separations Option	Planning Basis Option	Transuranic Separations Option	Hot Isostatic Pressed Waste Option	Direct Cement Waste Option	Early Vitrification Option	***Steam Reforming Option***	At INEEL	At Hanford[a]	***Vitrification without Calcine Separations Option***	***Vitrification with Calcine Separations Option***
Maximally exposed offsite individual dose (millirem/year)[b]	6.0×10^{-4}	1.7×10^{-3}	1.2×10^{-4}	1.8×10^{-3}	6.0×10^{-5}	1.8×10^{-3}	1.7×10^{-3}	8.9×10^{-4}	***6.2×10^{-4}***	9.5×10^{-4}	2.8×10^{-5}	***6.5×10^{-4}***	***6.8×10^{-4}***
Integrated maximally exposed offsite individual dose (millirem)[c]	0.022	0.019	2.5×10^{-3}	6.3×10^{-3}	1.3×10^{-3}	***0.020***	0.019	0.031	***0.022***	0.024	5.0×10^{-5}	***0.022***	***0.023***
Estimated probability of latent cancer fatality for the maximally exposed offsite individual	1.0×10^{-8}	1.0×10^{-8}	1.2×10^{-9}	3.2×10^{-9}	6.5×10^{-10}	1.0×10^{-8}	1.0×10^{-8}	1.5×10^{-8}	***1.1×10^{-8}***	1.0×10^{-8}	2.5×10^{-11}	***1.1×10^{-8}***	***1.2×10^{-8}***
Noninvolved worker dose (millirem/year)[d]	7.0×10^{-6}	1.8×10^{-5}	4.4×10^{-5}	9.0×10^{-5}	3.4×10^{-5}	3.6×10^{-5}	3.0×10^{-5}	4.8×10^{-5}	***2.2×10^{-5}***	1.0×10^{-4}	1.3×10^{-5}	***2.3×10^{-5}***	***2.3×10^{-5}***
Integrated noninvolved worker dose (millirem) [c]	2.5×10^{-4}	2.0×10^{-4}	9.2×10^{-4}	8.6×10^{-4}	7.1×10^{-4}	5.8×10^{-4}	3.6×10^{-4}	1.3×10^{-3}	***4.8×10^{-4}***	1.4×10^{-3}	2.3×10^{-5}	***4.8×10^{-4}***	***4.8×10^{-4}***
Estimated probability of latent cancer fatality for the noninvolved worker	1.0×10^{-10}	***8.0×10^{-11}***	***3.7×10^{-10}***	***3.4×10^{-10}***	***2.8×10^{-10}***	***2.3×10^{-10}***	***1.4×10^{-10}***	***5.2×10^{-10}***	***1.9×10^{-10}***	***5.6×10^{-10}***	***9.2×10^{-12}***	***1.9×10^{-10}***	***1.9×10^{-10}***
Dose to population within 50 miles of INTEC (person-rem per year)[e]	***0.038***	***0.11***	***6.6×10^{-3}***	***0.11***	***3.6×10^{-3}***	***0.11***	***0.11***	***0.056***	***0.040***	***0.056***	1.3×10^{-3}[(f)]	***0.045***	***0.047***

Table 5.2-20. Estimated public and occupational radiological impacts from atmospheric emissions (continued).

Receptor	No Action Alternative	Continued Current Operations Alternative	Separations Alternative: Full Separations Option	Separations Alternative: Planning Basis Option	Separations Alternative: Transuranic Separations Option	Non-Separations Alternative: Hot Isostatic Pressed Waste Option	Non-Separations Alternative: Direct Cement Waste Option	Non-Separations Alternative: Early Vitrification Option	Non-Separations Alternative: ***Steam Reforming Option***	Minimum INEEL Processing Alternative: At INEEL	Minimum INEEL Processing Alternative: At Hanford[a]	***Direct Vitrification Alternative: Vitrification without Calcine Separations Option***	***Direct Vitrification Alternative: Vitrification with Calcine Separations Option***
Integrated collective dose to population (person-rem)[c]	***1.4***	***1.2***	***0.14***	***0.39***	***0.075***	***1.3***	***1.3***	***2.0***	***1.4***	***1.4***	2.3×10^{-3}	***1.5***	***1.5***
Estimated number of latent cancer fatalities to population	***7.0×10^{-4}***	***6.0×10^{-4}***	***7.0×10^{-5}***	***2.0×10^{-4}***	***3.8×10^{-5}***	***6.5×10^{-4}***	***6.5×10^{-4}***	***1.0×10^{-3}***	***7.0×10^{-4}***	***7.0×10^{-4}***	1.1×10^{-6}	***7.5×10^{-4}***	***7.5×10^{-4}***

a. Data based on analysis of the Interim Storage Shipping Scenario which has higher impacts than the Just-in-Time Shipping Scenario. See Appendix C.8.

b. Doses are maximum values over any single year during which waste processing occurs; annual doses from waste stored on an interim basis after waste processing is completed would be much less.

c. The annual average project doses were multiplied by the project duration and summed for all projects within a given option to determine the integrated dose and resultant health effects for each option.

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

e. Population dose assumes growth rate of 6 percent per decade between 1990 and 2035.

f. Dose to population within 50 miles of Hanford Site (person-rem per year).

mated doses for the Continued Current Operations Alternative ***and*** the Direct Cement Waste Option. The highest integrated offsite maximally exposed individual dose of ***0.031*** millirem occurs under the Early Vitrification Option. The noninvolved worker doses from facility emissions would also be a small fraction of the allowable limit. The Federal occupational dose limit is 5,000 millirem per year, as established in 10 CFR 835.202. The highest predicted onsite worker annual dose of 1.0×10^{-4} millirem and integrated dose of 1.4×10^{-3} millirem would occur from the Minimum INEEL Processing Alternative. No applicable standards exist for collective population doses; however, DOE policy requires that doses resulting from radioactivity in effluents be reduced to levels as low as reasonably achievable. The highest annual collective dose to the population within 50 miles of INTEC of ***0.11*** person-rem would occur for the ***Continued Current Operations Alternative and the Planning Basis,*** Hot Isostatic Pressed Waste, ***and Direct Cement Waste Options***. The highest total collective population dose of ***2.0*** person-rem would occur from the Early Vitrification Option and corresponds to $\boldsymbol{1.0 \times 10^{-3}}$ LCF for the entire operations period. The total integrated collective population doses associated with the other options are lower and range from ***0.075*** to ***1.5*** person-rem.

Involved Worker Impacts - Table 5.2-2***1*** provides a summary of radiological impacts to involved workers from facility operations. This table provides the number of involved ***worker-years***, total campaign collective worker dose, and estimated increased lifetime number of LCFs for each alternative. The highest collective worker dose, integrated over the entire campaign would occur from the Direct Cement Waste Option. The total collective worker dose is projected to be $\boldsymbol{1.1 \times 10^{3}}$ person-rem, which corresponds to ***0.43*** LCF.

Table 5.2-2***2*** presents annual radiological impacts for interim storage after the year 2035. Impacts are presented in terms of annual average worker dose for radiological workers and the resultant increase in LCFs. There are no toxic air pollutants or criteria pollutant emissions expected with interim storage activities after the year 2035. The Transuranic Separations ***and Steam Reforming*** Option***s are*** not listed in this table because there would be no interim storage of final waste forms produced under ***these*** options.

Nonradiological Air Emissions - Table 5.2-2***3*** presents hazard quotients for concentrations of noncarcinogenic toxic air pollutants at the INEEL site boundary for the option with the maximum value. The locations of these modeled concentrations are dependent on different points and times of release, so no single individual could be exposed to all of these chemicals at once. Therefore, these chemical hazard quotients are evaluated separately and not summed. For the individual noncarcinogens, the maximum concentrations for each of the pollutants occur most frequently from the Planning Basis Option. However, all hazard quotients are much less than 1, indicating no expected adverse health effects.

Table 5.2-2***4*** presents hazard quotients for concentrations of carcinogenic toxic air pollutants at the INEEL site boundary by option. As with noncarcinogens, the locations of these modeled maximum concentrations are dependent on different points and times of release so the risks are not summed. The results of this evaluation indicate that the hazard quotients for each chemical range from $\boldsymbol{4.7 \times 10^{-6}}$ for ***dioxins and furans*** to ***0.10*** for nickel. As stated in Section 5.2.6, the highest carcinogenic air pollutant impacts are projected for those options that involve the greatest amount of fossil fuel combustion, most notably the Planning Basis Option. For the Planning Basis Option, nickel concentrations could be as high as ***10*** percent of the State of Idaho standard at the INEEL boundary. Projected carcinogenic concentrations are based on the conservative assumption that all toxic pollutant sources are operating concurrently, and no credit is taken for reductions by air pollution control equipment. All other carcinogens are expected to be at very low ambient levels with negligible health impacts. As stated in Section 5.2.6, concentrations of all carcinogenic and noncarcinogenic substances at INEEL facility areas are less than 1 percent of occupational exposure limits in all cases. Ambient concentrations of carcinogenic and noncarcinogenic toxic pollutants at other public access locations, such as public roads and Craters of the Moon Wilderness Area are presented in Appendix C.2.5.2.

Table 5.2-21. Estimated radiological impacts to involved workers by alternative during facility operations.

			Separations Alternative			Non-Separations Alternative				Minimum INEEL Processing Alternative		Direct Vitrification Alternative	
Receptor	No Action Alternative	Continued Current Operations 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	At INEEL	At Hanford[c]	Vitrification without Calcine Separations Option	Vitrification with Calcine Separations Option
Number of involved worker - years	1.8×10^3	2.1×10^3	4.1×10^3	5.1×10^3	3.6×10^3	4.1×10^3	5.7×10^3	3.8×10^3	3.3×10^3	3.6×10^3	1.8×10^3	2.6×10^3	3.4×10^3
Total campaign collective worker dose (person-rem)[d]	350	410	780	980	680	790	1.1×10^3	710	630	690	350	500	650
Total number of latent cancer fatalities	0.14	0.16	0.31	0.39	0.27	0.31	0.43	0.29	0.25	0.27	0.14	0.20	0.26

a. Assumes LLW Class A type grout disposal in INEEL disposal facility (P35D and P27).

b. Assumes LLW Class C type grout disposal in INEEL disposal facility (P49D and P27).

c. Data based on analysis of the Interim Storage Shipping scenario which has higher impacts than the Just-in-Time Shipping Scenario. See Appendix C.8.4.11.

d. Total campaign dose is based on the average annual dose for each project that comprises each alternative multiplied by the duration for each project and then summed for each alternative.

Table 5.2-22. Estimated radiological impacts to involved workers from interim storage operations post-2035.

Alternatives/***Options***[a]	Radiological workers/year	Annual average worker dose (rem)	Annual average collective dose (person-rem)	Estimated ***increase in*** annual latent cancer fatalities
Full Separations Option (P24)	5	0.19	0.95	3.8×10^{-4}
Planning Basis Option (P24)	5	0.19	0.95	3.8×10^{-4}
Hot Isostatic Pressed Waste Option (P72)	2.5	0.19	0.48	1.9×10^{-4}
Direct Cement Waste Option (P81)	4.5	0.19	0.86	3.4×10^{-4}
Early Vitrification Option (P61)	4.5	0.19	0.86	3.4×10^{-4}
Minimum INEEL Processing Alternative (P24)	5	0.19	0.95	3.8×10^{-4}
Vitrification without Calcine Separations Option (P61)	***4.5***	***0.19***	***0.86***	***3.4×10^{-4}***
Vitrification with Calcine Separations Option (P24)	***5***	***0.19***	***0.95***	***3.8×10^{-4}***

a. Project Titles: P1D - No Action; P4- Long-Term Storage of Calcine in Bin Sets; P24 - Vitrified Product Interim Storage; P72 - Interim Storage of Hot Isostatic Pressed Waste; P81 - Unseparated Cementitious HLW Interim Storage; P61 - Vitrified Product Interim Storage; P24 - Interim Storage of Vitrified Waste at INEEL.

Table 5.2-23. Projected noncarcinogenic toxic pollutant maximum concentrations at the site boundary for the proposed waste processing alternatives.[a,b]

Pollutant[c]	Maximum concentration option	Concentration ($\mu g/m^3$)[d,e]	Idaho standard ($\mu g/m^3$)[f]	Hazard quotient
Antimony	Planning Basis Option	***4.7×10^{-4}***	25	***1.9×10^{-5}***
Chloride	Planning Basis Option	***0.032***	150	***2.1×10^{-4}***
Cobalt	Planning Basis Option	***5.4×10^{-4}***	2.5	***2.2×10^{-4}***
Copper	Planning Basis Option	***1.6×10^{-4}***	10	***1.6×10^{-5}***
Fluorides (as F)	***Planning Basis Option***	***1.7×10^{-4}***	125	***1.4×10^{-6}***
Lead	Planning Basis Option	***1.3×10^{-4}***	1.5	***8.7×10^{-5}***
Manganese (as Mn)	Planning Basis Option	***2.7×10^{-4}***	50	***5.4×10^{-6}***
Mercury	Planning Basis Option	***1.2×10^{-5}***	5	***2.4×10^{-6}***
Phosphorus	Planning Basis Option	***8.4×10^{-4}***	5	***1.7×10^{-4}***
Vanadium	Planning Basis Option	***2.8×10^{-3}***	2.5	***1.1×10^{-3}***

a. Emissions include chemical processing and fossil fuel combustion.

b. Only site boundary conditions are listed, conditions at public access on site roads can be found in Appendix C.2.

c. Pollutants listed are those that account for more than 95 percent of health risk.

d. $\mu g/m^3$ = micrograms per cubic meter.

e. All concentrations are 24 hour maximum values, except for lead which is a quarterly value.

f. Standards for each pollutant other than lead are toxic air pollutant increments specified in IDAPA 58.01.01.585; lead standard is primary ambient air quality standard from IDAPA 58.01.01.577.

Table 5.2-24. Projected carcinogenic toxic pollutant maximum concentrations at the site boundary for the proposed waste processing alternatives.[a,b]

Pollutant[c]	Maximum concentration option	Concentration ($\mu g/m^3$)[d,e]	Idaho standard ($\mu g/m^3$)	Hazard quotient
Arsenic	Planning Basis Option	***6.8×10^{-6}***	2.3×10^{-4}	***0.030***
Beryllium	Planning Basis Option	***1.4×10^{-7}***	4.2×10^{-3}	***3.3×10^{-5}***
Cadmium compounds	Planning Basis Option	***2.1×10^{-6}***	5.6×10^{-4}	***3.7×10^{-3}***
Chromium (hexavalent forms)	Planning Basis Option	***1.3×10^{-6}***	8.3×10^{-5}	***0.016***
Dioxins and furans	Hot Isostatic Pressed Waste Option	***1.0×10^{-13}***	2.2×10^{-8}	***4.7×10^{-6}***
Formaldehyde	Planning Basis Option	***1.7×10^{-4}***	0.08	***2.1×10^{-3}***
Hydrazine	***Early Vitrification*** Option	***1.1×10^{-7}***	3.4×10^{-4}	***3.2×10^{-4}***
Nickel	Planning Basis Option	***4.4×10^{-4}***	4.2×10^{-3}	***0.10***

a. Emissions include chemical processing and fossil fuel combustion.
b. Only site boundary conditions are listed. Conditions at public access on site roads can be found in Appendix C.2.
c. Pollutants listed are those that account for more than 95 percent of health risk.
d. $\mu g/m^3$ = micrograms per cubic meter.
e. All concentrations are ***annual average*** values.

For each alternative, maximum incremental impacts of carcinogenic air pollutants are projected to occur at or just beyond the southern site boundary, while maximum noncarcinogenic air pollutant levels would occur along U.S. Highway 20.

5.2.10.4 Occupational Safety Impacts

Estimated occupational injury rates for waste processing alternatives are presented in Tables 5.2-2***5*** and 5.2-2***6***. The projected rates for injury are based on observed historic rates at the INEEL. Table 5.2-2***5*** provides estimates of the number of lost work days and total recordable cases that would occur during a peak employment year and for the entire period during construction for each of the alternatives. Table 5.2-2***6*** provides similar data for the operations phase for each of the alternatives. The projected injury rates are based on historic injury rates for ***INEEL*** workers over a 5-year period from ***1996*** through ***2000*** multiplied by the employment levels for each alternative. The data for lost work days represents 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 value includes work-related death, illness, or injury which resulted in loss of consciousness, restriction from work or motion, transfer to another job, or required medical treatment beyond first aid.

As shown in Table 5.2-2***5***, the highest occurrences of lost work days and total recordable cases during a peak construction year are projected to occur for the Planning Basis Option. This is due to the larger number of employees and work hours associated with these options during a peak year. The highest total number of cases of lost work days and total recordable cases would be likely to occur for the Planning Basis Option followed by the Full Separations Option due to the larger number of total worker hours associated with these options.

As shown in Table 5.2-2***6***, the highest occurrences of lost work days and total recordable cases during a peak operations year are projected to occur for the ***Direct Cement Waste*** Option followed by the ***Planning Basis*** Option. This is due to the larger number of employees and work hours associated with these options during a peak year. The highest total number of lost work days and total recordable cases would be likely

Table 5.2-25. Estimated worker injury impacts during construction at INEEL by alternative (peak year and total cases).

Receptor	No Action Alternative	Continued Current Operations Alternative	Separations Alternative: Full Separations Option	Separations Alternative: Planning Basis Option	Separations Alternative: Transuranic Separations Option	Non-Separations Alternative: Hot Isostatic Pressed Waste Option	Non-Separations Alternative: Direct Cement Waste Option	Non-Separations Alternative: Early Vitrification Option	Non-Separations Alternative: Steam Reforming Option	Minimum INEEL Processing Alternative: At INEEL	Minimum INEEL Processing Alternative: At Hanford[a]	Direct Vitrification Alternative: Vitrification without Calcine Separations Option	Direct Vitrification Alternative: Vitrification with Calcine Separations Option
Number of workers during peak year	21	89	850	870	680	360	400	330	550	200	NR[b]	350	670
Peak year lost workdays[c]	6.0	25	240	250	190	100	110	93	160	56	NR	100	190
Peak year total recordable cases[d]	0.78	3.3	32	32	25	13	15	12	20	7.3	NR	13	25
Total lost workdays	30	110	1.5×10^3	1.5×10^3	1.1×10^3	520	620	530	770	620	NR	710	1.3×10^3
Total recordable cases	3.9	14	190	200	150	67	81	69	100	81	230	93	170

a. Data based on analysis of the Interim Storage Scenario.

b. NR = Not reported.

c. 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.

d. 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 5.2-26. Estimated worker injury impacts at INEEL by alternative during operations (peak year and total cases).

			Separations Alternative			Non-Separations Alternative				Minimum INEEL Processing Alternative		Direct Vitrification Alternative	
Receptor	No Action Alternative	Continued Current Operations Alternative	Full Separations Option	Planning Basis Option	Transuranic Separations Option	Hot Isostatic Pressed Waste Option	Direct Cement Waste Option	Early Vitrification Option	Steam Reforming Option	At INEEL	At Hanford[a]	Vitrification without Calcine Separations Option	Vitrification with Calcine Separations Option
Number of workers during peak year	73	280	440	480	320	460	530	330	170	330	NR[b]	310	440
Peak year lost workdays[c]	21	79	130	140	90	130	150	93	49	93	NR	87	130
Peak year total recordable cases[d]	2.7	10	16	18	12	17	19	12	6.4	12	NR	11	16
Total lost workdays	850	1.1×10^3	3.0×10^3	3.7×10^3	2.3×10^3	2.5×10^3	2.9×10^3	2.5×10^3	1.4×10^3	2.0×10^3	NR	1.9×10^3	2.5×10^3
Total recordable cases	110	150	400	480	300	320	380	330	180	270	27	250	330

a. Data based on analysis of the Interim Storage Scenario. See Appendix C.8.4.11, Table C.8-17.

b. NR = Not reported.

c. 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.

d. 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.

to occur for the Planning Basis Option followed by the Full Separations Option due to the larger number of total worker hours associated with these options.

Table 5.2-27 presents the occurrences of lost work days and total recordable cases for interim storage activities after the year 2035. Impacts are highest for the Direct Cement Option due to the larger number of employees during interim storage operations. ***The Transuranic Separations and Steam Reforming Options are not listed in this table because there would be no interim storage of final waste forms produced under these options.***

5.2.11 ENVIRONMENTAL JUSTICE

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 Presidential Memorandum that accompanied Executive Order 12898 emphasized the importance of using existing laws, including the National Environmental Policy Act, to identify and address environmental justice concerns, "including human health, economic, and social effects, of Federal actions."

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 12898 in the NEPA process. This guidance, published in 1997, was intended to "…assist Federal agencies with their NEPA procedures so that environmental justice concerns are effectively identified and addressed."

As part of this process, DOE identified (in Section 4.12) minority and low-income populations within a 50-mile radius of INTEC, which was defined as the region of influence for the environmental justice analysis. The section that follows discusses whether implementing the proposed waste processing alternatives described in Chapter 3 would result in disproportionately high or adverse impacts to minority and low-income populations. Section C.8.4.19 discusses the environmental justice analysis at the Hanford Site under the Minimum INEEL Processing Alternative.

5.2.11.1 Methodology

The Council on Environmental Quality guidance (CEQ 1997) does not provide a standard approach or formula for identifying and addressing environmental justice issues. Instead, it offers Federal agencies general principles for conducting an environmental justice analysis under NEPA:

- Federal agencies should consider the population structure in the region of influence to determine whether minority populations, low-income populations, or Indian tribes are present, and if so, whether there may be disproportionately high and adverse human health or environmental effects on any of these groups.

- Federal agencies should consider relevant public health and industry data concerning the potential for multiple or cumulative exposure to human health or environmental hazards in the affected population and historical patterns of exposure to environmental hazards, to the extent such information is available.

- Federal agencies should recognize the interrelated cultural, social, occupational, historical, or economic factors that may amplify the effects of the proposed agency action. These would include the physical sensitivity of the community or population to particular impacts.

- Federal agencies should develop effective public participation strategies that seek to overcome linguistic, cultural, institutional, and geographic barriers to