5.4 Cumulative Impacts

Cumulative impacts result from the incremental impact of an action when added to other past, present, and reasonably foreseeable future actions regardless of what federal or nonfederal ***agency or entity*** undertakes such actions. Cumulative impacts can result from individually minor, but collectively significant actions taking place over a period of time (40 CFR 1508.7). These actions include on- or off-site ***actions undertaken*** within the spatial and temporal boundaries of the actions considered in this EIS.

5.4.1 METHODOLOGY

This analysis considers ***direct and indirect*** impacts that could occur ***from*** 2000 to 2095 ***as well as the residual effects that may cause impacts over an indefinite period of time such as potential groundwater contamination***. The ***2000-2095*** period ***is the timeframe established*** for completion of activities evaluated in this EIS ***and the*** assumed period of institutional control, ***although DOE has no plans to ever relinquish institutional control of INEEL facilities or lands.*** The methodology used to analyze the potential for ***cumulative*** impacts from alternatives evaluated in this EIS involved the following process:

1. ***The*** Region of Influence for impacts associated with projects analyzed in this EIS was defined.

2. The affected environment ***and*** baseline conditions were identified.

3. Past, present, and reasonably foreseeable actions and the effects of those actions were identified.

4. Aggregate ***(additive)*** effects of past, present, and reasonably foreseeable actions were assessed.

The Idaho HLW & FD EIS ***tiers*** from the SNF & INEL EIS. Volume 2, Part A of the SNF & INEL EIS was concerned with the selection of facilities and technologies for the management of spent nuclear fuel and radioactive wastes at INEEL, including the mixed transuranic waste/SBW and HLW that are the focus of this EIS. Anticipated future INEEL projects, including remediation of contaminated sites at INEEL, were ***also*** previously analyzed in the SNF & INEL EIS. The Record of Decision for that EIS provided the ***general*** scope and ***timeframe*** for spent nuclear fuel management and environmental restoration activities to be included in the cumulative impact analysis of this EIS. ***In*** addition, actions undertaken or proposed subsequent to the issuance of that Record of Decision were identified and included in the cumulative impact analysis of this EIS.

Data ***used to establish the cumulative impacts baseline*** were extracted from the SNF & INEL EIS via the INEL Spent Nuclear Fuel and Waste Engineering Systems comprehensive model (Hendrickson 1995). This systems model included all spent nuclear fuel, HLW, transuranic waste, low-level waste, mixed low-level waste, hazardous waste, and industrial waste activities. The model was based on planned treatment, storage, and disposal activities at the INEEL, EIS project summaries, and operating parameters of existing facilities, ***and*** was updated to reflect projects included in the SNF & INEL EIS Record of Decision and other projects that occurred subsequent to ***that*** EIS (Jason 1998). In ***the cumulative impacts*** analysis ***for this EIS***, data extracted from the updated model were used to project a baseline for impacts to air resources and generation of low-level waste, mixed low-level waste, hazardous waste, and industrial waste over a timeframe encompassing the time required for completion of the alternatives analyzed in this EIS. Anticipated projects included in the baseline are identified in Table 5.4-1. The contribution of each Idaho HLW & FD EIS alternative and option to these INEEL waste streams was obtained from project data sheets. Anticipated quantities of these waste streams from the INEEL baseline and Idaho HLW & FD EIS were combined and depicted graphically to provide a visual representation of cumulative waste quantities over time (see Section 5.4.3.*7*).

Section 5.4.2 identifies past, present, and reasonably foreseeable actions included in the cumulative impact analysis. Actions not included in the analysis because of the speculative nature of the action are also identified in Section 5.4.2. Subsequent sections present cumulative impact analysis by resource ***or pathway***.

Table 5.4-1. Projects included in the environmental baseline for analyses of cumulative impacts.

Borrow Source Silt Clay	Partnership Natural Disaster Reduction Test Station
Calcine Transfer Project	Pit 9 Retrieval
Central Liquid Waste Processing Facility D&D	Private Sector Alpha-MLLW Treatment
Dry Fuels Storage Facility	Radioactive Scrap/Waste Facility
EA Determination for CPP-627	Remediation of Groundwater Facilities
EBR-II Blanket Treatment	Remote Mixed Waste Treatment Facility
EBR-II Plant Closure	RESL Replacement
ECF Dry Cell Project	RWMC Modifications for Private Sector Treatment of Alpha-MLLW
Engineering Test Reactor D&D	Sodium Processing Plant
Fuel Processing Complex (CPP-601) D&D	TAN Pool Fuel Transfer
Fuel Receiving, Canning, Characterization & Shipping	Tank Farm Heel Removal Project
Gravel Pit Expansions (New Borrow Source)	Treatment of Alpha-MLLW
GTCC Dedicated Storage	TSA Enclosure and Storage Project
Headend Processing Plant (CPP-640) D&D	Vadose Zone Remediation
Health Physics Instrument Lab	Waste Calcine Facility (CPP-633) D&D
High Level Tank Farm Replacement (upgrade phase)	Waste Characterization Facility
Increased Rack Capacity for CPP-666	Waste Handling Facility
Industrial/Commercial Landfill Expansion	Waste Immobilization Facility
Material Test Reactor D&D	WERF Incineration
Mixed/LLW Disposal Facility	
Non Incinerable Mixed Waste Treatment	

5.4.2 IDENTIFICATION OF PAST, PRESENT, AND REASONABLY FORESEEABLE ACTIONS

The project impact zones of past, present, and reasonably foreseeable on- and off-site actions that could result in cumulative impacts were identified by reviewing DOE proposed and anticipated future actions on the INEEL and by contacting other Federal and state agencies. Actions determined to have environmental impacts that would ***add to or*** overlap in time and space with potential impacts from the actions evaluated in this EIS were included in the analysis. The City of Idaho Falls, the State of Idaho Department of Environmental Quality, and the Bureau of Land Management were contacted for information regarding anticipated future activities that could contribute to a cumulative impact on a particular resource ***or through a particular pathway*** within the Region of Influence. Past, present, and reasonably foreseeable onsite actions included in the cumulative impact analysis are presented in Table 5.4-2.

Onsite actions that could potentially have overlapping or connected impacts with waste processing activities include the Advanced Mixed Waste Treatment Project, ***and*** remedial activities at INTEC Waste Area Group 3 (WAG 3), ***including construction and operation of the INEEL CERCLA Disposal Facility***, excavation of silt/clay borrow sources, deactivation of obsolete nuclear facilities, and replacement of INTEC percolation ponds. Impacts associated with the Advanced Mixed Waste Treatment Project have been analyzed in detail and are presented in the *U.S. Department of Energy Idaho National Engineering and Environmental Laboratory Advanced Mixed Waste Treatment Project Draft Environmental Impact Statement* (AMWTP EIS) (DOE 1999a). The SNF & INEL EIS analyzed potential environmental impacts associated with remediation of contaminated sites at the INEEL, including INTEC, which are included in the analysis ***in*** this EIS. Excavation of silt ***and*** clay for use in INEEL operations and remedial activities was evaluated in this ***analysis*** because these materials may be required to support facility disposition activities at INTEC. Furthermore, residual contamination left in place from WAG 3 activities would contribute to the source for long-term risks associated with INTEC. DOE has chosen to remediate contaminated perched water at WAG 3 using institutional controls with aquifer recharge control (DOE 1999b). This will entail (1) restricting future use of contaminated perched water and

Table 5.4-2. Onsite actions included in the assessment of cumulative impacts.

Project	Description
SNF & INEL EIS	The SNF & INEL EIS provided the scope and timetable for spent nuclear fuel and environmental restoration activities to be included in the cumulative impact analysis of this EIS.
Advanced Mixed Waste Treatment Project[a]	Retrieve, sort, characterize, and treat mixed low-level waste and approximately 65,000 cubic meters of alpha-contaminated mixed low-level waste and transuranic waste currently stored at the INEEL Radioactive Waste Management Complex. Package the treated waste for shipment offsite for disposal.
WAG 3 Remediation[a]	Ongoing activities addressing remediation of past releases of contaminants at INTEC.
New silt/clay source development and use at the INEEL.	INEEL activities require silt/clay for construction of soil caps over contaminated sites, research sites, and landfills; replacement of radioactivity contaminated soil with topsoil for revegetation and backfill; sealing of sewage lagoons; and other uses. Silt/clay will be mined from three onsite sources (ryegrass flats, spreading area A, and WRRTF) (DOE 1997a).
Closure of various INTEC facilities unrelated to Idaho HLW&FD EIS Alternatives	Reduce the risk of radioactive exposure and release of hazardous constituents and eliminate the need for extensive long-term surveillance and maintenance for obsolete facilities at INTEC. Facilities included in the cumulative impact analysis are identified in Table 5.4-***5***.
Percolation Pond Replacement	DOE intends to replace the existing percolation ponds at the INTEC with replacement ponds located approximately 10,200 feet southwest of the existing percolation ponds (DOE 1999***c***).
EIS for the Treatment and Management of Sodium-Bonded Spent Nuclear Fuel (DOE/EIS-0306)	This EIS analyzes alternatives for the treatment and management of sodium bonded spent nuclear fuel at Argonne National Laboratory-West (ANL-W) located on the INEEL. Under some alternatives the sodium bonded SNF would be treated at ANL-W using an electrometallurgical process. This process was addressed in the SNF & INEL EIS (Experimental Breeder Reactor-II Blanket Treatment at Appendix C-4.1.7, and Electrometallurgical Process Demonstration at Appendix C-4.1.8). These actions are included in the projects that make up the environmental baseline for this EIS.

a. Included in the baseline conditions identified in the SNF & INEL EIS.

future recharge to contaminated perched water and (2) taking the existing INTEC percolation ponds out of service and replacing them with new ponds built outside of the zone influencing perched water contaminant transport. As a consequence, development of new percolation ponds is included in this cumulative impact assessment.

A potential future project identified but not considered in the cumulative impact analysis because of its speculative nature involves the INTEC coal fired steam heating plant. The plant could potentially be converted to a small commercial power generating facility. The potential for such a conversion is being considered by the Eastern Idaho Community Reuse Organization.

Since the Draft EIS was issued, updated information concerning the treatment of sodium-bonded fuel and irradiation of neptunium-237 targets at the Advanced Test Reactor (ATR) has been evaluated. Impacts associated with the treatment of sodium-bonded spent nuclear fuel have been analyzed in detail and are presented in the U.S. Department of Energy Final Environmental Impact Statement for the Treatment and Management of Sodium-Bonded Spent Nuclear Fuel (DOE 2000a).

Impacts from irradiation of neptunium-237 targets at ATR as well as ATR operations were evaluated in the Final Programmatic Environmental Impact Statement for Accomplishing Expanded Civilian Nuclear Energy Research and Development and Isotope Production Missions in the United States (Nuclear Infrastructure PEIS) (DOE 2000b).

Table 5.4-3 presents waste processing impacts for each Idaho HLW & FD EIS alternative. The maximum impact from the Idaho HLW & FD EIS waste processing and facility disposition alternatives, and other past, present, and reasonably foreseeable projects evaluated in this EIS are presented in Table 5.4-4. Although potential incremental impacts of actions analyzed in the Nuclear Infrastructure PEIS were considered in the cumulative analysis, they were small in every instance and would not contribute substantially to cumulative impacts. For this reason, they were not included in Table 5.4-4. Table 5.4-5 lists INTEC facilities unrelated to Idaho HLW alternatives planned for closure over approximately the same timeframe as the waste processing and facility disposition activities ***analyzed*** in this EIS. The impacts from these unrelated facility closures are included in the cumulative evaluation in Table 5.4-4.

Additional INTEC facilities have been determined through the CERCLA process to require "no action" (no contaminant source) or "no further action" (no exposure route for a potential source under current site conditions). A list of these facilities is provided in the Record of Decision for WAG 3 (DOE 1999b). As a result, these facilities were not included in the cumulative impact analysis ***because they possess no additive value***.

Impacts associated with the Hanford alternative are discussed in Appendix C.8. Actions at the Hanford Site that could result in cumulative impacts with the Minimum INEEL Processing Alternative include the Hanford Site waste management and environmental restoration programs, operation of the Environmental Restoration and Disposal Facility, the management of spent nuclear fuel, and activities at the U.S. Ecology Site. The level of activity associated with many of the Hanford Site cleanup functions would be declining by the time treatment of the INEEL waste would begin. Among the cumulative impacts that would occur are impacts to land use and biological resources, human health, transportation, and socioeconomics.

5.4.3 RESOURCES ***AND PATHWAYS*** INCLUDED IN THE CUMULATIVE IMPACT ANALYSIS

Implementation of alternatives evaluated in this EIS would contribute to cumulative impacts on lands, ***including ecology, cultural resources, and borrow materials,*** air, water, ***socioeconomics***, traffic and transportation, health and safety, long-term health risk, and waste management. No cumulative impacts were identified that would affect noise, aesthetic and scenic resources, or environmental justice.

5.4.3.1 Land ***Based Impacts Including Ecology, Cultural Resources, and Geology and Soils***

Land Use - Existing industrial development at the INEEL occupies approximately 11,400 acres of the total INEEL area (569,600 acres) (DOE 1995). Cumulatively, implementation of all ***anticipated*** activities ***sitewide*** would lead to converting ***an additional 1,600*** acres of land to industrial use, ***which would increase*** the total disturbance to approximately 13,000 acres, less than 3 percent of the total INEEL land area.

A majority of the potential land disturbance would be associated with environmental restoration activities identified in the SNF & INEL EIS (DOE 1995). This disturbance would be associated with remediation of contaminated areas and would largely involve previously disturbed ***areas*** contiguous with or adjacent to existing industrial facilities. Potential impacts to INEEL land resources from Idaho HLW & FD EIS activities would account for less than 2 percent of the total potential new development of INEEL land. Therefore, the contribution of the alternatives evaluated in this EIS to land use impacts would be small.

Land disturbance associated with the facility disposition alternatives analyzed in this EIS, including closure of those identified in Table 5.4-5, would occur within the previously disturbed industrial area of INTEC. Certain land uses (such as residential or future industrial development) within this area would be precluded indefinitely into the future.

Ecology - Cumulative impacts to the ecology of the INEEL from habitat loss as a result of any alternative analyzed in this EIS would be small. Radionuclides released from treatment operations could be deposited on vegetation surrounding INTEC. Exposure of individual plants and animals to radionuclides in areas adjacent to INTEC could increase slightly due to waste processing operations. Residual radionuclides and hazardous constituents in soils surrounding INTEC could be absorbed by plants and consumed by animals. Although exposure to these materials may affect individual animals or plants, measurable impacts to populations on or off the INEEL have not occurred and are not expected as a result of the incremental increase in exposure that could result from alternatives analyzed in this EIS. Additional deposition resulting from any of the alternatives analyzed in this EIS would not be expected to lead to levels of contaminants that would exceed the historically reported range of concentrations or ecologically based screening levels (See Section 5.2.8). Therefore, DOE does not anticipate cumulative impacts to the ecology of the INEEL or plant or animal populations as a result of any alternative analyzed in this EIS.

Cultural and Historic Resources - As stated above, the majority of reasonably foreseeable INEEL actions and waste processing activities would occur within previously disturbed areas contained within or adjacent to INTEC facility areas. The likelihood that these areas contain cultural materials in-tact or in their original context, is small. Nevertheless, there is the potential to unearth or expose cultural materials during excavation. Standard measures to avoid or minimize the impacts to cultural materials discovered during site development are in place. Cultural resource surveys would be conducted prior to construction or surface disturbance outside the INTEC fence and appropriate standard measures, such as avoidance or scientific documentation and tribal consultation, would be implemented prior to development of the site. Implementation of these measures would minimize the potential for impacts, including cumulative impacts, to cultural resources.

The types of cumulative impacts on historic resources are the same for each alternative analyzed in this EIS. All undertakings within developed facility areas on the INEEL have the potential to impact properties eligible for nomination to the National Register of Historic Places. Appropriate standard measures, including archival documentation of historic structures, would be implemented in accordance with an agreement with the State Historic Preservation Officer. Contribution of activities evaluated in this EIS to cumulative impacts on cultural and historic resources on the INEEL or in southeastern Idaho would be small.

Geology and Soils - Disposition of facilities and remediation of contaminated sites at INTEC and other INEEL facility areas would require the use of borrow materials such as gravel, silt and clay. Anticipated requirements for these materials in support of remediation of contaminated sites at the INEEL were identified in the SNF & INEL EIS and in an environmental assessment (EA) addressing impacts of developing new sources of silt and clay to support INEEL actions (DOE 1997a). The EA identified a need for 2,300,000 cubic yards of silt/clay material over a period of 10 years. To account for compaction, reject material not suitable for construction, and other uncertainties associated with construction activities, the volume of material analyzed in the EA was doubled to 4,600,000 cubic yards. Silt and clay required for construction activities associated with waste processing alternatives and facilities disposition at INTEC, as well as material for all other INEEL activities, including ongoing operations and remediation of contaminated sites, would be obtained from sources analyzed in the EA. Sources of sand, gravel, aggregate, etc. in support of remedial activities and INEEL operations were evaluated in the SNF & INEL EIS. The estimated need for gravel is estimated to be 1,772,000 cubic yards (DOE 1995). The development or expansion of borrow material sources would be within the boundaries of the

Table 5.4-3. Waste processing impacts from each Idaho HLW & FD EIS alternative.

Resource area	No Action Alternative	Continued Current Operations	Separations Alternative: Full Separations Option	Separations Alternative: Planning Basis Option	Separations Alternative: Transuranic Separations Options
Land resources	None	None	Conversion of 22 acres to industrial use	None	Conversion of 22 acres to industrial use
Cultural resources	None	***Minimal visual degradation through 2016***	Minimal visual degradation through 2035	Minimal visual degradation through 2035	Minimal visual degradation through 2035
Air resources					
Maximum consumption of PSD increment	39 percent	***39*** percent	***39*** percent	***40*** percent	***39*** percent
Water resources[a]					
Construction	***0.16***	***0.88***	***7.0***	7.2	4.9
Operations	15	65	9.0	75	56
Ecological resources	None	None	Loss of 22 acres of habitat	None	Loss of 22 acres of habitat
Waste management[b]					
Industrial					
Construction	1.4×10^{3}	6.8×10^{3}	5.5×10^{4}	6.0×10^{4}	3.9×10^{4}
Operations	1.4×10^{4}	1.9×10^{4}	5.3×10^{4}	5.2×10^{4}	4.3×10^{4}
Hazardous					
Construction	0	30	790	880	280
Operations	0	0	1.6×10^{3}	1.2×10^{3}	960
Mixed low-level waste					
Construction	220	240	1.1×10^{3}	1.1×10^{3}	1.1×10^{3}
Operations	1.3×10^{3}	3.2×10^{3}	5.9×10^{3}	7.9×10^{3}	5.3×10^{3}
Low-level waste					
Construction	0	20	330	210	210
Operations	190	9.5×10^{3}	1.2×10^{3}	1.0×10^{4}	960
Socioeconomics[c]					
Construction					
Direct	20	90	850	870	680
Indirect	20	90	***830***	***840***	***650***
Year of peak	2005	2008	2013	2013	2012
Operations					
Direct	***73***	280	440	480	320
Indirect	***140***	***550***	***870***	***950***	***630***
Year of peak	***2007***	2015	2018	***2020***	2015

a. Million gallons per year.
b. Total waste volumes in cubic meters.
c. Peak employment.

Table 5.4-3. Waste processing impacts from each Idaho HLW & FD EIS alternative (continued).

Non-Separations Alternative					***Direct Vitrification Alternative***	
Hot Isostatic Pressed Waste Option	Direct Cement Waste Option	Early Vitrification Option	***Steam Reforming Option***	Minimal INEEL Processing at INEEL	***Vitrification Without Calcine Separations Option***	***Vitrification With Calcine Separations Option***
None	None	None	***None***	Conversion of 22 acres to industrial use	***None***	***None***
Minimal visual degradation ***through 2035***	***Minimal*** visual degradation ***through 2035***	***Minimal*** visual degradation ***through 2035***	***Minimal visual degradation through 2035***	***Minimal*** visual degradation ***through 2035***	***Minimal visual degradation through 2035***	***Minimal visual degradation through 2035***
39 percent	***39*** percent	***39*** percent	***39 percent***	39 percent	***39 percent***	***39 percent***
3.3 93	3.7 67	2.8 9.2	***4.3*** ***8.1***	3.2 9.1	***2.7*** ***9.1***	***5.0*** ***15***
None	None	None	***None***	Loss of 22 acres of habitat	***None***	***None***
2.6×10^4 4.3×10^4	3.0×10^4 5.0×10^4	2.3×10^4 4.2×10^4	***2.4×10^4*** ***2.5×10^4***	2.6×10^4 3.5×10^4	***2.3×10^4*** ***3.0×10^4***	***4.3×10^4*** ***4.2×10^4***
790 4	560 4	640 4	***200*** ***58***	340 40	***570*** ***4.0***	***840*** ***1.4×10^3***
1.1×10^3 6.4×10^3	1.1×10^3 8.6×10^3	1.1×10^3 6.0×10^3	***1.1×10^3*** ***4.1×10^3***	1.1×10^3 5.7×10^3	***1.1×10^3*** ***6.0×10^3***	***1.1×10^3*** ***7.5×10^3***
260 1.0×10^4	340 1.0×10^4	310 750	***0*** ***560***	110 700	***1.6×10^3*** ***700***	***1.7×10^3*** ***1.3×10^3***
360 ***350*** 2008	400 ***390*** 2008	330 ***320*** 2008	***550*** ***530*** ***2010***	200 ***190*** 2008	***350*** ***340*** ***2011***	***670*** ***650*** ***2019***
460 ***910*** 2015	530 ***1,000*** 2015	330 ***650*** 2015	***170*** ***340*** ***2012***	330 ***650*** 2018	***310*** ***600*** ***2015***	***440*** ***880*** ***2023***

a. Million gallons per year.

b. Total waste volumes in cubic meters.

c. Peak employment.

Table 5.4-4. Maximum impact from Idaho HLW & FD EIS alternatives and other past, present, and reasonably foreseeable projects evaluated in this EIS. (Health & Safety and Transportation impacts are addressed in applicable sections.)

Resource area	Idaho HLW & FD EIS		SNF & INEL EIS (inclusive of WAG 3 and AMWTP) (DOE 1995)	New silt/clay source development and use at the INEEL	Disposition of unrelated INTEC facilities	Percolation pond replacement
	Waste Processing	Facility Disposition				
Land resources/acres disturbed	22 acres	None	1,346 acres[a]	21 acres and 24 acres per year[b]	None	***17*** acres
Socioeconomics	Direct employment of 870 during construction and 530 during operations	Direct peak year employment of ***790***	Overall decrease in employment	None/use of existing workforce	Small numbers of workers drawn from existing labor pool	None/use of existing workforce
Air resources	Consumption of up to ***40*** percent of PSD increment/no health based standards exceeded	No health based standards exceeded	Below applicable standards	Short-term elevated levels of fugitive dust and exhaust emissions	Emissions of fugitive dust/vehicle exhaust during demolition activities	Temporary emissions of fugitive dust and vehicular exhaust during construction activities
Water resources groundwater withdrawal and contamination	93 million gallons per year; negligible latent cancer fatality risk	Increase of ***11*** million gallons per year; latent cancer fatality risk of $\boldsymbol{2.9\times10^{-4}}$[c] from facility disposition.	Increase of 83 million gallons per year[d]; latent cancer fatality risk of 5×10^{-5}	Negligible	Within existing water use; latent cancer fatality risk of 2×10^{-6} from closure of CPP-633	Relocation of ponds reduces potential for contaminant migration
Ecological resources/ acreage loss	22 acres	None	1,346 acres[a]	21 acres and 24 acres per year[b]	None	***6.2*** acres
Geology and soils	Negligible (use of existing onsite sources)	Negligible (use of existing onsite sources)	1,772,000 ***yd***^{3}	4,600,000 ***yd***^{3} as a silt/clay source	Materials obtained from existing INEEL sources	Soil disturbance on ***17*** acres
Cultural resources	Negligible	Potential for loss of historic data on nuclear facilities	70 structures and 23 sites impacted[e]	No significant resources identified in surveys of 40-acre plots at each onsite location	Potential for loss of historic data on nuclear facilities	Surveys will be conducted/resources avoided

a. SNF & INEL EIS involves 1,339 acres, plus 7 acres impacted as a result of AMWTP.
b. Represents temporary disturbance; rehabilitation of disturbed acres will occur annually.
c. Represents the total for all existing HLW management facilities.
d. SNF & INEL EIS activities use 79 million gallons per year and AMWTP involves use of 4.2 million gallons per year.
e. SNF & INEL EIS impacts plus 1 additional site impacted from AMWTP.
AMWTP = Advanced Mixed Waste Treatment Project; PSD = Prevention of Significant Deterioration.

Table 5.4-5. List of INTEC facilities subject to closure and anticipated closure action and time of closure activity.

Building	Name	Closure Action	Deactivation Activity Period	Demolition Activity Period
Service Waste Group A				
CPP-709	Service Waste Monitoring System (Completed)	Closure to Landfill Standards	1999	1999-2000
CPP-734	Service Waste Monitoring Station for West Side (Completed)	Closure to Landfill Standards	1999	1999-2000
CPP-750	Service Waste Diversion Pump Station	Clean Closure	2035-2037	2038-2043
CPP-796	West Side Service Waste Building	Clean Closure	2035-2037	2038-2043
CPP-797	East Side Service Waste Building	Clean Closure	2035-2037	2038-2043
CPP-631	RALA Process "L" Off-Gas Blower Room (Completed)	Closure to Landfill Standards	1998-1999	2000
Service Waste Group B				
CPP-642	Hot Waste Pump House and Pit	Clean Closure	1999	1999-2000
CPP-648	Basin Sludge Tank Control House	Clean Closure	1999-2000	2000-2002
CPP-740	Settling Basin and Dry Well (Near CPP-603)	Clean Closure	2035-2037	2038-2043
CPP-751	Service Waste Monitoring Station for CPP-601	Clean Closure	2035-2037	2038-2043
CPP-752	Service Waste Diversion Station for CPP-601	Clean Closure	2035-2037	2038-2043
CPP-753	Service Waste Monitoring Station for CPP-633	Clean Closure	2035-2037	2038-2043
CPP-754	Service Waste Diversion Station for CPP-633	Clean Closure	2035-2037	2038-2043
CPP-763	Waste Diversion Tank Vault	Clean Closure	2030-2032	2033-2037
CPP-764	SFE Hold Tank Vault	Performance-Based	1999	1999-2000
Laboratory and Office Buildings				
CPP-602	Laboratory and Office Building	Closure to Landfill Standards	2010-2012	2015-2025
CPP-608	Storage-Butler Building (Contains Rover ash under concrete)	Clean Closure	2014-2015	2015-2025
CPP-620	Chemical Engineering High Bay Facility & HCWHNF	Clean Closure	2010-2012	2015-2025
CPP-630	Safety and Spectrometry Building	Clean Closure	2014-2015	2015-2025
CPP-663	Maintenance Building	Clean Closure	2038	2043
CPP-637	Process Improvement Facilities	Clean Closure	2038	2043
Ponds and Service Waste Lines				
NA	Service Waste Lines (Low-Level Liquid Waste)	Clean Closure	2035-2037	2038-2043
Miscellaneous				
NA	Overhead Pneumatic Transfer Lines	Clean Closure		
CPP-1776	Utility Tunnel System throughout Chem Plant	Clean Closure		
CPP-618	Measurement and Control Building/Tank Farm	Clean Closure	2030-2034	2034-2035
Waste Storage Building				
CPP-1617	Waste Staging Building	Clean Closure	2037	2038-2043
CPP-1619	Hazardous Chemical/Radioactive Waste Facility	Clean Closure	2037	2038-2043
Waste Calcining Facility				
CPP-633	Waste Calcining Facility	Closure to Landfill Standards		
CPP 603				
CPP-603	Fuel Receiving and Storage Building	Performance-Based		

INEEL, the acreage used would be small and subject to standard cultural resources protection measures and site restoration including revegetation with native plant species. Therefore, cumulative impacts to lands based resources including site geology and soils are anticipated to be small.

5.4.3.2 Socioeconomics

Table 5.4-4 presents employment impacts for each project evaluated in this EIS. Over the timeframe ***analyzed in this EIS***, waste processing activities would sustain a maximum of 870 direct jobs during the peak year (2013) of the construction phase and a maximum of 530 direct jobs during the peak year (2015) of the operations phase. However, the timing of peak employment and the number of workers, both direct and indirect, is highly variable across all alternatives. Facility disposition activities would require direct employment of up to ***790*** workers. DOE anticipates these workers would be drawn from the existing workforce through retraining and reassignment. DOE anticipates total employment would decline and the net change in jobs associated with alternatives ***analyzed in this EIS*** would represent a continuation of current site employment that may otherwise cease. Considering that direct employment at the INEEL was approximately 11,000 workers in 1990 (DOE 1995) and that ***2001*** INEEL employment was approximately 8,100 workers (see Section 4.3.2), future changes in employment as a result of activities described in this EIS would be within normal INEEL workforce fluctuations.

5.4.3.3 Air Resources

Cumulative impacts of radiological and nonradiological air emissions have been assessed for each alternative in this EIS. Since issuance of the Draft EIS, DOE has updated estimated impacts to the noninvolved worker resulting from baseline conditions. Radiological emission impacts at on- and off-site locations are well below applicable standards (see Table 5.4-6). The highest dose to an offsite individual from waste processing activities would be less than 1.8×10^{-3} ***millirem per year (under the Continued Current Operations Alternative, Planning Basis Option, Hot Isostatic Pressed Waste Option, and Direct Cement Waste Option). The cumulative dose to the maximally exposed offsite individual would be about 0.16 millirem per year. This dose, which is predominantly caused by baseline sources, is less than 2 percent of the 10 millirem per year dose limit specified in the National Emissions Standards for Hazardous Air Pollutants (40 CFR 61.92) and is a small addition to the 360 millirem dose received from natural background and man-made sources. Cumulative doses to noninvolved INEEL workers and the total population within 50 miles of INTEC would also be very low under each of the waste processing alternatives, and would be due mainly to baseline emissions.***

Summing maximum impacts from sources located in different areas (e.g., Radioactive Waste Management Complex, INTEC) and with different release parameters (e.g., stack heights) is inherently conservative since the maximum impacts from each source are likely to occur at different offsite locations.

Cumulative nonradiological air quality impacts are expressed in terms of concentrations of criteria and toxic air pollutants in ambient air and general deterioration of current air quality. Table 5.4-7 presents a comparison of recent criteria pollutant emission estimates. Analyses of SNF & INEL EIS maximum baseline concentrations are presented in Table 5.7-5 of the SNF & INEL EIS and are well within the National Ambient Air Quality Standards (DOE 1995). The highest predicted concentrations of criteria pollutants from Idaho HLW & FD EIS activities remain well below the SNF & INEL EIS maximum baseline case. Since maximum baseline concentrations are much greater than actual sitewide emissions and the total emissions from other activities evaluated in this EIS remain substantially lower, these results likely overstate the consequences that would actually occur.

Toxic air pollutants were assumed to be emitted at the maximum levels allowed under the maximum achievable control technology rule. ***Toxic air pollutant incremental impacts at offsite and onsite locations are well below applicable standards in all cases. The highest offsite impact from any waste processing alternative would be for nickel, which could reach about 10 percent of the standard under the Planning Basis***

Table 5.4-6. Summary of radiation dose impacts associated with airborne radionuclide emissions.

	Maximally exposed offsite individual (millirem per year)	Noninvolved worker (millirem per year)	Population (person-rem per year)
Baseline conditions[a]	0.16	***0.35***	***1.1***
Idaho HLW & FD EIS[b]	***1.8×10^{-3}***	1.0×10^{-4}[c]	***0.11***
Total	0.16	***0.35***	***1.2***
Standard	10[d]	5,000	NA[e]

a. Includes contributions from foreseeable sources including Advanced Mixed Waste Treatment Project (see Table C.2-8).
b. Maximum dose for any alternative.
c. Location of highest onsite dose is Central Facilities Area.
d. EPA dose limit specified in 40 CFR 61.92; applies to effective dose equivalent from air releases only.
e. NA = Not available. No standard has been established.

Table 5.4-7. Comparison of recent criteria pollutant emissions estimates with the levels assessed under the maximum emissions case in the SNF & INEL EIS.

Pollutant	SNF & INEL EIS maximum baseline case (kilograms per year)[a]	Advanced Mixed Waste Treatment Project (kilograms per year)[b]	Idaho HLW&FD EIS (kilograms per year)	Actual sitewide emissions (1996) (kilograms per year)[c]	Total (kilograms per year)	Percent of baseline case
Carbon monoxide	2,200,000	2,100	***24,000***	155,000	183,100	***8.2***
Nitrogen dioxide	3,000,000	25,000	***85,000***	220,000	338,000	11
Particulate matter[d]	900,000	290	***5,400***	180,000	186,000	21
Sulfur dioxide	1,700,000	700	***170,000***	120,000	380,700	***17***
Lead components	68	1.9×10^{-5}	***3.6***	1.5	5.6	***7.5***
VOCs	not specified	480	***2,700***	16,000	19,000	-

a. Source: DOE (1995).
b. Source: DOE (1999a).
c. Source: DOE (1997b).
d. Particle size of particulate matter emissions is assumed to be in the respirable range (less than 10 microns).
VOCs = volatile organic compounds.

Option at, or just beyond, the INEEL boundary. The highest onsite nickel concentrations are not expected to exceed one percent of the occupational exposure limit for that substance.

The maximum consumption of Prevention of Significant Deterioration increment would occur under the Planning Basis Option. The combined effects of baseline sources, waste processing alternatives, and other planned future projects would consume ***40*** percent of increment at Craters of the Moon ***Wilderness Area*** (Class I area) and ***38*** percent of increment at the INEEL boundary (Class II area) for sulfur dioxide, averaged over 24 hours. All other waste processing options would result in a smaller cumulative consumption of Prevention of Significant Deterioration increment (see Table 5.2-9).

5.4.3.4 Water Resources

Potential impacts to water would include withdrawal of water from the aquifer in support of INEEL activities and potential long-term impacts on water quality from migration of residual contaminants to the aquifer.

Water Use - Current INEEL activities use an average of 1.6 billion gallons of water from the ***Snake River Plain*** Aquifer each year (DOE 1997c). Total water consumption from reasonably foreseeable activities, including waste processing activities ***analyzed*** in this EIS, could account for an additional ***187*** million gallons per year, of which ***104*** million gallons would be associated with activities from ***this*** EIS (see Table 5.4-4). This would have a small effect on the quantity of water in the aquifer, given that 470 billion gallons of water pass under the INEEL annually (Robertson et al. 1974).

Groundwater - Past waste disposal practices have ***contaminated groundwater***, primarily in isolated areas within the INEEL site boundaries, including the groundwater underlying INTEC. Tritium, strontium-90, iodine-129, americium-241, cesium-137, chloride, chromium, cobalt-60, nitrate, sodium, and plutonium isotopes have been detected in ***groundwater*** near INTEC. Some contaminant plumes, most notably tritium, strontium-90, and iodine-129, have concentrations in excess of EPA drinking water standards. Previous modeling of the vadose zone and saturated contaminant transport predicted no contaminants would migrate past the present INEEL site boundaries in concentrations exceeding maximum contaminant levels (DOE 1995). A more recent study (Rodriguez et al. 1997) predicts that without remediation, mercury, tritium, iodine-129, neptunium-237, and strontium-90 have already or will reach or exceed drinking water standards beneath INTEC before the year 2095. Iodine-129 was predicted to migrate to the INEEL southern ***boundary*** at a concentration near the drinking water standard (Rodriquez et al. 1997).

Relocation of the percolation ponds used for disposal of service waste to a location 10,200 feet southwest of INTEC would move the region of influence of the ponds far enough that infiltration of water discharged to the ponds (which in the past has exceeded drinking water standards) ***would*** not hydrologically interact with contaminated perched water bodies beneath INTEC ***(DOE 1999c)***. Contaminant ***plumes*** are known to occur in perched water zones and the Snake River Plain Aquifer in areas underlying and downgradient from other INEEL facilities. The potential for interaction between ***these*** plumes ***is not well understood*** at this time. However, the concentration of contaminants is greatest close to the INEEL facilities that are, ***or were,*** the source of the plume. Closure of facilities and residual contamination left in place after remediation of INTEC facilities could contribute to the concentration of contaminants in the aquifer over the long term. A discussion of long-term cumulative impacts from exposure to contaminants in groundwater can be found in Section 5.4.3.***6***.

5.4.3.*5* Traffic and Transportation

Transportation impacts analyzed in the SNF & INEL EIS are summarized in this section as well as cumulative impacts from the AMWTP EIS and WAG 3 remediation activities.

Traffic Volume - As noted in Section 5.2.9, DOE does not expect any change in the Level-of-Service on U.S. Highway 20 as a result of anticipated future activities at the INEEL.

Transportation Radiological Impacts - Radiological collective doses to workers and the general population were used to quantify cumulative transportation impacts. The analysis of cumulative transportation impacts focuses on offsite transportation because this method yields a larger dose to the general population in comparison to onsite transportation or occupational dose. Due to the difficulty in identifying a maximally exposed individual for historical and anticipated shipments that would occur all over the U.S. over an extended period of time (i.e., from 1953 through completion of transportation related activities evaluated in this EIS), this measure of impact was evaluated by estimating cancer fatalities using cancer risk coefficients. The collective dose for waste shipments associated with all alternatives in this EIS ***is*** summarized in Section 5.2.9, Traffic and Transportation. Total collective occupational and general population doses from past, present, and reasonably foreseeable actions are summarized in Table 5.4-8.

There are also general transportation activities unrelated to alternatives evaluated in the SNF & INEL EIS, this EIS, or to reasonably foreseeable actions. Examples of these activities are shipments of radiopharmaceuticals to nuclear medicine laboratories and shipment of commercial low-level radioactive waste to commercial

Table 5.4-8. Cumulative transportation-related radiological collective doses and cancer fatalities.

Category	Collective occupational dose (person-rem)	Latent cancer fatalities[a]	Collective general population dose (person-rem)	Latent cancer fatalities[a]
Historical				
Waste (1954 - 1995)	47	0.02	28	0.01
DOE Spent Nuclear Fuel (1953 - 1995)	56	0.02	30	0.02
Naval Spent Nuclear Fuel (1957 - 1995)	6.2	3.0×10^{-3}	1.6	8.0×10^{-4}
Alternative B (10-year plan)[b]				
Waste shipments				
Truck (100 percent)	870	0.35	460	0.23
Rail (100 percent)	20	***8.0×10^{-3}***	29	***0.015***
Spent Nuclear Fuel Shipments				
Truck (100 percent)	***350***	***0.14***	***810***	***0.41***
Rail (100 percent)	***67***	***0.027***	***100***	***0.050***
Maximum Waste Processing Alternative				
Direct Cement Waste Option (Truck)	***520***	0.21	2.9×10^{3}	1.4
Reasonably Foreseeable Actions				
Geological Repository				
Truck	8.6×10^{3}	3.4	4.8×10^{4}	24
Rail	750	0.3	740	0.37
Waste Isolation Pilot Plant				
Test Phase	110	0.043	48	0.03
Disposal Phase				
Truck	1.9×10^{3}	0.76	1.5×10^{3}	0.75
Rail	180	0.07	990	0.5
General Transportation				
Truck				
1953 - 1982	1.7×10^{5}	68	1.3×10^{5}	65
1983 - 2037	9.6×10^{4}	38	1.0×10^{5}	52
Summary				
Historical	109	0.043	60	0.030
Alternatives B (10-year plan)[b] ***and Spent Nuclear Fuel Shipments***				
Truck (100 percent)	***1.2×10^{3}***	***0.49***	***1.3×10^{3}***	***0.64***
Rail (100 percent)	***87***	***0.04***	***130***	***0.07***
Maximum Waste Processing Alternative	***520***	0.21	2.9×10^{3}	1.4
Reasonably Foreseeable Actions				
Truck (100 percent)	1.1×10^{4}	4.2	5.0×10^{4}	25
Rail (100 percent)	1.0×10^{3}	0.37	1.8×10^{3}	0.87
General Transportation (1953 - 2037)	2.7×10^{5}	110	2.3×10^{5}	120
Total collective dose[c]	2.8×10^{5}	110	2.8×10^{5}	140
Percent of total collective dose from Maximum Waste Processing Alternative	***0.19***	***0.19***	***1.0***	***1.0***

a. Dose conversion factors were 4.0×10^{-4} latent cancer fatality per person-rem for workers and 5.0×10^{-4} latent cancer fatality per person-rem for the general population.

b. Dose reported in SNF & INEL EIS (DOE 1995); includes Advanced Mixed Waste Treatment Project.

c. Assumes truck transport.

disposal facilities. The U.S. Nuclear Regulatory Commission evaluated these types of shipments based on a survey of radioactive materials transportation published in 1975 (NRC 1977). Categories of radioactive material evaluated by the Nuclear Regulatory Commission included limited quantity shipments, medical, industrial, fuel cycle, and waste. The Nuclear Regulatory Commission estimated the annual collective worker dose for these shipments was 5,600 person-rem, which would result in 2.2 cancer fatalities. The annual collective general population dose for these shipments was estimated to be 4,200 person-rem, which would result in 2.1 cancer fatalities. Because comprehensive transportation doses were not available, these collective dose estimates were used to estimate transportation collective doses for 1953 through 1982 (30 years). These dose estimates included shipments of spent nuclear fuel and radioactive waste shipments.

Weiner et al. (1991a,b) estimated doses to workers and the general public from land (truck) and air shipments of radioactive material and estimated the annual collective radiation dose to workers and the general population was 1,690 and 1,850 person-rem per year, respectively. Assuming similar exposure rates over the 1983 to 2037 period, the total collective doses to workers and the general public would be 96,000 person-rem and 103,000 person-rem, respectively.

The total number of cancer fatalities resulting from shipments of radioactive materials from 1953 through 2037 was estimated to be 255. Based on 300,000 cancer deaths/year (NRC 1977) over this same period (84 years), approximately 24,000,000 people will die from cancer. The transportation-related cancer deaths are less than 0.001 percent of this total. The maximum number of transportation-related cancer deaths that would occur as a result of the projects analyzed in this EIS would be less than 1 percent of the total number of cancer deaths resulting from transportation of radioactive materials and less than 0.00001 percent of the conservatively estimated total number of fatal cancers from all causes.

Like the historical transportation dose assessments, the estimates of collective doses due to general transportation exhibit considerable uncertainty. For example, data from 1975 were applied to all general transportation activities from 1953 through 1982. This approach may have overestimated doses because the amount of radioactive material transported and the number of shipments in the 1950s and 1960s was less than the amount shipped in the 1970s.

Comprehensive data that would enable a more accurate transportation dose assessment are not available so the dose estimates developed by the Nuclear Regulatory Commission were used. In addition, the collective doses identified in Weiner et al. (1991a,b) were assumed to be representative of the dose that would occur over the life of the project and are likely to understate the health effects that would occur as a result of unrelated shipments of radioactive material.

The estimate of the total number of fatal cancers from all causes that would occur over the life of the project is conservative, which tends to overstate the impacts of the project relative to the number of cancers that would occur from all causes. The number of cancer fatalities over time is influenced by numerous factors, including the population size and the age structure of the population. Although the estimate of 300,000 fatal cancers per year is probably too high for the 1950s and 1960s, the estimate is also too low for the 1980s, 1990s, ***and 2000s***. For example, there were more than ***553,000*** cancer fatalities in ***2001*** (American Cancer Society ***2001***).

Vehicular Accident Impacts - Facilities that involve the shipment of radioactive materials were surveyed for 1971 through 1993 using accident data from the U.S. Department of Transportation, the Nuclear Regulatory Commission, DOE and state radiation control offices. During this period, there were 21 vehicular accidents involving 36 fatalities. These fatalities resulted from the vehicular accidents and were not associated with the radioactive nature of the cargo; no radiological fatalities due to transportation accidents have ever occurred in the U.S. For the Transuranic Separations Option, it is estimated there would be approximately ***25*** vehicular accidents, which would be expected to result in approximately one (***0.98***) fatality over the shipment campaign. All other alternatives would involve fewer vehicular accidents and fatalities. During 1997, approximately 42,000 people were killed in all vehicle accidents (DOT 1997).

5.4.3.6 Health and Safety

Although there are a number of pathways through which radioactive materials at INTEC and INEEL operations could affect onsite workers or an offsite member of the public, air is the principal exposure pathway. Radiation doses ***and nonradiological impacts*** to public receptors in the vicinity of INEEL due to atmospheric releases have been analyzed in the SNF & INEL EIS and in Sections 5.2.6 and 5.2.10 of this EIS. Actual emissions of radionuclides are continuously monitored and the potential radiation dose to offsite members of the public is reported in INEEL annual site environmental reports (ESRF 1996, 1997).

The potential health effects from radiation exposure are presented as the estimated number of fatal cancers in the affected population. The potential health effects resulting from exposure to chemical carcinogens are presented as the number of lifetime cancers in the affected population. For exposure to noncarcinogenic chemicals, health effects are presented as estimated fatalities.

Historic radiation releases and subsequent offsite doses associated with INEEL operations have been evaluated and summarized in the SNF & INEL EIS (DOE 1995) and the Idaho National Engineering Laboratory Historical Dose Evaluation (DOE 1991). Airborne releases over the operating history of INEEL have always been within the radiation protection standards applicable at the time and the doses from those releases have been small in comparison to doses from sources of natural background radiation in the vicinity of INEEL (DOE 1991). Liquid-borne radioactive effluents from the INEEL have not, to this time, produced measurable exposure to offsite members of the public. Some potential biotic pathways ***such as*** animals and vegetation also exist, ***including*** game animals that assimilate radioactivity on the INEEL and are subsequently harvested. DOE has estimated that the potential radiation dose to individuals through ingestion of game animals, although unlikely, could be as high as 10 millirem per hunting season (DOE 1991). More recent analyses (ESRF 1998) of duck sampling data indicate the potential dose to be approximately 1 millirem.

Public exposure to residual radioactive materials left in place at INTEC after the completion of all remedial activities and implementation of a waste processing alternative would be small because of institutional controls. Materials left in place would potentially provide a source of contamination that could migrate to the Snake River Plain Aquifer. Public exposure to these contaminants could occur if the ***contaminant*** plumes within the aquifer migrated off the INEEL or to a point outside the institutionally controlled area. ***Since the Draft EIS, DOE has updated health and safety information specific to the long-term groundwater impacts (see Appendix C.9).***

Occupational Health - Activities to be performed by workers under each of the alternatives ***analyzed*** in this EIS are similar to activities currently performed at INTEC. Therefore, the potential hazards encountered in the workplace would be similar to existing hazards. For these reasons, the average measured radiation dose and the number of reportable cases of injury and illness are anticipated to be proportional to the number of workers employed under each alternative. The airborne pathway, through which materials released on the INEEL could affect workers, was modeled in the SNF & INEL EIS and was found to add negligible amounts to actual measured data.

As used in the SNF & INEL EIS, the average reportable radiation dose to an INEEL worker, including both INTEC and non-INTEC workers, was about 27 millirem per year. The value was based on 1991 occupational radiation monitoring results, but was projected to be representative over the 10-year period of the SNF & INEL EIS analysis. In addition, there is a potential for a small additional radiation dose due to atmospheric releases from INEEL facilities. The occupational dose received by the entire INEEL workforce would result in about one fatal cancer for ten years of operations (DOE 1995). For comparison, the natural lifetime incidence of fatal cancers in the same population from all other causes would be about 2,000. The greatest increase in the collective worker dose would occur under the Direct Cement Waste Option. This option would have a total campaign collective worker dose of ***1,100*** person-rem. The combined additional radiation dose to workers from this option would result in less than one (***0.43***) additional latent cancer fatality over the life of the project. All other options would result in a lower contribution to the cumulative collective worker dose.

For the evaluation of occupational health effects from chemical emissions, the modeled chemical concentrations were compared with applicable occupational standards (see Sections 5.2.6 and 5.2.10). Modeled concentrations below occupational standards were considered acceptable. Based on the analysis, no adverse health effects for onsite workers are projected to occur as a result of normal chemical emissions under any alternative.

Routine workplace safety hazards can result in injury or fatality. Projected injury rates were calculated based on INEEL historic injury rates for construction workers and for INEEL operations. The number of additional recordable cases and lost workdays that would be anticipated for each alternative are reported in Section 5.2.10.4.

Facility disposition at INTEC would also result in worker exposure to radiation. Clean Closure of the Tank Farm and bin sets would result in the greatest dose to workers at ***0.91*** latent cancer fatality. Disposition of other facilities and remedial activities undertaken at INTEC would also lead to worker exposure, but those doses were calculated to be much lower than for Clean Closure of the Tank Farm.

These analyses indicate that the cumulative radiological health effects, nonradiological health effects, and workplace safety hazards to the INEEL workforce would be small. The combined occupational risks are less than those encountered by the average worker in private industry.

Public Health - Air is the principal pathway through which radioactive materials released on the INEEL can reach offsite members of the public. The project-specific analysis of the potential radiation dose to the public in the vicinity of the INEEL indicates the potential radiation dose (to the maximally exposed individual and collectively) would be highest under the Continued Current Operations Alternative, Planning Basis Option, Hot Isostatic Pressed Waste Option, or Direct Cement Waste Option. These options would result in a potential annual radiological dose to the maximally exposed individual of approximately 0.002 millirem. This potential dose would be in addition to the dose from existing and proposed INEEL operations. Monitoring of existing operations indicated that the maximally exposed individual received a dose of 0.018 millirem and 0.031 millirem in 1995 and 1996, respectively (ESRF 1996, 1997). For comparison, the radiation dose to individuals residing in the vicinity of INEEL from natural background radiation ***and manmade sources*** averages approximately 360 millirem per year (ESRF 1997).

Waste processing options would add a maximum of ***0.11*** person-rem per year to the collective radiation dose received by the affected population. The collective radiological dose to the population within 50 miles of the INEEL in 1996 was ***0.24*** person-rem. Using the standard risk factors for estimating fatal ***cancers*** from a given calculated exposure, a ***maximum*** value of ***0.001*** fatal cancers would be obtained as a result of the cumulative radiation dose received by the population within 50 miles of the INEEL from existing INEEL operations, treatment of HLW, and other reasonably foreseeable actions at the INEEL. In essence, no fatalities would be expected. The natural lifetime incidence of cancer in the same population from all other causes would be about 24,000 cancers in a population of about 120,000 people (DOE 1995).

Other regional sources of atmospheric radioactivity have the potential to contribute to the radiation dose received by the public near the INEEL. The primary non-INEEL source of airborne radioactivity is emissions from phosphate processing operations in Pocatello, Idaho. EPA evaluated health effects in the exposed population from these emissions (EPA 1989). The number of fatal cancers in the population within 50 miles of Pocatello would be about one over a ten-year period. INEEL and the Pocatello phosphate plants are separated by enough distance that the population evaluated by EPA does not completely overlap the population evaluated in this EIS. The population exposed to the cumulative impact of both facilities would be small.

In addition to radiation dose from atmospheric emissions, there is a potential for impacts to the public from exposure to carcinogenic chemicals released to the air. No emissions of toxic air pollutants would exceed applicable standards ***under*** any alternative ***or option***, although emissions of ***nickel*** at the Maximum Achievable Control Technology limit, which is much higher than actual emissions are likely to be, could potentially reach ***10*** percent of the standard. Nevertheless, INEEL operations are not anticipated to exceed any applicable standards when emissions from the alternatives analyzed in this EIS are considered in conjunction with existing and anticipated emissions. The highest risks calculated for any alternative imply less than one fatal cancer in the exposed population. Therefore, no health effects are anticipated from releases of chemical carcinogens. No basis for use in evaluating risks from chemical exposure due to other regional commercial, industrial, and agricultural sources, such as combustion of diesel or gasoline fuels and agricultural use of pesticides, herbicides, and fertilizers, is available. Therefore, the ***cumulative*** potential health effects in the general population from INEEL activities combined with other sources of chemical exposure cannot be reliably estimated.

The volume of surface water ***flowing*** from the INEEL to offsite areas is negligible and there are no liquid discharges from operations to the intermittent streams on the INEEL. In the event storm water runoff from INTEC were to reach the Big Lost River channel, the flow would not leave the INEEL. Therefore, INEEL operations, including existing and proposed activities at INTEC, have a negligible contribution to cumulative impacts on public health resulting from the surface water pathway.

Long-term impacts from exposure to residual contamination - Long-term impacts to public health could potentially occur as a result of contaminants left in place after completion of closure activities and WAG 3 remedial action. Over time, these contaminants could migrate to the groundwater and ultimately be ingested by humans residing near the location of the INTEC and using the Snake River Plain Aquifer as a drinking water source.

Table 5.4-9 shows the unmitigated results of the baseline risk assessment for Operable Unit 3-13 and the results from the analyses of the facility disposition alternatives in this EIS. (Note the CERCLA Record of Decision for the Operable Unit 3-13 portion of WAG 3 committed DOE to meet the drinking water standards in the Snake River Plain Aquifer outside of the INTEC security fence by 2095.) For each evaluation, the dose is presented, along with the corresponding risks reported in the respective documents. Also included in the table are estimates of the annual dose to the maximally exposed individual and the time periods at which the presented doses and risks are applicable.

As shown in Table 5.4-9, the risk and dose ***shown in*** the WAG 3 risk assessment are both low but are not expected to overlap in time to any great extent with the doses and risks calculated for this EIS. The table presents the highest radiation dose for the maximally exposed resident farmer for facility disposition alternatives in this EIS, including the No Action Alternative. The table also contains estimates of annual doses due to groundwater consumption. The values in the table are below the drinking water standard of 4 millirem for beta/gamma-emitting radionuclides. Groundwater concentration limits for ***any of*** the radionuclides are also not exceeded.

In addition to the activities listed in Table 5.4-9, the total estimated cancer risk due to groundwater ingestion from closure in place of building CPP-633 would be 2.0×10^{-6} (DOE 1996). This value is small compared to the WAG 3 risk assessment. ***The potential for long-term cumulative impacts is discussed in Section 5.3.8.2. Section 5.2.14.6 provides a discussion of potential impacts to the groundwater from a postulated failure of five below grade storage tanks full of mixed transuranic waste/SBW.***

Additional health risk could occur as a result of nonradiological contaminants ***through the*** groundwater and fugitive dust pathways. However, in the cases assessed here, cancer risk ***would*** result only from inhalation of cadmium entrained in fugitive dust, as discussed in Appendix C.9. For all receptors and exposure scenarios, cancer risk from cadmium would be

Table 5.4-9. Comparison of groundwater impacts.

Evaluation Document	Total individual dose[a] over evaluation period (millirem)	Excess latent cancer fatality risk due to total individual dose	Annual individual dose due to drinking water during evaluation period[b] (millirem per year)	Time of evaluation (year)
Assessment derived from the Operable Unit 3-13 Baseline Risk Assessment ***(unmitigated)***	56[c] (beta/gamma emitting radionuclides) 250[c] (total radiation dose)	5.0×10^{-5}[d]	1.9 (beta/gamma-emitting radionuclides) 8.33 (total radiation dose)	2095
Idaho High-Level Waste and Facilities Disposition EIS				
Tank Farm	***4.4***[e]	$\boldsymbol{2.2\times10^{-6}}$[f]	***0.040***	***2800***
Bin Sets	***1.3***[e]	$\boldsymbol{6.5\times10^{-7}}$[f]	$\boldsymbol{7.8\times10^{-3}}$	***3000***
New Waste Calcining Facility	***0.034***[e]	$\boldsymbol{1.7\times10^{-8}}$[f]	$\boldsymbol{1.9\times10^{-4}}$	***3000***
Process Equipment Waste Evaporator	***0.036***[e]	$\boldsymbol{1.8\times10^{-8}}$[f]	$\boldsymbol{2.0\times10^{-4}}$	***3000***

a. The total radiation dose is presented for the duration reported in the respective documents.
b. The annual dose was estimated by dividing the total dose by the evaluation period duration.
c. The radiation dose for this receptor was calculated by using the groundwater concentrations reported by Rodriguez et al. (1997) and applying DOE dose conversion factors (DOE 1988).
d. The risk for this evaluation was calculated based on EPA methodology for risk assessment.
e. ***Values represent results for the maximally exposed resident for Performance-Based Closure.***
f. The risk for this evaluation was calculated based on National Council on Radiation Protection and Measurements and DOE guidance on risk assessment.

less than 1×10^{-9} and would not contribute substantially to the cumulative risk. Noncancer risk would be higher than for some receptors and scenarios, most notably those cases involving fluoride releases from onsite disposal of low-level Class A or C type grout.

5.4.3.7 Waste Management

Table 5.4-3 presents, by waste stream for each alternative, the total volumes of waste that would be generated under each alternative. Existing disposal of waste stored or buried on the INEEL includes approximately 145,000 cubic meters of low-level waste and about 62,000 cubic meters of transuranic waste. Although the volume of INEEL industrial waste previously ***disposed of*** in the INEEL Landfill Complex is unknown, it is estimated that the Landfill Complex would provide adequate capacity for the next 30 to 50 years, which would accommodate wastes generated over the life of the ***actions*** evaluated in this EIS.

Figures depicting the cumulative volume of specific waste streams that may be generated by INEEL activities over the projected life of the Idaho HLW & FD EIS alternatives have been developed using the INEEL baseline (Jason 1998) and LMITCO Project Data Sheets. Figures 5.4-1, 5.4-2, 5.4-3, and 5.4-4 project cumulative INEEL generation of low-level waste, mixed low-level waste, hazardous waste, and industrial waste, respectively.

Since issuance of the Draft EIS, more detailed information has become available on two INEEL projects, treatment of sodium-bonded spent nuclear fuel at Argonne National Laboratory-West (ANL-W) and irradiation of neptunium-237 targets at ATR. As discussed in

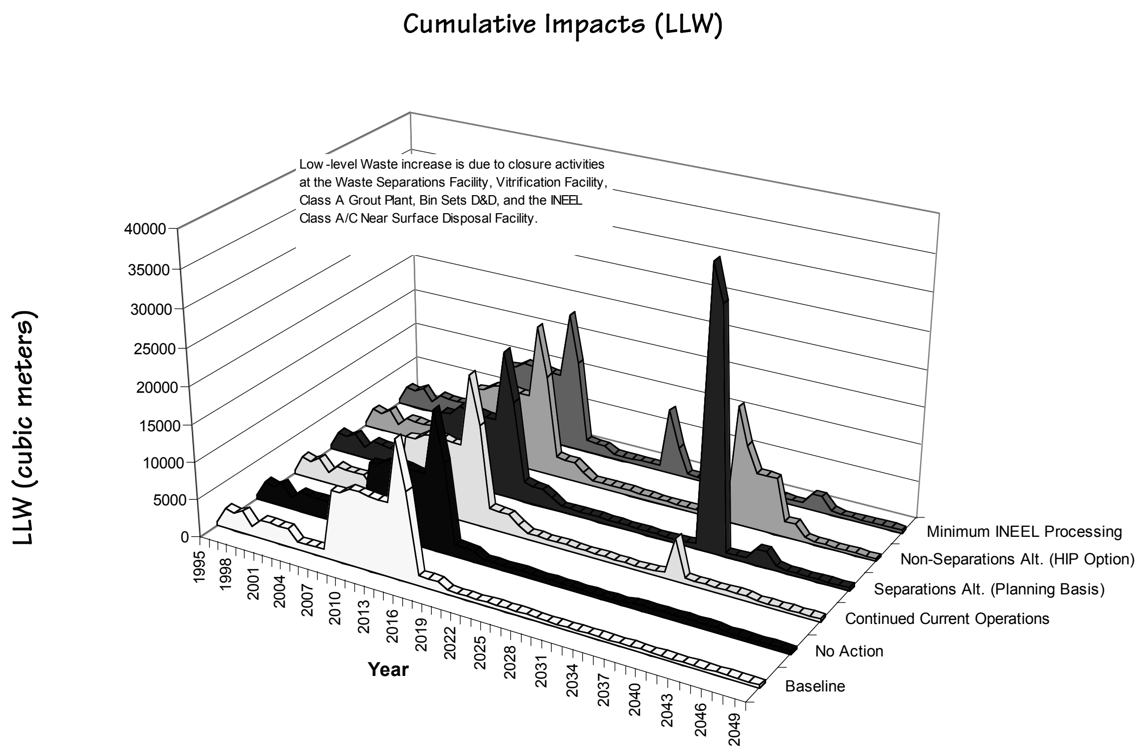

Figure 5.4-1. Cumulative generation of low-level waste at INEEL, 1995-2050.

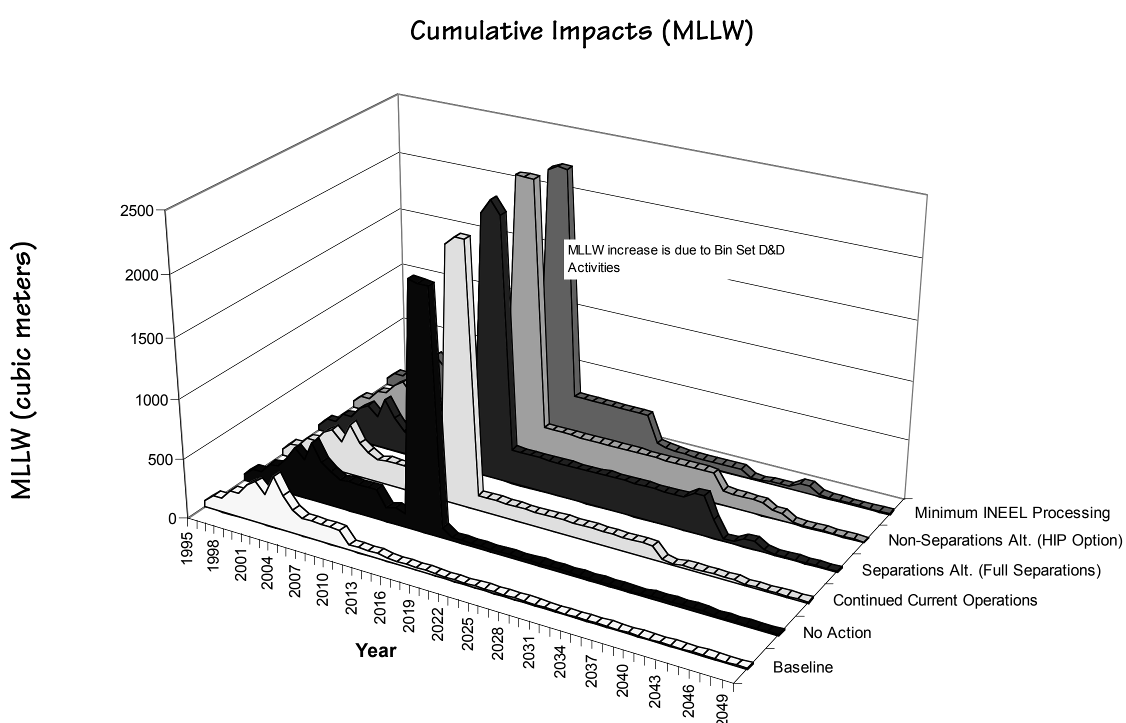

Figure 5.4-2. Cumulative generation of mixed low-level waste at INEEL, 1995-2050.

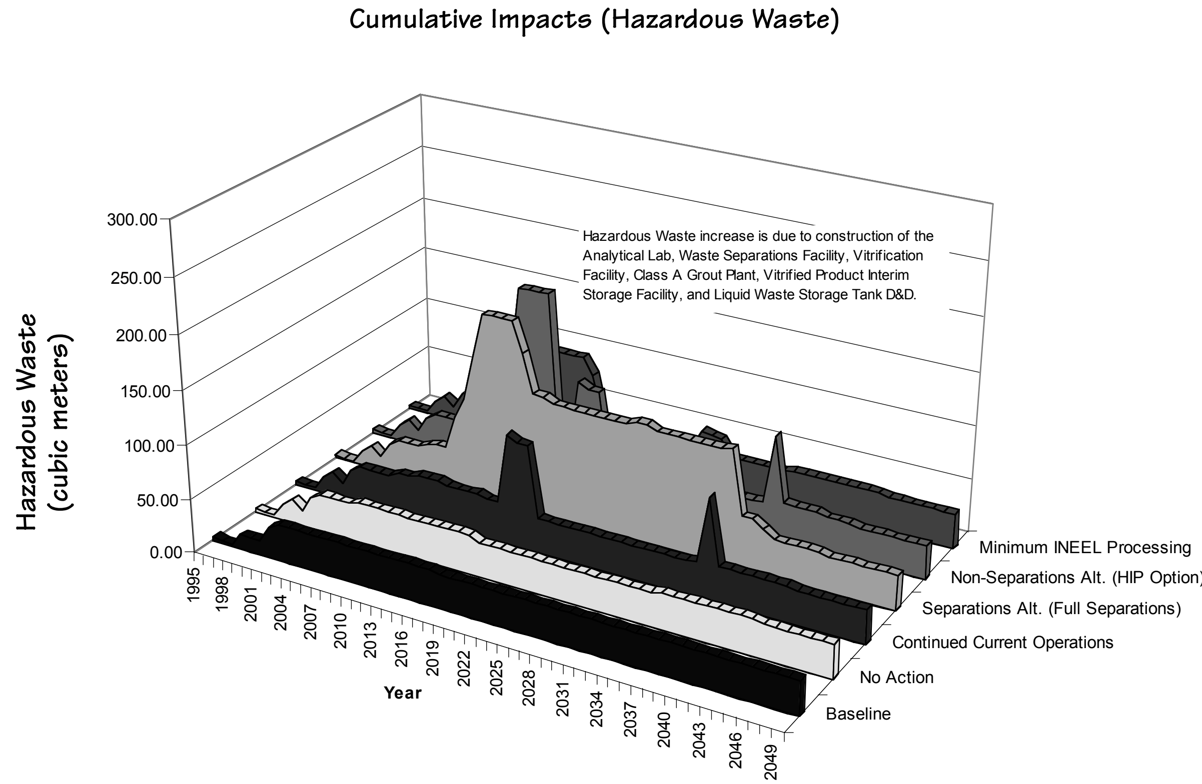

Figure 5.4-3. Cumulative generation of hazardous waste at INEEL, 1995-2050.

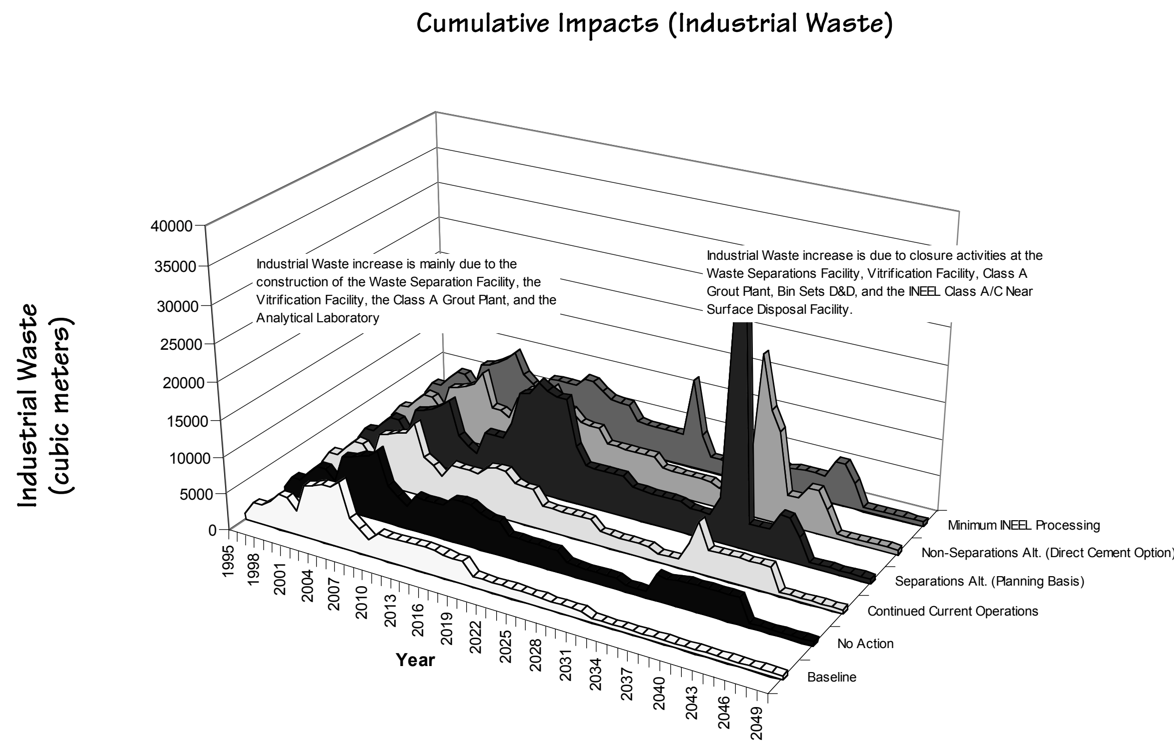

Figure 5.4-4. Cumulative generation of industrial waste at INEEL, 1995-2050.

Section 5.2.13 of this EIS, process waste volumes generated under the waste processing alternatives would be small relative to the volumes generated site-wide and complex-wide. Adding the modest volumes of process wastes likely to be produced by several other reasonably foreseeable projects listed in Table 5.4-2 would not substantially increase the volumes of waste generated at the INEEL and would not strain existing infrastructure or capacity. For example, HLW management activities are expected to generate a total of 9.7×10^3 cubic meters of mixed low-level waste over the 2000-2035 processing period (see Table 5.4-3). The electrometallurgical treatment of sodium-bonded fuel at ANL-W over the 2000-2015 timeframe would contribute another 40 cubic meters of mixed low-level waste to this total (DOE 2000a). Very small amounts of waste are expected to be generated by the irradiation of neptunium-237 targets at ATR and would not contribute to the mixed low-level waste total (DOE 2000b). DOE has plans to manage 1.4×10^5 cubic meters of mixed low-level waste over the next 20 years and is prepared to build additional treatment capacity should it be necessary.

HLW management activities are expected to generate as much as 1.0×10^4 cubic meters of low-level waste over the 2000-2035 processing period. Treatment of sodium-bonded fuel at ANL-W is expected to contribute another 850 cubic meters of low-level waste over a 15-year period, while irradiation of neptunium-237 targets at ATR is expected to produce 1 cubic meter of low-level waste. This compares to an average annual generation rate of 2.9×10^3 cubic meters for the INEEL site as a whole. DOE has plans to generate and safely manage approximately 1.5 million cubic meters of low-level waste over the next 20 years. The quantities of low-level waste that would be produced by the proposed action and other reasonably foreseeable activities are minor compared to the amount that would be produced by other DOE activities (complex-wide) and should have very little impact on the ability of existing DOE disposal facilities to manage this waste.

The waste processing alternatives would result in the generation of as much as 6.0×10^4 cubic meters per year of industrial (nonhazardous and nonradiological) waste during construction and 5.3×10^4 cubic meters per year during operations. The peak annual production of industrial waste (8.5×10^3 cubic meters, during construction) represents a 10 to 18 percent increase in the volumes currently disposed of at the INEEL Landfill Complex (in the Central Facilities Area), which in recent years have ranged between 4.6×10^4 and 8.5×10^4 cubic meters. Little or no additional industrial waste is expected to be generated by the treatment of sodium-bonded fuel at ANL-W or the irradiation of neptunium-237 targets at ATR. Although the volume of industrial waste previously disposed of in the Landfill Complex is unknown, it is estimated that the INEEL Landfill Complex would provide adequate capacity for the next 30 to 50 years, which would accommodate industrial wastes generated over the life of the projects analyzed in this EIS and other reasonably foreseeable projects.

Consistent with the Draft EIS, this discussion emphasizes process wastes, because ultimate disposition of these wastes is largely the responsibility of INEEL, whereas product wastes are generally intended for two national repositories, the Waste Isolation Pilot Plant and the national geologic repository. The potential cumulative impacts of managing product wastes result from the need to provide interim storage and ultimately transport the material to a repository for disposal.

DOE's decision (65 FR 56565; September 19, 2000) to select electrometallurgical treatment at ANL-W as the preferred alternative for treatment and management of INEEL sodium-bonded spent nuclear fuel will produce treated HLW forms in addition to those evaluated in this EIS, with potential cumulative impacts with respect to waste management and transportation. Electrometallurgical treatment of accumulated sodium-bonded fuel at the INEEL would produce approximately 80 cubic meters of high-level (ceramic and metallic) waste, the equivalent of approximately 130 HLW canisters (DOE 2000a). This added volume of treated HLW could require an expansion of interim storage facilities planned under the waste processing alternatives.

Based on the waste processing option and transportation mode selected, the waste processing alternatives would require between 650 and 18,000 truck shipments or between 130 and

3,600 rail shipments to transport treated HLW canisters from INTEC to a national geologic repository. An additional 130 truck shipments or 26 rail shipments would be needed to transport the HLW canisters produced from electrometallurgical treatment of accumulated sodium-bonded fuel at ANL-W.

5.5 Mitigation Measures

As required by the Council on Environmental Quality, ***DOE*** considered mitigation measures that could reduce or offset the potential environmental consequences of waste management activities that are not integral to the alternatives analyzed in this EIS. ***Under any of the alternatives analyzed in this EIS standard management controls, engineering, safety and health practices, cultural and biological surveys and site restoration requirements would be uniformly implemented. No impact resulting from normal operations under any of the alternatives or options analyzed in this EIS would require a specifically designed mitigation measure. If future connected actions have the potential to lead to impacts beyond those described in Chapter 5 of this EIS, mitigation action planning would begin concurrent with consideration of the need for appropriate National Environmental Policy Act documentation.*** Appendix C.8 discusses mitigation measures that could reduce or offset potential impacts at Hanford under the Minimum INEEL Processing Alternative.

5.6 Unavoidable Adverse Environmental Impacts

This section summarizes potential unavoidable adverse environmental impacts associated with the alternatives analyzed in this EIS. Unavoidable impacts are ***those*** that would occur after implementation of all ***standard management controls, engineering, safety and health practices, cultural and biological surveys and site restoration requirements and*** feasible mitigation measures. ***Appendix*** C.8 contains a discussion of potential unavoidable adverse impacts at Hanford associated with the Minimum INEEL Processing Alternative.

5.6.1 CULTURAL RESOURCES

Existing facilities or facilities constructed under the alternatives analyzed in this EIS as well as the institutional controls that would be necessary following facilities disposition could occupy INEC and adjacent areas for an indefinite period of time. Even after remediation, the appearance and presence of institutional controls would likely preclude the INTEC area from ever being returned to its natural cultural setting or to a condition where the effects of industrial activities were not the most evident feature of the landscape.

5.6.2 AESTHETIC AND SCENIC RESOURCES

INTEC is distant from points along U.S. Highways 20 and 26 where the facility is visible to the public. Changes in the specific configuration of facilities within the INTEC ***under the alternatives analyzed in this EIS*** would change the viewscape to some degree, but those changes would ***not*** likely be noticed ***by*** the casual observer.

Emission rates for pollutants under the waste processing alternatives are not expected to exceed levels currently or previously ***emitted*** by INEEL sources; therefore, the "visual impact" of these alternatives is already reflected in existing baseline conditions. Nevertheless, conservative visibility screening analysis has been performed to evaluate the relative potential for visibility impacts between alternatives. The views analyzed were at Craters of the Moon Wilderness Area and Fort Hall Indian Reservation. The results of the visibility analysis indicate that emissions ***under*** the waste processing alternatives ***analyzed in this EIS*** would not result in deleterious impacts on scenic views at Craters of the Moon Wilderness Area or Fort Hall Indian Reservation (including the view to Middle Butte,