3. ALTERNATIVES

For this EIS, the DOE evaluated four alternatives for the Spent Nuclear Fuel Program and the Environmental Restoration and Waste Management Program that represent a broad range of possible actions at the INEL over the next ten years.

These alternatives were developed during the public scoping process. DOE initially proposed the No Action and Ten-Year Plan alternatives. These alternatives were modified, and two other alternatives were added in response to comments received during the scoping process. The intent of these two added alternatives was to provide the extremes of minimum a the INEL during the 1995-to-2005 time period. Thus, these alternatives would bound foreseeable alternatives that would be selected as a result of this EIS. Each alt for remediation, decontamination and decommissioning, waste management, and spent n management. Infrastructure, technology development, and transportation requirement for each alternative.

ALTERNATIVES

A (No Action)

Complete all near-term actions identified and continue operating most existing facilities. Serves as benchmark for comparing potential effects from the other three alternatives.

B (Ten-Year Plan)

Complete identified projects and initiate new projects to enhance cleanup, manage INEL waste streams and spent nuclear fuel, prepare waste for ultimate disposal, and develop technologies for fuel disposition.

C (Minimum Treatment, Storage, and Disposal)

Minimize treatment, storage, and disposal activities at the INEL to the extent possible (including receipt of spent nuclear fuel). Conduct minimum cleanup and decontamination adn decommissioning prescribed by regulation. Transfer spent nuclear fuel and waste from environmental restoration activities to another s

D (Maximum Treatment, Storage, and Disposal)

Maximize treatment, storage, and disposal functions at the INEL to accom waste and spent nuclear fuel from the DOE complex. Conduct maximum cleanup and deco and decommissioning.

Alternative A (No Action) must be considered under the National Environmental serves as a benchmark for comparing potential effects of the other alternatives. I action alternatives are considered in this EIS: Alternative B (Ten-Year Plan), Alt Treatment, Storage, and Disposal), and Alternative D (Maximum Treatment, Storage, a illustrated in Figure 3.0-1, the proposed action alternatives for waste and spent n management decisions involving sources, disposition options, and location

Figure 3.0-1. The basic management decisions for spent nuclear fuel and waste. opt 1, 1995; (b) that generated at the INEL site between 1995 and 2005; and (c) that tr from other sites. The general handling options for spent nuclear fuel or waste wou treatment (processing for spent nuclear fuel), storage, disposition, or stabilizati handling activities would be either on the INEL or off the INEL.

Specific components of the alternatives were identified from a list of potent activities for the next ten years (through 2005), as reported by DOE planning docum managers. Relevant projects for which documentation under the National Environment expected to be complete before June 1, 1995, were considered as part of Alternative potential projects were candidates for inclusion in the various action alternatives alternative actions. Section 3.1 describes the alternatives, and Appendix C, Info Alternatives, gives detailed descriptions of the projects.

The alternatives represent different ways of accomplishing the following at t

a. Implementing reasonably foreseeable DOE-wide programmatic decisions for fuel, environmental restoration, and waste management

b. Continuing existing research and development missions

c. Fulfilling [except for Alternative A (No Action)] DOE and national requu spent nuclear fuel, environmental restoration, and waste management.

The range of alternatives in the EIS was developed to be inclusive, in accord of considering a full range of reasonable alternatives as required by the National and Council on Environmental Quality regulations. The alternatives analyzed in the Action alternative and minimum environmental restoration and waste management activ maximizing environmental restoration and waste management activities at the INEL. bound all reasonably foreseeable alternative actions.

3.1 Description of Alternatives

This section summarizes each of the four alternatives first at a general leve management decisions. Starting with Section 3.1.1, the description is more specifi contrasting how spent nuclear fuel, environmental restoration, and each waste strea waste, hazardous waste, or mixed low-level waste) would be managed under the variou discussion identifies functions, activities, projects, amounts of waste, and techno with each alternative for each waste stream. The proposed projects associated with presented in Table 3.1-1, and their locations are shown on Figure 3.1-1.

Alternative A (No Action)

Under Alternative A (No Action), existing environmental restoration and waste operations, facilities, and projects would continue to be managed. This includes c environmental restoration, waste management, decontamination and decommissioning, r development, and infrastructure facilities and projects that support the Environmen Management Program at the INEL. There would be no shipments of spent nuclear fuel exception of shipments of naval spent nuclear fuel during an approximately three-ye Existing inventories of spent nuclear fuel stored at the INEL would remain. Activi those that may be initiated after June 1, 1995, but that were proposed to have been National Environmental Policy Act regulations by June 1, 1995. New activities woul environmental safety and health activities needed to maintain safe operation. No n be undertaken. Implementation of this alternative would not fully meet all negotia commitments (that is, the Federal Facility Agreement and other consent orders). Th obligations to receive university, Fort St. Vrain, and West Valley Demonstration Pr

Alternative B (Ten-Year Plan)

Under Alternative B (Ten-Year Plan), existing environmental restoration and w facilities and projects would continue to be managed. Besides existing facilities proposed projects for 1995 through 2005 would be implemented. These projects

Table 3.1-1. Projects at the Idaho National Engineering Laboratory associated with alternatives.

Project name	Alternativ
Expended Core Facility Dry Cell Project	B,D
Increased Rack Capacity for CPP-666	B,D
Additional Increased Rack Capacity (CPP-666)	B,D
Dry Fuel Storage Facility; Fuel Receiving Canning/Characterization and Shipping	B, C, Db
Fort St. Vrain Spent Nuclear Fuel Receipt and Storage	B,D
Spent Fuel Processing	D
Experimental Breeder Reactor-II Blanket Treatment	B, D
Electrometallurgical Process Demonstration (formerly known as Actinide Recycle Project)	B, C, D
Central Liquid Waste Processing Facility Decontamination and Decommissioning (D&D)	B, D
Engineering Test Reactor D&D	B, D
Materials Test Reactor D&D	B, D
Fuel Processing Complex (CPP-601) D&D	B, D
Fuel Receipt and Storage Facility (CPP-603) D&D	B, D
Headend Processing Plant (CPP-640) D&D	B, D

Waste Calcine Facility (CPP-633) D&D	B, D
Tank Farm Heel Removal Project	B, C, D
Waste Immobilization Facilityc	B, C, D
High-Level Tank Farm New Tanks	C, D
New Calcine Storage	D
Radioactive Scrap/Waste Facility	B, C, D
Private Sector Alpha-Contaminated Mixed Low-Level Waste Treatment	B, D
Radioactive Waste Management Complex Modifications to Support Private Sector Treatment of Alpha-Contaminated Mixed Low-Level Waste	B, D
Idaho Waste Processing Facility	B, Db
Shipping/Transfer Station	C
Waste Experimental Reduction Facility Incineration	B, D
Mixed/Low-Level Waste Treatment Facility	D
Mixed/Low-Level Waste Disposal Facility	B, Db
	B, Db
Nonincinerable Mixed Waste Treatment	
Remote Mixed Waste Treatment Facility	B, D
Sodium Processing Project	B, D
Greater-Than-Class-C Dedicated Storage	B, D
Hazardous Waste Treatment, Storage, and Disposal Facilities	D
Industrial/Commercial Landfill Expansion	B, C, D
Gravel Pit Expansions	B, Db
Central Facilities Area Clean Laundry and Respirator Facility	B, D
Calcine Transfer Project (Bin Set #1)	B, C, D
Plasma Hearth Process Project	B, D
Test Area North Pool Fuel Transferd	A, B, D
Remediation of Groundwater Contaminationd	A, B, C,
Pit 9 Retrievald	A, B, C,
Vadose Zone Remediationd	A, B, C,
Auxiliary Reactor Area (ARA)-II D&Dd	A, B, C,
Boiling Water Reactor Experiment (BORAX)-V D&Dd	A, B, C,
High-Level Tank Farm Replacement (upgrade phase)d	A, B, C,
Transuranic Storage Area Enclosure and Storage Projectd	A, B, C,
Waste Characterization Facilityd	A, B, C,
Waste Handling Facilityd	A, B, C,
Health Physics Instrument Laboratoryd	A, B, C,
Radiological and Environmental Sciences Laboratory Replacementd	A, B, C,

a. Alternative A (No Action), Alternative B (Ten-Year Plan), Alternative C (Minimu Disposal), Alternative D (Maximum Treatment, Storage, and Disposal).

b. These projects would be expanded for Alternative D (Maximum Treatment, Storage,

c. Sodium-bearing and calcine waste treatment technology selection would be implem

d. These ongoing projects have been included in the environmental analysis represen Statement (EIS). At the time the analysis was performed, National Environmental Po planned to be completed by June 1995.

Figure 3.1-1. The Idaho National Engineering Laboratory location of projects assoc

compliance. Implementation of this alternative would meet negotiated agreements an the Federal Facility Agreement and other consent orders).

Under Alternative B (Ten-Year Plan), spent nuclear fuel and environmental res management activities would be continued and enhanced to meet current and expanded waste handling needs. These enhanced activities would be needed to comply with reg and would result from acceptance of additional offsite-generated materials and wast would increase (reflecting regulatory requirements and increased environmental rest nuclear fuel and selected waste would be received from other sites. Onsite managem greater treatment and disposal capabilities compared with Alternative A (No Action) and decommissioning and decontamination projects would be conducted under this alte Alternative A (No Action). Environmental restoration activities would be conducted Federal Facility Agreement and Consent Order and Action Plan. Also, some spent nuc waste management activities would be directed to the INEL from other DOE sites.

Alternative C (Minimum Treatment, Storage, and Disposal)

To the extent possible, under Alternative C (Minimum Treatment, Storage, and INEL spent nuclear fuel, waste management activities, and materials and waste would locations. Possible locations include DOE facilities, other government sites, or p Minimal treatment, storage, and disposal activities would be located at the INEL si All these elements are consistent with the Alternative C objective of encompassing at the INEL associated with the activities covered by this EIS for the 1995-to-2005

Under Alternative C (Minimum Treatment, Storage, and Disposal), neither waste fuel would be received from other sites for management. Whenever feasible, wastes environmental restoration activities would be minimized by emphasizing institutiona options. Also, many of the spent nuclear fuel and waste management activities curr proposed under Alternative B (Ten-Year Plan) and Alternative D (Maximum Treatment, Disposal) would be transferred to other sites. Existing onsite spent nuclear fuel capability would be expanded to the extent needed to comply with regulations and ag

Alternative D (Maximum Treatment, Storage, and Disposal)

To the extent possible, under Alternative D (Maximum Treatment, Storage, and nuclear fuel and waste would be transferred from other DOE facilities to the INEL s Environmental restoration activities would include the maximum planned decontaminat decommissioning projects and would emphasize residential use as the preferred end l potentially would result in maximum waste generation. Implementing this alternativ for additional projects not yet defined or for the expansion of identified projects identified in Alternative B (Ten-Year Plan). All alternative elements are consist objective of encompassing the upper level of impacts at the INEL associated with th this EIS for the 1995-to-2005 time period.

Under Alternative D (Maximum Treatment, Storage, and Disposal), acceptance of nuclear fuel from other sites would be maximized. Compared with other alternatives environmental restoration and waste management activities potentially would be grea and environmental restoration and waste management activities at the INEL would be enhanced to meet current and expanded spent nuclear fuel and waste handling needs. would be needed to comply with regulations and agreements and to allow for acceptan generated materials and waste. New waste generation would increase to a maximum po regulatory requirements and increased environmental restoration activities). Onsit emphasize greater treatment and disposal capabilities compared with Alternative A (the capabilities required would be greater compared with Alternative B (Ten-Year Pl additional waste (a) accepted from other sites or (b) generated because of proposed processing, environmental restoration, and waste management treatment activities. decommissioning and decontamination projects would be conducted under this alternat Alternative A (No Action).

3.1.1 Alternatives for Management of Spent Nuclear Fuel

SPENT NUCLEAR FUEL

Alternative A:

- Phase out examination of naval spent nuclear fuel after an approximat transition period
- No other spent nuclear fuel would be recieved
- Phase out storage pools at Building 603 at the Idaho Chemical Process

Alternative B:

- Examine and store naval spent nuclear fuel
- Recieve additional offsite spent nuclear fuel
- Complete Expended Core Facility Dry Cell Project
- Trasfer aluminum-clad spent nuclear fuel to the Savannah River Site
- Phase out CPP-603 storage pools
- Expand storage capacity in existing CPP-666 pools
- Phase in dry storage
- Demonstrate electrometallurgical process

Alternative C:

- Phase out examination of naval spent nuclear fuel during approximate three-year transition period. Expended Core Facility would close
- Transport all spent nuclear fuel to one another U.S. Department of Energy (DOE) site

- Phase out spent nuclear fuel handling facilities
- Demonstrate electrometallurgical process

Alternative D:

- Examine and store naval spent nuclear fuel
- Recieve DOE complex-wide spent nuclear fuel
- Phase out CPP-603 storage pools
- Expand storage capacity in existing CPP-666 pools
- Phase in expanded dry storage
- Demonstrate electrometallurgical process
- Phase in spent nuclear fuel stabilization

The goal for the alternatives to manage spent nuclear fuel at the INEL is to pr environmentally responsible interim storage until a suitable geologic repository is alternatives, corrective actions to resolve outstanding spent nuclear fuel manageme and prioritized per the Defense Nuclear Facilities Safety Board Recommendation 94-1 (DOE 1995) would be implemented as appropriate. The Recommendation 94-1 Implementa balanced with other factors such as budgetary constraints and public comments as th management path forward is designed by the DOE in the Record of Decision. The basi existing activities and facilities to manage spent nuclear fuel are

Table 3.1-2. Spent nuclear fuel: Summary of proposed management functions and rel Engineering Laboratory (INEL) by alternative.

Alternative	Transportation	Stabilization
A (No Action)	Naval spent nuclear fuel shipped to INEL site during 3-year transition period No other spent nuclear fuel shipments to INEL site Onsite spent nuclear fuel transfer in existing casks for consolidation	Minimum actions required to s spent nuclear fuel Continue canning/characteriza spent nuclear fuel including from CPP-603
B (Ten-Year Plan)	Additional receipts of non-Department of Energy (DOE) domestic research spent nuclear fuel, plus spent nuclear fuel from Fort St. Vrain, West Valley, and some foreign research reactors Naval spent nuclear fuel from defueling points received plus onsite transfer for interim storage Casks for offsite receipts supplied by others Onsite spent nuclear fuel transfer in existing casks for consolidation	Current INEL spent nuclear fu stabilized as planned Offsite receipts stabilized a (beyond stabilization provide originating site for transpor - Dry Fuel Storage Facility; Receiving, Canning/Characteri Shipping
C (Minimum Treatment, Storage, and Disposal)	Current (1995) INEL spent nuclear fuel inventory shipped offsite to selected DOE site Onsite spent nuclear fuel transfer for stabilization before offsite shipment	Adequate stabilization for sa shipment - Dry Fuel Storage Facility; Receiving, Canning/Characteri Shipping (no storage)

	Naval spent nuclear fuel to INEL site during 3-year transition period Casks for offsite shipments obtained commercially or supplied by others	
D (Maximum Treatment, Storage and Disposal)	Shipment of all spent nuclear fuel in DOE complex to INEL site Naval spent nuclear fuel from defueling points plus onsite transfer for interim storage Casks for offsite receipts supplied by others Onsite spent nuclear fuel transfer in existing casks for consolidation	Current (1995) INEL spent nuc inventory stabilized as plann Offsite receipts stabilized a - Dry Fuel Storage Facility; Receiving, Canning/Characteri Shipping Fuel processing as bounding c - Spent Fuel Processing

illustrated in figures associated with each alternative description, and details ar 3.1-2. The locations of the projects associated with spent nuclear fuel alternativ The activities and facilities are organized by options available for the management spent nuclear fuel. Each alternative emphasizes various options that implement the decisions on sources, handling, and locations discussed earlier (Figure 3.0-1). Ex Action alternative, the combination of technologies, facilities, and projects that each alternative were selected to meet the basic goals of the spent nuclear fuel pr

The spent nuclear fuel alternatives in this volume would implement, at the IN analyzed in Volume 1 of this EIS. Alternative A (No Action) in Volume 2 correspond alternative (Alternative 1) in Volume 1.

Alternative B (Ten-Year Plan) in Volume 2 encompasses the following Volume 1 Decentralization (Alternative 2), 1992/1993 Planning Basis (Alternative 3), and Reg (Alternative 4A). The Volume 1 Regionalization 4A alternative was used to analyze from implementing Alternative B (Ten-Year Plan) of Volume 2. This is

Figure 3.1-2. Spent nuclear fuel: Idaho National Engineering Laboratory locations

because the Regionalization 4A alternative would handle the largest quantities of s the most activities compared with the other two Volume 1 alternatives. Therefore, of the Regionalization 4A alternative would bound the potential consequences of Dec 1992/1993 Planning Basis alternatives, if either were implemented at the INEL.

Alternative C (Minimum Treatment, Storage, and Disposal) of Volume 2 correspo 1 Regionalization 4B alternative (regionalization of spent nuclear fuel is not at t alternative 5A (centralization is not at the INEL). This would result in the trans from the INEL site to the regional or central facility, respectively.

Under Alternative D (Maximum Treatment, Storage, and Disposal) of Volume 2, t would accept the maximum amount of spent nuclear fuel. This alternative would corr Regionalization 4B(1) alternative (INEL is the western regional facility for spent Centralization 5B alternative (INEL is the central facility for spent nuclear fuel) alternatives are similar, except that a slightly lower quantity of spent nuclear fu INEL under the Regionalization 4B(1) alternative.

Alternative A (No Action) in Volume 2 corresponds to the No-Action alternativ EIS. Alternative A (No Action) generally would continue existing operations and ha fuel (Table 3.1-2, Figure 3.1-3). There would be no shipments of spent nuclear fue exception of shipments of naval spent nuclear fuel during an approximately three-ye During that transition period, naval spent nuclear fuel would be examined at the Ex

the Naval Reactors Facility and then transported to the Idaho Chemical Processing P
Expended Core Facility would close after the transition period. Some consolidation
activities would continue. Older storage pools (in Building CPP-603) would be phas
nuclear fuel would be canned, as needed, and stored using dry storage methods.

Under Alternative B (Ten-Year Plan), offsite spent nuclear fuel would be rece
but including Fort St. Vrain, West Valley, and other spent nuclear fuel from some u

Figure 3.1-3. Management of spent nuclear fuel at the Idaho National Engineering L

and foreign research reactors (Figure 3.1-4). Aluminum-clad spent nuclear fuel wou
Savannah River Site. Naval spent nuclear fuel would be examined at the Expended Co
Reactors Facility and then stored at the Idaho Chemical Processing Plant. The Expe
Cell Project would be executed, as described in Appendix C, Information Supporting
Additional storage would be gained by installing additional racks in the storage po
Processing Plant (Building CPP-666). Dry storage would be phased in. Consolidatio
would occur. This alternative would also allow a demonstration of Experimental Bre
Treatment and the Electrometallurgical Process Demonstration at Argonne National La

One important project that would be implemented under both Alternatives B (Te
Alternative D (Maximum Treatment, Storage, and Disposal) is the Increased Rack Capa
pools in Building CPP-666 of the Idaho Chemical Processing Plant. This project wou

Figure 3.1-4. Management of spent nuclear fuel at the Idaho National Engineering L

involve replacing and rearranging (commonly called reracking) existing fuel storage
fuel storage area pools located in the Fluorinel Dissolution Process and Fuel Stora
(Building CPP-666). A second potential project (Additional Increased Rack Capacity
involve reracking existing fuel storage in at least two other pools in CPP-666. Mo
reracking projects are given in Appendix C, Information Supporting the Alternatives

For Alternative B, the implementation in 1997 of the Increased Rack Capacity
described and scheduled in the Project Summaries in Appendix C) would allow CPP-666
projected spent nuclear fuel receipts (Heiselmann 1995) until the Additional Rerack
2001. The implementation would, however, have to be coupled with stringent Fuel St
management and, if necessary, temporary storage of some aluminum clad fuel in stain
further addition of the Additional Increased Rack Capacity Project would allow CPP-
projected spent nuclear fuel receipts (Heiselmann 1995) until the Dry Fuels Storage
line in 2005.

To fully accommodate the projected spent nuclear fuel receipts for Alternativ
schedules may have to be accelerated compared with Alternative B for the Increased
the Additional Increased Rack Capacity Project, and the Expanded Dry Fuels Storage
Appendix C). For example, the Increased Rack Capacity Project may have to begin op
the Additional Increased Rack Capacity Project in late 1998, and the Expanded Dry F
2002. If the Expanded Dry Fuels Storage Project were to come on line even earlier,
could eliminate the need for the Additional Increased Rack Capacity Project. If th
met, then other fuel management strategies would have to be pursued, such as procee
time when reracking would be feasible, expediting the characterizing/canning of CPP
dry fuel storage modules on a temporary basis, delaying incoming shipments where po
existing storage capacities at facilities other than CPP-666.

Under Alternative C (Minimum Treatment, Storage, and Disposal), the current I
fuel inventory would be transported to another DOE site (Figure 3.1-5). Current pr
naval spent nuclear fuel at the Idaho Chemical Processing Plant would continue unti
the INEL site. Wet storage at Building CPP-603 at the Idaho Chemical Processing Pl
out. The Electrometallurgical Process Demonstration project at Argonne National La
proceed. Table 3.1-2 provides additional information on other activities that woul
alternative. Under Alternative C, less spent nuclear fuel would remain at the INEL
would be present by 2035.

Under Alternative D (Maximum Treatment, Storage, and Disposal), the INEL site
virtually all spent nuclear fuel for which DOE is responsible. Therefore, the quan
INEL site would increase from less than 500 metric tons of heavy metal under the ot
1,000 metric tons of heavy metal by the year 2005. Activities required to handle t
include the Expended Core Facility Dry Cell Project, adding
additional storage racks to increase spent nuclear fuel storage in pools at the Ida
(Building CPP-666), and phasing in expanded dry storage (Table 3.1-2). Older

Figure 3.1-5. Management of spent nuclear fuel at the Idaho National Engineering L

storage pools (in Building CPP-603) would be phased out and the spent nuclear fuel
dry storage methods. Consolidation of spent nuclear fuel would occur under this al

demonstration of the Experimental Breeder Reactor-II Blanket Treatment and the Elec Process Demonstration project at Argonne National Laboratory-West would be implemen

Aqueous processing of spent nuclear fuel to stabilize it for disposition woul Alternative D (Maximum Treatment, Storage, and Disposal). This processing would be Spent Fuel Processing project described in Appendix C, Information Supporting the A project would be initiated at the Idaho Chemical Processing Plant. The existing fl aluminum dissolution, and the solvent extraction system would be upgraded and resta partially constructed Fuel Process Restoration Facility would be completed.

The quantities of spent nuclear fuel stored at the INEL in 2005 and 2035 (as reflect the management decisions made for the four alternatives. The year 2035

Figure 3.1-6. Spent nuclear fuel volumes at the Idaho National Engineering Laborat C (Minimum Treatment, Storage, and Disposal), and Alternative D (Maximum Treatment, Disposal).

quantities are consistent with the corresponding Volume 1 alternatives. They resul 1995 quantities already at the INEL site from sources described in Section 2.2.5, S generation by operating reactors at the INEL site (see also Section 2.2.5), and (c)

The 2005 spent nuclear fuel inventory values reported in Figure 3.1-6 are co interpolations between the 1995 basis and the 2035 values. Assumptions that make t conservatively high include the following:

- Under Alternative C (Minimum Treatment, Storage, and Disposal), offsite assumed not to be ready to receive most of the 1995 INEL inventory.

- Under Alternative D (Maximum Treatment, Storage, and Disposal), by 2005 would accept about one-fourth of the DOE complex-wide spent nuclear fue fuel in temporary dry storage.

3.1.2 Alternatives for Environmental Restoration

The environmental restoration alternatives are described separately for remed decontamination and decommissioning. The alternatives for these elements of the En Program follow the basic alternative definitions described in the introduction to S (or noninclusion) of proposed projects and the different end land use preferences a that differentiate the alternatives.

3.1.2.1 Remediation.

The Federal Facility Agreement and Consent Order Action Plan would be followed under each alternative except Alternative A (No Action). In addition, thr authorized before June 1, 1995, under the Comprehensive Environmental Response, Com Liability Act would be completed under all four alternatives (Figure 3.1-7). The p are described in detail in Appendix C, Information Supporting the Alternatives, and in Figure 3.1-8:

- Retrieval and treatment of radioactive and hazardous wastes from Pit 9 Waste Management Complex

- Remediation of groundwater contamination by removing contaminated groun aquifer in the vicinity of an injection well at Test Area North

- Remediation of the unsaturated hydrogeologic (vadose) zone by removing contamination in the area of the Subsurface Disposal Area at the Radioa Management Complex.

Table 3.1-3 identifies the proposed projects and management functions at INEL environmental restoration projects would be carried through all the alternatives. between the projects in each alternative would be in the preferred end land use. A Plan) activities would be conducted to result in industrial land use. For Alternat Storage, and Disposal), environmental restoration would be minimized by emphasizing Alternative D (Maximum Treatment, Storage, and Disposal) would emphasize residentia end land use. New remedial design and remedial actions may be implemented, indepen

determined by the Record of

Figure 3.1-7. Management of remediation activities at the Idaho National Engineeri
Treatment, Storage, and Disposal), and Alternative D (Maximum Treatment, Storage, a

Figure 3.1-8. Environmental restoration: Idaho National Engineering Laboratory lo

Table 3.1-3. Environmental restoration: Summary of proposed management functions (denoted by bullets) at the Idaho National Engineering Laboratory (INEL) by alterna

A (No Action)	B (Ten-Year Plan)	C (Minimum Treatme Storage, and Dis
Conduct no activities other than already approved projects under Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) process	Conduct projects in accordance with FFA/CO and Action Plan	Conduct projects accordance with FFA/CO and Actio Plan
FFA/CO would be violated	Waste generation quantity and increase similar to current quantities planned	Seek minimal was generation
Waste generation would be minimal compared to other alternatives	Reuse and partial dismantlement of D&D projects	Surveillance and maintenance of D projects
D&D Projects - ARA-II - BORAX-V	D&D Projects - ARA-II - BORAX-V - Engineering Test Reactor - Materials Test Reactor - Fuel Processing Complex (CPP-601) - Fuel Receipt and Storage Facility (CPP-603) - Headend Processing Plant (CPP-640) - Waste Calcine Facility (CPP-633) - Central Liquid Waste Processing Facility	D&D Projects - ARA-II - BORAX-V
		Focus on institu controls to the possible for rem projects
Remediation Projects - Remediation of Groundwater Contamination - Pit 9 Retrieval - Vadose Zone Remediation - Ongoing RI/FS.	Remediation Projects - Remediation of Groundwater Contamination - Pit 9 Retrieval - Vadose Zone Remediation - Complete all RI/FS scheduled under FFA/CO, including comprehensive RI/FS for WAGs 1 through 10 - RI/FS-RD/RA for spills, contaminated soil, tanks, sewage lagoons, etc.	Remediation Proj - Remediation of Groundwater Contamination - Pit 9 Retrieva - Vadose Zone Remediation - Complete all R scheduled under FFA/CO, includin comprehensive RI WAGs 1 through 1 - RI/FS-RD/RA fo spills, contamin tanks, sewage la etc.

a. ARA-Auxiliary Reactor Area; BORAX-Boiling Water Reactor Experiment; D&D-Deconta FFA/CO - Federal Facility Agreement and Consent Order; RD/RA-remedial design/remedi feasibility study; SDA - subsurface disposal area, WAGs-Waste Area Groups: 1- Test Chemical Processing Plant (ICPP), 4-Central Facilities Area, 5-Power Burst Facility Reactor -I/Boiling Water Reactor Experiment, 7-Radioactive Waste Management Complex Argonne National Laboratory-West, 10-Snake River Aquifer and other areas.

Decision from the Comprehensive Environmental Response, Compensation, and Liability each remedial investigation and feasibility study completed.

Under Alternative A (No Action), only existing and ongoing remediation activi permitted. These ongoing activities include the three projects described above and investigations and feasibility studies at each waste area group (Table 3.1-3). No and remedial actions would be implemented under this alternative. No end land use

Under Alternative B (Ten-Year Plan), all currently planned and new remedial i feasibility studies would be implemented at each waste area group, leading to a com investigation/feasibility study for all waste area groups. The three ongoing proje addition, new remedial design and remedial actions would be implemented under this action is determined necessary by the Record of Decision determined under the Comp Environmental Response, Compensation, and Liability Act process and the Federal Fac Consent Order for each interim action or remedial investigation and feasibility stu

Under Alternative C (Minimum Treatment, Storage, and Disposal), remediation a the same as identified under Alternative B (Ten-Year Plan). The emphasis of remedi implementation of remedial actions to clean up sites, however, may be less extensiv B. This is because the assumed end land use would be to restrict access and use by controls when allowed under the Record of Decision determined under the Comprehensi Response, Compensation, and Liability Act process and the Federal Facility Agreemen This potentially would result in less waste generated that would be transferred to Program.

Under Alternative D (Maximum Treatment, Storage, and Disposal), remediation a the same as identified under Alternative B (Ten-Year Plan). The emphasis of remedi implementation of remedial actions to clean up sites, however, may be more extensiv B. This is because the assumed end land use would be residential when allowed unde determined under the Comprehensive Environmental Response, Compensation, and Liabil the Federal Facility Agreement and Consent Order. This potentially would result in that would be transferred to the Waste Management Program.

3.1.2.2 Decontamination and Decommissioning.

The decontamination and decommissioning process at the INEL is one of the functions of the Environmental Re where surplus contaminated facilities are either decontaminated and reused or decom of the process are described in Section 2.2.6.2. The projects under each alternati and their locations are shown in Figure 3.1-8.

The alternatives and related decontamination and decommissioning actions cons Alternative A (No Action), continuing with ongoing projects and not beginning any n (Ten-Year Plan), continuing with ongoing projects and, in accordance with the estab completing new ones to a level consistent with overall risk reduction and reuse cap (Minimum Treatment, Storage, and Disposal), providing primarily surveillance and ma decontamination and dismantlement as possible; and Alternative D (Maximum Treatment Disposal), more completely removing the facility when it is not going to be reused

3.1.2.2.1 Alternative A (No Action)-The two ongoing decontamination and

decommissioning projects, Auxiliary Reactor Area-II facilities and the Boiling Wate (BORAX)-V reactor building, would be completed by 1998 and the wastes (low-level, m hazardous, and industrial) generated would be dispositioned to existing waste handl this alternative, the approximate total quantities for all the decontamination and are estimated to be 1,500 cubic meters (2,000 cubic yards) of low-level waste, 4 cu of mixed low-level waste, 5 cubic meters (6.5 cubic yards) of hazardous waste, and cubic yards) of INEL industrial waste. Approximately 3 hectares (7 acres) would be Under Alternative A (No Action), no other facilities would be decontaminated and de

3.1.2.2.2 Alternative B (Ten-Year Plan)-All the facilities currently on the Surplus

Facilities List scheduled for decontamination and decommissioning at the INEL would and decommissioned under this alternative. Besides the two facilities identified u Action), seven other projects would be initiated, as shown on Table 3.1-3 and

Figure 3.1-9. Management of decontamination and decommissioning (D%Figure 3.1-9. Engineering Laboratory under the proposed alternatives: Alternative A (No Action), ((Ten-Year Plan), Alternative C (Minimum Treatment, Storage, and Disposal), and Alt

Treatment, Storage, and Disposal).
Figure 3.1-8. Alternative B (Ten-Year Plan) would emphasize, when possible, reuse of the facility.

Current estimates of wastes generated for each project are given in the appli in Appendix C, Information Supporting the Alternatives. For this alternative, the quantities for all the decontamination and decommissioning projects are estimated t (34,000 cubic yards) of low-level waste, 10 cubic meters (13 cubic yards) of transu meters (79 cubic yards) of mixed low-level waste, 6 cubic meters (8 cubic yards) of 31,000 cubic meters (41,000 cubic yards) of INEL industrial waste. Approximately 7 would be restored for reuse.

3.1.2.2.3 Alternative C (Minimum Treatment, Storage, and

Disposal)-Decontamination and decommissioning activities under Alternative C (Minim Storage, and Disposal) would be similar to those described under Alternative A (No Alternative C (Minimum Treatment, Storage, and Disposal), the use of surveillance a would be preferred over dismantlement if human health and the environment would be The two ongoing projects would continue and the other candidate facilities would be status, that is, with a formal surveillance and maintenance program that would keep the contents safe and secure. Since this alternative would create several potentia surveillance and maintenance program would, if a new mission is not identified for significantly enlarged over the other alternatives.

3.1.2.2.4 Alternative D (Maximum Treatment, Storage, and Disposal)-The

decontamination and decommissioning projects under this alternative would be the sa identified under Alternative B (Ten-Year Plan). Alternative D (Maximum Treatment, would emphasize, when possible, complete dismantlement and restoration of the site. (Maximum Treatment, Storage, and Disposal), the volume of wastes generated would be than under Alternative B (Ten-Year Plan). Most of these increases would be for low industrial waste because the major effect of this activity would be the removal of metal, and concrete that generally are in these categories.

3.1.3 Alternatives for Waste Management

The following discusses the alternatives for waste management activities unde Restoration and Waste Management Program. The same three basic management decision discussed earlier are applicable for all waste streams (Figure 3.0-1 and Table 3.1- and emphasis for each management decision option that differentiates each alternati each waste stream. This is because of the number of waste types that must be manag complicating factors:

- Interrelationship between waste management, spent nuclear fuel manageme environmental restoration. The interrelation for waste volumes present are given in Pole et al. (1993), as modified and supplemented by Heisel (1995), and Morton and Hendrickson (1995). Together these documents pr stream data accurate when the documents were generated. Volume estimat documents include waste generated from spent nuclear fuel and environme activities.

Table 3.1-4. Summary of proposed waste management activities at the Idaho National Laboratory (INEL) by alternative.

A (No Action)	B (Ten-Year Plan)	C (Minimum Trea and Disposal)
Continue managing existing operations and existing waste management, research and development, and infrastructure facilities and projects	Continue managing existing activities Plan, manage, and implement currently proposed projects for 1995 through 2005 to continue to meet the historic INEL role; ensure regulatory compliance;	Manage waste activities by activities an Department of facilities or private secto in minimal tr and disposal

Initiate no new activities with the exception of minor environmental safety and health activities that are necessary for maintaining safe operation	and meet commitments to the State of Idaho May include use of private sector	INEL site Receive a min waste from th purposes of t disposal
Start no new major upgrades or facilities		

- Interrelationships among waste types. Distinctions between waste types Treatment may convert one waste type to another. Facilities may be sha types.

- Technical limitations. For some waste types there is currently no mean one location to another. Disposal criteria have not been confirmed and such as the Waste Isolation Pilot Plant, have not been permitted to acc

- Privatization. Some of the management (treatment, storage, and disposa already being carried out in private/commercial facilities. DOE could commercial treatment, storage, and disposal.

The alternative descriptions for each waste stream identify the specific faci would be required under each alternative to disposition the potential waste quantit allows for a clearer understanding of the differences among alternatives.

The basic steps in managing the wastes involve determining what wastes would management and how and where they would be managed. The sources of wastes would be existing onsite, (b) newly generated onsite on a continuing basis, or (c) transport of waste expected to result from these sources would be estimated. Individual batc characterized by sampling and analyses to confirm the waste type. Characterization determine whether the waste meets, or could potentially meet, the acceptance criter facilities for treatment, storage, or disposal. The decision to treat, store pendi would be made, and the location of these waste management steps would be selected.

3.1.3.1 High-Level Waste.

The management of high-level waste under the four alternatives is illustrated in the flow diagrams associated with the descriptions of the four alter represent various strategies for completing the process, including various function in Table 3.1-5. Under all four alternatives, storage of liquid in underground

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HIGH-LEVEL WASTE

Alternative A:

- Convert liquid to solid calcine

Alternative B:

- Covert liquid to calcine (solid)
- Construct facility to immobolize both liquid and calcine for operati

Alternative C:

- Construct replacement liquid storage tanks
- Develop treatment that minimizes volume of high-activity waste
- Select technology and plan immobilization facility to start operatio

Alternative D:

- Construct replacement liquid storage tanks
- Convert liquid to calcine
- Develop treatment that minimizes volume of high-activity waste
- Select technology and plan immobilization facility to start operation 2015

Table 3.1-5. High-level waste: Summary of proposed management functions and rela Laboratory (INEL) by alternative.

Alternative	Generate	Retrieve	Receive	Characterize	Store
A (No Action)	From low-level waste stream via Process Equipment Waste evaporator	Not applicable	Not applicable	Not applicable	Contin tanks. - High (upgra Contin concre
B (Ten-Year Plan)	From low-level waste stream vi Process Equipment Waste Evaporator Some sodium-bearing waste from decontamina- tion and decommission- ing (D&D) projects at the Idaho Chemical Processing Plant	Demonstrate calcine retrieval from early bin set [see Section 3.1.4 for discussion of Calcine Transfer Project (Bin Set # 1)]	Not applicable	Develop acceptance criteria for disposal in geologic repository	Contin tanks. - High (upgra Prepar - Tank Contin concre Expand Nation - Radi W)
C (Minimum Treatment, Storage, and Disposal)	From low-level waste stream vi Process Equipment Waste Evaporator	Not applicable	Not applicable	Develop acceptance criteria for disposal in geologic repository	Contin tanks. - High (upgra Prepar - Tank Replac - High Contin concre Expand Nation - Radi
D (Maximum Treatment, Storage and Disposal)	From low-level waste stream vi Process Equipment Waste Evaporator Sodium-bearing waste as from D&D as in Alternative B Also potentially from processing spent nuclear fuel	Demonstrate calcine retrieval from early bin set [see Section 3.1.4 for discussion of Calcine Transfer Project (Bin Set # 1)]	Not applicable	Develop acceptance criteria for disposal in geologic repository	Contin tanks. - High (upgra Prepar - Tank Replac - High Contin concre - New Expand Nation - Radi

tanks and of solid (calcine) in near-surface bins would continue and the upgrade pr

piping (identified in Chapter 2) would be completed. The high-level waste volumes, volume reduction effects are documented in Freund (1995). This project and other p implement the alternatives would be located at the Idaho Chemical Processing Plant, of high-level waste storage at Argonne National Laboratory-West (see Figure 3.1-10)

As of 1995, the generation and management activities for high-level waste, as 2, Background, would have resulted in both liquid waste and calcine (see Figure 3.1 of the liquid waste is high-level resulting from previous reprocessing. This waste before January 1, 1998.

Figure 3.1-10. High-level waste: Idaho National Engineering Laboratory locations

Figure 3.1-11. High-level waste volumes at the Idaho National Engineering Laborato Storage, and Disposal), and Alternative D (Maximum Treatment, Storage, and Disposal

3.1.3.1.1 Alternative A (No Action)-Under Alternative A (No Action), liquid waste

from other sources and handled as high-level would continue to be generated (Figure continue to be stored in existing tanks. Periodic operation to convert liquid wast Waste Calcining Facility would continue in three 18-month intervals starting in 199 are authorized under Alternative A (No Action), this alternative would not lead tow the existing liquid storage tanks by 2015 (as required by current agreement).

3.1.3.1.2 Alternative B (Ten-Year Plan)-Under Alternative B (Ten-Year Plan), the

New Waste Calcining Facility would be operated for a total of three years, in two 1 in 1996 (Figure 3.1-13). In the first interval, high-level waste from previous rep (as described in Chapter 2, Background) to meet the January 1, 1998, deadline for c waste. Then, additional sodium-bearing waste would be

Figure 3.1-12. Management of high-level waste at the Idaho National Engineering La

calcined, as also described in Chapter 2. The calcine thus generated (see Figure 3 existing bin storage. When calcining is not in process, the liquid waste evaporato in the New Waste Calcining Facility, would operate intermittently to concentrate th waste.

Design and construction would be started on the Waste Immobilization Facility Appendix C, Information Supporting the Alternatives. This facility, assumed for an ready to operate in 2008, would be capable of treating both the liquid waste (inclu and the calcine into a form (either glass or glass ceramic) that is potentially acc into a geologic repository. Under Alternative B (Ten-Year Plan), the

Figure 3.1-13. Management of high-level waste at the Idaho National Engineering L

Waste Immobilization Facility would involve direct vitrification (with only minimum sodium-bearing liquids and calcined solids.

Without more extensive pretreatment, direct vitrification would produce a com amount of vitrified, disposable, high-activity solid waste [up to 19,000 cubic mete The Waste Immobilization Facility would potentially include enough storage capacity solid until a repository is available.

Operation of the liquid waste evaporator and the New Waste Calcining Facility waste minimization, should allow DOE to meet the Notice of Noncompliance Consent Or cease use of some Tank Farm tanks by 2009. Operation of the Waste Immobilization F begin in 2008 with liquid waste as the feed) should allow DOE to meet the Notice of Order requirement to cease use of the remaining Tank Farm tanks by 2015.

The activities necessary to take these storage tanks out of service include t Project (see Appendix C for details). The remaining few thousand gallons of liquid these tanks by new equipment because the "heel" (remaining liquid) is not removable transfer lines within the tanks.

3.1.3.1.3 Alternative C (Minimum Treatment, Storage, and Disposal)-Under

Alternative C (Minimum Treatment, Storage, and Disposal) (Figure 3.1-14), newly gen comparable to Alternative A (No Action). Activities consistent with the minimum t alternative would be implemented. Thus, the projects and activities would include

liquid waste storage. New tanks would be needed because the New Waste Calcining Fa used to calcine liquid waste or to concentrate sodium-bearing waste. With neither operating, more liquid waste would exist under Alternative C (Minimum Treatment, St in 2005 than under any other proposed alternative. (Even under this alternative, c to meet the court-mandated deadline of having all

Figure 3.1-14. Management of high-level waste at the Idaho National Engineering La
high-level waste calcined before January 1, 1998. Calcining was not, however, incl analysis for this alternative.) Because the existing liquid waste storage tanks wo taken out of service, the Tank Farm Heel Removal Project would proceed under Altern Treatment, Storage, and Disposal).

Design and construction of the Waste Immobilization Facility would be delayed operation was assumed for analysis purposes to begin in 2015 under this alternative Immobilization Facility (described in Appendix C, Information Supporting the Altern separations step for liquid waste before vitrification. Existing calcine would nee additional pretreatment step before the separation step. The separation options fo liquid waste and calcine would include precipitation and radionuclide partitioning. waste could also be separated by freeze crystallization.

Pretreatment would produce a high-activity waste form suitable for placement repository and a low-activity waste form that could be delisted or disposed of in a Recovery Act-approved waste disposal site. The high-activity waste form would be g and the low-activity waste form would be grout, glass, or glass-ceramic. The high- would possibly be only a few percent of that from direct vitrification.

3.1.3.1.4 Alternative D (Maximum Treatment, Storage, and Disposal)-Under

Alternative D (Maximum Treatment, Storage, and Disposal) (Figure 3.1-15), the newly would be greater than any other alternative (because of processing of spent nuclear generation is included in this alternative. The maximum number of projects and act to manage high-level waste between 1995 and 2005 is included. New projects would b store liquid waste, (b) the Tank Farm Heel Removal project, and (c) another bin set

As in Alternative A (No Action), the New Waste Calcining Facility was assumed periodically to the maximum extent permitted between 1995 and 2005 and would produc of new calcine (see Figure 3.1-11). (Even with the full operation of the New Waste calcine storage would not likely to be needed until well after 2005.) As in Altern Treatment, Storage, and Disposal), the design and construction of the Waste Immobil assumed to begin after 2005; and operation, including separation and

Figure 3.1-15. Management of high-level waste at the Idaho National Engineering La
vitrification, was assumed for analysis purposes to begin in 2015. The products of Facility, and corresponding disposition options, would be the same as for Alternati Treatment, Storage, and Disposal).

By including both new liquid storage tanks and continued calcining, Alternati Treatment, Storage, and Disposal) would bound the impact on high-level waste manage decision to process spent nuclear fuel under Alternative D. (See Section 3.1.1 and Processing Project description in Appendix C, Information Supporting the Alternativ

3.1.3.1.5 Summary-Major differences and similarities among the four alternatives for

high-level waste can be summarized as follows:

- Inventories of liquid waste to be treated would be essentially the same (No Action), B (Ten-Year Plan), and C (Minimum Treatment, Storage, and Some small amount of additional sodium-bearing waste would result from and decommissioning projects at the Idaho Chemical Processing Plant und (Ten-Year Plan) and D (Maximum Treatment, Storage, and Disposal). In liquid waste would be generated under Alternative D (Maximum Treatment, Disposal) if spent nuclear fuel were processed before ultimate disposal

- All alternatives except Alternative A (No Action) would lead to phaseou storage tanks, consistent with previous agreements. New tanks would ne Alternatives C (Minimum Treatment, Storage, and Disposal) and D (Maximu Storage, and Disposal) to meet this phase-out schedule.

- Under all alternatives, liquid would continue to be converted to calcin calcining is not analyzed under Alternative C (Minimum Treatment, Stora None of the alternatives, however, would result in the majority of the converted by the year 2005.

- Existing storage capacity for calcine would be sufficient for all alter

- Planning for conversion of both liquid and calcine to a final disposabl ceramic) would proceed under all alternatives except Alternative A (No Alternatives C (Minimum Treatment, Storage, and Disposal) and D (Maximu Storage, and Disposal), the process would be delayed to allow for devel methods that reduce the quantity of high-activity waste to be disposed.

- Alternatives B (Ten-Year Plan), D (Maximum Treatment, Storage, and Disp calcining, C (Minimum Treatment, Storage, and Disposal) would meet the consent orders and of compliance with regulations. Without calcining, (Minimum Treatment, Storage, and Disposal) would fail to meet one manda modified court order but would result in less high-activity waste havin Federal repository than Alternative B (Ten-Year Plan).

3.1.3.1.6 Technology Selection-DOE has identified reasonable technology

alternatives to process sodium-bearing liquid wastes and calcine and is currently e tests to determine the viability of the competing technologies. In the Record of D will select a technology for calcining or processing sodium-bearing liquid waste. Decision for this EIS, DOE will select a technology for converting calcined wastes for disposal.

Decisions on these treatment technologies will be made in conjunction with ef undertaken with the State of Idaho under the Federal Facility Compliance Act. Thes identification of potential treatment technologies for mixed wastes and the develop Plan, which will provide a schedule for the development and implementation of these A discussion of the evaluation and analyses for these treatment technology alternat wastes and calcine is provided in the Project Summary for the Waste Immobilization Appendix C, Information Supporting the Alternatives.

DOE has identified two primary treatment technology alternatives for evaluati and (b) separation, followed by vitrification and grouting. Within the separation options were identified: (a) radionuclide partitioning, (b) precipitation, or (c) f these two primary technology alternatives could be implemented through the Waste Im The emissions, effluents, and final waste forms from processes within the Waste Imm would depend on the treatment technology alternative selected. This EIS provides a the impacts of construction and operation of the Waste Immobilization Facility, inc waste form, for each of the treatment technology alternatives. The analyses perfor Immobilization Facility bound the impacts for each of the treatment technology alte the options within the primary treatment technology alternatives identified. Befor whether to proceed with construction of the Waste Immobilization Facility, further Policy Act review will be conducted, as appropriate.

TRANSURANIC WASTE

Alternative A:

- Accept offsite waste for storage on case-by-case basis
- Retrieve/move transuranic and alpha low-level waste to new storage
- Transport transuranic waste offsite for disposal

Alternative B:

- Accept transuranic waste from offsite for treatment
- Retrieve/move transuranic and alpha low-level waste to new storage
- Treat offsite and onsite transuranic and alpha low-level waste
- Transport transuranic waste offsite for disposal

Alternative C:

- Retrieve/move transuranic and alpha low-level waste to new storage
- Transport transuranic waste offsite for disposal
- Transport waste to offsite DOE facility for storage

Alternative D:
- Accept offsite transuranic waste
- Retrieve/move tansuranic and alpha low-level waste to new storage
- Treat offsite and onsite transuranic and alpha low-level waste
- Transport transuranic waste offsite for disposal
- Dispose of alpha low-level waste at new onsite facility

3.1.3.2 Transuranic Waste.

The management of transuranic waste and alpha low-level waste would involve completing the storage, characterization, treatment, and disposal pro diagrams associated with the descriptions of the alternatives. The four alternativ and described below, represent various strategies leading to such completion. The level waste volumes, treatment rates, and volume reduction effects are documented i and Hendrickson (1995).

For analysis under each of the four alternatives, a bounding case was assumed transport 12,500 cubic meters (16,500 cubic yards) of transuranic waste to the nati period of five years beginning in 1998. Each of the alternatives also calls for ap meters (61,000 cubic yards) of transuranic and alpha low-level waste to be retrieve and placed into new storage modules at the Transuranic Storage

Table 3.1-6. Transuranic waste: Summary of proposed management function and rela Laboratory (INEL) by alternative. ,b,c

Alternative	Generate	Retrieve/Handle	Receive	Characterize
A (No Action)	Generate minimal amount of waste (50 m3	Retrieve up to 10,400 m3/yr TRU and alpha low-leve waste and place in storage - TSA Enclosure and Storage Project	Accept waste on a case-by-case basis	Characterize a representative sample of retrieved waste - Waste Characterization Facility
B (Ten-Year Plan)	Generate small amount of waste from proposed onsite activiti (y300 m3)	Retrieve up to 10,400 m3/yr TRU and alpha low-leve waste and place in storage - TSA Enclosure and Storage Project	Receive y6,000 m3 from Rocky Flats and ANL-E	Characterize a representative sample of retrieved waste - Waste Characterization Facility
C (Minimum Treatment, Storage, and Disposal)	Generate small amount of waste from proposed onsite activiti (y300 m3)	Retrieve up to 10,400 m3/yr TRU and alpha low-level waste and place in storage - TSA Enclosure and Storage Project	No waste received	Characterize a representative sample of retrieved waste - Waste Characterization Facility
D (Maximum Treatment, Storage, and Disposal)	Generate small amount of waste from proposed onsite activiti (y350 m3)	Retrieve up to 10,400 m3/yr TRU and alpha low-leve waste and place in storage - TSA Enclosure an	Receive y20,000 m3 from Rocky Flats, ANL-E, and Los Alamos	Characterize a representative sample of retrieved waste - Waste Characterization

Storage Project	National Laboratory	Facility

a. Source: Morton and Hendrickson (1995)

b. ANL-E = Argonne National Laboratory-East; MLLW =mixed low-level waste; RWMC = Storage Area; WIPP = Waste Isolation Pilot Plant.

c. To convert cubic meters to cubic yards, divide by 0.76455.

Area during the period 1995 through 2000. This retrieval would continue several mo 52,000 cubic meters (68,000 cubic yards) of covered stored transuranic waste is ret 13,000 cubic meters (17,000 cubic yards) of transuranic and alpha low-level waste i Support Buildings would also be moved into new storage in all alternatives. The lo projects for transuranic waste associated with all the alternatives are shown in Fi of transuranic waste onsite in 2005 for all alternatives is shown in Figure 3.1-17.

Figure 3.1-16. Transuranic waste: Idaho National Engineering Laboratory locations

Figure 3.1-17. Transuranic waste volumes at the Idaho National Engineering Laborat

Storage, and Disposal), and Alternative D (Maximum Treatment, Storage, and Disposal D assume that the Idaho Waste Processing Facility is selected as the waste treatmen

3.1.3.2.1 Alternative A (No Action)-Alternative A (No Action) would continue the

current program of transuranic waste management in operation at the INEL (Figure 3. quantities of waste would continue to be generated from onsite operations, environm decontamination and decommissioning activities. Nominal additional volumes of wast from offsite generators, including Argonne National Laboratory-East and Rocky Flats transuranic waste would continue to be received from offsite sources on a case-by-c by the State of Idaho.

Existing transuranic and alpha low-level waste storage facilities on the asph Transuranic Storage Area and in the Air Support Buildings would continue to be used retrieved and placed into new storage modules. The program of examination, certifi for disposal of transuranic waste in a national repository would also continue. Th Examination Pilot Plant for certifying transuranic waste would continue to operate; would be examined, characterized, sorted, reclassified, and repackaged, as necessar Examination Pilot Plant and the new Waste Characterization Facility located at the Management Complex.

Figure 3.1-18. Management of transuranic waste at the Idaho National Engineering L

3.1.3.2.2 Alternative B (Ten-Year Plan)-Alternative B (Ten-Year Plan) would

supplement the current program of transuranic waste management at the INEL describe (No Action) by implementing transuranic and alpha low-level waste treatment project ultimate aim of these projects would be to prepare transuranic waste for disposal i Alpha low-level waste and transuranic waste that could not be certified for disposa in indefinite storage. Waste storage and characterization activities would continu A (No Action).

Under this alternative, approximately 6,000 cubic meters (8,000 cubic yards) would be received from Rocky Flats and Argonne National Laboratory-East.

Under Alternative B (Ten-Year Plan), DOE would add transuranic and alpha low-treatment capabilities before 2005. Technologies for treating transuranic and alph

preferred modes of making the technologies available, whether through the private s or through INEL facilities, would be chosen first. Then new waste treatment facili

Figure 3.1-19. Management of transuranic waste at the Idaho National Engineering L

would be constructed in two phases-the first to treat alpha-contaminated waste and transuranic waste.

If the Private Sector Alpha-Contaminated Mixed Low-Level Waste Treatment Faci approximately 10,000 cubic meters (13,000 cubic yards) of alpha low-level waste wou facility within the ten-year window of this EIS. If the Idaho Waste Processing Fac of transuranic waste and alpha low-level waste would start after 2005. Radioactive Complex modifications would be performed to support shipment if the facility is off volumes of transuranic and alpha low-level waste would be treated at this facility Alpha low-level waste treatment residuals from the treatment facility would be stor

3.1.3.2.3 Alternative C (Minimum Treatment, Storage, and

Disposal)-Alternative C (Minimum Treatment, Storage, and Disposal) would shut down, minimize treatment, storage, and disposal activities at the INEL site (Figure 3.1-2 maximum extent possible, transuranic and alpha low-level waste would be transported management. Under this alternative, no transuranic waste would be received from of management of wastes would be scaled down to the minimum required by regulations. T end all technology development and privatization initiatives for transuranic and al treatment at the INEL site. Selecting this alternative would not, however, end the characterization activities, described under Alternative A (No Action), that are re national transuranic waste repository.

Additional storage facilities would also be required to support the retrieva provide interim storage and staging of waste before shipment.

Figure 3.1-20. Management of transuranic waste at the Idaho National Engineering L

Transporting all the transuranic and alpha low-level waste stored at the INEL expanding transportation and characterization capabilities. The Shipping/Transfer expansion of the Stored Waste Examination Pilot Plant, would be constructed.

3.1.3.2.4 Alternative D (Maximum Treatment, Storage, and

Disposal)-Alternative D (Maximum Treatment, Storage, and Disposal) would increase o of transuranic and alpha low-level waste to accommodate increased waste management facilities in the DOE complex (Figure 3.1-21). Under Alternative D (Maximum Treatm Disposal), 20,000 cubic meters (26,000 cubic yards) of transuranic waste would be a generators. A low-level waste disposal facility for alpha low-level waste would al vicinity of the Radioactive Waste Management Complex so that this waste could be fi

Figure 3.1-21. Management of transuranic waste at the Idaho National Engineering L

Implementing this alternative would require accepting additional volumes of facilities for interim storage and building additional new storage. A maximum of a cubic meters (84,000 cubic yards) of transuranic and alpha low-level waste would be

3.1.3.2.5 Summary-The major differences and similarities among the four alternatives

for transuranic waste can be summarized as follows:

- Retrieval and transfer of transuranic waste would occur under all alter and alpha low-level waste would be retrieved from covered storage and p storage modules. The retrieval would continue until the entire amount storage was retrieved. Waste would also be moved from storage in the A Buildings to new storage.

- Receipt of offsite shipments of transuranic waste would continue under except Alternative C (Minimum Treatment, Storage, and Disposal). Under (Minimum Treatment, Storage, and Disposal), these shipments would be st Alternative A (No Action), these shipments would proceed as approved on basis. Under Alternatives B (Ten-Year Plan) and D (Maximum Treatment, Disposal), volumes of received waste would be increased.

- Under all the alternatives, over a period of five years, 12,500 cubic m yards) of transuranic waste would be transported from the INEL to the r to provide additional capabilities for waste characterization would be alternative.

- Under Alternatives B (Ten-Year Plan) and D (Maximum Treatment, Storage, waste treatment technologies would be developed and a transuranic waste would be constructed to meet current requirements of the U. S. Environm Agency regulations for land disposal of wastes and reasonably foreseeab certification requirements of the Federal repository. Alternative D (M Storage, and Disposal) would provide for final disposal of alpha low-le

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LOW-LEVEL WASTE

Alternative A:

- Treat onsite and offsite
- Dispose onsite in existing facility

Alternative B:

- Treat onsite and offsite
- Construct and operate additional treatment and disposal facilities onsite

Alternative C:

- Transport waste to other Department of Energy facilties for treatment, storage, and disposal

Alternative D:

- Recieve offsite waste
- Treat waste onsite
- Construct and operate additional treatment and disposal facilities o

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3.1.3.3 Low-Level Waste.

As explained in Section 2.2.7.1.3, the overall process for low-level waste management is minimization before and during generation, storage pending avai and disposal, treatment as appropriate, and disposal. The four alternatives, as de depicted in figures associated with the descriptions below, represent various strat generated waste. For analysis purposes, all low-level waste generated before June been treated and disposed. The low-level waste volumes, treatment rates, and volum documented in Section 3 of Morton and Hendrickson (1995). In all the alternatives, Facility would be constructed at Argonne National Laboratory-West to help handle an Figure 3.1-22 depicts the location of this and all new facilities for the handling Appendix C, Information Supporting the Alternatives, provides detailed descriptions

3.1.3.3.1 Alternative A (No Action)-For Alternative A (No Action) (Figure 3.1-23),

the INEL site would handle low-level waste of approximately 46,000 cubic meters (60 generated onsite from continuing activities over the ten years. Activities would b in Chapter 2. In addition to volume reduction by compaction and sizing at the Wast Facility and disposal onsite at the Radioactive Waste Management Complex, low-level incinerated at an existing offsite commercial facility.

Table 3.1-7. Low-level waste: Summary of proposed management functions and relate Laboratory (INEL) by alternative. ,b

Alternative	Generate	Receive	Store
A (No Action)	Generate 46,000 m3 Upgrade waste handling - Waste Handling Facility	No offsite wast received	Store waste pen treatment and d

B (Ten-Year Plan)	Generate 72,000 m3 Upgrade waste handling - Waste Handling Facility	No offsite wast received	Store waste pen treatment and d
C (Minimum Treatment, Storage, and Disposal)	Generate 47,000 m3 Upgrade waste handling - Waste Handling Facility	No offsite wast received	Store waste pen shipment
D (Maximum Treatment, Storage, and Disposal)	Generate 73,000 m3 Upgrade waste handling - Waste Handling Facility	770,000 m3 offsite waste received	Untreated waste pending treatme disposal

a. Source: Morton and Hendrickson (1995).

b. To convert cubic meters to cubic yards, divide by 0.76455.

Figure 3.1-22. Low-level waste: Idaho National Engineering Laboratory locations o

Figure 3.1-23. Management of low-level waste at the Idaho National Engineering Lab

3.1.3.3.2 Alternative B (Ten-Year Plan)-Under Alternative B (Ten-Year Plan)

(Figure 3.1-24), approximately 72,000 cubic meters (94,000 cubic yards) of low-leve generated during the ten years. This waste would be treated onsite at the Waste Ex Facility, using both nonincineration and incineration. Offsite commercial inciner treat all waste in a timely manner, most incinerable low-level waste would be treat facility, but the Waste Experimental Reduction Facility would also incinerate low-l wastes. The Waste Experimental Reduction Facility is a Resource Conservation and R status incineration facility located at the INEL site. The facility and the proces Experiment Reduction Facility project summary in Appendix C, Information Supporting The Idaho Waste Processing Facility, planned as a stand-alone facility near the Rad Management Complex, would be constructed for operation after 2005.

Waste remaining after onsite and offsite treatment would be disposed at the R Management Complex. To facilitate future disposal of low-level waste, a Mixed/Low- Facility would be constructed for operation in 2004. For analysis purposes, this f miles east of the Radioactive Waste Management Complex.

Figure 3.1-24. Management of low-level waste at the Idaho National Engineering Lab

3.1.3.3.3 Alternative C (Minimum Treatment, Storage, and Disposal)-Under

Alternative C (Minimum Treatment, Storage, and Disposal) (Figure 3.1-25), all low-l onsite, approximately 47,000 cubic meters (61,000 cubic yards), during the ten year

another DOE facility for treatment, storage, and disposal. To support transporting waste, a Shipping/Transfer Station, which would be located at the Radioactive Waste would be constructed. The INEL would phase out the use of existing onsite treatmen

3.1.3.3.4 Alternative D (Maximum Treatment, Storage, and Disposal)-Under

Alternative D (Maximum Treatment, Storage, and Disposal) (Figure 3.1-26), approxima meters (95,000 cubic yards) of low-level waste would be generated during ten years. onsite-generated waste, about 770,000 cubic meters (1,000,000 cubic yards) of offsi accepted for treatment and disposal at the INEL. Under this alternative, the volum environmental restoration and decontamination and decommissioning would be signific under Alternative B. Most of these increases would be for low-level waste and INEL because the major effect of these activities would be the removal of structural mat increases due to these activities are not included in the estimates for waste manag All treatment, storage, and disposal would be performed onsite. The Waste Experime capacity would be used to incinerate low-level and mixed low-level wastes. Some lo could be stored pending construction and operation of the Idaho Waste Processing Fa treatment capacity for many of the waste streams eligible for treatment at the Wast Facility would be available after 2005 through the operation of the Mixed/Low-Level Facility. For analysis purposes, the Idaho Waste Processing Facility and the Mixed Treatment Facility were assumed to be located 2.5 miles east of the Radioactive Was Complex.

Low-level waste would be disposed in the Radioactive Waste Management Complex existing and expanded capacity is filled. All additional waste would be stored pen Mixed/Low-Level Waste Disposal Facility. This facility would be put into operation purposes was assumed to be located 2.5 miles east of the Radioactive Waste Manageme

Figure 3.1-25. Management of low-level waste at the Idaho National Engineering Lab

Figure 3.1-26. Management of low-level waste at the Idaho National Engineering Lab

3.1.3.3.5 Summary-As shown in Figure 3.1-27, by the year 2005, all low-level waste

onsite would have been disposed through the activities in all alternatives except A Treatment, Storage, and Disposal). All alternatives plan to handle waste generated (Maximum Treatment, Storage, and Disposal) includes plans for handling of waste rec well as the onsite waste. In Alternative D, significant amounts of waste would rem completion of new treatment and disposal facilities onsite. As soon as these plann operational beyond 2005, they would allow the waste to be handled appropriately. A Plan) and D (Maximum Treatment, Storage, and Disposal) include facilities to treat, waste onsite. Alternative C (Minimum Treatment, Storage, and Disposal) would resul transported offsite for treatment, storage, and disposal.

Figure 3.1-27. Low-level waste volumes at the Idaho National Engineering Laborator Storage, and Disposal), and Alternative D (Maximum Treatment, Storage, and Disposal volumes are after treatment; therefore, the volumes cannot be summed to before trea

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MIXED LOW-LEVEL WASTE

Alternative A:

- Treat onsite (nonincineration)

Alternative B:

- Treat onsite by incineration and nonincineration
- Construct and operate facilities to treat waste by incineration and nonincineration
- Construct and operate disposal facility
- Transport waste offsite for treatment and disposal

Alternative C:

- Transport waste offsite for treatment, storage, and disposal

Alternative D:

- Recieve offsite waste
- Treat onsite by incineration and nonincineration

- Construct and operate new disposal facilities for onsite incineratio and nonincineration treatment
- Construct and operate new disposal faciltiy
- Transport waste offsite for treatment and disposal

3.1.3.4 Mixed Low-Level Waste.

As identified in Section 2.2.7.1.4, the current management of mixed waste is to minimize waste before and during generation, to treat, and to sto facilities onsite pending availability of treatment and disposal. The four alterna 8 and described below, represent various strategies for implementing this process a waste. The four alternatives focus on different management options (Figure 3.0-1), offsite waste, treatment onsite and offsite, and disposal onsite and offsite. The volumes, treatment rates, and volume reduction effects are documented in Section 4 Hendrickson (1995). In all the alternatives, a Waste Handling Facility would be co National Laboratory-West to provide an accumulation area and storage for less than new mixed low-level waste projects are described in Appendix C, Information Support and Figure 3.1-28 shows their locations.

Table 3.1-8. Mixed low-level waste: Summary of proposed management functions and Engineering Laboratory (INEL) by alternative. ,b

Alternative	Generate	Receive	Store	Treat
A (No Action)	Generate waste from environmental restoration, decontamination and decommissioning, and operations (15,400 m3) Improve waste handling - Waste Handling Facility	No offsite waste received	Store non-treated waste pending treatment and treated listed waste pending disposal	Noninc
B (Ten-Year Plan)	Generate waste from environmental restoration, decontamination and decommissioning, and operations (16,200 m3) Improve waste handling - Waste Handling Facility	No offsite waste received	Store treated listed waste pending disposal	Offsit Noninc - Wast Inc - Noni - Plas Techno Treatm - Sodi - Remo Plan f - Idah
C (Minimum Treatment, Storage, and Disposal)	Generate waste from environmental restoration, decontamination and decommissioning, and operations (15,500 m3) Improve waste handling - Waste Handling Facility	No offsite waste received	Store all wast pending shipment off-site	No ons
D (Maximum Treatment, Storage, and Disposal)	Generate waste from expanded environmental restoration, decontamination and decommissioning, and operations (16,200 m3) Improve waste handling - Waste Handling Facility	Receive 149,000 m3 of waste from offsite	Store non-treated waste pending treatment, sto- treated listed waste pending disposal.	Noninc - Wast - Noni - Plas Techno Treatm - Sodi - Remo

Plan f
- Idah
- Mixe

a. Source: Morton and Hendrickson (1995).

b. To convert cubic meters to cubic yards, divide by 0.76455.

Figure 3.1-28. Mixed low-level waste: Idaho National Engineering Laboratory locat

3.1.3.4.1 Alternative A (No Action)-In Alternative A (No Action) (Figure 3.1-29),

existing [1,100 cubic meters (1,440 cubic yards)] and newly generated mixed low-lev meters (20,000 cubic yards)] would continue to be stored in existing onsite facilit Chapter 2, Background, including those on operational standby, would operate. Onsi treatment (stabilization) would be performed at the Waste Experimental Reduction Fa meets the Waste Acceptance Criteria for the Radioactive Waste Management Complex wo This alternative would provide for no change in the current handling of mixed waste

3.1.3.4.2 Alternative B (Ten-Year Plan)-Existing and newly generated waste of

approximately 17,300 cubic meters (22,600 cubic yards) would be stored in existing incineration and nonincineration treatment and offsite treatment, as needed, under Plan) (Figure 3.1-30). Treated waste meeting the Waste Acceptance Criteria for the Management Complex would be disposed onsite. Until disposed, treated and untreated stored in existing facilities onsite. By 2005, all waste would have been treated a

Figure 3.1-29. Management of mixed low-level waste at the Idaho National Engineeri

Figure 3.1-30. Management of mixed low-level waste at the Idaho National Engineeri

To treat and dispose of most of the mixed waste generated from activities ide Alternative B (Ten-Year Plan), the Waste Experimental Reduction Facility Incinerati operate. The Nonincinerable Mixed Waste Treatment project, to be located in the Wa Development Facility, would operate small-scale treatment processes. All mixed was treated starting in 1996 when the Waste Experimental Reduction Facility and the Was Development Facility would be operational. Waste that can be treated and reused (f be returned for commercial or internal laboratory use after treatment. In addition Project and Remote Mixed Waste Treatment Facility, to be located at Argonne Nationa would treat coolant waste from metal-cooled breeder reactors.

All mixed waste that remains after treatment cannot be disposed in the Radioa Management Complex and would be disposed in 2004 when the Mixed/Low-Level Waste Dis would become operational. For analysis purposes, the planned location for the Mixe Disposal Facility is 2.5 miles east of the existing Radioactive Waste Management Co

3.1.3.4.3 Alternative C (Minimum Treatment, Storage, and Disposal)-Existing

and newly generated waste of approximately 16,600 cubic meters (21,700 cubic yards) existing onsite facilities pending shipment to offsite facilities for treatment, st Alternative C (Minimum Treatment, Storage, and Disposal) (Figure 3.1-31). All exis disposal operations would be phased out. To achieve transport of all waste offsite Station would be constructed at the Radioactive Waste Management Complex.

3.1.3.4.4 Alternative D (Maximum Treatment, Storage, and Disposal)-Under

Alternative D (Maximum Treatment, Storage, and Disposal) (Figure 3.1-32), approxima meters (22,600 cubic yards) of existing waste and newly generated waste and approxi meters (195,000 cubic yards) of waste received from offsite would be stored in exis facilities pending onsite treatment and disposal. All activities identified in Cha continue and would be enhanced during a transition to treating, storing, and dispos mixed low-level waste at the INEL site.

Figure 3.1-31. Management of mixed low-level waste at the Idaho National Engineeri

Figure 3.1-32. Management of mixed low-level waste at the Idaho National Engineeri

The ten-year focus for this alternative provides a transition to allow time f constructing facilities. During this transition phase, offsite treatment facilitie generated incinerable waste. Offsite waste would be characterized by the generator to the commercial incinerator for treatment. Onsite waste would be incinerated in Reduction Facility and disposed or stored, as appropriate.

Waste generated both onsite and offsite requiring treatment other than incine macroencapsulation or stabilization) would be handled by the nonincinerable mixed w processes located in the Waste Engineering Development Facility. Sodium coolant wa cooled breeder reactors would be treated with the Sodium Processing Project and the Treatment Facility, to be located at Argonne National Laboratory-West. To minimize offsite commercial treatment, onsite treatment facilities would be planned and cons facilities could be commercially or DOE-operated.

After treatment, all waste would be transported to the Radioactive Waste Mana disposal if appropriate, or storage, pending availability of the Mixed/Low-Level Wa Additional storage might be required before availability of appropriate treatment a storage modules would be procured and constructed as necessary to store mixed low-l compliance with the Resource Conservation and Recovery Act, pending completion of t

3.1.3.4.5 Summary-For mixed low-level waste, Alternatives B (Ten-Year Plan) and D

(Maximum Treatment, Storage, and Disposal) would achieve long-term treatment and di waste. Alternative C (Minimum Treatment, Storage, and Disposal) would provide for transported offsite, negating the requirement for INEL treatment and disposal facil storage, mixed waste would be stored in noncompliance with the Resource Conservatio under Alternative A (No Action). The waste inventory onsite in 2005 for all altern 3.1-33.

Figure 3.1-33. Mixed low-level waste volumes at the Idaho National Engineering Labo Treatment, Storage, and Disposal), and Alternative D (Maximum Treatment, Storage, a of these volumes are after treatment; therefore, the volumes cannot be summed to th volumes.)

GREATER-THAN-CLASS-C LOW-LEVEL WASTE

Alternative A:

- Continue greater-than-Class-C low-level waste management programs

Alternative B:

- Recieve sealed sources for recycle or storage
- Construct dedicated storage facility

Alternative C:

- Discontinue greater-than-Class-C management programs

Alternative D:

- Recieve sealed sources for recycle or storage
- Construct dedicated storage facility

3.1.3.5 Greater-Than-Class-C Low-Level Waste.

The INEL has been assigned responsibility for managing the greater-than-Class-C low-level waste program. The focus of the pr the disposition of the greater-than-Class-C sources. Projections indicate that app sources/devices are held by the U. S. Nuclear Regulatory Commission and Agreement S greater-than-Class-C low-level waste volumes, treatment rates, and volume reduction in Section 5 of Morton and Hendrickson (1995). Under Alternative A (No Action), th Class-C low-level waste management activities would continue.

Under Alternative B (Ten-Year Plan), the INEL would receive greater-than-Clas

before determining the final disposition. The U. S. Nuclear Regulatory Commission acceptance of up to 2,000 sealed sources over a five-year period could be required safety. Nearly all these sealed sources would be received and managed as radioacti recycle and reuse rather than as greater-than-Class-C low-level waste, because of t functionality and value. While the INEL would attempt to recycle these sources to need storage or disposal over the next 30 years. This would be a baseline rate of year. The sources or devices would be unwanted calibration reference sources, inst radiography sources and devices. These sources or devices would typically be recei containing strontium-90, cesium-137, americium/beryllium, and plutonium/beryllium. other greater-than-Class-C low-level waste types may be accepted for storage on an

Under Alternative C (Minimum Treatment, Storage, and Disposal), all greater-t management activities would be transferred to another site. Alternatives B (Ten-Ye (Maximum Treatment, Storage, and Disposal) are identical in their receipt and handl Class-C low-level waste. This waste would be stored in monitored, retrievable cask leaktight, and weather-tight until a disposal facility was developed. The Greater- Low-Level Waste Storage Facility (located at Test Area North, the Test Reactor Area location, as indicated on Figure 3.1-34) would provide for consolidated management greater-than-Class-C low-level-waste at one centralized location under Alternatives (Maximum Treatment, Storage, and Disposal).

Figure 3.1-34. Greater-than-Class-C and hazardous waste: Idaho National Engineeri

HAZARDOUS WASTE

Alternative A:
- Transport waste offsite for treatment, storage, disposal

Alternative B:
- Transport waste offsite for treatment, storage, disposal

Alternative C:
- Transport waste offsite for treatment, storage, disposal

Alternative D:
- Transport waste offsite for treatment, storage, disposal
- Possibly construct onsite treatment, storage and disposal facility

3.1.3.6 Hazardous Waste.

Management practices for hazardous waste at the INEL and throughout the DOE complex rely primarily on the private sector, as shown on Figure from these practices are assumed for any alternative, as shown in Table 3.1-9. Alt to move toward onsite treatment, storage, and disposal. The hazardous waste

Figure 3.1-35. Management of hazardous waste at the Idaho National Engineering Lab

Treatment, Storage, and Disposal), and Alternative D (Maximum Treatment, Storage, a volumes, treatment rates, and volume reduction effects are documented in Section 6 Hendrickson (1995).

Under all alternatives, a new Waste Handling Facility would be placed in serv area for Argonne National Laboratory-West. This facility and the proposed Hazardou Storage, and Disposal Facility are described in Appendix C, Information Supporting 3.1-34 in Section 3.1.3.5 shows their locations.

All alternatives except Alternative D (Maximum Treatment, Storage, and Dispos activities identified in Chapter 2 for handling of hazardous waste generated onsite meters (16,000 cubic yards) would be generated under all alternatives. The majorit generated by the planned environmental restoration activities. Onsite activities and shipment offsite for treatment and disposal of all other hazardous waste for Al B (Ten-Year Plan), and C (Minimum Treatment, Storage, and Disposal). Under Alterna Treatment, Storage, and Disposal), hazardous waste generated at the INEL could be t DOE site, rather than a commercial facility.

Table 3.1-9. Hazardous waste: Summary of proposed management functions and relate Laboratory (INEL) by alternative.

Alternative	Store	Treat
A	Store short-term pending offsite	Treat reactives onsite

(No Action)	shipment Stage Waste - Waste Handling Facility	
B (Ten-Year Plan)	Store short-term pending offsite shipment Stage Waste - Waste Handling Facility	Treat reactives onsite Incineration treatment - Plasma Hearth process (s 3.1.4, Technology Developm
C (Minimum Treatment, Storage, and Disposal)	Store short-term pending offsite shipment Stage Waste - Waste Handling Facility	Treat reactives onsite
D (Maximum Treatment, Stora and Disposal)	Plan future onsite storage - Hazardous Waste Treatment, Storage and Disposal Facility Stage Waste - Waste Handling Facility	Treat reactives onsite Incineration treatment - Plasma Hearth process (s 3.1.4, Technology Developm Move toward 80 percent ons Plan future onsite treatme - Hazardous Waste Treatmen Disposal Facility

Under Alternative D (Maximum Treatment, Storage, and Disposal), current pract continue. DOE has considered consolidating the treatment of all organic hazardous locations, such as the INEL. Organics constitute an estimated 80 percent of all ha the DOE complex. These plans are not, however, sufficiently firm to be included in Treatment, Storage, and Disposal). To implement these plans, a new Hazardous Waste and Disposal Facility would be required. This facility, if constructed, would be o this operational date is shortly after 2005, hazardous waste could be managed diffe stored) under Alternative D (Maximum Treatment, Storage, and Disposal) than under t alternatives.

For all alternatives, all waste would be transported offsite and no inventory would remain onsite in 2005.

3.1.3.7 Infrastructure. The infrastructure that exists at the INEL includes a new transportation complex.

Also, the site-wide sewer system, new electrical system, and new life safety system have been upgraded. For the different alternatives, however, additional infrastructure projects would be needed. The INEL industrial waste volumes, treatment rates, and volume reduction effects are documented in Section 7 of Morton and Hendrickson (1995). Figure 3.1-36 shows the location of the proposed projects. Under all alternatives, previously approved infrastructure projects would be completed.

INFRASTRUCTURE

Alternative A:

- Radiological and Environmental Sciences Laboratory Replacement
- Health Physics Insrument Laboratory

Alternative B:

- Radiological and Environmental Sciences Laboratory Replacement
- Health Physics Instrument Laboratory
- Industrial/Commercial Landfill
- Gravel Pit Expansions
- Cnetral Facilities Area Clean Laundry and Respirator Facility

Alternative C:

- Radiological and Environmental Sciences Laboratory Replacement
- Health Physics Instrument Laboratory
- Industrial/Commercial Landfill

Alternative D:

- Radiological and Environmental Sciences Laboratory Replacement

- Health Physics Instrument Laboratory
- Expanded Industrial/Commercial Landfill
- Larger Gravel Pit Expansion project
- Central Facilities Area Clean Laundry and Respirator Facility

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Figure 3.1-36. Infrastructure: Idaho National Engineering Laboratory locations of

Under Alternative A (No Action), those facilities not scheduled for closure w operated; minor maintenance would be performed to maintain their existing status. T correct outstanding environmental citations that may exist against some aspects of

Under Alternative B (Ten-Year Plan), existing facilities would be upgraded to to comply with the current State and DOE regulations. INEL industrial landfill fac The gravel pits located at several locations around the INEL site would be expanded Respirator Facility, located at the Central Facilities Area, would be evaluated for

Under Alternative C (Minimum Treatment, Storage, and Disposal), a phase-out p those infrastructure activities necessary to support operating reactors, the shipme waste offsite, and continuing high-level waste work) would be developed and impleme project would be a restricted expansion of the INEL industrial landfill to support that are necessary under this alternative.

Under Alternative D (Maximum Treatment, Storage, and Disposal), the planned i projects (landfill and gravel pits) identified for Alternative B (Ten-Year Plan) wo of the laundry in the Central Facilities Area would be evaluated. Construction of infrastructure support facilities could be necessary, primarily at or near the Radi Complex. These facilities would consist of new or upgraded offices and the associa the additional people who would be working with the increased waste management acti

3.1.4 Technology Development

Under Alternative A (No Action), only ongoing research, development, demonstr evaluation activities would be permitted. Tests on waste treatment technologies an sodium-bearing waste treatment technology studies would continue. Other projects w radionuclide sensor development, fissile material detection capability, material co tests, and existing environmental analysis methodology development. Laboratory ana packaging development would also continue. No new technology development initiati and existing technology studies would not be expanded.

Under Alternative B (Ten-Year Plan), existing technology development and priv would continue and additional activities would be implemented. Activities discusse (No Action) would be expanded.

Specific examples of new initiatives include the Calcine Transfer Project Bin Hearth Process project; Figure 3.1-37 shows the location of these projects. The Ca Set #1 would demonstrate methods to retrieve calcine from bin set #1 at the Idaho C The plasma hearth process is a high-temperature thermal treatment process. It uses refractory lined chamber to destroy organics and stabilize the residuals in a nonle waste form. Plasma arc technology is used commercially, primarily to produce high project would adapt this existing technology.

The key elements of the plasma hearth process technology are (a) extremely hi operation that completely destroys organics while stabilizing inorganics; (b) accep

Figure 3.1-37. Technology development: Idaho National Engineering Laboratory loca

range of waste types without pretreatment; (c) treatment of waste without removing generation of separate slag and metallic phases, allowing segregation and possible preference of many radionuclides (especially the actinides) and toxic heavy metals slag phase.

Several alternatives are being considered for the safe management of spent nu from wet or dry canning of the fuel to stabilization by oxidation or vitrification. particular instance depends on the type of fuel and its current condition. DOE has engineering methodology to plan the development of technologies and facility resour effective management of spent nuclear fuel. Systems engineering provides a formal ensure that all factors and necessary interfaces are identified and satisfied, and and constraints and stakeholder values are accommodated in decisions related to the nuclear fuel. In addition to identifying and integrating fuel management requireme engineering process implements a formal method for selecting the best technologies conditioning, packaging, transporting, and storing the spent nuclear fuel.

Under Alternative C (Minimum Treatment, Storage, and Disposal), technology de for high-level and hazardous waste treatment would continue. Technology developmen activities for other wastes and spent nuclear fuel, however, would be phased out. initiatives for transuranic, low-level, and mixed low-level wastes would be discont development activities would be limited. These limited new initiatives would inclu waste generation or to improve the treatment of those wastes and materials treated, INEL site.

Technology development activities proposed under Alternative D (Maximum Treat and Disposal) would be similar to those activities in Alternative B (Ten-Year Plan)

3.2 Alternatives Eliminated from Detailed Analysis

This section describes alternatives that were considered and subsequently eli analysis. On the basis of scientific and engineering judgment, detailed analysis o considered unnecessary.

3.2.1 Relocate All Idaho National Engineering Laboratory Site Activities to Another Site

This alternative was examined to evaluate relocating facilities and activitie specific emphases of the INEL mission.

DOE is considering a full range of reasonable alternatives for managing spent alternatives at the INEL site that would involve the transport, receipt, processing fuel at sites other than the INEL. The relocation of all spent nuclear fuel activi evaluated in Volume 1 of this EIS and is also considered under Alternative C (Minim and Disposal) of Volume 2. However, total relocation of all spent nuclear fuel act accomplished completely at the INEL during the ten-year timeframe analyzed in detai because many of the facilities required to handle INEL spent nuclear fuel would not the ten-year period.

Relocating waste management facilities to another site, however, would requir in storage, from ongoing INEL projects (most of which is industrial waste), and fro restoration to another site. This alternative is not feasible because neither liqu can be transported without further treatment and some transuranic waste would requi before transport. Minimal facilities would be required onsite for transporting oth other programs continue onsite. Alternative C (Minimum Treatment, Storage, and Dis minimum treatment, storage, and disposal facilities and activities. This alternati detailed analysis.

3.2.2 Restore the Idaho National Engineering Laboratory Site

The alternative of restoring the INEL site to pristine conditions was evaluat engineering judgment. This alternative represents an approach requiring intensive decontamination, removal of buildings, and restoration of disturbed areas. Restora special end land uses, such as the following:

- To provide public access to productive land for agriculture, animal hus housing development. Restoring the currently used portion (8 percent) pristine conditions would be impractical due to cost. However, the und percent) of the site would be available for these land uses.

- To extend and preserve a unique or very limited land resource; for exam grasslands of the Northern Great Plains. The areas in use on the INEL a limited or unique land resource in the area.

- To recreate or preserve an aesthetically pleasing landform or landscape portion of the INEL site is small compared with the entire site area an include any unusual aesthetic features.

For whatever cost, this option would not significantly contribute to existin end land uses cited. Only about 8 percent of the 230,000-hectare (890-square-mile) facilities, including highways. The industrial development at the INEL site occupi the total land area of the site. In addition, lava beds that have already been dist pristine conditions. Eliminating existing public highways is not likely to be acce

this alternative has been eliminated from detailed analysis.

3.2.3 No Cleanup or Controls

Leaving the surplused facilities and identified remediation sites without cle controls would not only violate the Federal Facility Agreement and Consent Order an Environmental Response, Compensation, and Liability Act and DOE commitments to the Idaho, but could also pose a threat to the environment and to workers (and possibly site access controls and the presence of contaminated areas of soil and industrial potential for exposure to hazardous materials and for accidents. Thus, this alterna from detailed analysis.

3.3 Comparison of Impacts

This section compares the potential environmental consequences of implementin alternatives described in Section 3.1, Description of Alternatives. Each alternati actions that would support a particular direction for environmental restoration, wa nuclear fuel programs at the INEL over the next ten years. This brief comparison o help decisionmakers and the public understand the potential environmental consequen each of the alternatives at the INEL. In its Record of Decision, DOE may also choo and activities from more than one alternative.

The following discussion is based on the detailed information presented in Ch Consequences. The environmental impact analyses are designed to produce a reasonab upper bound for potential environmental consequences. This requires the use of app assumptions and analytical approaches. Further discussion of the level of conserva uncertainty in these analyses is presented in Chapter 5. Also, Table 3.3-1 summari of each alternative for the various environmental disciplines and lists proposed me eliminate these impacts.

3.3.1 Land Use

In terms of land use (Section 5.2), implementing each of the alternatives wou amounts of acreage-40 acres for Alternative A (No Action), 823 acres for Alternativ approximately 355 acres for Alternative C (Minimum Treatment, Storage, and Disposal 1,339 acres for Alternative D (Maximum Treatment, Storage, and Disposal). Some of previously disturbed by INEL site activities (88 percent for Alternative A, 30 perc percent for Alternative C, and 21 percent for Alternative D). The remaining acreag (Calculations of acreage disturbed by proposed projects are based on individual pro 2, Appendix C.) Regardless of the alternative, the total amount of acreage that wo represent less than one percent of all land within the INEL site boundary.

Proposed activities at the INEL site would be consistent with existing DOE pl operations, environmental restoration, and waste management and would be similar to

Table 3.3-1. Comparison of projected environmental consequences at the Idaho Natio

Discipline	Alternative A (No Action)	Alternative B (Ten-Year Plan)
Land usea	About 40 total acres would be disturbed; 5 acres newly dis- turbed. Consistent with existing DOE plans and policies. No effect on surrounding land uses or local plans. Minimal im- pacts ex- pected. Mitigations: None proposed.	About 823 total acres new- ly disturbed. Co DOE plans and po surrounding land impacts expected Mitigations: Non
Socio- economicsa	Decrease of 1,280 direct and secondary jobs by 2004. Corresponding population decrease of 1,660. No impact on community services or public finance.	Increase of 1,28 2004. Correspon 640. No impact public finance.

	Mitigations: None proposed.	Mitigations: Non posed.
Cultural resourcesa	About 40 acres, 6 structures, no known sites affected by ground disturbance, structural modifications, and so forth. Requires additional survey for cultural and paleontological resources. Impacts due to alteration of setting unlikely. Mitigations: Specific mitigation measures (for example, data recovery, rehabilitation) determined through consultation with State Historic Preservation Office and Native American groups.	Similar to Alter acres, 70 struct Requires additio vey. Mitigations: Sim
Aesthetic and scenic resources	No impacts from new construction or modification of structures. Potential visibility degradation at Craters of the Moon Class I Wilderness Area with air emissions. Mitigations: Potential visual impacts would be further defined and resolved during the permitting process before projects could proceed. Mitigation may include emission control equipment, relocation of projects, or both. Use of standard construction practices to minimize erosion and dust.	Same as Alternat modification of for visibility d Mitigations: Sa controls may be to reduce oxides
Geology	Removal of 158,000 cubic meters of aggregate from onsite gravel and borrow pits. Potentially increased erosion. Consumption of fossil fuels and other earth resources. Mitigations: Possible measures to control localized erosion include minimizing surface disturbance and fugitive dust.	Similar to Alter 392,000 cubic me Mitigations: Sa
Air resources	Radiological emissions similar in type to those currently experienced; impacts well below acceptable levels, and a very small percentage of the natural background dose. Criteria pollutant impacts and toxic pollutant increments within acceptable levels. Localized dust from construction and decontamination and decommissioning activities. Potential visual impacts discussed under aesthetics and scenic resources in this table. Mitigations: Use of controls on radiological emissions sources. Best available control technology required to reduce emissions of nitrogen dioxide and sulfur dioxide. Standard control measures to reduce fugitive dust generation during construction activities.	Impacts similar Alternative A. Mitigations: Sa addition of best control mercury
Water resources	Water use or effluent discharge would	Same as Alternat

	have little effect on the quality or quantity of surface and subsurface waters. Groundwater withdrawal would increase by 106,900 cubic meters over normal annual INEL withdrawal of 7.4 million cubic meters. Mitigations: Implementation of pollution prevention plans and best management practices to reduce future pollution.	with- draw- al would increas meters. Mitigations: Sam
Ecologya	Disturbance to 40 acres of habitat. Direct mortality of some displaced animals. No habitat fragment- ation. Potential establish- ment of non-native species. No or limited effects from increased vehi- cle traffic, lights, noise, human pre- sence, air emissions, etc. Increased potential for train/wildlife collisions. Potential long- term exposure of biota to unrem- ediated wastes. No effects to sensitive or protected species, jurisdictional wetlands, or critical habitats. Mitigations: Preactivity surveys, consultation with U.S. Fish and Wildlife Service, and, if necessary, project modification to ensure no adverse effect on species with special protective status. Identification and, if necessary, avoidance of jurisdictional wetlands. Use of various measures to minimize ground disturbance, reduce animal mortality by vehicles, and minimize exposure and uptake of radionuclides during remediation.	Similar to Alter 823 acres of hab revegetation. P collisions is up 100 percent rail Potential habita exposure of biot levels possible active uptake in decrease after c up. Mitigations: Si
Noise	Noise levels of new projects and activities similar to ex- isting noise levels. No adverse im- pact ex- pected. Mitigations: None proposed.	Same as Alternat Mitigations: No
Traffic and transportation	Incident-free waste (truck): 0.081 latent cancer fatalities. Nonradiological risk of fatality: 0.019. Incident-free spent nuclear fuel (truck): Differs by subalternative and degree of examination: 0.0022 latent cancer fatalities. Nonradiological risk of fatality: 0.059. Offsite accident risk for waste (truck):1 Differs by waste type. Highest risk for low-level waste transport by truck. Accident risk: 0.0028 latent cancer fatalities. Nonradiological risk of fatality: 0.30. Offsite accident risk for spent nuclear fuel (truck): Differs by subalternative. Accident risk: 4.1 x 10-6 latent cancer	Incident-free wa cancer fatalitie fatality: 0.14. Incident-free sp Differs by subal cancer fatalitie fatality: 0.045 Offsite accident Differs by waste level waste tran 0.0029 latent ca risk of fatality Offsite accident (truck): Differs risk: 0.0011 la Nonradiological

	fatalities. Nonradiological risk of fatality: 0.047. Mitigations: Choose truck routes using U.S. Department of Transportation (DOT) guidelines; use of approved shipment containers; abide by DOT requirements; use U.S. Environmental Protection Agency protective action guidelines.	Mitigations: Sam
Health and safety	Estimated excess cancers and other health effects, illnesses and injuries are expected to be less than current levels each year of site operation. Mitigations: Best management practices. Occupational and radiological safety programs.	Same as Alternat Mitigations: Sam
INEL services	Estimated annual increases above current levels: 20,000 megawatt-hours electricity; 106,900 cubic meters water; 3.8 million liters wastewater discharge; 2.5 million liters fossil fuel. No adverse impact expected. Mitigations: Energy and water conservation management practices, materials recycling.	Estimated annual levels: 95,200 m cubic meters wat wastewater disch fuel. Possibly security, and em impact ex- pected. Mitigations: Si
Accidents	Probability of a fuel handling accident: 1 in 100 each year, resulting in a 2.0 y 10-3 rem dose, and a 1.0 y 10-8 risk of fatal cancer to the maximally exposed individual. Probability of a chain reaction accident at the Idaho Chemical Processing Plant: 1 in 1,000 each year, resulting in a 0.001 rem dose, and a 5.0 y 10-10 risk of fatal cancer to the maximally exposed individual. Probability of fire at the Waste Experimental Reduction Facility unit: 1 in 1000 each year, resulting in a 0.0028 rem dose, and a 1.4 y 10-9 risk of fatal cancer to the maximally exposed individual. Risks from accidents are low and well within DOE safety goal. Mitigations: Emergency planning preparedness and response programs.	Probability of a each year, resul and a 4.8 y 10-8 maximally expose fire at the Wast Facility unit: 0.0028 rem dose, cancer to the ma Risks from accid DOE safety goal. Mitigations: Si

a. Numbers for these sections have been rounded. Exact numbers may be found in Se Environmental Impact Statement.

in existing developed areas on the INEL site (see Section 4.2). None of the altern existing land use policies for the INEL site, existing uses of lands bordering the plans.

Minimal impact to land use would be anticipated for any of the alternatives, measures are proposed.

3.3.2 Socioeconomics

In evaluating socioeconomic impacts (Section 5.3), each of the four alternati comparing projected changes in employment, earnings, population, housing, community finance with 1995 baseline conditions. This analysis was based on the expected cha

population that would occur under each alternative. It is projected that after 199 the INEL would decline over the course of the ten-year study period. Therefore, to changes in employment and population from 1995 to 2005, changes caused by each alte combined with the projected baseline changes.

None of the alternatives would result in greater employment and population in by 2005 than in 1995. However, when compared to projected baseline employment decl increases associated with Alternatives B (Ten-Year Plan) and D (Maximum Treatment, Disposal) would partially offset projected baseline employment declines in every ye Conversely, employment decreases associated with Alternatives A (No Action) and C (Storage, and Disposal) would significantly add to projected baseline employment dec All four alternatives would generate initial increases in employment, due primarily

Implementation of Alternative A (No Action) would result in an employment dec approximately 1,280 jobs by 2004, with a corresponding population decrease of appro persons. Implementation of Alternative B (Ten-Year Plan) would result in an employ approximately 1,280 jobs by 2004, with a corresponding population increase of appro Implementation of Alternative C (Minimum Treatment, Storage, and Disposal) would re employment decrease of approximately 830 jobs by 2004, with a corresponding populat approximately 1,470 persons. Implementation of Alternative D (Maximum Treatment, S Disposal) would result in an employment increase of approximately 2,080 jobs by 200 corresponding population increase of approximately 970 persons.

All four alternatives would, when added to the declining employment baseline, employment and population decreases. Alternative A (No Action) would result in cum employment and population of approximately 4,810 and 6,220, respectively. Alternat would result in cumulative decreases in employment and population of approximately respectively. Alternative C (Minimum Treatment, Storage, and Disposal) would resul decreases in employment and population of approximately 4,350 and 6,030, respective (Maximum Treatment, Storage, and Disposal) would result in cumulative decreases in population of approximately 1,450 and 3,590, respectively.

Under all alternatives, estimated employment and population changes would not sufficient to generate discernible impacts to the economic resources of the region. measures would be required.

3.3.3 Cultural Resources

As discussed in Section 5.4, potential direct impacts to cultural resources a caused primarily by ground disturbance from construction activities, vandalism, mod significant structures, or changes in the environmental setting.

Alternative A (No Action) would disturb 40 acres, at least 6 potentially sign known archaeological sites; Alternative B (Ten-Year Plan) would affect 823 acres, 7 known sites; Alternative C (Minimum Treatment, Storage, and Disposal) would affect acres, 11 structures, and no known archaeological sites; and Alternative D (Maximum and Disposal) would disturb approximately 1,339 acres, 70 structures, and 22 known of the land that would be disturbed under the alternatives has undergone intensive resources (Alternative A, 18 percent; Alternative B, 9 percent; Alternative C, 15 p percent). In the unsurveyed areas, undiscovered archaeological, traditional Native paleontological resources may exist and could potentially be adversely impacted. T the alternatives, a cultural resource or paleontological survey would be required.

Except for Alternative D (Maximum Treatment, Storage, and Disposal), none of would be likely to adversely affect the environmental setting of potentially signif

Under the regulations of the National Historic Preservation Act, impacts to s resources that would otherwise be found to be adverse may be reduced by appropriate research or by rehabilitating buildings and structures. The Shoshone-Bannock Tribe during planning and while implementing actions potentially affecting traditional cu

3.3.4 Aesthetic and Scenic Resources

No adverse impacts to aesthetic and scenic resources at the INEL would be exp construction or modification of structures associated with any of the four alternat likely be located within or near existing facility areas and at least 0.5 mile (0.8 highways. In all instances, new facilities would resemble existing facilities and character of the INEL site.

Very conservative modeling has indicated that the potential exists for visual

of the Moon Class I Wilderness Area. Potential visual impacts could be averted by by using combustion control equipment to limit nitrogen dioxide emissions. These i defined and resolved during the permitting process. Standard construction practice minimize erosion and dust.

3.3.5 Geology

Implementing any one of the four alternatives would result in minor, localize resources. The impacts would be caused by excavating and grading at new constructi excavating aggregate material to construct new facilities. Estimates for the requi 158,000 cubic meters for Alternative A (No Action) to 1.8 million cubic meters for Treatment, Storage, and Disposal). A secondary impact to geology would be the pote erosion. Indirect impacts to geologic resources would include the consumption of f other earth resources.

The potential for soil erosion would be mitigated by using construction pract storm runoff and slope stability. No other mitigation measures are proposed.

3.3.6 Air Resources

Estimates of the type and amount of airborne radionuclide emissions (Section from the various alternatives indicate that in all four cases the types of emission would be similar to those emitted by current INEL site operations, but that the qua substantially depending on the waste management option. These releases would occur stacks or vents, although some fugitive emissions could also occur. In all cases, applicable standards and a very small percentage of the natural background dose.

Nonradiological pollutants include criteria pollutants and toxic (hazardous) from stacks, vents, and fugitive sources. For criteria pollutant emissions, the pr concentrations in ambient air at INEL site boundary locations, along public roads, Wilderness Area would be below the State and National Ambient Air Quality Standards Concentrations of toxic air pollutants at offsite and public road locations are pre State of Idaho incremental standards for all alternatives. In all instances, predi toxic air pollutants from the alternatives are below occupational exposure limits e Conference of Governmental Industrial Hygienists and Occupational Safety and Health

The alternatives were evaluated to determine if predicted emissions would exc standards for the potential for ozone formation, Prevention of Significant Deterior consumption, degradation of visibility at Craters of the Moon Wilderness Area, stra depletion, acidic deposition, and global warming. The following conclusions were r

- For all alternatives, emissions of volatile organic compounds would be small effect on ozone formation.

- Prevention of Significant Deterioration regulations state that a propos together with the sum of other major projects in the same impact area, an increase in attainment pollutants above an allowable increment. The increment consumption has been assessed for each alternative and found percent of the allowable increment for 3-hour sulfur dioxide, and lesse averaging times and pollutants. In Class II areas, the maximum increme would be 50 percent of the 24-hour increment for respirable particulate

- Conservative visibility screen analysis indicated that a potential for Craters of the Moon Wilderness Area for all alternatives, due primarily emissions. These impacts would be further defined and resolved during process. Project relocation, emission controls, or both would be requi modeling still predicts visibility impact. Emission controls may, in f regulations, even if visibility degradation criteria are not exceeded.

- While none of the alternatives would involve production or use of ozone substances, each alternative could potentially release certain chemical depletion of the ozone layer, primarily from environmental remediation releases would be extremely small compared with global loadings and can have small effects.

- Emissions of sulfur and nitrogen compounds would not be expected to con significantly to acidity levels in precipitation either in the region o
- Emissions of greenhouse gases (carbon dioxide, methane, nitrous oxides, chlorofluorocarbons) from alternatives would be exceedingly small on a would not have any detectable effect on global warming.

The alternatives would be expected to provide only a small increase in vehicu impacts. Construction of projects associated with each of the proposed alternative result in exceeding the ambient air quality standards for respirable particulate ma particulates at the INEL site boundary, although short-term localized exceedances a could occur.

For Alternatives B (Ten-Year Plan), C (Minimum Treatment, Storage, and Dispos (Maximum Treatment, Storage, and Disposal), air pollutant control equipment, admini changes in raw material feed, or design changes would likely be required on specifi emissions of nitrogen dioxide, sulfur dioxide, and mercury to levels that are consi technology. Similar levels of control would be required in sources of sulfur dioxi under Alternative A (No Action).

3.3.7 Water Resources

Each alternative was evaluated with respect to its potential impacts on water and subsurface water) and water use (Section 5.8). Computer modeling of contaminan unsaturated and saturated zones shows that existing contaminant plumes do not have regional groundwater quality and that no contaminants are presently migrating or li concentrations above U.S. Environmental Protection Agency drinking water standards.

None of the environmental restoration or waste management projects would inte hazardous or radioactive liquid effluents above established standards to subsurface Implementation of pollution prevention plans and best management practices would fu possibility of future pollution. Therefore, no discernible impacts on regional wat for any of the alternatives.

Estimated groundwater withdrawal would increase over the normal annual ground of 7.4 million cubic meters for all alternatives. The increases would range from 1 million gallons) for Alternative A (No Action) to 298,600 cubic meters (79 million (Ten-Year Plan). These increases in usage would be within INEL's consumptive use w cubic meters (11.4 billion gallons) per year. The maximum increase in water usage one additional irrigation pump operating for 8 days a year. No adverse impact on w anticipated.

3.3.8 Ecology

Potential ecological effects for all alternatives would vary in scale, depend locations of proposed activities (Section 5.9). The primary effect would be loss o would be sagebrush-steppe or previously disturbed habitat. Other potential effects mortality caused by land clearing, facility removal, or vehicular traffic; displace in habitat use by animals due to human presence nearby; and exposure to radionuclid contaminants, and wastes. Habitat fragmentation would be a potential impact in all A (No Action).

Federal protected and candidate species and State-sensitive species would pro by implementing any alternative. No critical habitat for protected species has bee site; therefore, no effects would occur. Jurisdictional wetlands and aquatic resou affected under any of the alternatives.

Activities under Alternatives A (No Action), B (Ten-Year Plan), C (Minimum Tr and Disposal), and D (Maximum Treatment, Storage, and Disposal) would result in sim term and long-term ecological impacts, although the size and location of impacted a Potential short-term impacts from the alternatives include loss of plant productivi loss, and the potential establishment of nonnative plants on the acreage that would term net loss of land productivity would result from constructing and operating new landfill, and excavating sand and gravel. For all alternatives except Alternative plants and grasses on disturbed land would lessen the long-term net loss of potenti sites and facilities would lower long-term radionuclide exposure and uptake by plan in the short-term, remediation may increase exposure and uptake by plants and anima

current levels. For Alternatives B, C, and D, potential long-term exposure and upt compared with Alternative A as additional sites and facilities would be remediated.

For all alternatives, preactivity surveys for sensitive and protected species of jurisdictional wetlands, and consultation with appropriate agencies may be requi would be explicitly identified, based on the results of the surveys and consultatio

3.3.9 Noise

As discussed in Section 5.10, noise impacts at INEL for each alternative woul generated during the transportation of personnel and materials to and from the INEL communities. These noises would largely be a function of the size of the workforce the use of buses.

Because the overall operations workforce stationed at the INEL site would be during the ten-year study period for all alternatives (see Section 5.3, Socioeconom resulting from INEL site bus transportation would be expected to decrease slightly.

No adverse noise impacts would be anticipated, and no mitigation measures wou

3.3.10 Traffic and Transportation

The increased traffic and transportation near the INEL caused by activities a the alternatives would be within the capacity of the current road system and would (see Section 5.11).

The risks of health effects from transporting radiological and nonradiologica calculated considering both incident-free conditions and accident scenarios. For o transportation of radioactive waste and spent nuclear fuel, about three latent canc to result from all alternatives for both occupational and general population exposu nonradiological fatality was estimated for all alternatives for members of the publ

The potential impacts from onsite transportation accidents involving spent nu waste were evaluated for the alternatives by assessing bounding accident scenarios. scenarios are extremely unlikely events with likelihoods ranging from once in 26,00 million years. For the bounding onsite spent nuclear fuel transportation accident, population within 80 kilometers (50 miles) would be on the order of one in a millio population zone and about one in 90,000 years for a suburban population zone. For radioactive waste transportation accident, the fatal cancer risk for the population miles) would be on the order of one in 500 million years for a rural population zon million years for a suburban population zone.

The potential impacts from offsite transportation accidents involving spent n radioactive waste were evaluated by calculating the probabilities and consequences unlikely accidents. The resulting estimates of accident risk were used to compare impacts among the alternatives, as shown in Table 3.3-1. For spent nuclear fuel, t transportation accidents would be highest for Alternative C (Minimum Treatment, Sto would be minimized by Alternative A (No Action). For radioactive waste, radiologic transportation accidents would be highest for Alternative B (Ten-Year Plan) and the occur under Alternative C.

In addition to radiological risks associated with the accidental release of r accidents also pose nonradiological risks, such as risk of fatality from the physic accident. As shown in Section 5.11, the risk of fatalities from vehicle impacts wo 10,000 times higher than the risk of fatal cancers from accidental release of radio perspective, the nonradiological risk from transportation accidents would be highes (Maximum Treatment, Storage, and Disposal) and would be minimized by Alternative A

The potential impacts from offsite transportation accidents involving nonradi materials and wastes would be bounded by accidents associated with shipments of bul bounding accident would be a release of nitric acid from a tanker truck and has a l in 2,000 years to once in 200,000 years. The accident would be most likely to occu zone with neutral weather conditions and one person might be exposed to potentially concentrations of nitric acid in the air. The most unlikely accident would occur i under stable weather conditions and could potentially expose over 3,000 persons to concentrations.

The impacts to the regional traffic system around the INEL would be minimal f

Impacts of transportation could be mitigated in a number of ways, including c

routes using U.S. Department of Transportation routing guidelines and using approve

3.3.11 Health and Safety

Under all the alternatives, the activities to be performed by workers and the hazards would be similar to those for current INEL activities. Conservative estima public health and safety were made for all alternatives for both radiological and n Implementing any of the alternatives would result in a small potential for addition population within 80 kilometers (50 miles) of the INEL site due to radiological exp additional fatal cancers would range from about 0.002 for Alternatives A (No Action Treatment, Storage, and Disposal) to about 0.05 for Alternative D (Maximum Treatmen Disposal). Risk of fatal cancer to the maximally exposed worker would range from o (Alternatives A and C) to one in about 400,000 (Alternative D). The risk of fatal exposed offsite individual would range from one in about 1,400,000 (Alternative A) (Alternative D).

Again, using conservative modeling methods and assumptions, exposure to nonra substances would not be expected to result in adverse health effects for onsite wor contributions in Alternative D (Maximum Treatment, Storage, and Disposal) would rep increase (about 0.1 percent) over the baseline. At the INEL site boundary and publ effects from exposure to mercury and hydrochloric acid cannot be completely ruled o (Ten-Year Plan) and D. The lifetime cancer risk from offsite concentrations of car was assessed for offsite individuals at areas predicted to have the highest estimat concentrations. This risk would be approximately one in 500,000 for all alternativ

Work place hazards would be reduced by the occupational and radiological saf regulatory standards currently in place. Collective radiation doses, resulting hea nonradiological health effects would be expected to be less than current levels for the expected decline in total employment at the INEL.

3.3.12 Idaho National Engineering Laboratory Services

The consumption of electrical energy and fossil-based fuels, the withdrawal o discharge of wastewater at the INEL site would be greatest under Alternative D (Max Storage, and Disposal). Under all alternatives, impacts from new facility construc utility usage would be expected to be minor. The expected increases in fossil fuel INEL site supply capability. Increases in INEL fire, security, and emergency servi Alternatives B (Ten-Year Plan) and D (Maximum Treatment, Storage, and Disposal).

The INEL facilities within the City of Idaho Falls would not be expected to e alternatives. Therefore, city services and natural gas supplies would not be impac any of the alternatives.

3.3.13 Facility Accidents

The potential accidents that could occur at INEL facilities during implementa would be expected to be similar to those that have occurred in the past. Additiona as fire, human error, sabotage, and natural phenomena, were identified and analyzed human health and the environment. The maximum reasonably foreseeable accident scen reflect the waste types, hazardous materials, and decontamination and decommissioni to every alternative.

For Alternative A (No Action), limited potential would exist for a fuel handl of occurrence of one in 100 each year). Limited potential exists for calcined wast Chemical Processing Plant (likelihood of occurrence of one in 100,000 each year). produce a one in 100 million risk of fatal cancer per year for a person who receive exposure while standing at the INEL site boundary. Limited potential (likelihood o 1,000 each year) would exist for a fire at the Waste Experimental Reduction Facilit Waste Management Complex. Fires at these facilities could release mixed low-level waste to the environment; however, the risk of fatal cancer would be less than cite

Using the same maximum reasonably foreseeable accident scenarios for Alternat Plan), there would be an increased potential (one in 21 each year) for a fuel handl construction activities and the receipt of additional offsite spent nuclear fuel sh

Alternative A (No Action), the risk of fatal cancer per year for the maximally expo the INEL site boundary would be small (one in 21 million). The risk of fire at the Management Complex or the Waste Experimental Reduction Facility would increase by a Alternative A because of projected waste-handling activities. The risks of fatal c these accidents would be one in 300 million.

For Alternative C (Minimum Treatment, Storage, and Disposal), there would be (likelihood of occurrence of one in 12 per year) for a fuel handling accident due t activities. The chance of a fire at the Waste Experimental Reduction Facility woul the increased handling necessary to package and transport mixed low-level and low-l INEL site. Like Alternatives A (No Action) and B (Ten-Year Plan), the correspondin year would be small for the maximally exposed individual at the site boundary.

The potential for accidents under Alternative D (Maximum Treatment, Storage, be greater than under the other alternatives because of the receipt of additional o relatively long-cooled spent nuclear fuel, and spent nuclear fuel processing for ul additional handling needed to receive and store spent nuclear fuel would be approxi Alternative A (No Action). Although the frequency of potential fuel handling accid under other alternatives, the consequences would not. Likewise, the consequences w the same for an accidental fire involving mixed low-level and low-level waste. The expected to be more than ten-fold greater than under Alternative A due to the recei waste for treatment, storage, and disposal.

For all alternatives, the risk of accidents would be low and well within DOE

3.3.14 Conclusion

The four alternatives present different approaches to organizing environmenta nuclear fuel, and waste management activities at the INEL over the next ten years. some continuity for existing facilities and activities. Implementing each alternat different environmental consequences.

For the various disciplines, these impacts may be major or minor, direct or i beneficial, long-term or short-term. For example, one difference among the alterna of remediation at the INEL site, which would have implications for environmental co the alternatives except Alternative A (No Action), contaminated areas would be clea with agreements outlined in the Federal Facility Agreement and Consent Order. The available for reuse, reducing the potential long-term risks of contamination to hum environment. Implementing Alternative A (No Action), however, would continue the c for land identified as contaminated, as well as violate DOE commitments and applica

Among the four alternatives, Alternative C (Minimum Treatment, Storage, and D perhaps have the fewest overall environmental consequences for the INEL. Because s waste types, except high-level waste, would be transferred to another site, impacts safety, air resources, and water resources would decrease. However, environmental consequently increase at the receiving DOE site(s). Alternative C would also offer using INEL facilities and developing new technologies to address waste-related issu complex.

Alternative D (Maximum Treatment, Storage, and Disposal) would probably have overall potential for environmental consequences. This alternative would also resu commitment of the INEL resources to address waste-related issues throughout the DOE

The alternatives differ in the approximate disturbed acreage within and outsi More land would be disturbed by Alternatives B (Ten-Year Plan) and D (Maximum Treat Disposal) because of waste management and environmental restoration. Immediate con disturbing land, especially outside current facility areas, would include habitat l of individual plants or animals, and temporary exposure of plants and animals to el

Different patterns of moving nonradioactive and radioactive materials in each result in different collective doses to workers and the public during normal (incid More shipments of waste and spent nuclear fuel are planned for Alternative D (Maxim Storage, and Disposal) than for the other alternatives, which would result in corre exposures. Alternative A (No Action) would yield the smallest collective dose, whi Alternatives B (Ten-Year Plan) and C (Minimum Treatment, Storage, and Disposal) wou equal.

3.4 Preferred Alternative

DOE's Preferred Alternative for Volume 2 of this EIS is the most like Alternat

Plan), but includes elements of other alternatives for some waste types.

Under the Preferred Alternative, similar to the activities described under Alt Plan), existing environmental restoration projects and waste management facility op would continue. Besides existing facilities and projects, currently proposed proje for 1995 through 2005 would be implemented. These projects would be implemented to INEL's mission and to help ensure regulatory compliance.

Ongoing spent nuclear fuel management, environmental restoration, and waste man would be continued and enhanced to meet current and expanded spent nuclear fuel and These enhanced activities would comply with regulations and agreements and would de based on Site Treatment Plans, to be negotiated under the Federal Facility Complian Management Programmatic EIS. These activities could result in acceptance of additi materials and waste. Newly generated waste would potentially increase, reflecting as negotiated, and increased environmental restoration activities. Non-aluminum-cl transuranic, and mixed low-level waste would be received from offsite. Aluminum-cl would be transported to the Savannah River Site. Naval spent nuclear fuel would co examined at the Expended Core Facility. Onsite waste management would emphasize tr The transuranic waste and mixed low-level waste received from other DOE sites would residue would be returned to the original (generating) DOE site or transported to a facility, as negotiated under the Federal Facility Compliance Act with the State of Environmental Protection Agency, and with other affected states. Ongoing remediati and decontamination projects would be continued, and additional projects would be c Environmental restoration activities would be conducted in accordance with the Fede and Consent Order and associated Action Plan.

	Preferred Alternative
Spent nuclear fuel	- Examine and store naval spent nuclear fuel
	- Receive additional non-aluminum-clad spent nuclear fu
	- Complete Expended Core Facility Dry Cell Project
	- Phase out pools at Building 603 of the Idaho Chemical
	- Expand storage capacity in pools at Building 666 of t Processing Plant (rerack)
	- Phase in new dry storage
	- Demonstrate electrometallurgical processing
	- Transfer aluminum-clad spent nuclear fuel to Savannah
Environmental restoration	- Conduct all planned projects in all Waste Area Groups
	- Decontaminate and decommission Auxiliary Reactor Area Water Reactor Experiment (BORAX)-V, Engineering Test Test Reactor, Fuel Processing Complex, Fuel Receipt a Headend Processing Plant, Waste Calcine Facility, and Processing Facility
	- Clean up groundwater contamination and vadose zone; r wastes
High-level waste	- Convert liquid to calcine (solid)
	- Develop treatment processes that minimize high-activi
	- Plan a facility to immobilize both liquid and solid c
Transuranic waste	- Accept transuranic waste from offsite for treatment
	- Retrieve/move transuranic and alpha low-level waste t
	- Treat offsite and onsite transuranic and alpha low-le
	- Transport transuranic waste offsite for disposal
	- Return treated offsite waste to the generator or an a
Low-level waste	- Treat onsite and offsite
	- Construct and operate additional treatment and dispos
Mixed low-level waste	- Treat onsite by incineration and nonincineration
	- Construct and operate facilities to treat waste by in
	- Construct and operate disposal facility
	- Transport waste offsite for treatment and disposal
	- Accept offsite mixed low-level waste for treatment
	- Return treated offsite waste to the generator or an a
Greater-than-Class-C low-level waste	- Receive sealed sources for recycle or storage
	- Construct dedicated storage facility (may or may not Engineering Laboratory)
Hazardous waste	- Transport waste offsite for treatment, storage, dispo
Infrastructure	- Radiological and Environmental Sciences Laboratory Re
	- Health Physics Instrument Laboratory

- Industrial/Commercial Landfill
- Gravel Pit Expansions
- Central Facilities Area Clean Laundry and Respirator

Table 3.4-1. Projects at the Idaho National Engineering Laboratory associated w

Expended Core Facility Dry Cell Project
Increased Rack Capacity for CPP-666
Additional Increased Rack Capacity (CPP-666)
Dry Fuel Storage Facility; Fuel Receiving Canning/Characterization and Shipping
Fort St. Vrain Spent Nuclear Fuel Receipt and Storage
Experimental Breeder Reactor-II Blanket Treatment
Electrometallurgical Process Demonstration
Central Liquid Waste Processing Facility Decontamination and Decommissioning (D&D)
Engineering Test Reactor D&D
Materials Test Reactor D&D
Fuel Processing Complex (CPP-601) D&D
Fuel Receipt and Storage Facility (CPP-603) D&D
Headend Processing Plant (CPP-640) D&D
Waste Calcine Facility (CPP-633) D&D
Tank Farm Heel Removal Project
Waste Immobilization Facilityb
Radioactive Scrap/Waste Facility
Private Sector Alpha-Contaminated Mixed Low-Level Waste Treatment
Radioactive Waste Management Complex Modifications to Support Private Sector Treatm
Contaminated Mixed Low-Level Waste
Idaho Waste Processing Facility
Waste Experimental Reduction Facility Incineration
Mixed/Low-Level Waste Disposal Facility
Nonincinerable Mixed Waste Treatment
Remote Mixed Waste Treatment Facility
Sodium Processing Project
Greater-Than-Class-C Dedicated Storage
Industrial/Commercial Landfill Expansion
Gravel Pit Expansions
Central Facilities Area Clean Laundry and Respirator Facility
Calcine Transfer Project (Bin Set #1)
Plasma Hearth Process Project
Test Area North Pool Fuel Transferc
Remediation of Groundwater Contaminationc
Pit 9 Retrievalc
Vadose Zone Remediationc
Auxiliary Reactor Area (ARA)-II D&Dc
Boiling Water Reactor Experiment (BORAX)-V D&Dc
High-Level Tank Farm Replacement (upgrade phase)c
Transuranic Storage Area Enclosure and Storage Projectc
Waste Characterization Facilityc
Waste Handling Facilityc
Health Physics Instrument Laboratoryc
Radiological and Environmental Sciences Laboratory Replacementc

a. The Department of Energy would conduct appropriate further National Environmenta some projects.
b. Sodium-bearing and calcine waste treatment technology selection would be implem
c. These ongoing projects have been included in the environmental analysis represe National Environmental Policy Act documentation had been or was planned to be compl

3.4.1 Preferred Alternative Decision Process

DOE's decision process was designed to objectively identify and evaluate a Pref indicated in Section 3.3, the environmental impacts for Alternatives A (No Action), B (Ten-Year Plan), C (Minimum Treatment, Storage, and Disposal), and D (Maximum Tre and Disposal) were all very small. Thus, the identification process considered sev environmental impacts, including regulatory compliance, DOE programmatic missions, national security and defense, cost, practicality of treatment implementation, and

considered in the decision process included public comments regarding air, water, l transportation.

In developing the decision criteria, regulatory compliance was of overriding im to regulatory compliance, each alternative was rated on its ability to meet selecte Performance criteria used included (a) public issues and concerns, (b) cost, (c) DO with INEL mission, and (d) practicality of implementing treatment, storage, and dis quantitative factors were used to make objective comparisons among the alternatives criterion. The final identification of the Preferred Alternative was based on the alternative's ability to satisfy the performance criteria.

3.4.2 Conclusions

The process resulted in the identification of a Preferred Alternative that is v Alternative B (Ten-Year Plan). The modifications to Alternative B (Ten-Year Plan) Alternative would be actions that would enhance DOE's ability to comply with applic and obligations, enhance the regulatory compliance posture of the INEL, and enhance capability.

DOE's Preferred Alternative is consistent with the Navy's Preferred Alternative nuclear fuel management identified in the draft EIS-to continue refueling and defue vessels and prototypes, and to transport naval spent nuclear fuel to the Idaho Nati Laboratory for full examination and interim storage, using the same practices as in of the DOE alternatives for spent nuclear fuel management, see Volume 1 of this EIS

Projects proposed within the Preferred Alternative are listed in Table 3.4-1 a detail in Appendix C (Information Supporting the Alternatives). Specifics on how t used to complete the goals of the major waste programs, spent nuclear fuel manageme restoration are described in the following sections and accompanying tables.

3.4.3 Spent Nuclear Fuel Management

For spent nuclear fuel management, the Preferred Alternative would be the same (Ten-Year Plan). As shown in Table 3.4-2, specific types of offsite spent nuclear including naval, Fort St. Vrain, West Valley, and other special-case commercial rea non-aluminum-clad spent nuclear fuel from university and foreign research reactors. nuclear fuel currently stored at the INEL would be shipped to the Savannah River Si spent nuclear fuel would be examined at the Expended Core Facility at the Naval Rea stored at the Idaho Chemical Processing Plant. The Expended Core Facility Dry Cell implemented. Additional storage would be gained by implementing projects for insta the storage pools at the Idaho Chemical Processing Plant Building 666. Wet storage be completely phased out. A new dry storage facility would be constructed and phas would be consolidated onsite at CPP-666. At Argonne National Laboratory-West, the Reactor-II Blanket Treatment project and demonstration of the electrometallurgical

3.4.4 Environmental Restoration

3.4.4.1 Remediation.

For environmental remediation, the Preferred Alternative would be the same as Alternative B (Ten-Year Plan). Environmental remediation activities would with the negotiated agreements and in accordance with the Comprehensive Environment Compensation, and Liability Act process and the Federal Facility Agreement and Cons currently planned interim actions and new remedial investigations and feasibility s implemented at each waste area group, leading to a comprehensive remedial investiga for all waste area groups. Remedial actions would be implemented under this altern necessary by the Record of Decision determined under the Comprehensive

Table 3.4-2. Preferred Alternative: Summary of proposed spent nuclear fuel manage Idaho National Engineering Laboratory (INEL).

Generation	Transportation	Stabilization/Treatment	Storage

Limited onsite generation from INEL test reactors	Additional receipts of non-aluminum-clad spent nuclear fuel from Fort St. Vrain, West Valley and other special-case commercial reactors, as well as some university and foreign research reactors Naval spent nuclear fuel from defueling points plus onsite transfer for interim storage Casks for offsite receipts supplied by others Onsite spent nuclear fuel transfer in existing casks for consolidation Shipment of aluminum-clad spent nuclear fuel to the Savannah River Site	Current INEL spent nuclear fuel inventory stabilized as needed Offsite receipts stabilized as needed - Dry Fuel Storage Facility; Fuel Receiving, Canning/ Characterization, and Shipping	Onsite con plus upgra expansion accommodat receipts - Test Are Fuel Trans - Increase Capacity f - Addition Rack Capac 666) - Fort St. Nuclear Fu and Storag Phase out storage fa CPP-603 we Phase in d - Dry Fuel Facility; Canning/ Characteri Shipping

Environmental Response, Compensation, and Liability Act process and the Federal Fac Consent Order.

3.4.4.2 Decontamination and Decommissioning.

For decontamination and decommissioning, the Preferred Alternative would be the same as Alternative B (Ten- Preferred Alternative, decontamination and decommissioning would be initiated for t identified in Table 3.4-3. Ongoing projects would be completed in accordance with established priorities, and the proposed actions would be completed to a level cons reduction and reuse capabilities. When possible, actions would emphasize possible dismantlement of facilities.

3.4.5 Waste Management

The activities and facilities proposed for managing waste (high level, transura and hazardous) under the Preferred Alternative are summarized in the following sect tables.

Table 3.4-3. Preferred Alternative: Summary of environmental restoration manageme related projects (denoted by bullets) at the Idaho National Engineering Laboratory

Activities	Decontamination and Decommissioning (D&D) Projects	
Conduct projects in accordance with Federal Facility Agreement and ConsentOrder (FFA/CO) Action Plan	- Auxiliary Reactor Area-II	
	- Boiling Water Reactor Experiment-V	
	- Engineering Test Reactor	-
	- Materials Test Reactor	-
Waste generation quantity and	- Fuel Processing Complex (CPP-601)	-

increase similar to current quantities planned	- Fuel Receipt/Storage Facility (CPP-603)	
Reuse and partial dismantle-ment of D&D projects	- Headend Processing Plant (CPP-640) - Waste Calcine Facility (CPP-633) - Central Liquid Waste Processing Facility	-

a. Waste Area Groups: 1-Test Area North, 2-Test Reactor Area, 3-Idaho Chemical Pr
Power Burst Facility/Auxiliary Reactor Area, 6-Experimental Breeder Reactor-I/Boili
Management Complex, 8-Naval Reactors Facility, 9-Argonne National Laboratory-West,

3.4.5.1 High-Level Waste.

The following discusses the management activities and technology decisions associated with high-level waste.

3.4.5.1.1 Management Activities -For high-level waste management, the Preferred

Alternative differs from Alternative B (Ten-Year Plan), as summarized in Table 3.4-
to 2005 under the Preferred Alternative, operation of the New Waste Calcining Facil
that high-level waste from previous reprocessing would be calcined before January 1
existing liquid waste storage tanks would be taken out of service during this time
Removal Project would proceed. The upgrade of an existing facility at Argonne Nati
for interim high-level waste storage would be achieved.

Planning for the conversion of both liquid and calcine to a final disposable so
would involve a waste immobilization facility that includes separation technology t
volume of high-activity waste. DOE would conduct appropriate further National Envi
review before making decisions on the design, construction, and operation of a wast
Development of this facility would be negotiated in conjunction with efforts curren
the State of Idaho under the Federal Facility Compliance Act. These efforts includ
Treatment Plan, which would provide a schedule for the development and implementati
technologies. The High-Level Tank Farm New Tanks Project would not be implemented
Alternative.

3.4.5.1.2 Technology Selection -A waste immobilization facility would include a

separations step for liquid waste before vitrification. Existing calcine would be
step before separation. The separation options for both sodium-bearing liquid wast
precipitation, radionuclide partitioning, and freeze crystallization. Separation w
reduced high-level waste volume.

Treatment would produce a high-activity waste form suitable for placement in a
and a low-activity waste form that could be delisted or disposed of in a waste disp
Resource Conservation and Recovery Act. The high-activity waste form would be glas
the low-activity waste form would be grout, glass, or glass-ceramic.

Table 3.4-4. Preferred Alternative: Summary of proposed high-level waste managem
at the Idaho National Engineering Laboratory (INEL).

Generate	Retrieve	Receive	Characterize	Store	Tre
From high-level waste calcining system flushes/ cleanups via high-level waste evaporator and Process Equipment Waste Evaporator	Demonstrate calcine retrieval from early bin - Calcine Transfer Project (Bin set #1)	No offsite waste received	Develop acceptance criteria for disposal in geologic repository	Interim storage of liquid in underground tanks pending treatment - High-Level Tank Farm Replacement (upgrade phase) Prepare existing	Cont liqu (sol Plan immo faci conv and or c

Waste from decontamination and decommissioning projects at the Idaho Chemical Processing Plant	tanks to phase out use - Tank Farm Heel Removal Project Continue storing solids in existing bins in concrete vaults Expand high-level waste storage at Argonne National Laboratory-West - Radioactive Scrap/Waste Facility	ulti Immo tech incl of h acti - Wa Immo Faci

3.4.5.2 Transuranic Waste.

For transuranic waste, the Preferred Alternative as described in

Table 3.4-5 differs from Alternative B (Ten-Year Plan) in that it allows the INEL t from offsite for treatment (possibly 20,000 cubic meters instead of 6,000 cubic met Additional waste would be received depending on decisions based on the Site Treatme under the Federal Facility Compliance Act and the Waste Management Programmatic EIS the transuranic waste is mixed waste and may require treatment before disposal, it requirements of the Federal Facility Compliance Act. The Site Treatment Plans deve Facility Compliance Act may require that some types of waste be shipped from one si advantage of existing or future regionalized capability. The Preferred Alternative construction of the treatment facilities necessary to comply with the Federal Facil Transuranic waste could be transported to the Waste Isolation Pilot Plant if the wa met.

Projects for retrieving, characterizing, and treating INEL transuranic waste w These projects would prepare the waste for disposal in a national repository or for that can meet the onsite performance assessment). In addition to projects identifi Storage Area Enclosure and Storage project and the Waste Characterization Facility) Processing Facility or the Private Sector Alpha-Contaminated Mixed Low-Level Waste could be constructed (an alternate could be the use of Pit 9 facilities for treatin treatment of INEL waste and depending on the Site Treatment Plan negotiated under t Compliance Act and the decision associated with the Waste Management Programmatic E cubic meters (26,000 cubic yards) of waste would be received from the DOE complex a became available. After treatment, the waste residuals would be returned to the ge approved offsite disposal facility. INEL waste that meets the Waste Acceptance Cri Isolation Pilot Plant would be transported for disposal.

3.4.5.3 Low-Level Waste.

For low-level waste, the Preferred Alternative is the same as Alternative B (Ten-Year Plan). This alternative best meets the mission requirement for onsite disposal and treatment, but does not make INEL a disposal site for large INEL-generated low-level waste would be treated onsite and offsite and disposed ons Waste Management Complex and the Mixed Low-Level Waste Disposal

Table 3.4-5. Preferred Alternative: Summary of proposed transuranic waste (TRU) m at the Idaho National Engineering Laboratory (INEL). ,b

Generate	Retrieve	Receive	Characterize	S
Generate small amount of waste from proposed onsite	Retrieve up to 10,400 m3 per year TRU and alpha-low-level waste from Transuranic	Depending on the decisions based on the Site Treatment Plan negotiated under the Federal	Characterize a representative sample of retrieved waste -Waste Characterization	Store retrie newly waste after pendin

activities (350 m3)	Storage Area (TSA), Air Support Building and Environmental Remediation activities, and place in storage -TSA Enclosure and Storage Project	Facility Compliance Act and the Waste Management Programmatic EIS, recieve up to 20,000 m3 of waste from the Department of Energy (DOE) Complex	Facility	ablili dispos -TSA E and St Projec

a. All waste quantities are totals for the 1995 to 2005 period unless otherwise sp
b. To convert cubic meters to cubic yards, divide by 0.765.

Facility, as indicated in Table 3.4-6 . Low-level waste that is most suitable for at the Waste Experimental Reduction Facility or at an offsite commercial facility.

3.4.5.4 Mixed Low-level Waste.

For mixed low-level waste, the Preferred Alternative differs from Alternative B (Ten-Year Plan), as described in Table 3.4-7, to allow offsite w treatment at the INEL. The modification would allow the movement of waste to compl Treatment Plans negotiated under the Federal Facility Compliance Act and decisions Management Programmatic EIS. Mixed waste management activities would include onsit treatment of mixed waste. To achieve these activities, the Waste Experimental Redu would operate, and the Nonincinerable Mixed Waste Treatment Project would be comple Mixed/Low-level Waste Disposal Facility would be constructed for onsite disposal of low-level and mixed low-level waste.

To support treatment of onsite and offsite generated waste, the Idaho Waste Pro the Private Sector Alpha-Contaminated Mixed Low-Level Waste Treatment Facility woul to treat mixed low-level waste (an alternate could be the use of Pit 9 facilities f analysis purposes, this capacity has been assumed to be similar to the mixed waste Mixed/Low-level Waste Treatment Facility.) Offsite waste would be accepted as trea available. Small quantities of untreated offsite waste could be accepted for stora facility permit limitations. Treated offsite waste would be returned to the genera appropriate offsite disposal facility.

3.4.5.5 Greater-Than-Class C Low-Level Waste.

For greater-than-Class C low-level waste, the Preferred Alternative differs from Alternative B (Ten-Year Plan) as follows. T low-level waste program would continue at the INEL; also work would continue on the than-Class C low-level waste storage facility that may not necessarily be located a would be the subject of separate National Environmental Policy Act review regardles dedicated facility would receive up to 30,000 (at a rate of 1,000 per year) greater storage. This waste would be stored in monitored, retrievable casks that are shiel tight until the sources were recycled or until a disposal facility was available.

Table 3.4-6. Preferred Alternative: Summary of proposed low-level waste managemen Idaho National Engineering Laboratory (INEL). ,b

Generate	Receive	Store	Tr
Generate 72,000 m3	No offsite waste received	Store waste short-term pending treatment and disposal	Non tre exi Exp Red Fac

Waste treated offsite or onsite by incineration - Waste Experimental Reduction Facility Incineration - Idaho Waste Processing Facility

a. All waste quantities are totals for the 1995 to 2005 period unless otherwise sp
b. To convert cubic meters to cubic yards, divide by 0.765.

Table 3.4-7. Preferred Alternative: Summary of proposed mixed low-level waste man bullets) at the Idaho National Engineering Laboratory (INEL). ,b

Generate	Receive	Store
Generate waste from environmental restoration, decontamination and decommissioning, and operations (16,200 m3)	Depending on the decisions based on the Site Treatment Plan negotiated under the Federal Facility Compliance Act and the Waste Management Programmatic EIS, receive waste from the Department of Energy (DOE) Complex up to the maximum onsite treatment capacity.	Store non-treated INEL waste pending treatment. Store treated INEL waste pending disposal

a. All waste quantities are totals for the 1995 to 2005 period unless otherwise sp
b. To convert cubic meters to cubic yards, divide by 0.765.

3.4.5.6 Hazardous Waste.

For hazardous waste, the Preferred Alternative would be the same as Alternative B (Ten-Year Plan) and is summarized in Table 3.4-8. Private-sector off and disposal facilities would continue to be used.

3.4.5.7 Infrastructure.

For INEL infrastructure, the Preferred Alternative would be the same as

Alternative B (Ten-Year Plan). Existing facilities may be upgraded, including expa commercial landfill and the gravel pits.

3.4.6 Environmental Consequences of the Preferred Alternative

3.4.6.1 Introduction.

The environmental consequences that may result from implementing the Preferred Alternative are described in this section. The structure of this section Chapter 4, Affected Environment, and of Chapter 5, Environmental Consequences. The the Preferred Alternative are described in the following sections relative to the f (No Action), B (Ten-Year Plan, C (Minimum Treatment, Storage, and Disposal), and D Treatment, Storage, and Disposal)] described in Section 3.1 and analyzed in Chapter

3.4.6.2 Land Use Impacts from the Preferred Alternative.

The Preferred Alternative would result in land disturbance similar to Alternative B (Ten-Year Plan). Approxi acres) would be disturbed; of this total, approximately 100 hectares (246 acres) ha disturbed and 217 hectares (537 acres) are open space. Of the 317 hectares that wo 44 percent (138 hectares) are inside existing facility area fence lines or boundari hectares) are outside of these boundaries. The projects with the largest land dist Alternative would be the Industrial/Commercial Landfill Expansion Project, the Priv Contaminated Mixed Low-Level Waste Treatment Facility, and the Mixed Low-Level Wast Facility. These projects are described in Appendix C (Information Supporting the A activities would be consistent with existing DOE land use plans for continued opera restoration, and waste management, and would be similar to uses in existing develop Under this alternative, no effects on surrounding land uses or local land use plans

Table 3.4-8. Preferred Alternative: Summary of proposed hazardous waste managemen the Idaho National Engineering Laboratory.

Store	Treat	Transport	Dispos
Store short-term pending offsite shipment	Treat reactives onsite	Transport waste offsite for treatment, storage, and disposal	No onsite
Stage Argonne National Laboratory -West Waste - Waste Handling Facility	Research and development - Plasma Hearth Process Project		

3.4.6.3 Socioeconomic Impacts from the Preferred Alternative.

The socioeconomic impacts under the Preferred Alternative would be similar to those under Alternative Implementing the Preferred Alternative could potentially generate 600 direct jobs i during the peak employment year (2000), representing a 7.0 percent increase over th employment of approximately 8,620. By 2004, direct employment would amount to appr a 6.3 percent increase from baseline. The secondary employment generated in the re employment impacts of 1,470 jobs in 2000 and 1,310 jobs in 2004. Total employment under the Preferred Alternative represent less than 1.4 percent of total regional e employment associated with the Preferred Alternative would partially offset the red the INEL resulting from contractor consolidation.

Population in-migration associated with implementing the Preferred Alternative 960 persons during the peak employment year, an increase that represents less than regional population. By 2004, population increases would decline to approximately percent increase in regional population. During the peak employment year, populati in a temporary increase in housing demand of about 280 units, representing approxim current housing stock in the region of influence. Assuming that the general condit current housing market continue (see Section 4.3.2.2, Housing), this increase in de generate perceptible impacts on the existing market. By 2004, the expected housing population in-migration under the Preferred Alternative would amount to approximate

representing approximately 0.3 percent of total available units. In-migration coul the jobs could be filled locally from people made available by INEL contractor cons
The population changes estimated under the Preferred Alternative are not likely impacts on community services, public finance, or other socioeconomic resources wit influence.

3.4.6.4 Cultural Resource Impacts from the Preferred Alternative.

Impacts to cultural resources under the Preferred Alternative would be similar to those under Alternati Facility expansion, new facility construction, and gravel pit expansion would affec acres) of land and 66 structures would be modified, decommissioned, or demolished. (33 acres) have been surveyed and 22 sites, which may be affected by the Preferred identified. The remaining 304 hectares (750 acres) have not been surveyed. In all would have the potential to affect archaeological, traditional, and paleontological of the ground or buried beneath recent sediments. In locations that have been inte areas of concern can be identified, but in unsurveyed locations, the sensitive area field work was completed. Potential impacts may occur due to alteration in the set archaeological, or historic resource caused by the introduction of additional noise lights. Although most of these activities would take place within or immediately a currently engaged in similar activities, some construction is proposed for areas ou If significant archaeological or historic sites or traditional resources are in pro pollution, contamination, or lighting may adversely affect these resources.

3.4.6.5 Aesthetic and Scenic Impacts from the Preferred Alternative.

The Preferred Alternative would implement projects similar to those described under Alternative B with the other alternatives, the air quality analysis of contrast reduction due to the acceptable criterion limits for views within the Craters of the Moon Wilderness indicated a potential for visual degradation associated with project emissions from Processing Facility, the Waste Immobilization Facility, and two boilers at the Radi Management Complex. Emission controls for oxides of nitrogen, as discussed for Alt Plan), may be required to pass the screening-level analysis.
Construction of the proposed facilities and demolition of existing facilities w dust that may affect visibility temporarily in localized areas. Such activities wo however, and the INEL would follow standard construction practices to minimize both

3.4.6.6 Geologic Impacts from the Preferred Alternative.

The geological impacts from the Preferred Alternative would be associated with (a) excavating surface deposits at n sites and (b) using aggregate resources to construct and operate new facilities and as needed. The volume of aggregate extracted from INEL site gravel and borrow pits under Alternative B (Ten-Year Plan).

3.4.6.7 Air Resources Impacts from the Preferred Alternative.

The potential radiological and nonradiological consequences on air resources from implementation of the Prefer described below.

3.4.6.7.1 Radiological Emissions and Dose Consequences-Radionuclides

emitted by facilities associated with the Preferred Alternative would be similar in of Alternative B (Ten-Year Plan). With respect to specific waste stream or program impacts from the Preferred Alternative would be essentially identical to Alternativ low-level waste, greater-than-Class C low-level waste, hazardous waste, and environ the high-level, transuranic, and mixed low-level waste program areas, these impacts estimated for Alternative B (Ten-Year Plan) and Alternative D (Maximum Treatment, S

Disposal). For all waste streams taken together, the net result would be impacts t individual less than 5 percent higher than those for Alternative B; for comparison, exposed individual under Alternative D would be approximately 30 percent higher tha B. These dose consequences would be very low, both with respect to applicable stan compared with natural background levels.

3.4.6.7.2 Nonradiological Emissions and Consequences-The nonradiological

emissions and impacts from the Preferred Alternative would be similar to Alternativ spent nuclear fuel, low-level waste, greater-than-Class C low-level waste, hazardou environmental restoration. For the high-level, transuranic, and mixed low-level wa impacts would lie between those estimated for Alternative B (Ten-Year Plan) and Alt Treatment, Storage, and Disposal). For the total alternative, cumulative emissions would be similar to the amount calculated for Alternative B.

Toxic air pollutant emissions and impacts would be slightly higher than Alterna Plan). This would be due to the projected increased processing of transuranic and under the Preferred Alternative activities, which would have greater toxic air poll Emissions of combined toxic air pollutants resulting from implementing the Preferre less than 1 percent higher than those for Alternative B; for comparison, the emissi pollutants under Alternative D (Maximum Treatment, Storage, and Disposal) could be percent higher than those for Alternative B. This alternative would also contribut toxic air pollutants to onsite levels. Impacts would be within allowable criteria

The degree to which other air quality-related values (such as visibility degrad ozone depletion, and so forth) would be affected are less than the impacts projecte (Maximum Treatment, Storage, and Disposal), as described in Section 5.7.4. Simila impacts would be less than those described for Alternative D (Maximum Treatment, St in Section 5.7.6. The Preferred Alternative would result in small increases in veh impacts, as described in Section 5.7.5.

3.4.6.8 Water Resources Impacts from the Preferred Alternative.

Impacts to water resources from the Preferred Alternative would be similar to Alternative B (Ten-Yea shipments of spent nuclear fuel would not affect the quality of water resources bec contained storage pools or dry storage containers and isolated from the environment Preferred Alternative would not discharge waste to the subsurface; hence, it would identified by Lehto (1993) and used in modeling. Water consumption would be about (53 million gallons), which represents an increase of 3.1 percent above average tot Most of this increase would be associated with the Waste Immobilization Facility an Processing Facility. Given that 1.77 billion cubic meters (470 billion gallons) of site each year (Robertson et al. 1974), the additional volume of water consumed und only be 0.017 percent of that passing under the INEL site. The Preferred Alternati impact on the quality or quantity of surface water or groundwater in the Snake Rive

3.4.6.9 Ecological Impacts from the Preferred Alternative.

Potential nonradiological and radiological effects to biota from the Preferred Alternative would be similar to th Alternative B (Ten-Year Plan). About 317 hectares (783 acres) would be disturbed u Alternative [217 hectares (537 acres) of undisturbed habitat and 100 hectares (246 disturbed habitat]. To minimize the potential short-term effects of the disturbanc 94 hectares (232 acres) of the disturbed area would be revegetated. Consequently, term net loss of 223 hectares (551 acres). The majority of the long-term acreage l construction and operation of one of two new facilities (Private Sector Alpha-Mixed Treatment Facility or the Idaho Waste Processing Facility) several kilometers from from the expansion of the landfill. Either of the two new facilities would encompa acres), while the landfill expansion would encompass about 113 hectares (280 acres) construction of a new facility would result in limited habitat fragmentation.

3.4.6.10 Noise Impacts from the Preferred Alternative.

Because the operations workforce
stationed at the INEL site would be expected to be less than the baseline for all y overall noise level resulting from site transportation would be expected to be gene baseline. The number of trucks carrying waste and spent nuclear fuel under any alt lower than the several hundred buses (about 300 routes) that travel to and from the environmental impact due to noise would be expected from the any of the alternative the Preferred Alternative.

3.4.6.11 Traffic and Transportation Impacts from the Preferred Alternative.

Under the
Preferred Alternative, the INEL would receive increased shipments of transuranic an from various DOE sites similar to, but less than, Alternative D (Maximum Treatment, Disposal). Treated residue would be returned to the generator or transported to an Shipments of low-level waste, shipments of hazardous waste to offsite disposal faci bulk hazardous chemicals to the INEL site would be similar to Alternative B (Ten-Ye number of waste shipments under the Preferred Alternative would be less than Altern would not receive low-level waste from offsite locations, as analyzed for Alternati

The Preferred Alternative for spent nuclear fuel corresponds to Alternative B (Navy would resume shipments of spent nuclear fuel from naval sites to the INEL and irradiated test specimens would continue from the INEL to offsite locations. All o nuclear fuel currently in storage in Colorado and all commercial-type spent nuclear Valley Demonstration Project in New York and the Babcock & Wilcox Lynchburg Researc Virginia would be transported to the INEL site. The INEL site would receive shipme aluminum-clad spent nuclear fuel from DOE research and test reactors currently stor addition, the INEL site would receive non-aluminum-clad spent nuclear fuel shipment university and foreign research reactors and other non-DOE, U.S. Government reactor spent nuclear fuel currently stored at the INEL would be shipped to the Savannah Ri

3.4.6.11.1 Incident-Free Transportation-For truck shipments of waste, the impacts

would be similar to, but less than, Alternative D (Maximum Treatment, Storage, and Over the 1995 to 2005 period, collective radiation dose would be less than 1,700 pe and 940 person-rem general population, and less than one cancer fatality is estimat period, spent nuclear fuel truck shipments would yield approximately 340 person-rem person-rem (general population). Train shipments of waste and spent nuclear fuel w doses.

3.4.6.11.2 Transportation Accidents-Under all alternatives considered, including the

Preferred Alternative, the maximum reasonably foreseeable onsite transportation acc spent nuclear fuel and waste would involve baseline activities. The maximum reason spent nuclear fuel transportation accident involves the inadvertent shipment of a s (fuel out of the reactor for 10 to 25 days) from the Advanced Test Reactor to the I Plant.

The impacts of offsite transportation accidents involving radioactive wastes wo Alternative B (Ten-Year Plan) for low-level waste and would be less than Alternativ Treatment, Storage, and Disposal) for transuranic waste and mixed low-level waste.

The potential impacts from offsite transportation accidents involving nonradiol materials and wastes would be bounded by accidents associated with shipments of bul tanker truck containing nitric acid. One or more individuals could be exposed to l concentrations of nitric acid in the air should such an accident occur.

The impacts to the regional traffic system around the INEL would be minimal for Alternative.

3.4.6.12 Health and Safety Impacts from the Preferred Alternative.

In general, the
potential impacts to the health and safety of workers at the INEL and the public li INEL would be very similar to those for Alternative B (Ten-Year Plan). Small incre

Alternative B would result from differences in the management of high-level, transu
level waste under the Preferred Alternative. However, as discussed below, impacts
Alternative B than Alternative D (Maximum Treatment, Storage, and Disposal).

3.4.6.12.1 Health effects to the Public and Worker from Releases to the

Environment-Health risks from radioactive emissions to air and water would be essen
those for Alternative B (Ten-Year Plan) for spent nuclear fuel, low-level waste, gr
level waste, hazardous waste, and environmental restoration. For the high-level, t
level waste programs, radiological health impacts would be slightly larger than tho
all waste streams taken together, the net result would be impacts to a maximally ex
5 percent higher than those for Alternative B; for comparison, the impacts to a max
under Alternative D (Maximum Treatment, Storage, and Disposal) would be approximate
than those for Alternative B.

Health risks from toxic chemical emissions for the Preferred Alternative would
than those for Alternative B (Ten-Year Plan). This increase would be due to the ma
transuranic, and mixed low-level wastes under the Preferred Alternative. These act
with the largest contribution to total chemical emissions. Toxic air pollutants em
allowable criteria in all cases. For all waste streams taken together, the net res
combined toxic air pollutants less than 1 percent higher than those for Alternative
emissions of combined toxic air pollutants under Alternative D (Maximum Treatment,
would be approximately 100 percent higher than those for Alternative B.

3.4.6.12.2 Occupational Health and Safety Impacts from the Preferred

Alternative-The average radiation dose and the number of occupational injuries and
to be proportional to the number of workers at the INEL under each alternative. Th
construction and nonconstruction workers under the Preferred Alternative would be 1
than those for Alternative B (Ten-Year Plan). For comparison, the corresponding nu
D (Maximum Treatment, Storage, and Disposal) would be approximately 45 percent high
occupational health and safety impacts under the Preferred Alternative would be ver
B.

3.4.6.13 Idaho National Engineering Laboratory Services Impacts from the Preferred Alternative.

The Preferred Alternative includes all the projects included in Alternative B (Ten-
In addition, the scope of two of the projects would be expanded under the Preferred
accommodate the increased quantities of materials. The new buildings constructed a
102,000 square meters (1,096,000 square feet) of floor space. Accordingly, the Pre
increases, above baseline, in usage rates for utilities are estimated to be 98,000
electricity (47 percent increase), 202,000 cubic meters (53.4 million gallons) per
increase), and 7.2 million liters (1.9 million gallons) per year of wastewater disc
(Hendrickson 1995). These usage rates would be similar to those for Alternative B
would be expected to be below the system capabilities and use limits.

Fossil fuel usage would increase by 5,495,000 liters (1,450,000 gallons) of hea
liters (286,000 gallons) of diesel fuel, and 2,732,000 liters (722,000 gallons) of
(Hendrickson 1995). The Preferred Alternative heating oil usage would be 49 percen
fuel usage would be 19 percent above baseline, and propane usage would be 480 perce
large increase in propane usage results from both facility heating and incineration
similar to the Alternative B (Ten-Year Plan) increases and would be within the INEL
capabilities. Construction associated with the Preferred Alternative projects woul
about 100,000 cubic meters (130,000 cubic yards) of concrete.

The Preferred Alternative would not be expected to require increases in INEL si
emergency services.

3.4.6.14 Facility Accident Impacts from the Preferred Alternative.

Potential secondary
impacts from facility accidents are shown in Table 5.14-4 of Volume 2 of this EIS.
similar to those characterized by Alternative A (No Action). Workers near the sour
potential risk of injury or death. Potential facility accident impacts for the Pre

below for spent nuclear fuel and waste types.

3.4.6.14.1 Spent Nuclear Fuel-The bounding accident characteristics within each

frequency category that differ from those specified for Alternative A (No Action), Section 5.14.3 of Volume 2 of this EIS, would be the same as those characterized fo Year Plan), as described in Section 5.14.4 of Volume 2 of this EIS and illustrated and 5.14-8. The incremental risk of accidents over those assessed in Alternative A 5.14.3) would be related to construction activities and the receipt of additional o shipments at the INEL site.

For analysis purposes, operations at Argonne National Laboratory-West were assu in Alternative A (No Action), and because of the short-cooled fuel handled at this accidents would continue to bound the design basis and beyond design basis accident under Alternative B (Ten-Year Plan).

3.4.6.14.2 High-Level Waste-The frequency of construction accidents and minor

radiological accidents would increase as a result of proposed actions. The consequ associated with high-level waste facilities under the Preferred Alternative, howeve those described under Alternative B (Ten-year Plan) and would be bounded by those a Alternative A (No Action).

3.4.6.14.3 Transuranic Waste-The incremental risk accidents over those assessed in

Alternative A (No Action) would be related to the receipt of DOE complex waste from examination, treatment, and shipping to offsite storage or disposal sites. The tra the INEL site would be increased by less than that evaluated for Alternative D (Max Storage, and Disposal) because the Preferred Alternative requires offsite shipment waste. The frequency of fires was assumed to increase by no more than a factor of would be associated with the increased handling and storage of waste. The frequenc would be the same as that assessed under Alternative A, but the consequences are as than that evaluated for Alternative D (Maximum Treatment, Storage, and Disposal) be inventory. Risks from facility accidents involving transuranic wastes, therefore, evaluated under Alternative D (Maximum Treatment, Storage, and Disposal).

3.4.6.14.4 Mixed and Low-Level Waste-The incremental risk of accidents over those

assessed in Alternative A (No Action) would be related to the receipt of DOE comple from offsite locations for treatment, storage, and disposal. The annual mixed low-managed at the INEL site would be increased over Alternative A (No Action) but woul assumed under Alternative D (Maximum Treatment, Storage, and Disposal). Waste woul additional inventory turnover in existing storage facilities and a new treatment fa would be characterized by increased frequencies of handling-related fires and highe higher inventories. However, the risks for the Preferred Alternative would be less Alternative D (Maximum Treatment, Storage, and Disposal) because of the lower waste

3.4.6.14.5 Hazardous Materials-The consequences of maximum reasonably

foreseeable accidents associated with hazardous waste or chemicals would be the sam Alternative as those analyzed under Alternative A (No Action). Lower consequence a occur as a result of proposed actions.

3.4.6.14.6 Environmental Remediation and Decontamination and

Decommissioning-The incremental risk of accidents over those assessed in Alternativ would be related to expanded environmental remediation and decontamination and deco activities (including construction) on the basis of current plans. However, accide environmental remediation at Pit 9 at the Radioactive Waste Management Complex woul consequences of accidents at other activities on the INEL site. Therefore, the con reasonably foreseeable accidents associated with environmental remediation and deco

decommissioning activities would be the same under the Preferred Alternative as tho
Alternative A (No Action).

3.4.7 Cumulative Impacts from Connected or Similar Actions

Cumulative impacts are the incremental impact of the proposed action added to a
present, and reasonably foreseeable future actions. The cumulative impacts of the
would be similar to those described for Alternative B (Ten-Year Plan) in Section 5.
EIS, and less than those for Alternative D (Maximum Treatment, Storage, and Disposa

3.4.8 Adverse Environmental Effects Which Cannot be Avoided

The construction and operation of facilities under the Preferred Alternative wo
unavoidable adverse impacts to the environment. Such impacts would be similar to t
Alternative B (Ten-Year Plan) in Section 5.16 of Volume 2 of this EIS. Changes in
measures could eliminate, avoid, or reduce many of these to minimal levels.

3.4.9 Relationship Between Short-Term Use of the Environment and the Maintenance and

Enhancement of Long-Term Productivity

Implementing the Preferred Alternative would cause some small impacts to the en
would permanently commit certain resources (see Section 5.17 of Volume 2 of this EI
Alternative, short-term uses of resources would be greater than Alternative A (No A
for Alternative D (Maximum Treatment, Storage, and Disposal). Because of remediati
the Preferred Alternative, impacts would result in enhanced long-term productivity
Alternatives A (No Action) and C (Minimum Treatment, Storage, and Disposal).

3.4.10 Irreversible and Irretrievable Commitments of Resources

Implementing the Preferred Alternative would cause the irreversible and irretri
certain resources. Under the Preferred Alternative, the commitment of such resourc
energy, water, and land allocated for waste disposal, would be similar to those for
Plan) as described in Section 5.18 of Volume 2 of this EIS, and would be less than
(Maximum Treatment, Storage, and Disposal).

3.4.11 Mitigation

Possible mitigation measures for proposed activities in the Preferred Alternati
those discussed in Section 5.19 of Volume 2 of this EIS.

3.4.12 Environmental Justice

The effects of proposed actions under the Preferred Alternative are small and w
disproportionately high adverse impact to any particular segment of the population,
low-income communities (see Section 5.20).

PAGE TOC FIGURES TABLES PAGE

4. AFFECTED ENVIRONMENT

4.1 Introduction

Chapter 4 describes the existing environment at the Idaho National Engineerin Idaho Falls facilities, and the surrounding region. Only those areas that might be spent nuclear fuel program and environmental restoration and waste management alter This chapter provides the environmental conditions against which the potential envi various alternatives can be measured.

Chapter 4 summarizes the existing data and technical literature in each disci to the supporting technical references listed in Chapter 9 that contain substantiat

4.2 Land Use

The INEL site encompasses 571,000 acres (230,000 hectares) within Butte, Bing Jefferson, and Clark counties (see Figure 4.2-1). This section includes a brief de uses at the INEL and in the surrounding region, and land use plans and policies app area.

4.2.1 Existing and Planned Land Uses at the Idaho National Engineering Laboratory

Categories of land use at the INEL site include facility operations, grazing, infrastructure, such as roads. Facility operations include industrial and support energy research and waste management activities (activities also conducted at the I is also used for recreation and environmental research associated with the designat National Environmental Research Park. Much of the INEL site is open space that has specific uses. Some of this space serves as a buffer zone between INEL facilities 2 percent of the total INEL site area (11,400 acres or 4600 hectares) is used for f Public access to most facility areas is restricted. Approximately 6 percent of the (13,870 hectares), is devoted to public roads and utility rights-of-way that cross include public tours of general facility areas and the Experimental Breeder Reactor Landmark) and controlled hunting, which is generally restricted to half a mile (0.8 boundary. Between 300,000 and 350,000 acres (121,000 and 142,000 hectares) are use grazing. A 900-acre (400-hectare) portion of this land, located at the junction of and 33, is used by the U.S. Sheep Experiment Station as a winter feed lot for appro Grazing is not allowed within 2 miles (3 kilometers) of any nuclear facility, and, milk contamination by long-lived radionuclides, dairy cattle are not permitted. Ri permits are granted and administered by the U. S. Department of the Interior's Bur Selected land uses at the INEL and in the surrounding region are presented in Figur

DOE land use plans and policies applicable to the INEL include the INEL Insti 1994-1999 (DOE-ID 1993a) and the INEL Technical Site Information Report (Smith et a Institutional Plan provides a general overview of INEL facilities, outlines strateg

Figure 4.2-1. Idaho National Engineering Laboratory site vicinity map. Figure 4.2-
program directions and major construction projects, and identifies specific technic equipment needs. The Technical Site Information Report presents a 20-year master p activities at the site. In general, it is expected that energy research and waste continue in existing facility areas and, in some instances, expand into undeveloped documents also describe environmental restoration, waste management, and spent nucl Projected future land use scenarios for the next 25 to 50 years include outgrowth o and possible development of waterfowl production ponds within existing grazing area

The INEL site is located within the Medicine Lodge Resource Area (approximate 56,800 hectares in the eastern and southern portions of the INEL site) and the Big (430,499 acres or 174,000 hectares in the central and western portions), both of wh the Bureau of Land Management (see Figure 4.2-1). Under Resource Management Plans, resource areas are managed for grazing and wildlife habitat. No mineral exploratio

allowed on INEL land.

No onsite land use restrictions due to Native American treaty rights would ex alternatives described in this Environmental Impact Statement. The INEL site does land boundaries established by the Fort Bridger Treaty. Furthermore, the entire IN the U.S. Department of Energy, and therefore that provision in the Fort Bridger Tre Shoshone and Bannock Indians the right to hunt on the unoccupied lands of the Unite presently apply to any land upon which the INEL is located. Potential impacts of t American and other cultural resources, and potential mitigation measures, are discu 5.20 on Environmental Justice, and Section 5.4, Cultural Resources.

4.2.2 Existing and Planned Land Use in Surrounding Areas

Lands surrounding the INEL site are owned by the Federal government, the Stat private parties. Land uses on federally owned land consist of grazing, wildlife ma mineral and energy production, and recreation. State-owned lands are used for graz and recreation. Privately owned lands are used primarily for grazing, crop product

Small communities and towns located near the INEL boundaries include Mud Lake Butte City, and Howe to the west; and Atomic City to the south. The larger communi Falls/Ammon, Rexburg, Blackfoot, and Pocatello/Chubbuck are located to the east and site. The Fort Hall Indian Reservation is located southeast of the INEL site. Rec attractions in the region surrounding the INEL site include Craters of the Moon Nat Half Acre Wilderness Study Area, Black Canyon Wilderness Study Area, Camas National Market Lake State Wildlife Management Area, North Lake State Wildlife Management Ar National Park, Targhee and Challis National Forests, Sawtooth National Recreation A Wilderness Area, Sawtooth National Forest, Grand Teton National Park, Jackson Hole and the Snake River (see Figures 4.2-1 and 4.2-2).

Lands surrounding the INEL site are subject to Federal and State planning law Planning for and use of Federal lands and their resources are governed by Federal r require public involvement in their implementation. Land use planning in the State the Local Planning Act of 1975 (State of Idaho Code 1975). Since the State current planning agency, the Idaho legislature requires that each county adopt its own land guidelines. County plans that are applicable to lands bordering the INEL site incl Planning and Zoning Ordinances and Interim Land Use Plan (Clark County 1994), the Comprehensive Plan (Bonneville County 1976), the Bingham County Zoning Ordinance an Handbook (Bingham County 1986), the Jefferson County Comprehensive Plan (Jefferson the Butte County Comprehensive Plan (Butte County 1976). Land use planning for INE within the Idaho Falls city limits is subject to Idaho Falls planning and zoning re 1989, 1992).

All county plans and policies encourage development adjacent to previously de to minimize the need to extend infrastructure improvements and to avoid urban spraw Because the INEL is remotely located from most developed areas, INEL lands and adja likely to experience residential and commercial development, and no new development INEL site (DOE-ID 1993b). However, recreational and agricultural uses are expected surrounding area in response to greater demand for recreational areas and the conve land (DOE-ID 1993b).

4.3 Socioeconomics

Socioeconomic resources assessed here are characterized in terms of employmen population, housing, community services, and public finance. These resources are o response to a particular action. Changes in employment, for example, may lead to p into or out of a region, leading to changes in demand for housing and community ser

The region of influence for the socioeconomic analysis was determined to be a comprised of Bingham, Bonneville, Butte, Clark, Jefferson, Bannock, and Madison cou Section F-1, Socioeconomics). Based on a survey of INEL personnel (DOE-ID 1991), o employees reside in this region of influence. The region of influence also include Reservation and Trust Lands (home of the Shoshone-Bannock Tribes), located in Banno Caribou, and Power counties.

The following sections present a brief overview of existing and projected bas socioeconomic characteristic.

4.3.1 Employment and Income

Historically, the regional economy has relied predominantly on natural resour today, farming, ranching, and mining remain important components of the economy. I and service center for the region of influence, and Pocatello has evolved into an i distribution center and site of higher education institutions. Agriculture and ran ranching, are important contributors to the economy of the Fort Hall Indian Reserva

4.3.1.1 Employment.

The labor force in the region of influence has increased from 92,159 in 1980 to 104,654 in 1991 (see Table 4.3-1) at an average annual growth rate of appro 1991, the region of influence accounted for approximately 20 percent of the total S (ISDE 1992). The labor force in the region of influence is expected to increase to

Table 4.3-2).

Table 4.3-1. Historical labor force and unemployment rates for counties and the re Laboratory.

Area	1980 Labor force	Unemployment rate	Labor
Bannock	32,064	7.2	33,
Bingham	14,768	7.9	16,
Bonneville	30,220	5.2	35,
Butte	1,318	5.8	1,
Clark	416	7.0	5
Jefferson	6,212	6.8	7,1
Madison	7,161	5.4	7,8
Region of Influence	92,159	6.4	102,9

a. Source: ISDE (1986, 1991, 1992).

Table 4.3-2. Projected labor force, employment, and population in the region of in

Category	1995	1996	1997	1998
Labor force	108,667	109,607	110,547	111,487
Employment	101,450	102,328	103,205	104,083
Population	247,990	251,518	255,096	258,726

a. Source: ISDE (1992); SAIC (1994).

Unemployment rates varied considerably among the counties of the region of in ranging from 2.6 percent in Clark County to 6.3 percent in Bannock and Bingham Coun Since 1980, the average annual unemployment rate for the region has ranged from 5.3 percent in 1983. In 1991, the average annual unemployment rate for the region of i compared to the average State-wide rate of 6.2 percent.

Retail trade and educational services are the two largest employment sectors respectively accounting for 17.6 and 11.4 percent of employment in 1989 (USBC 1992) County, retail trade accounted for 17.9 percent of the total county employment of 3 and related services accounted for 16.8 percent. The largest employment sectors in manufacturing in Bingham County; retail trade in Bannock and Jefferson Counties; ag fishing in Butte and Clark Counties; and educational services in Madison County.

4.3.1.2 Income.

Between 1979 and 1989, real median household income increased in Butte, Clark, Jefferson, and Madison counties and decreased in Bannock, Bingham, and Bonne 1982, 1992). In 1989, median household income ranged from $23,000 in Madison Count Bonneville County, compared to $25,257 for Idaho and $30,056 for the nation. Per c

was consistent with median income, with Bonneville County having the highest per ca and Madison County the lowest ($7,385). However, all counties had per capita incom the United States of $14,420.

4.3.1.3 Idaho National Engineering Laboratory.

The INEL plays a substantial role in the regional economy. During Fiscal Year 1990, the INEL directly employed approximatel accounting for almost 12 percent of total regional employment. The population dire employment was estimated to be approximately 38,000 persons, or 17 percent of the t population. Major employment groups at the INEL are DOE-ID contractors, DOE-ID, Ar Laboratory-West, and the Naval Reactors Facility (see Figure 4.3-1). In 1992, tota was approximately 11,600 jobs (DOE-ID 1994). Projections indicate that the total INEL is expected to be 8,620 in Fiscal Year 1995 and 7,250 in Fiscal Year 2004 (Tel

Figure 4.3-1. Historical and projected baseline employment at the Idaho National E

Projected decreases in direct INEL employment are primarily related to contra productivity improvements, and privatization, which account for 67 percent of proje Fiscal Year 1994 and Fiscal Year 2004, and to reduced activities at the Naval React accounts for 30 percent of projected job losses. Contract consolidation at DOE-ID consolidation of several contracts under one contract. The consolidation eliminate previously performed by each individual contractor and offered early retirement opt example, voluntary separation) to current INEL contractor employees. Privatization shift employment from direct INEL employment to private companies.

For Fiscal Year 1990, the total budget for the INEL was $1,200 million. Fina projections for the INEL indicate that funding levels are expected to decrease from Year 1995 to $820 million in Fiscal Year 2004 (see Figure 4.3-2). These figures do projects associated with the alternatives analyzed in Section 5.3, Socioeconomics.

Figure 4.3-2. Historical and projected funding at the Idaho National Engineering L

The largest DOE-ID program is environmental restoration and waste management, with almost $557 million in Fiscal Year 1995 and $420 million in Fiscal Year 2004. Fund restoration and waste management is expected to decrease by 25 percent between Fisc 2004, while funding for the INEL as a whole is expected to decrease by 20 percent. 46 percent of total INEL expenditures (20 percent of nonpayroll expenditures and 97 expenditures) would be spent within the region of influence.

Wages and salaries paid to INEL employees totaled nearly $477 million in Fisc addition, $113.9 million of direct expenditures were made in the regional economy f Consistent with the projected decrease in employment over the period 1995 to 2005, to decline. Total INEL payroll is expected to decrease from $373 million in Fiscal approximately $314 million by Fiscal Year 2004 (in 1993 constant year dollars).

4.3.2 Population and Housing

Population and housing statistics for the region of influence surrounding the the following sections.

4.3.2.1 Population.

From 1960 to 1990, population growth in the region of influence mirrored State-wide growth. During this period, the region's population increased at an ave approximately 1.3 percent, while the growth rate for the State was 1.4 percent. Be population growth in the region of influence approximately equaled that of the Stat rate of 0.6 percent per year. The region of influence had a 1990 population of 219 percent of the State's total population of 1,006,749. The most populous counties w Bonneville, which together contained over 60 percent of the seven-county total (Fig Clark were the least populous of the counties in the region of influence. The larg influence were Pocatello and Idaho Falls, with 1990 populations of approximately 46 respectively. In 1990, the Fort Hall Indian Reservation and Trust Lands contained majority (52 percent) residing in Bingham County.

Figure 4.3-3. Historical and projected total population for the counties of the re

The population within an 80-kilometer (50-mile) circle centered at Argonne Na West (on the INEL site) has been characterized for the purposes of identifying whet high and adverse impacts might exist to minority or low-income populations. The po circle surrounding the INEL site is shown to be 7 percent minority and 14 percent l Bureau of Census information and the definitions and approach presented in Section Justice.

Population in the region of influence is projected to reach 276,395 persons b population and employment trends (see Table 4.3-2). Over the period 1990 to 2004, growth rate is projected to be 1.6 percent compared to a projected State-wide annua percent.

4.3.2.2 Housing.

Bonneville and Bannock counties (which respectively include the cities of Idaho Falls and Pocatello) provided 67 percent of the 73,230 year-round housing units in 1990 (see Table 4.3-3). Of this number, approximately 70 percent were single-famil multifamily units, and 13 percent were mobile homes. Most of the multifamily units located in Bonneville and Bannock Counties. About 29 percent of the occupied housi were rental units and 71 percent were homeowner units.

Table 4.3-3. Number of housing units, vacancy rates, median house value, and media county and the region of influence surrounding the Idaho National Engineering Labor

	Homeowner housing units			Rental units	
County/region	Number of units	Vacancy rates	Median value ($)	Number of units	Vaca
Bannock	16,447	2.4	53,300	7,467	
Bingham	9,010	2.0	50,700	2,955	
Bonneville	17,707	1.9	63,700	7,375	
Butte	780	4.6	41,400	302	
Clark	177	1.7	37,300	114	
Jefferson	4,000	2.0	54,300	992	
Madison	3,522	1.3	68,700	2,392	
Region of influence	51,674	2.1	(b)	21,556	

a. Source: USBC (1992).

b. Not applicable.

The median value of owner-occupied housing units ranged from $37,300 in Clark in Madison County, and median monthly rents ranged from $243 in Butte County to $36 County. In 1990, there were 1,510 occupied housing units on the Fort Hall Indian R Lands (USBC 1992) and a vacancy rate of 14 percent.

4.3.3 Community Services and Public Finance

Selected community services and public finance statistics for the region of i INEL are discussed in the following sections.

4.3.3.1 Community Services.

The following selected community services within the region of influence are considered: public schools, law enforcement, fire protection, and ho characteristics of these services for the region of influence are summarized in Tab

Seventeen public school districts and three non-public schools provide educat 57,000 children within the region of influence. Of these students, about 6,500 are related employees. During the 1990-1991 academic year, most public school district $3,000 to $4,000 per student annually. Higher education in the region is provided Idaho State University, Brigham Young University - Ricks College, and the Eastern I

Law enforcement services in the region are provided by 7 county sheriff's off

departments, and the Idaho State Police. There was a total of 426 sworn officers a enforcement personnel in 1991, over 59 percent of which served Bannock and Bonnevil

There are 18 fire districts in the region of influence, which operate a total by 179 paid and 313 volunteer firefighters. Bingham, Bonneville, Butte, Clark, and surround the INEL, have developed emergency plans to be implemented in the event of hazardous materials emergency. The emergency plans include memoranda of understand procedures for notification and response, listings of emergency equipment and facil and training programs.

Table 4.3-4. Summary of public services available in the region of influence surro

Public service	Bannock	Bingham	Bonne
Schools			
Number of public school districts	2	5	3
Total enrollment	15,455	11,311	17,89
Number of INEL-related students (excluding military	485	1,532	4,040
Health Care Delivery			
Number of hospitals	3	2	1
Number of licensed beds	309	238	311
Law Enforcement			
Number of sworn law enforcement officers	151	65	143
Total personnel per 1,000 population	2.5	2.0	2.2
Fire Protection			
Number of fire stations	9	7	6
Number of firefighters	166	96	121
Number of firefighting vehicles	37	25	24
Municipal Solid Waste Disposal			
Number of landfills meeting U.S. Environment Protection Agency regulations	1b	3c	1
Expected lifespan in years	30	3-6	50

a. Sources: IDE (1991), IDHW (circa 1990), IDLE (1991), Kouris (1992a), and Kouri

b. Fort Hall Mine Landfill is being redesigned to meet U.S. Environmental Protecti

c. Aberdeen Landfill may close due to noncompliance with U.S. Environmental Protec

Eight hospitals serve the region of influence with a total of over 900 licens nearly 128,000 patient days. Occupancy rates range from 22.0 to 61.7 percent in th 1990). Regional ambulance services are provided by county governments and the Blac Falls, and Pocatello fire departments. A private ambulance company serves resident region of influence is also served by four quick response units, two medical helico specializing in emergency medical services (Hardinger 1990, U.S. West Direct 1992).

Municipal solid waste generated in the region is transported to county landfi landfills served the region of influence. Four county landfills (one each in Banno Madison counties) are being closed before reaching their planned capacity due to no U.S. Environmental Protection Agency standards (CFR 1991). New municipal landfills Environmental Protection Agency standards will replace the closed county landfills.

4.3.3.2 Public Finance.

In Fiscal Year 1991, total county revenues for the region of influence amounted to approximately $90 million excluding Bonneville County (see Table 4.3-5) and intergovernmental transfers. In 1991, the total assessed value of taxable prop influence was about $4.47 billion. In addition to property tax revenues, local gov counties) also receive revenue from sales tax disbursements and revenue-sharing pro 60 to 85 percent of the total revenues received by each county is derived from thes

Although DOE is a Federal agency and exempt from paying State or local taxes, and contractors are not. In 1992, INEL employees paid an estimated $59.6 million i and $23.5 million in State withholding tax.

In 1991, the major categories of county government expenditures were as follo government services, 27 percent; road maintenance, 18 percent; public safety, 16 pe

programs, 16 percent; sanitation and public works, 9 percent; debt service, 3 perce percent; and other expenditures, 9 percent.

Table 4.3-5. Total revenues and expenditures by county in the region of influence National Engineering Laboratory for Fiscal Year 1991.

County	Total revenues ($)	Total expenditures ($)
Bannock	16,232,274	14,216,708
Bingham	11,434,200	10,708,011
Bonnevilleb	50,186,650	51,850,100
Butte	1,417,684	1,397,012
Clark	1,236,849	1,086,379
Jefferson	4,408,236	4,566,074
Madison	5,249,432	5,662,080
Seven-county region	90,165,325	89,446,364

a. Sources: Ghan (1992), Bingham County (circa 1992), McFadden (circa 1992), Swag (1992a), Swager & Swager (1992b), Draney, Searle, and Associates (1992), Schwendima (1992).

b. Bonneville County's financial statements and total revenue data include specia cities, cemeteries, fire districts, ambulance districts, and other special accounts budgets. The majority of intergovernmental revenue is used to fund these accounts.

4.4 Cultural Resources

This section discusses all cultural resources at the INEL, including prehisto archaeological sites, historic sites and structures, and traditional resources that importance to local Native Americans. Paleontological localities on the INEL site

4.4.1 Archaeological Sites and Historic Structures

As summarized in the INEL Draft Management Plan for Cultural Resources (Mille contains a rich and varied inventory of cultural resources. This includes fossil l important paleoecological context for the region and the numerous prehistoric archa preserved within it. These latter sites, including campsites, lithic workshops, ca among others, are also an important part of the INEL inventory. These sites provid activities of aboriginal hunting and gathering groups who inhabited the area for ap Archaeological sites, pictographs, caves, and many other features of the INEL lands contemporary Native American groups for historical, religious, and traditional reas document use of the area during the late 1800s and 1900s. These include the abando Powell/Pioneer, a northern spur of the Oregon Trail known as Goodale's Cutoff, many irrigation canals, sheep/cattle camps, and stage/wagon trails. Finally, important development of nuclear science in America is also preserved in the many scientific constructed within the INEL boundaries.

As of June 1994, more than 100 cultural resource surveys have been conducted percent of the area within the INEL site. During the course of these surveys, most conducted near major facility areas, 1,506 archaeological resources have been ident prehistoric sites, 38 historic sites, 753 prehistoric isolates, and 27 historic iso Ringe 1993). Until formal significance evaluations (archaeological testing and his completed, all of the cultural sites in this inventory are considered to be potenti the National Register of Historic Places. However, all of the isolates have been meet eligibility requirements (Yohe 1993).

Due to the relatively high density of prehistoric sites on the INEL site and consideration of these resources during Federal undertakings, a preliminary study, development of a predictive model, has been completed. This study identified areas are apparently highest and the potential impacts to significant archaeological reso compliance, will likely increase correspondingly (Ringe 1993). This information is guidance for INEL project managers in selecting appropriate areas for new construct not take the place of inventories that are required by the National Historic Preser

ground-disturbing projects (NHPA 1966). The predictive model was constructed using technique on environmental variables associated with areas containing sites and are model shows that prehistoric cultural resources appear to be concentrated in associ physical features of the land. In this context, very high densities of resources a Big Lost River and Birch Creek, atop buttes, and within craters and caves. The Lem Terreton basin, and a 1.75-mile- (2,800-meter-) wide zone along the edge of local l contain a fairly high density of sites. Within the extensive flows of basaltic lav of the Lemhi Mountains, site density is classified as moderate. The lowest density probably occurs within the floodplain of the Big Lost River and the alluvial fans e Creek Valley, within the sinks, and within the recent Cerro Grande lava flow. Howe low or medium density does not eliminate the possibility that significant resources Although this model has not been tested, it is useful as a planning guide for defin to contain archaeological resources based on past surveys.

Although no systematic inventory of historically significant facilities assoc operation of the INEL has been completed, a preliminary study indicated that all IN evaluation (Braun et al. 1993). The Experimental Breeder Reactor-I is a National H the National Register of Historic Places. To date, however, few of the other prope evaluated for eligibility to the National Register of Historic Places. However, Me between DOE, the Idaho State Historic Preservation Office, and the National Advisor Preservation establish that certain structures located at Test Area North (DOE 1993 Area (DOE 1993b) are eligible for nomination. These memoranda outline specific tec the historic value of the areas in conformance with the requirements of the Histori Survey and the Historic American Engineering Record. Other facilities on the INEL similar efforts if scheduled for major modification, demolition, or abandonment.

4.4.2 Native American Cultural Resources

Because Native American people hold the land sacred, in their terms the entir culturally important. Cultural resources, to the Shoshone-Bannock Tribes, include lifeways and usages of all natural resources. This includes not only prehistoric a important in a religious or cultural heritage context, but also features of the nat water, or animal resources that have special significance. These resources may be visual environment (construction, ground disturbance, or introduction of a foreign dust particles, or by contamination. Geographically, the INEL site is included wit inhabited by and still of importance to the Shoshone-Bannock. Plant resources used Bannock that are located on or near the INEL site are listed in Table 4.4-1. Areas Shoshone-Bannock would include the buttes, wetlands, sinks, grasslands, juniper woo and the Big Lost River.

Five Federal laws prompt consultation between Federal agencies and Native Ame National Environmental Policy Act (NEPA 1970), the National Historic Preservation A (NHPA 1966), the American Indian Religious Freedom Act (AIRFA 1978), the Archaeolog Protection Act (ARPA 1979), and the Native American Graves Protection and Repatriat 1990). In accordance with these directives and in consideration of DOE's written N (DOE 1990, 1992), DOE at the INEL has committed to additional interaction and excha with the Shoshone-Bannock Tribes of the nearby Fort Hall Indian Reservation and is for consultation and coordination. This relationship is outlined in a formal Work Shoshone-Bannock and DOE (DOE-ID 1992). In addition, the Cultural Resources Manage INEL (Miller 1992) and the curation agreement for permanent storage of archaeologic for completion by June 1996. The Cultural Resources Management Plan would define p involving the Shoshone-Bannock during the planning stages of project development.

Table 4.4-1. Plants used by the Shoshone-Bannock that are located on or near the I Engineering Laboratory site.

Plant family	Type of use	Location on INEL site	Abundance
Desert parsley	Medicine, food	Scattered	Common
Milkweed	Food, tools	Roadsides	Scattered,
Sagebrush	Medicine, tools	Throughout	Common, ab
Balsamroot	Food, medicine	Around buttes	Common but
Thistle	Food	Scattered throughout	Common but
Gumweed	Medicine	Disturbed areas	Common
Sunflower	Medicine, food	Roadside	Common
Dandelion	Food, medicine	Throughout	Common
Beggar's ticks	Food	Disturbed areas throughout	Common, ab

Tansymustard	Food, medicine	Disturbed areas	Common
Cactus	Food	Throughout	Common, ab
Honeysuckle	Food, tools	Big Southern Butte	Common on
Goosefoot	Food	Throughout	Common, ab
Russian thistle	Food	Disturbed areas throughout	Common, ab
Dogwood	Food, medicine, tools	Webb Springs, Birch Creek	Common whe
Juniper	Medicine, tools, food	Throughout	Common to
Gooseberry	Food	Scattered throughout	Common
Mentha arvensis	Medicine	Big Lost River	Uncommon
Wild onion	Food, medicine, dye	Throughout	Common
Calochortus spp	Food	Buttes	Common
Fireweed	Food	Throughout	Common
Pine	Food, tools, medicine	Big Southern Butte	Common on
Douglas fir	Medicine	Big Southern Butte	Common on
Plantain	Medicine, food	Throughout	Uncommon
Wildrye	Food, tools	Throughout	Common, ab
Indian ricegras	Food	Throughout	Common, ab
Bluegrass	Food, medicine	Throughout	Common, ab
Serviceberry	Food, tools, medicine	Buttes	Common whe
Chokecherry	Food, medicine, tools, fuel	Buttes	Common whe
Wood's rose	Food, smoking, medicine, ritual	Big Lost River, Big Southern Butte	Common, ab
Red raspberry	Food, medicine	Big Southern Butte	Uncommon
Willow	Medicine	Throughout in moist areas	Common
Coyote tobacco	Smoking, medicine	Big Lost River, Webb Springs	Uncommon
Cattail	Food, tools	Sinks, outflow from facilities	Uncommon

a. Source: Anderson et al. (1995).
agreement would provide for the repatriation of burial goods in accordance with the Protection and Repatriation Act.

4.4.3 Paleontological Resources

There are 31 known fossil localities at the INEL site, and available informat region has relatively abundant and varied paleontological resources. Preliminary a materials are most likely to be found in association with archaeological sites; in deposits of the Big Lost River, Little Lost River, and Birch Creek; in deposits of some wind and sand deposits; and in sedimentary interbeds or lava tubes within loca 1992: Table 3-1).

4.5 Aesthetic and Scenic Resources

This section describes the visual character of the INEL site and briefly discu in the vicinity of the INEL. An additional description of visual impacts to ofisite in Section 4.7, Air Resources.

4.5.1 Visual Character of the Idaho National Engineering Laboratory Site

The INEL site is bordered on the north and west by the Bitterroot, Lemhi, and mountain ranges. Volcanic buttes near the southern boundary of the INEL can be seen locations on the site and the Fort Hall Indian Reservation. Most of the INEL site c undeveloped land, predominantly covered by large sagebrush and grasslands (see Sect Ecological Resources). Pasture and irrigated farmland border much of the INEL site 4.2, Land Use).

Nine facility areas are located on the INEL site. Although the INEL has a mas specific visual resource standards have been established. The generally low density look like commercial/industrial complexes and are dispersed throughout the INEL sit range in height from 10 feet (3 meters) to approximately 100 feet (30 meters), with towers that reach up to 250 feet (76 meters). Although many INEL facilities are vis

highways, most facilities are located over half a mile (0.8 kilometers) from public closest to a public road (0.4 mile or 0.6 kilometer) is the Water Reactor Research 60 feet or 18 meters in height), located off State Highway 33. This section of High primarily by the INEL workforce at Test Area North.

About 90 miles (144 kilometers) of paved public highway run through the INEL Highway 20 runs east and west across the southern portion, and has one rest stop wi boundaries. This is the highway most heavily used by the INEL workforce. It is a di the Idaho Falls area to Boise, Idaho, and recreational areas such as Sun Valley and Moon National Monument. The Experimental Breeder Reactor-I, just off Highway 20, is Historic Landmark. It had 14,000 visitors in 1992 (Braun 1993) but was closed tempo repairs in 1993. U.S. Highway 26 runs southeast and northwest, intersecting Highway Central Facilities Area. State Highways 22, 28, and 33 cross the northeastern part

4.5.2 Scenic Areas

The Craters of the Moon National Monument is located about 15 miles southwest site's western boundary. The seasonal visual range from Craters of the Moon is from (130 to 156 kilometers) (Notar 1993). The Monument is located in a designated Wilde which Class I (very high) air quality standards, or minimal degradation, must be ma defined by the Clean Air Act (CFR 1977, 1990). Under the Clean Air Act, air quality include visibility and scenic view considerations.

Lands adjacent to the INEL site, under Bureau of Land Management jurisdiction, designated as Visual Resource Management Class II areas (BLM 1984, 1986). This desi preservation and retention of the existing character of the landscape. Lands within boundaries are designated as Class III and IV, the most lenient classes in terrns o Bureau of Land Management is considering the Black Canyon Wilderness Study Area, lo adjacent to the INEL, for Wilderness Area designation (BLM 1986), which, if approve in an upgrade of its Visual Resource Management class from Class II to Class I.

Features of the natural landscape have special significance to the Shoshone-Ba The visual environment of the INEL site is within the visual range of the Fort Hall Reservation.

4.6 Geology

This section describes the geological, seismic, and volcanic characteristics surrounding region.

4.6.1 General Geology

The INEL site is located on the Eastern Snake River Plain (Figure 4.6-1). Th northeast-trending, crescent-shaped trough with low relief, comprised primarily of flows at the surface range in age from 1.2 million to 2,100 years. The Plain featu interbedded deposits of wind-blown loess and sand; water-borne alluvial fan, lacust alluvial sediments; and rhyolitic domes formed 1,200,000 to 300,000 years ago (Kunt 4.6-2). The Plain is bounded on the north and south by the north-to-northwest-tren valleys of the Basin and Range Province, comprised of folded and faulted rocks that years old. The Plain is bounded on the northeast by the Yellowstone Plateau. The and Range faulting began 20 to 30 million years ago and continues today, most recen October 28, 1983, Borah Peak earthquake [Ms 7.3; 0.022 to 0.078g at the INEL site (occurred along the Lost River fault, approximately 100 kilometers (62 miles) from I the 1959 Hebgen Lake earthquake (Ms 7.5), approximately 150 kilometers (93 miles) f (Figure 4.6-1).

The northeast-trending volcanic terrain of the Plain has a markedly different tectonic pattern compared to the older folded and faulted terrain of the northwest- The northwest-trending Basin and Range faults have not been observed to extend acro northwest-trending volcanic rift zones are known to lie across the Plain at or near been attributed to basaltic eruptions that occurred 4 million to 2,100 years ago (B Smith 1992, Kuntz et al. 1990).

The seismic characteristics of the Plain and the adjacent Basin and Range Pro Earthquakes and active faulting are associated with Basin and Range tectonic activi historically experienced few and small earthquakes (King et al. 1987, Pelton et al.

et al. 1993).

Figure 4.6-1. Geologic features in the region of the Idaho National Engineering La
0.3048.)

A typical soil association occurring on a lava flow on the INEL site consists series differentiated from one another largely on the basis of soil depth. The INE covered with a thin-to-thick blanket of eolian sediments, which are deposited in ep climatic cycles. The thickness of eolian sediments on the INEL site is generally l and commonly between 0.3 to 0.9 meters (1 to 3 feet). Most soils formed in eolian layer of secondary carbonates, which ranges from powdery to cemented.

4.6.2 Natural Resources

A geothermal exploration well was drilled at the INEL site to a depth of 3,14 in 1979. A temperature of 142yC (288yF) was measured, but no commercial quantities were identified (Mitchell et al. 1980). Mineral resources include several quarrie boundary to supply sand, gravel, pumice, silt, clay, and aggregate for road constru facility construction and maintenance, waste burial activities, and ornamental land the course of excavation, the gravel pits may be studied to characterize the local site. Outside the INEL site boundary, mineral resources include sand, gravel, pumi and precious metals (Strowd et al. 1981, Mitchell et al. 1981). The geologic histo potential for petroleum production at the INEL site very low.

4.6.3 Seismic Hazards

The distribution of earthquakes at and near the INEL site from 1884 to 1989 c Plain has a remarkably low rate of seismicity, whereas the surrounding Basin and Ra of seismicity (Figure 4.6-3, WCC 1992). The mechanism for faulting and generation Basin and Range is attributed to northeast-southwest directed crustal extension.

Several investigators have suggested hypotheses for the low rate of seismic a compared to the Centennial Tectonic Belt (Stickney and Bartholomew 1987) and Interm (Smith and Arabasz 1991):

Figure 4.6-3. Historical earthquakes in the Idaho National Engineering Laboratory

- Smith and Sbar (1974) and Brott et al. (1981) suggested that high crust beneath the Plain and adjacent region inside the seismic parabola (Figu ductile deformation (aseismic creep), in contrast to the brittle deform that occurs in the Basin and Range.

- Anders et al. (1989) suggested that the Plain and the adjacent region i parabola (Figure 4.6-1) have increased integrated lithospheric strength the presence of mid-crustal mafic intrusive rock strengthens the crust to fracture (see also Smith and Arabasz 1991).

- Parsons and Thompson (1991) proposed that magmatic dike injection suppr faulting and associated seismicity by altering the local tectonic stres injected in volcanic rift zones, they push apart the surrounding rocks differential stress, thereby preventing earthquakes from occurring.

- Recently, Anders and Sleep (1992) proposed that introduction of mantle- the midcrust beneath the Plain has decreased faulting and earthquakes b of deformation.

The markedly different late-Tertiary and Quaternary tectonic and seismic hist Basin and Range Province reflect the dissimilar deformational processes acting in e are being subjected to the same extensional stress field (Weaver et al. 1979, Zobac and Morgan 1992, Jackson et al. 1993); however, crustal deformation within the Plai injection and, in the Basin and Range, through large-scale normal faulting (Rodgers Thompson 1991, Hackett and Smith 1992).

Major seismic hazards include the effects from ground shaking and surface def faulting, tilting). Other potential seismic hazards (for example, avalanches, land settlement, and soil liquefaction) are not likely to occur at the INEL site because

are not conducive to them. Based on the seismic history and the geologic condition magnitude 5.5 (and associated strong ground shaking and surface fault rupture) are within the Plain. However, moderate to strong ground shaking can affect the INEL s the Basin and Range. Patterns of seismicity and locations of mapped faults are use sources of future earthquakes and to estimate levels of ground motion at the INEL s maximum magnitudes of earthquakes that could produce the maximum levels of ground m site facilities include (WCC 1990, 1992):

- A moment magnitude 7.0 earthquake at the southern end of the Lemhi faul and Fallert Springs segments
- A moment magnitude 7.0 earthquake at the southern end of the Lost River Arco segment
- A moment magnitude 5.5 earthquake associated with dike injection in eit Lava Ridge-Hell's Half Acre Volcanic Rift Zones and the Axial Volcanic
- A "random" moment magnitude 5.5 earthquake occurring within the Eastern Plain.

An example of the relationship of the peak ground acceleration on the INEL si frequency of occurrence of seismic events for various seismic hazards in the region events, is illustrated in Figure 4.6-4 (WCFS 1993). The curves were developed spec Idaho Chemical Processing Plant in the south-central INEL site and do not directly areas. Ground motion contributions from seismic sources not shown on Figure 4.6-4 Seismic Belt, Idaho Batholith, and Yellowstone Region) are significantly smaller be locations or lower maximum magnitudes. The INEL site-specific seismic hazard study provide curves similar to Figure 4.6-4 for other INEL site areas. INEL site seismi determined by the INEL Natural Phenomena Committee and incorporated into the INEL A Engineering Standards based on studies (WCC 1990). Section 5.14, Facility Accident potential impacts of postulated seismic events.

Figure 4.6-4. Contribution of the various seismic sources to the mean peak ground

4.6.4 Volcanic Hazards

Volcanic hazards at the INEL site can come from sources inside or outside the Volcanic hazards include the effects of lava flows, ground deformation (fissures, u earthquakes (associated with magmatic processes as distinct from earthquakes associ ash flows or airborne ash deposits (Bowman 1995). Most of the basalt volcanic acti million to 2,100 years ago in the INEL site area. The most recent and closest volc 2,100 years ago at the Craters of the Moon National Monument 25 kilometers (15 mile INEL site (Kuntz et al. 1992). The rhyolite domes along the Axial Volcanic Zone fo 0.3 million years ago and have a recurrence interval of about 200,000 years. There future dome formation affecting INEL site facilities is very low.

Catastrophic Yellowstone eruptions have occurred three times in the past 2 mi INEL site lies more than 160 kilometers (70 miles) from the Yellowstone Caldera rim winds would not disperse Yellowstone ash in the direction of the INEL site. For th great distance, and unfavorable dispersal, pyroclastic flows or ash fallout from fu are not expected to impact the INEL site.

Basaltic lava flows and eruptions from fissures or vents have been considered Impact Statement. Based on a probability analysis of the volcanic history in and n site area, the Volcanism Working Group (VWG 1990) estimated that the conditional pr volcanism would affect a south-central INEL site location is less than 2.5 y 10-5 p years or longer), where the hazard associated with Axial Volcanic Zone volcanism is probability of volcanic impact on INEL site facilities farther north, where both si have been older and less frequent, is estimated to be less than 10-6 per year (once longer). The statistics of 116 measured INEL-area lava flow lengths and areas were lava flow hazard zones (Figure 4.6-5). The mean lava flow length plus one standard corresponds to 14 kilometers (8.7 miles). The hazard for a particular site within much lower, typically by an order of magnitude or more, and must be assessed on a s (Bowman 1995). Section 5.14, Facility Accidents, presents the effects of a hypothe the INEL Radioactive Waste Management Complex (RWMC).

Figure 4.6-5. Map of the Idaho National Engineering Laboratory, showing locations

4.7 Air Resources

This section describes the air resources of the INEL site and the surrounding discussion includes the climatology and meteorology of the region, a summary of app regulations, descriptions of radiological and nonradiological air contaminant emiss characterization of existing and projected levels of air pollutants. The analysis i facilities and those that were expected (at the time the analysis was performed) to before June 1, 1995. Additional detail and background information on the material p section is presented in Appendix F, Section F-3, Air Resources, of Volume 2 of this

4.7.1 Climate and Meteorology

The Eastern Snake River Plain climate exhibits low relative humidity, wide da swings, and large variations in annual precipitation. Average seasonal temperatures range from -7.30C (Celsius) [(18.8~F (Fahrenheit)] in winter to 18.20C (64.8~F) in annual average temperature of about 5.60C (42~F). Temperature extremes range from a maximum of 39.40C (103~F) to a wintertime minimum of 450C (490F). Large year-to-yea variations in average monthly and seasonal temperatures are common, as are large va temperature in different locations. Annual precipitation is light, averaging 22.1 c (8.71 inches), with monthly extremes of zero to 12.8 centimeters (5 inches). The ma precipitation rate is 4.6 centimeters (1.8 inches). The greatest short-term precipi primarily attributable to thunderstorms, which occur approximately two or three day during the summer. The average annual snowfall is 70.1 centimeters (27.6 inches), w 151.6 centimeters (59.7 inches) and 17.3 centimeters (6.8 inches). Relative humidit average minimum of 27 percent to a maximum of 79 percent on an annual basis.

The INEL site is in the belt of prevailing westerlies; however, these winds a channeled by the mountain ranges bordering the Eastern Snake River Plain into a sou Most offsite locations experience the predominant southwest/northeast wind flow of River Plain, although subtle terrain features near some locations cause considerabl this flow regime. An illustration of annual wind flow is provided by the wind roses These wind roses show the frequency of wind direction (in other words, the directio

Figure 4.7-1. Annual average wind direction and speed at metereological monitoring

wind blows) and speed at three meteorological monitoring sites on the INEL site for to 1992. The highest hourly average near-ground wind speed measured onsite is 22.8 second (51 miles per hour) from the west-southwest, with a maximum instantaneous gu 34.9 meters per second (78 miles per hour) (Clawson et al. 1989). Other than thunde weather is uncommon. Five funnel clouds (tornadoes nOt touching the ground) and no been reported onsite from 1950 to 1988. Visibility in the region is good because of content of the alr and minimal sources of visibility-reducing pollutants. At Crater Wilderness Area [approximately 20 kilometers (12.4 miles) southwest of the INEL sit visual range is from 130 to 156 kilometers (81 to 97 miles) (Notar 1993).

Air pollutant dispersion is a result of the processes of transport and diffus contaminants in the atmosphere. Transport is the movement of a pollutant in the win diffusion refers to the process whereby a pollutant plume is diluted by turbulent e diffusion of pollutants may be restricted or enhanced by the temperature gradient o (that is, the change in temperature with altitude). Lapse conditions, which tend to diffusion, occur slightly less than 50 percent of the time. Conversely, thermal str inversion conditions, which inhibit vertical diffusion, occur slightly more than 50 The height to which the pollutants can freely diffuse is known as the mixing depth, air from the ground up to the mixing depth is known as the mixed layer. Estimates o average depth of the mixed layer range from 120 meters (400 feet) in December to 90 (3,000 feet) in July. Nocturnal (nighttime) inversions form at approximately sunset about one to two hours after sunrise. These inversions are often ground-based, mean temperature increases with height from the ground (Clawson et al. 1989).

4.7.2 Standards and Regulations

Air quality regulations have been established to protect the public from pote

effects of air pollution. These regulations (a) designate acceptable levels of poll (b) establish limits on radiation doses to members of the public, (c) establish lim emissions and resulting deterioration of air quality due to vehicular and other ant (d) require air permits to regulate (control) emissions from stationary (nonvehicul pollution, and (e) designate prohibitory rules, such as rules that prohibit open bu Clean Air Act (and amendments) provides the framework to protect the nation's air r public health and welfare. In Idaho, the U.S. Environmental Protection Agency and t Idaho Department of Health and Welfare, Division of Environmental Quality, are join for establishing and implementing programs that meet the requirements of the Federa INEL site activities are subject to air quality regulations and standards establish Act and by the State of Idaho (IDHW 1994) and to internal policies and requirements quality standards and programs applicable to INEL site operations are summarized in and described in further detail in Appendix F, Section F-3, Air Resources, of Volum

4.7.3 Radiological Air Ouality

The population of the Eastern Snake River Plain is exposed to environmental r both natural and manmade sources. This section summarizes the sources and levels of exposure in this geographical region, including sources of airborne radionuclide em INEL site. Estimates of radioactivity levels and radiological doses from current IN including anticipated increases to the baseline (increases from facilities expected operational by June 1, 1995), are provided and discussed.

4.7.3.1 Sources of Radioactivity.

The major source of radiation exposure in the Eastern Snake River Plain is natural background radiation. Sources of radioactivity related operations contribute a small amount of additional exposure.

Background radiation includes sources such as cosmic rays; radioactivity natu soil, rocks, and the human body; and airborne radionuclides of natural origin (such Radioactivity still remaining in the environment as a result of atmospheric testing also contributes to the background radiation level, although in very small amounts. background dose for residents of the Eastern Snake River Plain is estimated at 351 with more than half (about 200 millirem per year) caused by the inhalation of radio formed by the decay of radon (Hoff et al. 1992, NCRP 1987).

INEL site operations can result in releasing radioactivity to air either dire stacks or vents) or indirectly (such as by resuspension of radioactivity on contami Concentrations of radionuclides in direct releases are monitored or estimated based

Figure 4.7-2. Overview of Federal, State, and U.S. Department of Energy programs fo

calculations that relate surface contamination levels to expected airborne concentr

Emissions from INEL site facilities include the noble gases (argon, krypton, iodine; particulate fission products, such as ruthenium, Strontium, and cesium; rad by neutron activation, such as tritium (hydrogen-3), carbon-14, and cobalt-60; and such as uranium, thorium, and plutonium, and their decay products. Historically, th with the highest emission rate is the noble gas krypton-83, which is released mainl reprocessing of spent nuclear fuel and processing of high-level waste at the Idaho Processing Plant (ICPP). Activities at the Idaho Chemical Processing Plant also r small amounts of iodine-I 29, an isotope of concern because of its long half-life (biological properties. (Iodine isotopes taken into the body tend to accumulate in t Reactor operations release mainly noble gas isotopes with short half-lives, includi isotopes of xenon (mainly xenon-131m, -133, -135, and -138). Other activities at th including waste management operations, result in very low levels of airborne radion

Table 4.7-1 provides a summary of the principal types of airborne radioactivity emi INEL site facilities, plus estimated emissions from projects expected at the time t performed to become operational before June 1, 1993. For all existing facilities ex Chemical Processing Plant, these estimates are based on emissions data for 1991. Em the Idaho Chemical Processing Plant are based on actual 1993 emissions data, scaled reflect operation of the New Waste Calcining Facility (a high-level waste processin maximum permitted levels. Thus, the radiological emissions are representative of a includes processing of high-level waste, but not spent nuclear fuel processing.

4.7.3.2 Existing Radiological CondlUons.

Monitoring and assessment activities are
conducted to characterize existing radiological conditions at the INEL site and sur
environment. Results of these activities show that exposures resulting from airborn
emissions are well within applicable standards and are a small fraction of the dose
sources. These results are discussed separately below for onsite and offsite enviro
a. Fuel reprocessing at the INEL site ceased in April 1992, and baseline emission r
contributions from reprocessing. Rather, Processing-related emissions are assessed
Resources, as potential impacts associated with possible future spent nuclear fluid

Table 4.7-1 Summary of airborne radionuclide emissions (in curies) from facility ar

4.7.3.2.1 Onsite Doses-An indication of onsite radiological conditions is obtained

by comparing measured concentrations with those from INEL site boundary communities
locations. Results from onsite and boundary community locations include contributio
background conditions and INEL site emissions, while distant locations represent ba
conditions beyond the influence of INEL site emissions. These data show that 1991 a
radioactivity and radiation exposure levels within and around the INEL site were no
those at distant stations. The average annual dose (as measured by thermoluminescen
during 1991) was 127 millirem for distant locations and 125 millirem for boundary c
locations (Hoff et al. 1992).

Air dispersion models were applied to assess the radiation dose to workers at
facility areas as a result of cumulative emissions from existing facilities and tho
operational before June 1, 1995 (Leonard 1993, 1994). Results of this assessment in
maximum dose at any onsite area is currently about 0.2 millirem per year. This dose
to about 4 millirem per year if the maximum projected operation of the Portable Wat
Unit at the Power Burst Facility Area is included; however, that operation is tempo
years) and is not representative of a permanent increase in the baseline. If only p
emissions are considered, the baseline worker dose could increase to 0.32 millirem
actual and projected doses are a very small fraction of the DOE-established occupat
(5,000 millirem per year) and are below the National Emissions Standard for Hazardo
Pollutants (NESHAP) dose limit of 10 millirem per year. The National Emissions Stan
Hazardous Air Pollutants limit, established under the Clean Air Act, applies to the
member of the public (not to workers) but is the most restrictive limit for airborn
as a useful comparison for these results.

4.7.3.2.2 Offsite Doses-The offsite population may receive a radiation dose as a

result of radiological conditions directly attributable to INEL site operations. Th
with baseline radiological emissions (existing facilities and those expected at the
performed to become operational before June 1, 1995) is assessed for a maximally ex
and for the population within 80 kilometers (50 miles). The maximally exposed indiv
hypothetical person whose habits and proximity to the INEL site are such that the p
receive the highest dose projected to result from sitewide radiological emissions.
for the maximally exposed individual~as a result of current and projected sitewide
0.05 millirem, which is well below both the National Emissions Standard for Hazardo
Pollutants dose limit (10 millirem per year) and the dose received from background
(351 millirem per year). Figure 4.7-3 illustrates a comparison of these dose rates.
figure, the 10-millirem dose limit is a very small fraction of the background level
degree of protection.

Figure 4.7-3. Comparison of radiation dose to the maximally exposed individual (due
Emission Standard for Hazardous Air Pollutants dose limit and the dose from backgro

The collective dose to the surrounding population as a result of INEL site em
using 1990 U.S. Census Bureau data for the total population residing within a circu
50-kilometer (50-mile) radius extending from each facility, is about 0.3 person-rem
dose is distributed over a population of about 120,000, resulting in an average ind
below 0.001 millirem. The population dose of 0.3 person-rem is very small when comp
dose received by the same population from background sources (over 40,000 person-re

years, the baseline population dose is projected to increase (even though baseline not rise) by an amount corresponding to the growth of the surrounding population.

4.7.3.3 Summary of Radiological Conditions.

Radioactivity and radiation levels
resulting from INEL site emissions are very low, well within applicable standards, when compared to doses received from natural background sources. This applies both conditions to which INEL site workers or visitors may be exposed, and offsite locat general population resides. Health risks associated with maximum potential exposure onsite and offsite environments are described in Section 4.12, Health and Safety.

4.7.4 Nonradiological Conditions

Persons in the Eastern Snake River Plain are exposed to sources of air pollut agricultural and industrial activities, residential woodburning, wind-blown dust, a exhaust. Many of the activities at the INEL also emit air pollutants. The types of assessed here include (a) the criteria pollutants regulated under the National and Quality Standards and (b)other types of pollutants with potentially toxic propertie hazardous) air pollutants. Criteria pollutants include nitrogen dioxide, sulfiir di monoxide, lead, ozone, and respirable particulate matter (particles less than 10 mi diameter, which are small enough to pass easily into the lower respiratory tract), Ambient Air Quality Standards have been established. Total suspended particulate ma designated by the State of Idaho as a criteria pollutant. Volatile organic compound precursors leading to the development of ozone. Toxic air pollutants include canc such as arsenic, benzene, carbon tetrachloride, and formaldehyde, as well as materi health hazards, such as fluorides, ammonia, and hydrochloric and suiftiric acids.

4.7.4.1 Sources of Air Emissions.

The types of nonradiological emissions from INEL
facilities and activities are similar to those of other major industrial complexes Combustion sources such as boilers and emergency generators emit both criteria and pollutants. Sources such as chemical processing operations, waste management activi combustion), and research laboratories emit primarily toxic air pollutants. A total pollutants have been identified that are emitted from existing INEL facilities in q the screening level established by the State of Idaho. Cflie health hazard associat pollutants emitted in lesser quantities is considered low enough by the State of Id detailed assessment.) Waste management, construction, and related activities (such also generate fligitive particulate matter.

a. Ozone is formed by iaactions of oxides of nitrogen and oxygen in the presence of hydrocarbons, sometimes called precursor organics, contribute to the formation of o and volatile organic hydrocarbons are, therefore, regulated as precursors to ozone

Baseline emission rates for existing facilities have been characterized for tw The actual emtssions case represents the collective emission rates of nonradiologic experienced by INEL facilities during 1991 for criteria pollutants and 1989 for tox These are the most recent years for which complete data are available. In contrast emissions have also been estimated for a hypothetical maximum year. This is appropr many facilities that are governed by conditions imposed by operating permits (such hours of operation or emission rates) typically operate at levels well below those permit. It is conceivable that emission rates of currently operated facilities coul still remain within the bounds of permitted conditions. The maximum emissions case been characterized. This baseline case represents a scenario in which all permitted INEL are assumed to operate in such a manner that they emit specific pollutants to extent allowed by operating permits or applicable regulations. The baseline also in increases (that is, emissions from projects expected at the time the analysis was p operational before June 1, 1995.) A summary of criteria and toxic air pollutant emi actual and maximum emissions cases, including projected increases, is provided in T

4.7.4.2 Existing Conditions.

For most of the pollutants included in this assessment (including all toxic air pollutants), insufficient monitoring data exist to allow a of existing air quality. Rather, the characterization of existing nonradiological c extensive program of air dispersion modeling. The modeling program applied for this utilized computer codes, methods, and assumptions that are considered acceptable by Environmental Protection Agency and the State of Idaho for regulatory compliance pu general, the Industrial Source Complex-2 (ISC-2) model was used for assessment of c and selected toxic air pollutants; the Fugitive Dust Model (FDM) was used to assess fugitive dust emissions; and the simpler SCREEN model was used to assess other toxi contaminants. The SCREEN model incorporates methods and data that tend to overestim and it is useful for idenflfying cases that require additional, more refined (ISC-2 methodology applied in these assessments is described in detail in Appendix F, Sect Resources, of Volume 2 of this EIS. The remainder of this section describes the res dispersion modeling effort in terms of air quality conditions associated with the a baseline cases. In particular, assessment results are presented for concentrations within and around the INEL site.

<u>Table 4.7-2 Annual average and maximum hourly emission rates of nonradiological air</u>

4.7.4.2.1 Onsite Conditions-The existing conditions have been assessed for each

facility area as a result of cumulative emissions from sources located within that areas of the INEL site. Except for public roads, criteria pollutant levels are not locations because standards for these pollutants apply only to ambient air location to which the general public has access). Toxic air pollutants, however, are assesse potential exposure of workers to these haaardous substances. Typically, the dominan pollutant levels at each of these areas are sources within that area. Onsite levels compared to occupational exposure limits set for these substances by either the occ and Health Administration (OSHA) or the American Conference of Government Industria (The lower of the two limits is used.)

Results of the onsite assessment for both the actual and maximum emissions ar

Table 4.7-3. For most of the toxics, the estimated onsite concentrations of toxic a well below levels established for protection of workers. The maximum short-term ben concentration (that is, the highest level predicted to occur over an eight-hour per the standard at the highest predicted location within the Central Facilities Area. primarily from emissions associated with petroleum fuel storage, handling, and comb toxic pollutant levels at onsite locations are well within the most restrictive occ limits.

4.7.4.2.2 Offsite Conditions-Estimated maximum offsite pollutant concentrations

were calculated for locations along the INEL site boundary and for public roads wit boundary. These are considered ambient air locations because the public has general Pollutant levels were also calculated for Craters of the Moon Wilderness Area. The criteria pollutants are presented in Table 4.7-4 and indicate that all concentratio ambient air quality standards for both the actual and maximum emissions cases. For emissions baseline, the highest sulfur dioxide concentration (over a 3-hour period) boundary is about 13 percent of the standard, while the highest 24-hour particulate about 33 percent of the standard. Levels of all other pollutants are below 12 perce standards. The highest offsite levels are estimated to occur at the boundary south south-southwest of the Central Facilities Area. Somewhat higher results were obtain roads traversing the site, with 24-hour particulate matter at 53 percent of the sta

<u>Table 4.7-3 Highest predicted concentrations of toxic air pollutants at onsite loca</u>
increases to the baseline.

<u>Table 4.7-4 Ambient air concentrations of criteria pollutants for the maximum basel</u>
24-hour sulfur dioxide at 45 and 37 percent of the standard, respectively. Values a Moon Wilderness Area were below 10 percent of applicable standards in all cases. It that actual emissions from INEL site facilities are much lower than those assumed f

scenario, so there is a wide margin of protection inherent in these results. Figure difference in actual and maximum emissions for criteria and toxic air pollutants.

Concentrations of criteria pollutants from certain sources are also compared Significant Deterioration (PSD) regulations, which have been established to ensure remains good in those areas where ambient air quality standards are not exceeded. (F-3.3. 1.2 for a description of these regulations.) These Prevention of Significant increments are allowable increases over baseline conditions from sources that have operational after certain baseline dates. Increments have been established by Feder

Figure 4.7-4. Comparison of actual emission rates for criteria and toxic pollutants

regulations for sulfur dioxide, total suspended particulates, and nitrogen dioxide, regulations for respirable particulate matter. Separate increments are established such as national parks or wilderness areas (termed Class I areas) and for the natio II areas). Craters of the Moon Wilderness Area is the Class I area nearest the INEL amount of increment consumed by existing sources subject to Prevention of Significa regulation has been assessed (Raudsep et al. 1995). These results are presented in 4.7-6 for Class I and II areas, respectively. for all increment consummg sources pr 1, 1994. The amount of increment consumed for Prevention of Significant Deteriorati operatmg at maximum allowable emission rates is less than 10 percent of the allowab all annual evaluations but somewhat higher for short-term assessments. The maximum consumed at Craters of the Moon is 53 percent of the 3-hour sulfur dioxide level an areas, 43 percent of the 24-hour level for respirable particulate matter.

Concentrations of toxic air pollutants are compared to the ambient air standa promulgated for new sources by the State of Idaho Rules for Control of Air Pollutio (IDHW 1994). These standards are increments that apply only to new or modified sour existing emissions. Nevertheless, these increments are useful as reference levels f current conditions with recommendations for ensuring public health protection in as sources of emissions. Thus, the discussion that follows refers to these increments Annual average concentrations of carcinogenic toxics are assessed for offsite locat and Craters of the Moon Wilderness Area), while levels of noncarcinogenic toxics ar locations along public roads as well as offsite locations.

Maximum offsite concentrations of carcinogenic toxics, which are summarized i are observed to occur at the site boundary due south of the Central Facilities Area air pollutant levels are below the reference levels. Noncarcinogenic air pollutant summarized in Table 4.7-8. For site boundary locations, these levels are all well b levels (1 percent or less). Levels at some public road locations, which are closer sources, are higher than site boundary locations, but still well below the referenc pollutant levels estimated for Craters of the Moon Wilderness Area are much less th the reference levels suitable for comparison.

Table 4.7-5 Prevention of Significant Deterioration (PSD) increment consumption at
Deterioration regulation.(a)

Table 4.7-6 Prevention of Significant Deterioration (PSD) increment consumption at
Significant Deterioration regulation.(a)

Table 4.7-7 Highest predicted concentrations of carcinogenic air pollutants at site
anticipated increases to the baseline.

Table 4.7-8 Highest predicted concentrations of noncarcinogenic toxic air pollutant
anticipated increases to the baseline.

4.7.4.3 Summary of Nonradiological Air Quality.

The baseline conditions of
nonradiological air quality on and around the INEL site have been estimated for act emissions scenarios. The air quality is good and within applicable guidelines. The INEL site is in attainment or unclassified for all National Ambient Air Quality Sta criteria pollutants are well within the ambient air quality standards for both scen emissions, all INEL site boundary and public road levels are below reference levels comparison. Within the INEL site, a very localized and slight exceedance occurs for benzene at the Central Facilities Area. All other toxic pollutant levels at onsite below applicable limits. Health risks associated with maximum potential exposure le

and offsite environments are described in Section 4.12, Health and Safety, of Volum

4.8 Water Resources

This section describes existing regional and INEL site hydrologic conditions water quality for surface and subsurface water, water use, and water rights. The s describes the saturated zone below the water table and the vadose zone (or unsatura water bodies) located between the land surface and the water table. Technical supp provided in Appendix F, Section F-2, Geology and Water, of Volume 2 of this EIS.

4.8.1 Surface Water

Other than intermittent streams and surface water bodies and manmade percolat evaporation ponds, there is little surface water at the INEL site. The following s drainage conditions, local runoff, flood plains, and surface water quality. Figure in this section.

4.8.1.1 Regional Drainage.

The INEL site is located in the Mud Lake-Lost River Basin, a closed drainage basin that includes three main tributaries-the Big and Little Lost These surface water features drain mountain watersheds located directly west and no However, most of the surface water flow is diverted for irrigation before it reache (Barraclough et al. 1981), resulting in little or no surface water flow for periods duration within the boundaries of the INEL site (Pittman et al. 1988).

The Big Lost River drains approximately 376,000 hectares (1,450 square miles) reaching the INEL site. Approximately 48 kilometers (30 miles) upstream of Arco, I controls and regulates river flow, which continues southeast past the towns of Moor Eastern Snake River Plain. The river channel then crosses the southwestern boundar surface water flow can be controlled by the INEL Diversion Dam. During heavy runof is diverted to a series of natural depressions, designated as spreading areas. The system is to prevent flooding of downstream facilities and ice jams from developing Lost River continues northeasterly across the INEL site to an area of natural infil sinks) near Test Area North. Surface

Figure 4.8-1. Locations of selected Idaho National Engineering Laboratory site fac (Bennett 1990).

water from the Big Lost River does not usually reach the western boundary of the IN an unusually wet year, flow can continue as far north as the Birch Creek Playa (Pla INEL is located in a closed basin, surface water rarely, if ever, flows off the si

Birch Creek drains an area of approximately 194,000 hectares (750 square mile upstream of the INEL site, surface water from Birch Creek is diverted for irrigatio production. In the winter, water flow crosses the northwest corner of the INEL sit channel constructed 6.4 kilometers (4 miles) north of Test Area North, where it the gravels, recharging the aquifer (Bishop 1993).

The Little Lost River drains an area of approximately 183,000 hectares (705 s Streamflow is diverted for irrigation use north of Howe. Surface water from the Li reached the INEL site in recent times; however, during high stream flow years, wate River has reached the INEL site, where it then infiltrated into the subsurface (EG&

4.8.1.2 Local Runoff.

Surface water generated from local precipitation will flow into topographic depressions (lower elevations than the surrounding terrain) on the INEL either evaporates or infiltrates into the ground. Ponding of the runoff in a few l subsurface moisture content, enhancing migration of localized contaminants in the u (Wilhelmson et al. 1993).

Localized flooding can occur at the INEL site when the ground is frozen and r snow is combined with heavy spring rains. The Radioactive Waste Management Complex 1962, 1969, and 1982 by local runoff from rapid spring thaws; and Test Area North w to rapid snowmelt (Koslow and Van Haaften 1986). After the flooding events, the ad

diversion channels, settling basins, and sump pumps at the Subsurface Disposal Area Waste Management Complex and Test Area North have alleviated snowmelt flooding at t (Dames & Moore 1992, Koslow and Van Haaften 1986).

The Dames & Moore study (1992) evaluated the design of these flow systems for potential for flood waters to come into contact with stored wastes and to ensure th not expose buried or covered-up radioactive waste materials (Dames & Moore 1992, DO flows, water surface elevations, and velocities for the 100-, 500-, and 1,000-year probable maximum flood, and the probable maximum flood were estimated at key locati Radioactive Waste Management Complex Main and East Channel flow systems. This anal the existing Adams Boulevard culvert would be overtopped by the one-half probable m probable maximum flood events, allowing for potential erosion in the vicinity. Fie railroad embankments, and culverts indicated that these structures may not be able event, for which their failure would result in higher flood peaks at downstream loc impacts of any potential overtopping breaches was beyond the scope of the study.

4.8.1.3 Flood Plains.

Intermittent surface water flow and the INEL Diversion Dam (constructed in 1958 and enlarged in 1984) have effectively prevented flooding from the Big Lost site. However, flooding from the Big Lost River might occur onsite if high water i Big Lost River were coupled with a dam failure. Koslow and Van Haaften (1986) exam consequences of a Mackay Dam failure during a seismic event, structural failure coi 500-year recurrence interval floods, and during a probable maximum flood (hypotheti considered to be the most severe event possible). The results from all dam failure would occur outside the banks of the Big Lost River from Mackay Dam to Test Area No Box Canyon (Figure 4.8-1). The water velocity on the INEL site would range from 0. second (0.6 to 3.0 feet per second), with water depths outside the banks of the Big 0.61 to 1.22 meters (2 to 4 feet) (Koslow and Van Haaften 1986). Because of the lo depth of the water, flooding would not pose a threat of structural damage to facili

An updated 100-year floodplain map for the Big Lost River is currently being personnel and is expected to be completed in 1996. The projects identified in Appe Supporting the Alternatives, of Volume 2 of this EIS would be located using the mos floodplain information. Pending completion of the updated 100-year floodplain map, area encompassed by the probable maximum flood is greater than that for the 100-yea above, the impact to INEL facilities from the probable maximum flood would be small

4.8.1.4 Surface Water Quality.

Water quality in the Big and Little Lost Rivers and Birch Creek is similar and has not varied a great deal over the period of record. Measured phy radioactive parameters have not exceeded applicable drinking water quality standard Chemical composition is determined primarily by the carbonate mineral composition o surrounding mountain ranges northwest of the INEL site and by the chemical composit return flow to the surface water (Robertson et al. 1974).

INEL site activities do not directly affect the quality of surface water outs surface water does not flow directly offsite (Hoff et al. 1990). Discharges from I to manmade seepage and evaporation basins, rather than to natural surface water bod the Clean Water Act. However, water from the Big Lost River System, as well as see disposal facilities (in other words, percolation and evaporation ponds and septic t water injection wells, does infiltrate into the Snake River Plain Aquifer (Robertso Low 1988, Bennett 1990). These areas are inspected, monitored, and sampled as stip Stormwater Pollution Prevention Program (DOE-ID 1993a).

4.8.2 Subsurface Water

Subsurface water at the INEL site occurs in the Snake River Plain Aquifer and section describes regional and local hydrogeologic conditions and subsurface water term groundwater refers to water in the saturated zone that enters freely into well unconfined conditions (Driscoll 1986). Subsurface water in the vadose zone, or uns to as vadose water. (See Section 4.8.2.5.3, Perched Water Quality, for a descripti hydrology.)

4.8.2.1 Regional Hydrogeology.

The INEL site overlies the Snake River Plain Aquifer, the
largest aquifer in Idaho (Figure 4.8-2). This aquifer underlies the Eastern Snake
area of approximately 2,490,000 hectares (9,611 square miles). Groundwater in the
to the south and southwest. Water storage in the aquifer is estimated at 2.5 y 101
acre-feet), which is approximately the same as the volume of water contained in Lak
1974). Irrigation wells can yield as much as

__Figure 4.8-2. Location of the Idaho National Engineering Laboratory site, Eastern__
26.5 cubic meters per minute (7,000 gallons per minute) of water (Garabedian 1992).
Aquifer is among the most productive aquifers in the nation.

The drainage basin recharging the Snake River Plain Aquifer covers an area of
9,060,000 hectares (35,000 square miles). The aquifer is recharged by infiltration
seepage from stream channels and canals, underflow from tributary stream valleys ex
watershed, and direct infiltration from precipitation (Garabedian 1992). Most rech
water-irrigated areas and along the northeastern margins of the plain. Groundwater
from the aquifer through springs that flow into the Snake River and pumping for irr
and seepages that flow from the aquifer are located near the American Falls Reserv
Pocatello), the Thousand Springs area between Milner Dam and King Hill (near Twin F
Lorenzo and Louisville, along the Snake River.

4.8.2.2 Local Hydrogeology.

The INEL site covers about 230,000 hectares (890 square miles)
of the north-central portion of the Snake River Plain Aquifer. Depth to groundwate
the INEL site ranges from approximately 61 meters (200 feet) in the north to over 2
the south (Pittman et al. 1988). Groundwater flow is generally toward the south-so
surface is primarily unconfined (not overlain by impermeable soil or bedrock). How
as if it were partially confined because of localized geologic conditions (Whitehea
and movement of groundwater in the aquifer is dependent on the geologic setting and
discharge of water within that setting. Most of the aquifer is comprised primarily
basaltic flows with interbedded sediments extending to depths of 1,067 meters (3,50
surface (Bishop 1993). A majority of the groundwater migrates horizontally through
zones (broken and rubble zones) that occur at various depths. Water also migrates
the interfingering edges of interflow zones (Garabedian 1986). Sedimentary interbe
vertical movement of groundwater.

The rate water moves through the ground depends on the hydraulic gradient (ch
pressure with distance in a given direction) of the aquifer, the effective porosity
and hydraulic conductivity (capacity of a porous media to transport water) of the s
upper 61 to 244 meters (200 to 800 feet) of the basalts have a markedly higher hydr
rocks below 458 meters (1,500 feet). Therefore, the base of the aquifer is conside
458 meters (800 to 1,500 feet) below land surface. Estimated flow rates within the
6.1 meters per day (5 to 20 feet per day) (Barraclough et al. 1981).

The ability to transmit water (transmissivity) and the ability to store water
physical properties of the aquifer. In general, the hydraulic characteristics of t
readily transmitted, particularly in the upper portions. The variability in how th
water increases the difficulty in aquifer investigations and modeling.

Near the INEL site, the aquifer is recharged by irrigation return and precipi
the west and north. Most of the inflow to the aquifer results from underflow of gr
filled valleys adjacent to the Eastern Snake River Plain and secondarily from adjac
(that is, Big and Little Lost Rivers and Birch Creek). Recharge at the INEL site i
of precipitation, particularly snowfall, for a given year (Barraclough et al. 1981)

4.8.2.3 Vadose Zone Hydrology.

The vadose zone (unsaturated zone) extends from the land
surface down to the regional water table. Within the vadose zone, the geologic mat
partially by water and partially by air. Subsurface water occurring in the vadose
water. This complex zone at the INEL site consists of surface sediments (primarily
sand and gravel) and numerous relatively thin, basaltic flows, with some sedimentar

surficial deposits are found in the northern part of the INEL site, which thin sout exposed at the surface.

The vadose zone protects the groundwater by filtering out many contaminants t buffering dissolved chemical wastes, and slowing the transport of contaminated liqu vadose zone also protects the aquifer by slowing the migration of large volumes of contaminants released to the environment through spills or migration from disposal natural decay processes to occur.

Travel times for water through the vadose zone are important for understandin movement. The flow rates in the vadose zone are directly dependent on the extent o coatings on the fractures, the percentage of sediments versus basalt, and the moist material. Flow increases under wetter conditions and slows under dryer conditions. unsaturated flow conditions near the Radioactive Waste Management Complex, an inves movement in surface sediments found that infiltration ranged from 0.36 to 1.1 centi 0.43 inches per year) (Cecil et al. 1992). However, under nearly saturated conditi standing water at land surface in the same area moved vertically 2.1 meters (6.9 fe (Kaminsky 1991). Under saturated conditions and matrix flow, over 100 days were re a 50-centimeter- (20-inch)-long basalt rock from the Radioactive Waste Management C 1991).

4.8.2.4 Perched Water.

Locally, saturated conditions may exist within the vadose zone above the water table and are called perched water. Perched water occurs when water migr laterally from the surface until it encounters an impermeable layer of dense basalt material (Bishop 1993). Perched water may spread laterally, sometimes hundreds of over the edges of the impermeable layer and continue downward. Several perched wat between the land surface and the water table.

In general, the formation of perched water bodies slows the downward migratio infiltrate into the vadose zone from the surface. The largest occurrence of perche generally related to the presence of disposal ponds or other surface water bodies b vadose zone disposal wells. These bodies have been detected at the Idaho Chemical Reactor Area, Test Area North, and Radioactive Waste Management Complex (Bishop 199 a field study performed in 1986 at the Idaho Chemical Processing Plant showed that three areas at possibly three depth zones. These bodies are located at depths rang meters (30 feet) to 98 meters (322 feet) below ground surface and extend laterally (3,600 feet) (Bishop 1993). In general, the chemical concentrations, shape, and si fluctuated over time in response to the volume of water discharged to the infiltrat

4.8.2.5 Subsurface Water Quality.

Subsurface water quality is affected by natural water chemistry and contaminants originating at the INEL site. Monitoring programs are c INEL Groundwater Protection Management Program (Case et al. 1990). Under this prog Groundwater Monitoring Plan (Sehlke and Bickford 1993) was established to fulfill t monitoring requirements of DOE Order 5400.1, "General Environmental Protection Prog As specified in the plan, samples are collected from surface water, perched water, identify contaminants and contaminant migration to and within the aquifer.

4.8.2.5.1 Natural Water Chemistry-The natural groundwater chemistry of the Snake

River Plain Aquifer beneath the INEL site is determined by several factors. These weathering reactions that occur as water interacts with minerals in the aquifer and of (a) groundwater originating outside of the INEL site, (b) precipitation falling and (c) streams, rivers, and runoff infiltrating into the aquifer (Wood and Low 198 of the groundwater is different, depending on the source areas. For example, groun contains calcium, magnesium, and bicarbonate leached from sedimentary rocks; and gr east contains sodium, fluorine, and silicate resulting from contact with volcanic r

The natural chemistry affects the mobility of contaminants introduced into th site activities. Many dissolved contaminants are adsorbed (or attached) to the sur in the subsurface, thereby retarding the movement of contaminants in the aquifer an migration of contamination. However, many naturally occurring chemicals compete wi adsorption sites on the rocks and minerals or react with contaminants to reduce the

mineral surfaces.

4.8.2.5.2 Groundwater Quality-Previous waste discharges to unlined ponds and

injection wells have introduced radionuclides, nonradioactive metals, inorganic sal into the subsurface. Solid low-level and transuranic wastes have also been dispose Subsurface Disposal Area within the Radioactive Waste Management Complex since 1952 waste disposal at the Complex was discontinued in 1970; however, disposal of low-le continue until 2020.) Table 4.8-1 summarizes highest detected concentrations of co the aquifer between 1985 and 1992, concentrations near the INEL site boundary, exis Protection Agency maximum contaminant levels, and DOE Derived Concentration Guides. paragraphs discuss each category of contaminants and comparisons of observed concen contaminant levels. Trends in groundwater quality are discussed in Section 5.8, Wa

Table 4.8-1. Summary of highest detected contaminant concentrations in groundwater National Engineering Laboratory site (1985 to 1992).

Parameter	Highest detected recent concentrationa (year)	Recent bo (year)
	Radionuclides in picocuries	
Americium-241	0.91b (1990)	< detecti
Cesium-137	2,050b (1992)	< detecti
Cobalt-60	890b (1987)	< detecti
Iodine-129	3.6b (1987)	0.00083-B
Plutonium-238	1.28b (1990)	< detecti
Plutonium-239/240	1.08b (1990)	< detecti
Strontium-90	640b (1992)	< detecti
Tritium	48,000b (1988)	Backgroun
	Nonradioactive metals in mi	
Cadmium	0.0073b (1992)	Backgroun
Chromium (total)	0.21b (1988)	Backgroun
Lead	0.009b (1987)	Backgroun
Mercury	0.0004b (1987)	Backgroun
	Inorganic salts in milligra	
Chloride	200b (1991)	-
Nitrate	5.4b (as N) (1988)	Backgroun
Sulfate	140m (1985)	Backgroun
	Organic compounds in millig	
Carbon tetrachloride	0.0066b (1993)	

4.8.2.5.3 Perched Water Quality-Wastewater discharges from INEL site operations

have infiltrated into the vadose zone and created locally perched water beneath the concentrations of the following contaminants have been detected in samples collecte locations: tritium, cesium-137, cobalt-60, chromium, and sulfate concentrations in the Test Reactor Area; tritium in shallow perched water and carbon tetrachloride, c trichloroethane, tricholorethylene, tetrachloroethylene, and 1,1,-dichloroethylene the Radioactive Waste Management Complex; and strontium-90 in perched water near th Processing Plant (Bishop 1993). In general, the chemical concentrations, shape, an fluctuated over time in response to the volume of water discharged to the infiltrat concentrations of contaminants in all perched water bodies have not yet been measur water quality are discussed in Section 5.8, Water Resources.

4.8.3 Water Use and Rights

Surface water is not withdrawn at the INEL site. The three surface water fea INEL site (Big and Little Lost Rivers and Birch Creek) have the following designate water supply, cold-water biota, salmonid spawning, and primary and secondary contac surface water is not used for any of these designations within the INEL site bounda the Big Lost River and Birch Creek have been designated for domestic water supply a waters.

Groundwater use on the Snake River Plain includes irrigation, food processing

domestic, rural, public, and livestock supply. Water use for the upper Snake River River Plain Aquifer was 16.4 y 109 cubic meters per year (4.3 y 1012 gallons per ye was over 50 percent of the water used in Idaho and approximately 7 percent of agric nation. Most of the water withdrawn from the eastern Snake River Plain [1.8 y 109 y 1011 gallons per year)] is used for agriculture. The aquifer is the source of al INEL site activities withdraw water at an average rate of 7.4 y 106 cubic meters pe per year) (DOE-ID 1993b, c). However, the baseline annual withdrawal rate dropped meters (1.7 y 109 gallons) in 1995. The average annual withdrawal is equal to appr the water consumed from the Snake River Plain Aquifer, or 53 percent of the maximum typical irrigation well, if pumped 365 days a year. Of the quantity of water pumpe substantial portion is discharged to the surface or subsurface and eventually retur 1993b, c).

As designated by the Safe Drinking Water Act (42 U.S.C, Section 1427), a sole defined as one that supplies 50 percent of the drinking water consumed in the area Sole-source aquifer areas have no alternative source or combination of sources that and economically supply all who obtain their drinking water from the aquifer. Beca 100 percent of the drinking water consumed within the eastern Snake River Plain (Ga an alternative drinking water source or combination of sources is not available, th Protection Agency designated the Snake River Plain Aquifer a sole-source aquifer in

DOE holds a Federal Reserved Water Right for the INEL site, which permits a w capacity of 2.3 cubic meters per second (80 cubic feet per second) and a maximum wa million cubic meters per year (11.4 y 109 gallons per year) for drinking, process w cooling. Because it is a Federal Reserved Water Right, the INEL site's priority on its establishment in 1950. The legal and administrative framework for the water ri is currently being evaluated for the State of Idaho.

4.9 Ecological Resources

This section describes the biotic resources on the INEL site, which are typic Columbia Plateau. Threatened and endangered species, wetlands, and the extent of h radionuclides in plants and animals are discussed. Because the existing major faci be affected most by the proposed actions, the biotic resources in those areas are e because other resources (for example, more mobile species like pronghorn) could be for the entire INEL site also are briefly described.

4.9.1 Flora

Vegetation on the INEL site is primarily of shrub-steppe vegetation and is a million hectares (111.2 million acres) of this vegetation type found in the Intermo vegetation associations identified on the INEL site range from primarily shadscale-altitudes through sagebrush- and grass-dominated communities to juniper woodlands a the nearby mountains and buttes (Rope et al. 1993, Kramber et al. 1992, Anderson 19 associations can be grouped into six types: juniper woodland, native grassland, sh and wetland vegetation types (Figure 4.9-1). Over 90 percent of the INEL is covere vegetation, which is dominated by big sagebrush (Artemisia tridentata), saltbush (A rabbitbrush (Chrysothamnus spp.). Grasses include cheatgrass (Bromus tectorum), In (Oryzopsis hymenoides), wheatgrasses, (Agropyron spp.), and squirreltail (Sitanion plants include phlox (Phlox spp.), wild onion (Allium), milkvetch (Astragalus spp.) kali), and various mustards. Additional detailed information on plant communities (1993).

Disturbed areas (grazing not included) cover only 1.3 percent of the INEL sit frequently are dominated by introduced annuals, including Russian thistle and cheat usually provide less food and cover for wildlife compared to perennial native speci perennial native species. Therefore, these disturbed areas serve as a source of se potential for the increased establishment of Russian thistle and cheatgrass into th areas. Vegetation adjacent to each facility is generally similar to the vegetation Vegetation within each facility area is primarily disturbed

Figure 4.9-1. Approximate distribution of vegetation map at the Idaho National Eng

or landscaped. Species diversity on the INEL is similar to diversity on like-sized the Intermountain west. The diversity on the INEL is heavily influenced by the shr

covering over 90 percent of the INEL. Diversity is lower on disturbed and modified of greater moisture content.

4.9.2 Fauna

The INEL site supports animal communities typical of shrub-steppe vegetation 270 vertebrate species have been observed, including 46 mammal, 204 bird, 10 reptil fish species (Arthur et al. 1984, Reynolds et al. 1986). Common species include sm ground squirrels, rabbits, and hares), elk, songbirds (sage sparrow, western meadow lizards, and snakes (rattlesnakes). Migratory species, including pronghorn, waterf INEL site for part of the year. (Some pronghorn remain on the site year round.) P INEL site include bobcats, mountain lions, and coyotes. Trout and salmon species h Big Lost River when it has flowed on to the INEL site. Additional information on f et al. (1993). Baseline train and wildlife collisions are discussed in 4.11.4 (Acc Environmental Impact Statement.

4.9.3 Threatened, Endangered, and Sensitive Species

Federal- and State-protected, candidate, and sensitive species were identifie regulatory agency lists (Lobdell 1992, 1995), the Idaho Department of Fish and Game Center list, and information from INEL site surveys.

Two Federal endangered and nine Federal Category 2 candidate animal species w potentially occurring on the INEL site (Table 4.9-1). Federal endangered peregrine observed within the boundary of the INEL infrequently only in winter and for only b endangered bald eagles are observed each winter near or on the INEL, but only in th INEL about 32 kilometers (20 miles) north of the Test Area North and on the INEL si of these areas is close to proposed activities. The Federal candidate Category 2 f observed primarily near juniper woodlands. This habitat is remote from facilities. Category 2 white-faced ibis is an infrequent migrant

Table 4.9-1. Threatened and endangered species, species of special concern, Laboratory site.

	Name	Statusa
Birds	Northern goshawk (Accipiter gentilis)	C2, SSC, FS
	Burrowing owl (Athene cunicularia)	C2, BLM
	Ferruginous hawk (Buteo regalis)	C2, BLM
	Swainson's hawk (Buteo swainsoni)	BLM
	Great egret (Casmerodius albus)	SSC
	Merlin (Falco columbarius)	SSC, BLM
	Peregrine falcon (Falco peregrinus)	E
	Gyrfalcon (Falco rusticolus)	BLM
	Common loon (Gavia immer)	SSC, FS
	Bald eagle (Haliaeetus leucocophalus)	E
	Long-billed curlew (Numenius americanus)	SPS, BLM
	American white pelican (Pelicanus erythrorhynchos)	SSC
	White-faced ibis (Plegadis chihi)	C2
Mammals	Merriam's shrew (Sorex merrami)	SPS
	Pygmy rabbit [Brachylagus (Sylvilagus) idahoensis]	C2, BLM, SS
	California myotis (Myotis californicus)	SSC
	Fringed myotis (Myotis thysanodes)	SSC
	Western pipistrelle (Pipistrellus hesperus)	SSC, BLM
	Townsend's western big-eared bat (Plecotus townsendii)	C2, SSC, FS
	Long-eared myotis (Myotis evotis)	C2
	Small-footed myotis (Myotis subulatus)	C2
Plant	Lemhi milkvetch (Astragalus aquilonius)	BLM, FS, IN
	Painted milkvetch (Astragalus ceramicus var. apus)	3c, INPS-M
	Winged-seed evening primrose (Camissonia pterosperma)	BLM, INPS-S
	Nipple cactus (Coryphantha missouriensis)	INPS-M
	Sepal-tooth dodder (Cuscuta denticulata)	INPS-1
	Spreading gilia [Ipomopsis (Gilia) polycladon]	BLM, INPS-2
	King's bladderpod (Lesquerella kingii var. cobrensis)	INPS-M

	Tree-like oxytheca (Oxytheca dendroidea)	INPS-S
Insects	Idaho pointheaded grasshopper (Acrolophitus punchellus)	C2, BLM

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a. Key: C2 = Federal category 2 species.
3c = No longer considered for Federal listing.
E = Federal and State endangered species.
SSC = State species of special concern.
SPS = State protected species

BLM = Bur
FS = U.S
INPS-S = I
INPS-M = Id
INPS-1 = I
INPS-2 = I

that uses aquatic and upland areas. The Federal candidate Category 2 burrowing owl that uses grassland and shrub-steppe habitat. Caves used by the Townsend's big-ear from proposed activities, and a survey of bat species is currently under way.

Two State-protected species (Merriam's shrew and the long-billed curlew) pote INEL site. Ten animal species listed by the State as species of special concern oc of the Federal- or State-listed animal species have been observed near any of the f actions would occur (Rope et al. 1993, Reynolds 1993a). No Federal- or State-liste identified as potentially occurring on the INEL site. Eight plant species identifi and the Idaho Native Plant Society as sensitive, rare, or unique are known to occur 1995).

4.9.4 Wetlands

Aquatic habitats on the INEL site are limited to scattered wet areas, artific waters. The U.S. Fish and Wildlife Service National Wetlands Inventory maps show o wetlands; these maps and a subsequent survey (Hampton et al. 1995) indicate these p more than 1,180 hectares (2,900 acres) of the INEL site. Over 70 percent of the po near the Big Lost River and its spreading areas and playas, the Birch Creek Playa, in the general vicinity of Argonne National Laboratory-West. The rest are scattere site. In 1994, the INEL began evaluating the potential wetlands to determine which Corps of Engineers definition of jurisdictional wetlands (COE 1987). In addition, importance of the potential wetlands is being evaluated. As of December 1994, at l Lost River sinks was found to meet the criteria for jurisdictional wetland delineat

Approximately 20 potential wetlands listed by the U.S. Fish and Wildlife Ser and are mostly man-made (for example, industrial waste and sewage treatment ponds, pits) and, therefore, may not be considered regulated jurisdictional wetlands (Figu north of the Test Reactor Area under evaluation as a jurisdictional wetland. Other portions of the Big Lost River channel near the Idaho Chemical Processing Plant and containing Test Area North facilities. Limited riparian (riverbank) communities wi along the Big Lost River (Reynolds 1993a), reflecting the intermittent flow in the the last two years with flow reported on the site). The scattered artificial ponds intermittent waters serve as water sources to many wildlife species including bats, Some artificial ponds are not fenced (for example, ponds at Argonne National Labora by pronghorn.

4.9.5 Radioecology

Potential radiological effects on plants and animals are measured at the popu ecosystem level. However, for threatened and endangered species, harm to individua Radionuclides are found above background levels in individuals belonging to some pl on and surrounding the INEL site (Morris 1993b). Measurable effects of radionuclid animals, however, have only been observed in individuals on areas adjacent to INEL population, community, or ecosystem levels. The following is information on doses, effects reported for animals on the INEL site.

Halford and Markham (1984) and Arthur et al. (1986) studied maximally exposed the Test Reactor Area radioactive waste percolation pond and at the Subsurface Disp Radioactive Waste Management Complex. These studies concluded that the small mamma similar to those shown to reduce life expectancies in other small mammals at other significant differences in several physiological parameters were found between deer Reactor Area radioactive waste percolation pond, the Subsurface Disposal Area, and 1981). However, radiation exposures were too small to cause cellular changes in th

between barn swallow nestlings exposed to sediments from the Test Reactor Area pond revealed a statistically significant difference in growth rates (Millard et al. 199 could not definitely be attributed to exposure. All studies reported that doses to too low to cause any effects at the population level. Doses and exposures to anima Subsurface Disposal Area and the Test Reactor Area are probably lower than the dose studies because 0.6 meter (2 feet) of additional soil cover the contaminated pits a and Wright 1992), and the percolation pond is now less attractive to animals (Morri

Elevated radionuclide concentrations have been observed in some individual an outside the boundaries of INEL facilities and off the INEL site. Iodine-129 concen in rabbit thyroids have been reported in excess of background up to 30 kilometers (Chemical Processing Plant fence (Markham 1974). Iodine-129 has also been detected pronghorn tissue collected on the INEL site (Markham 1974) and from pronghorn colle Craters of the Moon National Monument and Monida Pass (Markham et al. 1982). In a nesting, Craig et al. (1979) concluded that detectable radionuclide levels would on kilometers (2.2 miles) from the Radioactive Waste Management Complex. In these exa internal consumption of radionuclides was less than is thought to be required for o to individual animals (IAEA 1992). Also, on the basis of limited data and the infr and ferruginous hawks observed near contaminated areas, these species probably are concentrations of radioactive contaminants in their prey (Morris 1993c). A similar for peregrine falcons because they have rarely been seen on or near the INEL site, near contaminated INEL ponds.

4.10 Noise

Existing INEL-related noises of public significance stem from buses, trucks, helicopters, and freight trains that transport people and materials to and from the Falls facilities. During the normal work week, most of the 4,000 to 5,000 employee site are transported daily to the site from surrounding communities and back again bus routes. About 300 to 500 private vehicles also travel to and from the INEL sit measurements taken along U.S. Highway 20 about 15 meters (50 feet) from the roadway commuting period indicate that the sound level from traffic ranges from 64 to 86 de al. 1990), with the primary source coming from buses (71 to 81 dBA). Although few meters (50 feet) of the roadway, the results indicate that INEL traffic noise may b of the public residing near principal highways or busy bus routes.

Public exposure to aircraft noise is also due in part to INEL-related activit business travel of INEL personnel via commercial air transport represents a substan travel in and out of regional airports. Onsite INEL security patrol and surveillan affect individuals offsite because of the INEL site's remoteness. However, INEL he originate or terminate in Idaho Falls do expose members of the public to the unique aircraft. Because the number of flights per day is limited and most flights occur people are not sleeping, public exposure to aircraft nuisance noise is not consider

Normally, no more than one train per day and usually fewer than one train per INEL via the Scoville spur. Rail transport noises originate from diesel engines, w whistle-warnings at rail crossings. Even with only one or two exposures to these s residing near the railroad tracks find the noises mildly objectionable.

The noise level at the INEL ranges from 10 dBA for the rustling of grass to limit for unprotected hearing exposure established by the Occupational Safety and H (OSHA), from the combined sources of industrial operations, construction activities including aircraft. The playas and remote lava flows of the INEL site have relativ of about 35 to 40 dBA. Onsite, in accordance with INEL procedures, industrial hygi hearing protection for workers. Noise limits for the workplace are established to accordance with OSHA standards (CFR 1992). Site workers are required by OSHA to we devices when exposed to noise levels above 85 dBA on an eight-hour time-weighted av painting operations at the Central Facilities Area produced the highest noise level 104 dBA and 99 dBA, respectively. The computer room measured 88 dBA, and the snack dBA. The noise generated at the INEL site is not propagated at detectable levels o are at least 8 kilometers (5 miles) away from site facility areas.

Previous studies of the effects of noise on wildlife indicate that even very levels at the INEL (over 100 dBA) would have no deleterious effect on wildlife prod

4.11 Traffic and Transportation

Roads are the primary access to and from the INEL site. Commercial shipments truck and plane, some bulk materials are transported by train, and waste is transpo This section discusses the existing traffic volumes, transportation routes, transpo and materials transportation. Also discussed are the historical waste and material baseline radiological exposures from waste and materials transportation. The infor been summarized from Lehto (1993).

4.11.1 Roadways

4.11.1.1 Infrastructure-Regional and Site Systems.

The existing regional highway system is shown in Figure 4.11-1. Two interstate highways serve the regional area. south route that connects several cities along the Snake River, is approximately 40 of the INEL site. Interstate 86 intersects Interstate 15 approximately 64 kilomete INEL site and provides a primary linkage from Interstate 15 to points west. Inters 91 are the primary access routes to the Shoshone Bannock reservation. U.S. Highway main access routes to the southern portion of the INEL site. Idaho State Routes 22 the northern portion of the INEL site, with State Route 33 providing access to the facilities. Table 4.11-1 shows the baseline (1991) traffic for several of these ac service of these segments currently is designated "free flow," which is defined as virtually unaffected by the presence of other vehicles."

An onsite road system of approximately 140 kilometers (87 miles) of paved sur developed, including about 29 kilometers (18 miles) of service roads that are close the roads are adequate for the current level of normal transportation activity and traffic volume. The onsite road system at the INEL undergoes continuous maintenanc

4.11.1.2 Infrastructure-Idaho Falls.

Approximately 4,000 DOE and DOE contractor personnel administer and support INEL work through offices in Idaho Falls. DOE shu

Figure 4.11-1. Transportation routes in the vicinity of the Idaho National Enginee Engineering Laboratory site.

Route	Average daily traffic
U.S. Highway 20-Idaho Falls to INEL	2,290
U.S. Highway 20/26-INEL to Arco	1,500
U.S. Highway 26-Blackfoot to INEL	1,190
State Route 33-west from Mud Lake	530
Interstate 15-Blackfoot to Idaho Falls	9,180

a. Source: 1991 Rural Traffic Flow Map, State of Idaho.

b. Estimated as 15 percent of average daily traffic.

provide hourly transport between in-town facilities. Currently, one of the busiest Center Drive and Fremont Avenue, which serves the Willow Creek Building, Engineerin Building, INEL Electronic Technology Center, and DOE office buildings. The interse during peak weekday hours, but it is designed for the current traffic.

4.11.1.3 Transit Modes.

Four major modes of transit use the regional highways, community streets, and INEL site roads to transport people and commodities: DOE buses and sh pool vehicles, commercial vehicles, and personal vehicles. Table 4.11-2 summarizes INEL-related traffic.

4.11.2 Railroads

Union Pacific Railroad lines in southeastern Idaho are shown on Figure 4.11-1

railroad freight service from Butte, Montana, to the north, and from Pocatello and
The Union Pacific Railroad's Blackfoot-to-Arco Branch, which crosses the southern p
provides rail service to the INEL site. This branch connects with a DOE spur line
links with developed areas within the INEL. Rail shipments to and from the INEL si
bulk commodities, spent nuclear fuel, and radioactive waste. Table 4.11-3 shows th
Fiscal Years 1988 through 1992.

Table 4.11-2. Baseline annual vehicle miles traveled for traffic related to the Id
Laboratory site.

Mode of travel and transportation	Vehicle miles travele
DOE buses	6,068,200
Other DOE vehicles	9,183,100
Personal vehicles on highways to INEL	7,500,000
Commercial vehicles	905,900
TOTAL	23,657,200

a. Source: Lehto (1993).

b. To convert from miles to kilometers, multiply by 1.609.

Table 4.11-3. Loaded rail shipments to and from the Idaho National Engineering Lab
1992).

Fiscal year	Inbound	Outbound
1988	63	44
1989	43	19
1990	34	3
1991	18	0
1992	23	0

a. Sources: DOE Shipment Mobility/Accountability Collection System database; Volu
(Appendix D, Attachment A, Transportation of Naval Spent Nuclear Fuel).

4.11.3 Airports and Air Traffic

Airlines provides Idaho Falls with jet aircraft passenger and cargo service.
provide commuter service to both the Idaho Falls and Pocatello airports. In additi
available in Idaho Falls, and private aircraft use the major airport and numerous o
total number of landings at the Idaho Falls airports for 1991 and 1992 were 5,367 a
The Idaho Falls and Pocatello airports collectively record nearly 7,500 landings an

Non-DOE air traffic over the INEL site is limited to altitudes greater than 3
over buildings and populated areas, and non-DOE aircraft are not permitted to use t
traffic at the INEL site is DOE helicopters, which are used for security and very r
Specific operations stations and duties are designated for these helicopters.

4.11.4 Accidents

For the years 1987 through 1992, the average motor vehicle accident rate was
million kilometers (1.5 accidents per million miles) for INEL vehicles, which compa
of 1.5 accidents per million kilometers (2.4 accidents per million miles) for all D
accidents per million kilometers (12.8 accidents per million miles) nationwide for
1993). There are no recorded air accidents associated with the INEL.

Collisions between wildlife and trains or motor vehicles are an impact from a
involving transportation of materials or humans. In years with high snow accumulat
wildlife and trains increase. Wildlife, such as antelope, often bed down on the tr
for migration routes when snow is abundant. Train collisions with wildlife can inv
animals and have a significant impact on the local population. For example, one la
train/antelope accident near Aberdeen, Idaho, in the winter of 1976 resulted in a t
antelope (Compton 1994). While this accident was not related to INEL operations, i
impacts of such collisions. Accidents involving motor vehicles and wildlife genera

animals, and may occur during any season.

4.11.5 Transportation of Waste and Materials

Hazardous, radioactive, industrial, commercial, and recyclable wastes are tra site. Numerous regulations and requirements govern transportation of hazardous and (Lehto 1993). Hazardous materials include commercial chemical products and hazardo nonradioactive and are regulated and controlled based on their chemical toxicity. radioactive materials are associated with environmental restoration and waste manag nuclear fuel, transuranic wastes, mixed low-level wastes, and low-level wastes. Hi at the INEL, but shipments of high-level wastes are not planned within the timefram

4.11.5.1 Baseline Radiological Doses from Waste and Materials Transportation.

To
establish a baseline of radiological doses from incident-free, onsite waste and mat INEL that is not related to the shipments for the alternatives evaluated in this EI through 1992, inclusive) were used. Results are presented in

Table 4.11-4 in terms of the collective doses and cancer fatalities for 1995 to 200 offsite shipments; offsite shipments are addressed in the analyses of alternatives

Table 4.11-4. Cumulative doses and fatalities from incident-free onsite shipments Engineering Laboratory site for 1995 to 2005.

	Estimated collective dose (person-rem)	Estimated cancer fatalities	Estima nonrad fatali
Occupational	6.6	0.0026	0
General population	0.14	0.000070	0

a. Source: Maheras (1993).

b. There are no nonradiological accident-free fatalities for onsite shipments. Th applicable to urban areas, and the INEL site is a rural area.

4.12 Health and Safety

The purpose of this section is to present the potential health effects to wor result of current operations at the INEL. For the purpose of this assessment, curr existing facilities and those projects that were expected to be completed by June 1

This section provides estimates of health impacts from releases of radioactiv contaminants to the atmosphere and groundwater. This section also summarizes histo data and INEL programs designed to protect workers. A detailed explanation of the methodology is contained in Appendix F, Section F-4, Health and Safety, of this EIS

4.12.1 Public Health and Safety

Health risks from air emissions are estimated by modeling worst-case emission emissions have been estimated for a baseline case. This baseline case represents a permitted sources at the INEL are assumed to operate in such a manner that they emi the maximum extent allowed by operating permits or applicable regulations. Further baseline atmospheric emissions is found in Section 4.7, Air Resources. These model postulate maximum potential exposure levels in the onsite and offsite environments. calculated using this type of information provide an extremely conservative "worst-health effects.

Health effects estimates from groundwater contaminants were calculated using drinking water supply system concentrations or, in the case of public exposure, the

groundwater concentrations. These concentration estimates are based on those discu Water Resources, of this EIS.

4.12.1.1 Health Effects Resulting from Atmospheric Releases.

For routine airborne releases from facilities, health effects were assessed for the following three cate (a) maximally exposed individual located at the site boundary, (b) population withi of the operating facilities, and (c) maximally exposed onsite worker.

4.12.1.1.1 Radiological Health Risk-The human health risk associated with

radiological air emissions is assessed based on risk factors contained in 1990 Reco International Commission on Radiological Protection (ICRP 1991). The measure of im evaluating potential radiation exposures is risk of fatal cancers. Population effe radiation dose (in person-rem) and the estimated number of fatal cancers in the aff maximum individual effects are reported as individual radiation dose (in millirem) probability of fatal cancer.

For the calculation of health effects from exposure to airborne radionuclides doses provided in Section 4.7, Air Resources, of this EIS, were multiplied by the a from ICRP (1991). The risk, from one year of exposure, is expressed as the increas developing fatal cancer. A detailed explanation of the health effects methodology Section F-4, Health and Safety, of this EIS.

Tables 4.12-1 and 4.12-2 provide summaries of the annual dose, risk factor, a lifetime risk of developing fatal cancer based on the annual exposure. These data maximally exposed onsite worker, maximally exposed individual near the site boundar population for the year 1995.

Table 4.12-1. Lifetime excess fatal cancer risk due to annual exposure to routine Idaho National Engineering Laboratory site.

Maximally exposed individual	Annual dose (millirem)	Risk factor (risk/millirem)	Risk (excess fatal cancer
Onsite worker	3.2 y 10-1	4.0 y 10-7	1.3 y 10-7
Offsite individual (public)	5.0 y 10-2	5.0 y 10-7	2.5 y 10-8

Table 4.12-2. Increased population risk of developing excess fatal cancers due to the Idaho National Engineering Laboratory site.

Year	Population dose (person-rem)	Risk factor (risk/person-rem)	Risk (number of fatal canc
1995a	3.0 y 10-1	5.0 y 10-4	1.5 y 10-4

a. The population dose and cancer risk for 1995 is based on data provided in Secti

The offsite individual annual dose of 0.05 millirem corresponds to a lifetime risk of approximately 1 in 40 million. The worker dose of 0.32 millirem correspond fatal cancer risk of approximately 1 in 7 million.

Table 4.12-2 provides summaries of the dose, risk factor, and estimated incre developing fatal cancer based on the annual exposure to the surrounding population surrounding population consists of approximately 120,000 people within a 80-kilometer (50-mile) radius of the individual INEL sources. The total baseline c of 0.30 person-rem corresponds to approximately 0.0002 fatal cancers occurring with the next 70 years.

4.12.1.1.2 Nonradiological Health Risk-For nonoccupational exposures, data

concerning the toxicity of carcinogenic and noncarcinogenic constituents were obtai values approved by the U.S. Environmental Protection Agency. These values include risks for evaluating cancer risks, reference doses and reference concentrations for noncarcinogens, and primary National Ambient Air Quality Standards for evaluating c evaluating occupational exposures, the applicable occupational standards were used.

For the evaluation of occupational health effects, the modeled chemical conce with the applicable occupational standard. The comparison was made by calculating

hazard quotient is the ratio between the calculated concentration in air and the ap hazard quotient is less than 1, then no adverse health effects are expected.

Table 4.12-3 presents hazard quotients for onsite toxic air pollutants. The index (summed hazard quotients) for each facility is less than 1. This indicates t are projected as a result of noncarcinogenic emissions.

Table 4.12-4 provides the hazard quotients for onsite carcinogens. These mode not representative of average workplace concentrations, but reflect the maximum pot could occur. In all cases, with the exception of benzene, the hazard quotients for than 1.

Table 4.12-3. Hazard quotients for highest predicted concentrations of noncarcinog at Idaho National Engineering Laboratory site locations for the maximum baseline ca

Toxic air pollutant	Location of maximum concentrationa	Baseline concentration (-g/m3)	Occupational exposure limitb (-g/m3)
Ammonia	ICPP	9.7 y 102	1.7 y 104
Cyclopentane	CFA	1.1 y 103	1.7 y 106
Hydrochloric acid	CFA	1.1 y 102	7.0 y 103
Mercury	ICPP	3.0 y 100	5.0 y 101
Naphthalene	CFA	2.3 y 103	5.0 y 104
Nitric acid	ICPP	7.7 y 102	5.0 y 103
Phosphorus	TAN	5.5 y 101	1.0 y 102
Potassium hydroxide	ANL-W	1.4 y 101	2.0 y 103
Styrene	PBF	3.5 y 102	2.1 y 105
Toluene	CFA	2.5 y 104	1.9 y 105
Trimethylbenzene	CFA	1.3 y 104	1.2 y 105
Trivalent chromium	TAN	6.3 y 100	5.0 y 102

a. ANL-W = Argonne National Laboratory-West; ICPP = Idaho Chemical Processing Plan Test Reactor Area; RWMC = Radioactive Waste Management Complex; TAN = Test Area No

b. Occupational exposure limits are eight-hour time-weighted averages established Industrial Hygienists or Occupational Safety and Health Administration; the lower (

Carcinogenic Effects. For carcinogenic effects to the public, risks ar incremental probability of an individual developing cancer over a lifetime as a res potential carcinogen (that is, incremental or excess individual lifetime cancer ris

Values for slope factors and unit risks were taken from the U.S. Environmenta Integrated Risk Information System database (EPA 1994). If the information was not database, other sources were used, primarily the U.S. Environmental Protection Agen Assessment Summary Tables (EPA 1993).

Table 4.12-4. Hazard quotients for highest predicted concentrations of carcinogeni National Engineering Laboratory site locations for the maximum baseline case.

Toxic air pollutant	Location of maximum concentrationa	Baseline concentration (-g/m3)	Occupational exposure limit (-g/m3)
Acetaldehyde	ANL-W	1.1 y 102	1.8 y 105
Arsenic	CFA	2.8 y 10-1	1.0 y 101
Benzene	CFA	3.1 y 103	3.0 y 103
Butadiene	TRA	3.8 y 103	2.2 y 104
Carbon tetrachloride	RWMC	2.5 y 102	1.3 y 104
Chloroform	RWMC	1.7 y 101	9.8 y 103
Formaldehyde	ANL-W	5.7 y 101	9.0 y 102
Hexavalent chromium	ICPP/TAN	2.4 y 100	5.0 y 101
Hydrazine	TRA	1.8 y 10-3	1.0 y 102
Methylene chloride	CFA/ICPP	3.2 y 100	1.7 y 105
Nickel	CFA	4.1 y 101	1.0 y 102
Perchloroethylene	CFA	4.3 y 102	1.7 y 105
Trichloroethylene	RWMC	4.0 y 101	2.7 y 105

a. ANL-W = Argonne National Laboratory-West; ICPP = Idaho Chemical Processing Plan Test Reactor Area; RWMC = Radioactive Waste Management Complex; TAN = Test Area Nor

For carcinogenicity, the probability of an individual developing cancer over multiplying the slope factor (milligram per kilogram-day) for the substance by the

daily intake. Hence, the slope factor converts estimated daily intakes averaged o directly to incremental risk of an individual developing cancer. This risk is cons estimate because the upper bound estimate for the slope factor is used, with the "t

Noncarcinogenic Effects. Noncarcinogenic effects are presented using t described in the U.S. Environmental Protection Agency's Risk Assessment Guidance fo I, Human Health Evaluation Manual (Part A) (EPA 1989). This approach presents nonc in terms of a hazard quotient, which is the ratio between the calculated concentrat and the reference dose or reference concentration, respectively. Doses or concentr and exposure pathway are compared with the route-specific reference dose or referen hazard quotient is less than 1, then no adverse health effects are expected. For o applicable standard, instead of the reference concentration, was used to calculate

For criteria pollutants (ozone, carbon monoxide, nitrogen dioxide, sulfur dio and lead) that are regulated through the National Ambient Air Quality Standards, th effects was based on a hazard quotient given by the ratio of calculated air concent regulatory limit.

Table 4.12-5 provides hazard quotients based on maximum noncarcinogenic conce site boundary and public highway locations. The locations of these modeled concent different points and times of release, so that no single individual could be expose once. Therefore, these chemical hazard quotients are evaluated separately and not individual chemicals, all hazard quotients are less than 1. This indicates that no projected as a result of noncarcinogenic emissions.

Table 4.12-6 provides an estimate of the excess cancer risk for 70-year expos baseline offsite carcinogenic concentrations. Like the data in Table 4.12-5, the l concentrations are dependent on different points and times of release so the risks results of this assessment indicate that the offsite lifetime excess cancer risk ra occurrence in 1.4 million) to 1.6 y 10-9 (about 1 occurrence in 625 million).

Table 4.12-7 presents hazard quotients for maximum baseline offsite criteria hazard quotient for each chemical at the various locations is less than 1. This in effects are projected as a result of criteria pollutant emissions. Because the locations of these modeled concentrations are dependent on point and time of re are not summed.

Table 4.12-5. Hazard quotients for highest predicted noncarcinogenic toxic air pol the Idaho National Engineering Laboratory-eight-hour site boundary and public road exposures.

Toxic air pollutant	Location	Maximum concentration (-g/m3)	Reference concentration (-g/m3)	Haz quo
Ammonia	Public road	6.0 y 100	1.8 y 102	0.0
	Site boundary	4.1 y 10-1		<0.
Cyclopentane	Public road	2.7 y 100	1.7 y 104	<0.
	Site boundary	3.9 y 10-2		<0.
Hydrochloric acid	Public road	9.8 y 10-1	7.5 y 100	0.1
	Site boundary	9.7 y 10-2		0.0
Mercury	Public road	4.2 y 10-2	1.0 y 100	0.0
	Site boundary	1.3 y 10-2		0.0
Naphthalene	Public road	1.8 y 101	5.0 y 102	0.0
	Site boundary	1.9 y 10-3		<0.
Nitric acid	Public road	6.4 y 10-1	5.0 y 101	0.0
	Site boundary	2.6 y 10-1		<0.
Phosphorus	Public road	3.0 y 10-1	1.0 y 100	0.3
	Site boundary	8.9 y 10-3		<0.
Potassium hydroxide	Public road	2.0 y 10-1	2.0 y 101	0.0
	Site boundary	2.0 y 10-1		0.0
Propionaldehyde	Public road	3.0 y 10-1	4.3 y 100	0.0
	Site boundary	6.4 y 10-3		<0.
Styrene	Public road	1.3 y 100	1.0 y 103	<0.
	Site boundary	2.4 y 10-4		<0.
Toluene	Public road	3.7 y 102	3.8 y 103	0.1
	Site boundary	6.2 y 10-2		<0.
Trimethylbenzene	Public road	1.0 y 102	1.2 y 103	0.0
	Site boundary	1.0 y 10-2		<0.
Trivalent chromium	Public road	3.6 y 10-2	5.0 y 100	<0.
	Site boundary	2.2 y 10-3		<0.

Table 4.12-6. Excess cancer risk based on 70-year exposure to the highest predicte
carcinogenic air pollutants at Idaho National Engineering Laboratory site boundary

Toxic air pollutant	Baseline concentration (-g/m3)	Unit risk (risk per -g/m3)	Risk (exce
Acetaldehyde	1.1 y 10-2	2.2 y 10-6	2.4 y
Arsenic	9.0 y 10-5	4.3 y 10-3	3.9 y
Benzene	2.9 y 10-2	8.3 y 10-6	2.4 y
Butadiene	1.0 y 10-3	2.8 y 10-4	2.8 y
Carbon tetrachloride	6.0 y 10-3	1.5 y 10-5	9.0 y
Chloroform	4.0 y 10-4	2.3 y 10-5	9.2 y
Formaldehyde	1.2 y 10-2	1.3 y 10-5	1.6 y
Hexavalent chromium	6.0 y 10-5	1.2 y 10-2	7.2 y
Hydrazine	1.0 y 10-6	4.9 y 10-3	4.9 y
Methylene chloride	6.0 y 10-3	4.7 y 10-7	2.8 y
Nickel	2.7 y 10-3	2.4 y 10-4	6.5 y
Perchloroethylene	1.1 y 10-1	4.8 y 10-7	5.3 y
Trichloroethylene	9.7 y 10-4	1.7 y 10-6	1.6 y

4.12.1.2 Health Effects Resulting from Groundwater Releases.

This section summarizes
potential health effects to both onsite and offsite populations from radionuclides noncarcinogenic chemicals in water. More detailed information on concentrations of contained in Section 4.8, Water Resources, of this EIS. A discussion of health eff contained in Appendix F, Section F-4, Health and Safety, of this EIS. To calculate radionuclide concentrations in water, the total quantity of radionuclide ingested m effective dose equivalent and then the appropriate risk factor applied. This is ac the concentration of radionuclide in the drinking water (microcuries per liter) by per day) and by the consumption period (days) to obtain the quantity of radionuclid quantity (microcuries) is then multiplied by the appropriate dose conversion factor to obtain the dose that is then multiplied by the appropriate risk factor.

Table 4.12-7. Hazard quotients for ambient air concentrations of criteria pollutan
Laboratory site.

Pollutant	Averaging time	Baseline concentration (-g/m3)	
		Site boundary	Public roads
Carbon monoxide	1-hour	600	1,200
	8-hour	180	340
Nitrogen dioxide	Annual	5	9
Lead	Quarterly	0.0008	0.002
Particulate matter	24-hour	17	31
	Annual	1	3
Particulate matter	24-hour	50	80e
	Annual	2	5e
Sulfur dioxide	24-hour	100	230
	3-hour	240	520
	Annual	2	4

a. National Ambient Air Quality Standards; all standards are primary except for 3-

b. Hazard quotients were calculated by dividing the baseline concentrations (befor

c. Particulate matter from stationary emission points; all particulate matter is a less than 10 microns in diameter (that is, PM-10). The State of Idaho also has a s but the Federal standard for PM-10 is more restrictive.

d. Cumulative contributions from stationary point fugitive emission sources such a and landfill and concrete batch plant operation.

e. Does not include fugitive emissions caused by vehicle traffic.

Dose conversion factors were obtained from Federal Guidance Report No. 11, Li Radionuclide Intake and Air Concentration and Dose Conversion Factors for Inhalatio Ingestion (EPA 1988). These dose conversion factors were used to convert a quantit effective dose equivalent for the subsequent application of the appropriate risk fa (1991). Table 4.12-8 lists the exposure-to-dose conversion factors.

4.12.1.2.1 Potential Health Effects to the Onsite Population-Estimates of

potential health effects for onsite workers were made assessing drinking water samp Anderson and Peterson-Wright (1993). The highest average radionuclide concentratio drinking water distribution system occurred at the Central Facilities Area. The ra tritium, at a concentration of 16,470 picocuries per liter. This level is below re to decrease because of changes in facility procedures, dilution in the aquifer, and tritium. Consumption of this water for 50 years would result in an estimated dose with a corresponding estimated fatal cancer risk of about 1 occurrence in 180,000.

No chemical carcinogens were detected in a drinking water distribution system maximum contaminant levels. This would indicate an excess incidence of cancer risk occurrence in 1 million.

For all reported noncarcinogenic chemical contaminants, the calculated hazard ratio of contaminant to reference dose) was less than 1. This indicates that no ad expected as a result of these contaminants.

Table 4.12-8. Exposure-to-dose conversion factors for selected radionuclides.

Isotope	Dose conversion factor (millirem per microcurie)
Tritium	6.40 y 10-2
Iodine-129	2.76 y 102
Strontium-90	1.42 y 102

4.12.1.2.2 Potential Health Effects to the Offsite Population-For the offsite

population, health effects were estimated using an iodine-129 concentration of 0.00 measured at the INEL site boundary in 1992 (Mann 1994). Consumption of this water individual would result in an estimated dose equivalent of 0.012 millirem, with a c fatal cancer risk of about 1 occurrence in 170 million.

4.12.2 Occupational Health and Safety

This section summarizes historical health and safety data and INEL programs d workers. The radiation doses and nonradiological hazards presented here are based reported injuries. For routine workplace hazards, the health risk is presented as fatalities in the workforce. For occupational exposure to ionizing radiation, heal based on actual exposure measurements. In addition, there is a potential for small dose and exposure to toxic materials from atmospheric and groundwater releases on t Information on these potential impacts is presented above in Section 4.12.1.

4.12.2.1 Radiological Exposure and Health Effects.

Radiological protection programs for
INEL occupational workers are based on requirements in DOE orders and on guidance i radiological control manuals.

Workers at the INEL may be exposed either internally or externally to radiati of dose received by INEL workers is from external radiation. All personnel who cou external radiation exposures greater than 100 millirem are assigned a thermolumines worn at all times during work on the INEL site. The dosimeter measures the amount radiation dose the worker receives. Internal radiation doses constitute a small fr

dose at the INEL. All instances of measurable internal radioactivity are investiga and assess the potential for additional internal dose to the workforce.

Between 1987 and 1991, out of an average of 10,980 workers per year, about 6, monitored annually at the INEL for radiation exposure. Of those monitored, about 3 measurable radiation doses. For those five years, the average occupational dose to measurable doses was about 0.16 rem, giving an average collective dose of about 300 number of expected excess fatal cancers would be less than 1 for each year of opera cancers).

4.12.2.2 Nonradiological Exposure and Health Effects to the Onsite Population.

At the INEL, occupational nonradiological health and safety programs are composed of i programs and occupational safety programs. Industrial hygiene programs address suc chemicals and physical agents, carcinogens, noise, biological hazards, lasers, asbe and surplus materials. Occupational safety programs address such subjects as machi rigging, electrical safety, building codes, welding safety, and compressed gas cyli

The monitoring and sampling programs established by industrial hygienists pro characterize the more common toxic chemicals, such as asbestos, beryllium, cadmium, oxides of nitrogen, hydrogen fluoride, and acids. Through industrial hygiene surve to evaluate workplace hazards, measures are imposed to control exposures within per limits.

The DOE recordkeeping and reporting system is aimed at accurately measuring t performance of DOE and DOE contractors. Total injury and illness incidence rates a an annual average of 1.8 to 4.9 per 200,000 work hours from 1987 to 1991. There we recordable injury and illness cases at the INEL from 1987 to 1991 for an average of year working a total of 79,654,000 hours. Of the 1,337 cases at the INEL, 114 (8.5 as occupational illnesses (55-repeated trauma disorders; 34-skin diseases or disord condition because of toxic agents; 6-all other illnesses; 4-disorders because of ph 2-dust diseases of the lungs). Total injury and illness rates for INEL workers are DOE and its contractors, which averaged 3.4 per 200,000 work hours from 1988 to 199 comparison, rates in private industry across the United States were 8.5 per 200,000 1992 (NSC 1993).

Only one fatal accident occurred at the INEL over the period from 1987 to 199 Idaho Chemical Processing Plant was killed in a pedestrian-forklift accident in 199

The motor vehicle accident rate at the INEL (for government vehicles) for 198 accidents (over $500 loss) per 1 million miles.

Only two reportable losses over $1,000 caused by fire occurred from 1987 to 1 damage in 1989 and $63,000 in 1991. A total of 20 reportable nonfire property dama occurred from 1987 to 1991. The total value of the loss from these 20 cases was $1 cases accounted for a loss of $1,026,000 and represented 80 percent of the five-yea

4.13 Idaho National Engineering Laboratory Services

This section discusses water, electricity, and fliel capacities and consumpti disposal, and security and emergency protection at INEL facilities.

4.13.1 Water Consumption

The water supply for the INEL site is provided by a system of about 30 wells, and storage tanks, administered by DOE. Idaho Falls facilities are provided water b Idaho Falls water supply system, which includes about 16 wells. Because of the dist facility areas, the water supply systems for each facility are independent of each

DOE holds a Federal Reserved Water Right for the INEL site. Under this agreem has claim to 2.3 cubic meters per second (36,000 gallons per minute) of groundwater 43 million cubic meters (11.4 billion gallons) per year. The average INEL site wate from 1987 through 1991 was 7.36 million cubic meters (1.94 billion gallons) per yea based on the cumulative volumes of water withdrawn from the wells. Shutdown of the training facilities at the Naval Reactors Facility, which use about 1.0 million cub (265 million gallons) per year, should result in a projected 1995 baseline usage of cubic meters (1.7 billion gallons) per year. The average water consumption of Idaho

estimated to be 300,000 cubic meters (79 million gallons) per year. The total pumpi aquifer is not measured and would depend on the number of pumps operating. There is possibility that the pumping rate of 2.3 cubic meters per second (36,000 gallons pe exceeded for very short periods, such as during recovery from an extended power out pumps would be running to refill depleted storage tanks.

4.13.2 Electricity Consumption

Commercial electrical power is supplied to the INEL site from the Antelope su through two feeders to the federally owned Scoville substation. The Scoville substa electrical power directly to the INEL site electrical power distribution system. Th to supply electrical power to the INEL site is with Idaho Power Company and provide Power Company to furnish "up to 45,000 kilowatts monthly" at 13.8 kilovolts (IPC/DO Electric power supplied by Idaho Power is generated by hydroelectric generators loc Snake River in southern Idaho and by the Bridger and Valmy coal-fired thermal elect plants located in southwestern Wyoming and northern Nevada.

Rated capacity of the INEL site power transmission loop line is 124 megavolt-demand on the system from 1990 through 1993 was about 40 megavolt-amperes, and the usage was about 217,000 megawatt-hours per year. This usage rate would be expected about 4 percent by 1995 due to shutdown of the AiW and S5G facilities. Addition of substation for the Radioactive Waste Management Complex is expected to be completed is accounted for in the impact analysis of the power usage for the Radioactive Wast Complex facilities included in Section 5.13, Idaho National Engineering Laboratory

INEL facilities in Idaho Falls receive electric power from the City of Idaho operates four hydroelectric power generation plants on the Snake River along with s distribution facilities. Supplemental power is supplied to the City of Idaho Falls Power Administration, which operates hydroelectric plants on the Columbia River sys Idaho Falls facilities used 31,500 megawatt-hours of electricity.

4.13.3 Fuel Consumption

Fuels consumed at the INEL site include several liquid petroleum fuels, coal, gas. All fuels are transported to the site for storage and use. Natural gas is the consumed at the INEL Idaho Falls facilities; this fuel is provided by the Intermoun through a system of underground lines.

The average annual fuel consumption at the INEL site from 1990 through 1992 i oil, 10,578,000 liters (2,795,000 gallons); diesel fuel, 5,690,000 liters (1,500,00 gas, 568,000 liters (150,000 gallons); gasoline, 2,107,000 liters (557,000 gallons) 276,600 liters (73,100 gallons); and kerosene, 128,000 liters (33,800 gallons). Abo tons (9,000 tons) of coal are also used at the INEL site. Fuel storage is provided and fuel inventories are restocked as necessary. No fossil fuel shortage has ever o INEL site.

4.13.4 Wastewater Disposal

Wastewater systems at the smaller onsite facility areas consist primarily of fields, and lagoons. The larger facility areas, such as the Central Facilities Area Processing Plant, and Test Reactor Area, have wastewater treatment facilities. Idah are serviced by the City of Idaho Falls wastewater treatment system.

Average annual wastewater discharge volume at the INEL site for 1989 through 537 million liters (142 million gallons). Wastewater from Idaho Falls facilities is estimated to be 300 million liters (79 million gallons) per year. The difference be pumped and estimated wastewater discharge is caused mainly by evaporation from pond towers, irrigation of landscaped areas, and discharge of unmetered wastewater.

4.13.5 Security and Emergency Protection

This section describes the fire protection/fire prevention, security, and eme preparedness resources for the INEL site and the surrounding INEL areas. The discus the Fire Department for the area, the Safeguards and Security Division, and the Eme

Preparedness Organization.

4.13.5.1 Idaho National Engineedng Laboratory Fire Department The contractor-operated Fire Department staffs and operates three fire stations on the INEL site that support the entire INEL site.

These stations are located on the north end at Test Area North, at
Argonne National Laboratory-West, and at the Central Facilities Area. Each station
of one engine company capable of supporting any fire emergency in their assigned ar
Department has a staff of 44 fire fighters and 11 support personnel and operates wi
critical staff of 7 fire fighters at any one time. Besides providing fire fighting
Department provides the INEL site ambulance, emergency medical technician (EMT), an
material response services. The Fire Department has mutual aid agreements with othe
entities, such as the Bureau of Land Management and the Cities of Idaho Falls, Blac
Through these agreements, DOE facilities within the City of Idaho Falls are served
Fire Department.

4.13.5.2 Department of Energy and Idaho National Engineering Laboratory Emergency Preparedness.

Each DOE INEL contractor administers and staffs its own emergency
preparedness program under the direction and supervision of DOE. All contractor pro
emergency control and response are compatible. The Warning Communications Center, w
oversight from DOE, is the communication and overall control center for support to
commanders in charge of the emergency response. The DOE emergency preparednes5 syst
includes mutual aid agreements with all regional county and major city fire departm
medical facilities. Through the agreement, DOE facilities within the City of Idaho
by the Idaho Falls emergency preparedness organizations.

4.13.5.3 Department of Energy and Idaho National Engineering Laboratory Security DOE has oversight responsibility for safeguards and security at the INEL.

The security
program is divided into three categories: security operations, personnel security,
Security operations provides for asset protection (classified matter, special nucle
and personnel) and technical security (computer and information). The INEL protecti
by the INEL prime contractor, Lockheed Idaho Technologies Company, is administered
category. Personnel security processes personnel security clearances. Safeguards is
the management and accountability of special nuclear materials. The INEL protective
consisting of approximately 200 armed guards and approximately 350 support personne
onsite personnel that administer the programs. Each smaller INEL contractor also ha
and security staff, subdivided in a similar manner, to manage the security associat
specific facilities. Contractor safeguards and security staffs range in size from a
depending on the size and complexity of their associated facilities. Each staff wor
with the INEL protective forces.

PAGE TOC FIGURES TABLES PAGE

PAGE TOC FIGURES TABLES PAGE

5. ENVIRONMENTAL CONSEQUENCES

5.1 Introduction

Chapter 5 describes the environmental consequences to the Idaho National Engi site, Idaho Falls facilities, and surrounding region that may result from implement nuclear fuel and Environmental Restoration and Waste Management Program alternative potential consequences associated with each alternative, potential consequences ass specific projects are discussed in more detail.

Tables in Chapter 3, Alternatives, list projects to be implemented under each C, Information Supporting the Alternatives, identifies acres disturbed, resources u so forth), personnel required, and other important attributes of each project. The determine the potential impacts of each alternative as discussed below.

The potential effects for each alternative have been estimated by evaluating proposed for the alternative, summing the projects' collective effects under each a synergistic interactions among the individual projects that comprise each alternati

The calculations in this EIS have generally been performed in such a way that provided are unlikely to be exceeded during either normal operations or in the even routine operations, the results of monitoring of actual operations provide clearly when combined with conservative estimates of the effects of radiation, produce esti unlikely to be exceeded. The effects for all alternatives have been calculated usi other factors, so this EIS provides an appropriate means of comparing potential imp the environment.

The analyses of hypothetical accidents provide more opportunities for uncerta the calculations must be based on sequences of events and models of effects that ha EIS, the goal in selecting the hypothetical accidents analyzed has been to evaluate effects that would be as severe or more severe than any other accidents that might The models have attempted to provide estimates of the probabilities, source terms, and exposure, and the effects on human health and the environment that are as reali in many cases, the very low probability of the accidents postulated has required th for input that produce estimates of consequences and risks that are higher than wou of the desire to provide results that will not be exceeded.

The use of conservative analyses is not an important problem or disadvantage of the alternatives have been evaluated using the same methods and data, allowing a the alternatives on this same basis. It should be observed that, even using these methods, the risks for all of the alternatives are small.

As described in Chapter 3, Alternative A (No Action) is characterized by oper most existing facilities and programs. Alternative A provides a basis for comparis other alternative actions, although it may result in noncompliance with existing go agreements, and environmental requirements. Under Alternative B (Ten-Year Plan), t role and level of support would continue. This would include activities described would be enhanced to comply with regulatory requirements, protect the environment, missions. Alternative C (Minimum Treatment, Storage, and Disposal) would, to the e minimize spent nuclear fuel, waste management, and environmental restoration activi Alternative D (Maximum Treatment, Storage, and Disposal), the INEL would receive an maximum amount of waste and spent nuclear fuel (as defined in Volume 1 of this EIS Management Programmatic EIS) that DOE could transport to the INEL while complying w environmental requirements.

The structure of Chapter 5 closely parallels that of Chapter 4, Affected Envi sections of Chapter 4 have corresponding sections in Chapter 5. The sections each methodology followed by a discussion of the potential impacts of each alternative e six key disciplines more details on methodologies plus key data are given in Append disciplines are socioeconomics, geology, water, air, health and safety, and facilit Chapter 5 and Appendix F, citations are given to technical references supporting th citations are provided in Chapter 9 of this volume.

5.2 Land Use

This section discusses the potential effects of the four environmental restor management alternatives on land use at the INEL site and in the surrounding area.

5.2.1 Methodology

The methodology used in this assessment consisted of comparing proposed land existing land uses and plans. The evaluation of potential effects from each altern assessed. Potential effects, if any, from converting existing land uses to other u land use impacts of each ongoing and foreseeable project are quantified in Appendix Supporting the Alternatives.

5.2.2 Land Use Impacts from Alternative A (No Action)

Alternative A (No Action) would result in the disturbance of approximately 40 Out of this total, 35 acres (14 hectares) have been previously disturbed and 5 acre space. Of the 40 acres that would be disturbed, almost all (38 acres) are inside o fencelines and boundaries. The projects with the largest land disturbance under Al Transuranic Storage Area Enclosure and Storage Project, the Auxiliary Reactor Area Decontamination and Decommissioning Project, and the Pit 9 Retrieval Project. Thes in Appendix C, Information Supporting the Alternatives. Existing and planned land areas would not change as a result of Alternative A activities. Proposed activitie the existing DOE plans listed in Section 4.2, Land Use, for continued operations, e and waste management, and would be similar to uses in existing developed areas on t alternative, proposed activities would not be conducted outside of the INEL boundar surrounding land uses or local land use plans are expected.

5.2.3 Land Use Impacts from Alternative B (Ten-Year Plan)

Alternative B (Ten-Year Plan) would result in the disturbance of approximatel hectares). Out of this total, approximately 246 acres (100 hectares) have been pre acres (233 hectares) are open space. Of the 823 acres that would be disturbed, abo are inside existing facility area fencelines or boundaries and 58 percent (481 acre boundaries. The projects with the largest land disturbance under Alternative B wou Industrial/Commercial Landfill Expansion Project, the Private Sector Alpha-Contamin Waste Treatment Facility, and the Mixed Low-Level Waste Disposal Facility. These p in Appendix C, Information Supporting the Alternatives. Proposed activities would existing DOE plans for continued operations, environmental restoration, and waste m be similar to uses in existing developed areas on the site. Under this alternative not be conducted outside of the INEL boundaries and no effects on surrounding land plans are expected. Due to the greater number of acres that would be disturbed, pa of existing facility areas, and the withdrawal of some acreage for the disposal of Section 5.18, Irreversible and Irretrievable Effects, of Volume 2), the potential Alternative B activities would be greater than those associated with Alternative A

5.2.4 Land Use Impacts from Alternative C (Minimum Treatment, Storage, and Disposal)

Alternative C (Minimum Treatment, Storage, and Disposal) would result in the acres (144 hectares). Out of this total, approximately 233 acres (94 hectares) hav and 122 acres (49 hectares) are open space. Of the 355 acres that would be disturb are inside existing facility area fencelines or boundaries. The project with the l Alternative C would be the Industrial/Commercial Landfill Expansion Project. This Appendix C, Information Supporting the Alternatives. Proposed activities would be DOE plans for continued operations, environmental restoration, and waste management to uses in existing developed areas on the site. Under this alternative, proposed conducted outside of INEL boundaries and no effects on surrounding land uses or loc expected. Due to the greater number of acres that would be disturbed, potential ef activities would be greater than those associated with Alternative A (No Action) ac

5.2.5 Land Use Impacts from Alternative D (Maximum Treatment, Storage, and Disposal)

Alternative D (Maximum Treatment, Storage, and Disposal) would result in the approximately 1,339 acres (542 hectares). Out of this total, approximately 277 acr been previously disturbed and 1,062 acres (430 hectares) are open space. Of the 1, disturbed, about 27 percent (367 acres) are inside existing facility fencelines or (972 acres) are outside these boundaries. The projects with the largest land distu would be the Mixed Low-Level Waste Disposal Facility, the Mixed Low-Level Waste Tre Industrial/Commercial Landfill Expansion Project, and the Private Sector Alpha-Cont Level Waste Treatment Facility. These projects are described in Appendix C, Inform Alternatives. Proposed activities would be consistent with existing DOE plans for environmental restoration, and waste management and would be similar to uses in exi on the site. Under this alternative, proposed activities would not be conducted ou and no effects on surrounding land uses or local land use plans are expected. Due acres that would be disturbed, particularly acreage outside of existing facility ar some acreage for the disposal of radioactive waste and hazardous waste (see Section Irretrievable Effects), the potential effects of Alternative D would be greater tha Alternative A (No Action) activities.

5.3 Socioeconomics

Socioeconomic resources, such as employment, income, population, housing, com and public finance, are interrelated in their response to implementation of an acti the potential effects of the INEL environmental restoration and waste management al socioeconomic resources of the region of influence. Proposed changes in DOE-relate workforce levels have the potential to generate economic impacts that may affect lo population, and community resources. Mitigation of potential impacts is discussed Mitigation. Technical support for this section is provided by Appendix F, Section

5.3.1 Methodology

Socioeconomic impacts are addressed in terms of both direct and secondary eff are changes in INEL employment and expenditures expected to take place under each a both construction and operations phase impacts. Secondary effects include both ind impacts. Indirect effects are impacts to regional businesses and employment result regional purchases or nonpayroll expenditures. Induced effects are impacts to regi employment that result from changes in payroll spending by affected INEL employees. impact to the region is the sum of direct and secondary effects. Both the direct a estimated for the region of influence (ROI) described in Section 4.3, Socioeconomic

The direct impacts estimated in the socioeconomic analysis are based on proje developed by DOE in cooperation with INEL contractors and their representatives. D impacts represent actual increases or decreases in INEL staffing; they do not inclu to reassignment of the existing INEL workforce. Total employment and earnings impa using RIMS II multipliers developed specifically for the INEL region of influence b Economic Analysis. A comprehensive discussion of the methodology may be found in A F-1, Socioeconomics.

The importance of the actions and their impacts is determined relative to the environment. Projected baseline conditions in the region of influence, as presente Socioeconomics, provide the framework for analyzing the importance of potential soc could result from implementation of any of the alternatives. Baseline employment a socioeconomic conditions expected to exist in the region throughout the study perio impacts are analyzed in Chapter 5. Each alternative is expected to generate initia and earnings within the region of influence, primarily due to expected construction (No Action) and C (Minimum Treatment, Storage, and Disposal), which include the pha Expended Core Facility, will result in employment declines by 2004; Alternatives B (Maximum Treatment, Storage, and Disposal) result in moderate employment increases.

As presented in Section 4.3, Socioeconomics, baseline employment at the INEL decline over the study period. The projected declines in baseline INEL employment secondary job losses in the region of influence and may also contribute to effects

housing, and community services. The results of the socioeconomic analysis indicat associated with the alternatives are expected to offset the effects of these baseli years and under some alternatives and may compound the effects under others. The f been to estimate the potential socioeconomic impacts associated with the implementa in order to provide a basis for comparison in evaluating the alternatives. The off effect on projected baseline conditions is addressed in general; however, the proje INEL activity is not an alternative and, therefore, a comprehensive analysis of pot specifically addressed. A discussion of cumulative impacts can be found in Section Impacts and Impacts from Connected or Similar Actions.

5.3.2 Socioeconomic Impacts from Alternative A (No Action)

The impacts from Alternative A (No Action) on employment and earnings, popula and community services in the region of influence are discussed below. The project socioeconomic impacts under Alternative A would be the Pit 9 Retrieval Project and Area Enclosure and Storage Project. These projects are described in Appendix C, In Alternatives.

5.3.2.1 Employment and Earnings.

Implementation of Alternative A (No Action) is expected
to generate about 360 direct jobs during the peak employment year (1996), represent increase over the 1995 baseline INEL employment of approximately 8,620 (Table 5.3-1 primarily would be due to construction jobs for the projects approved before June 1 however, direct employment would decrease by 500 jobs (a 5.8 percent decrease from to the phaseout of the Expended Core Facility. Secondary employment generated unde expected to range from an increase of about 510 jobs in 1996 to a decrease of about total employment impact (direct plus secondary) in the region of influence is estim increase of about 870 jobs in 1996 to a decrease of about 1,280 jobs in 2002 (Figur F, Section F-1.3, for assumptions regarding employment and population.) Total emp expected under this alternative amount to less than 1.2 percent of total regional e of the study period. It is unlikely that employment impacts of this size would gen effects on the economic activity of the region.

Direct earnings, or payrolls, generated under Alternative A (No Action) would of $9.8 million in 1996 and a decrease of $21.6 million in 2002 (Appendix F, Sectio

Figure 5.3-1. Total direct and secondary employment by alternatives in the region
2, Appendix C, of this EIS).

Table 5.3-1. Net and overall employment and population impacts on the region of in alternative and fiscal year. ,b,c

	Fiscal year							
	1995	1996	1997	1998	1999	2000	2001	2
Change in baseline employment relative to 1995	0	-1121 1995	-1252	-2099	-2812	-3505	-3525	-
Direct	0	-437	-488	-818	-1096	-1366	-1374	-
Secondary	0	-684	-764	-1281	-1716	-2139	-2151	-
Change in baseline population relative to 1995	0	-1451 1995	-1620	-2715	-3638	-4534	-4561	-
		Alternative A (No Action)						
Employment impact	835	872	566	164	-28	-585	-1233	-
Direct	347	362	232	68	-2	-223	-480	-
Secondary	489	510	334	96	-26	-361	-752	-
Overall employment change relative to 1995	835	-24995	-686	-1935	-2840	-4089	-4758	-
Population impact	350	365	340	62	-346	-916	-1595	-
Overall population change relative to 1995c	350	-10855	-1280	-2653	-3984	-5451	-6155	-
		Alternative B (Ten-Year Plan)						
Employment impact	858	1130	1217	1020	1330	1465	537	1
Direct	356	469	502	420	548	598	220	5
Secondary	502	661	715	600	781	867	317	7

Overall employment change relative to 1995	858	9	-35	-1079	-1483	-2040	-2988	-
Population impact	360	474	625	543	679	955	334	6
Overall population change relative to 1995c	360	-977	-994	-2172	-2959	-3579	-4226	-3
	Alternative C (Minimum Treatment, Storage, and Dispo							
Employment impact	950	1330	909	507	315	-184	-1175	-
Direct	394	552	375	211	141	-57	-457	-
Secondary	555	778	535	297	175	-127	-719	-
Overall employment change relative to 1995	950	208	-343	-1591	-2497	-3689	-4701	-435
Population impact	398	557	484	206	-202	-749	-1571	-
Overall population change relative to 1995c	398	-893	-1136	-2509	-3840	-5283	-6131	-6
	Alternative D (Maximum Treatment, Storage, and Dispo							
Employment impact	858	1474	1560	1363	2131	2266	1338	1
Direct	356	612	644	563	881	931	552	6
Secondary	502	862	916	801	1250	1335	786	9
Overall employment change relative to 1995	858	352	308	-736	-682	-1239	-2188	-
Population Impact	360	618	769	687	1015	1290	670	7
Overall population change relative to 1995	360	833	-851	-2028	-2623	-3244	-3891	-

a. Sources: USBEA (1993) and project data sheets found in Volume 2, Appendix C, o
b. See Section F-1.3 for assumptions regarding employment and population.
c. Overall change equals baseline impact plus alternative impact.

Table F-1-4). Total earnings generated in the region of influence are estimated to million in 1996 and a decrease of $39.5 million in 2002. Similar to the estimated earnings are expected to vary considerably within this range over the study period.

Employment and earnings impacts expected under Alternative A (No Action) woul projected declines in baseline INEL employment and earnings; however, after 1998, e expected under Alternative A would compound projected baseline declines. The overa expected in the region of influence by 2004 amount to about 1,870 direct jobs and a

5.3.2.2 Population and Housing.

As the demand for workers in a region varies, the population within the region also tends to vary depending on the nature of the change in emplo example, as worker demand increases (or decreases) in a region, some potential work may move to (or out of) the region in search of new jobs. Likewise, changes in emp Alternative A (No Action) would presumably generate in-migration to the region of i employment increases, and out-migration, in the case of employment decreases.

Based on expected relocation ratios and average household size data, populati associated with the implementation of Alternative A (No Action) may amount to about the peak employment year, an increase which represents less than 0.2 percent of the (Table 5.3-2). By 2004, however, Alternative A could result in the out-migration o 0.6 percent decrease in regional population.

Under projected baseline employment conditions at the INEL, the number of dir jobs in the region of influence could fall by 3,520 over the ten-year period from 1 elimination of these jobs could induce the relocation of a number of these workers in the possible out-migration of approximately 4,560 persons by 2004. Through the the implementation of Alternative A (No Action) would contribute to this potential generating an overall population out-migration of approximately 6,220 persons. The total population effect would depend to a large extent on the future availability o opportunities within the region relative to the availability of employment elsewher subjective criteria.

Table 5.3-2. Population effects on the region of influence surrounding the Idaho N fiscal year. ,b

	Fiscal year					
Population	1995	1996	1997	1998	1999	2

Region of influence	247,990	251,518	255,096	258,726	262,406	2
Population change due to baseline declines	0	-1,451	-1,620	-2,715	-3,638	-
Region of influence less baseline declines	247,990	250,067	253,476	256,011	258,768	2
					Alterna	
Population impact	350	365	340	62	-346	-
Total regional population	248,340	250,433	253,816	256,073	258,422	2
					Alterna	
Population impact	360	474	625	543	679	9
Total regional population	248,350	250,541	254,102	256,554	259,447	2
				Alternative C (Minimum		
Population impact	398	557	484	206	-202	-
Total regional population	248,388	250,625	253,960	256,217	258,566	2
				Alternative D (Maximum		
Population impact	360	618	769	687	1,015	1
Total regional population	248,350	250,685	254,245	256,698	259,783	2

a. Sources: USBC (1982, 1992), USBEA (1993), and project data sheets found in Vo
b. See Section F-1.3 for assumptions regarding employment and population.

During the peak employment period, implementation of Alternative A (No Action temporary increase in housing demand of about 110 units, representing less than 0.2 housing stock in the region of influence. Assuming that the general conditions ass housing market continue (see Section 4.3.2.2), this small, temporary increase in de accommodated. By 2004, the potential out-migration expected under Alternative A co for housing in the region of influence by approximately 480 units, representing app total available housing units. Given current housing preferences and current vacan homeowner-occupied housing and 4.6 percent for rental housing, the decline in housi under Alternative A could result in vacancy rates for owner-occupied and rental uni 5.3 percent, respectively. The decline in projected baseline activity at the INEL housing by an additional 1,310 units by 2004, resulting in an overall decrease in d units, or 2.4 percent of the current housing stock.

5.3.2.3 Community Services and Public Finance.

The population decrease of
1,660 persons expected under Alternative A (No Action) by 2004 represents a decline percent in the total regional population. It is unlikely that such a small change generate any discernible impact on community services and public finance within the effects of the decline in baseline INEL activity, however, could result in an overa about 6,220 persons under Alternative A, a 2.3 percent decline in total regional po enrollments could decline by approximately 2.5 percent, accompanied by similar decr other community services. Similarly, revenues received by the county governments w influence may decrease slightly as a result of the projected declines in regional e

5.3.3 Socioeconomic Impacts from Alternative B (Ten-Year Plan)

The impacts from Alternative B (Ten-Year Plan) on employment and earnings, po housing, and community services in the region of influence are discussed below. Th greatest socioeconomic impacts under Alternative B would be the Waste Immobilizatio Remote Mixed Waste Treatment Facility. These projects are described in Appendix C, Supporting the Alternatives.

5.3.3.1 Employment and Earnings.

Implementation of Alternative B (Ten-Year Plan) is
expected to generate about 600 direct jobs in the region of influence during the pe (2000), representing a 7.0 percent increase over the 1995 baseline INEL employment (Table 5.3-1). By 2004, direct employment would amount to about 530 jobs, a 6.1 pe baseline. Secondary employment generated under Alternative B is expected to reach peak year and fall to about 750 jobs by 2004. The total employment impact (direct

region of influence is estimated to range from an increase of about 1,470 jobs in 2
2004 (Figure 5.3-1). Total employment impacts expected under Alternative B amount
percent of total regional employment in any given year of the study period. It is
impacts of this size would generate any long-term adverse effects on the economic a

Direct earnings, or payrolls, generated under Alternative B (Ten-Year Plan) w
million in 2000, decreasing to $15.0 million in 2004 (Appendix F, Section F-1, Tabl
generated in the region of influence are estimated to be $35.4 million in 2000, dec
2004. Similar to the estimated employment impacts, earnings are expected to vary w
study period.

The positive employment and earnings impacts expected under Alternative B (Te
tend to offset the magnitude of the effects of projected declines in baseline INEL
Baseline employment at the INEL is expected to steadily decline over the ten-year s
loss of approximately 1,370 direct jobs and 2,150 secondary jobs by 2004. The over
B would reduce these job losses to about 840 and 1,400, respectively, by 2004.

5.3.3.2 Population and Housing.

Population in-migration associated with the implementation
of Alternative B (Ten-Year Plan) may amount to about 960 persons during the peak em
increase that represents less than 0.4 percent of the total regional population (Ta
population increases would decline to approximately 640 persons, a 0.2 percent incr
population.

Under projected baseline employment conditions at the INEL, the number of dir
jobs in the region of influence could fall by 3,520 over the ten-year period from 1
elimination of these jobs could induce the relocation of a number of these workers
in the possible out-migration of approximately 4,560 persons by 2004. Through the
workers, the implementation of Alternative B (Ten-Year Plan) would alleviate the ef
population decline, reducing the overall out-migration to approximately 3,920 perso
depends to a large extent on whether the persons losing jobs at the INEL under proj
possess the skills required to fill the new jobs generated under Alternative B.

During the peak employment period, implementation of Alternative B (Ten-Year
in a temporary increase in housing demand of about 280 units, representing approxim
current housing stock in the region of influence. Given current housing preference
of 2.1 percent for homeowner-occupied housing and 4.6 percent for rental housing, t
demand anticipated under Alternative B could reduce the vacancy rates for owner-occ
1.7 percent and 4.2 percent, respectively. Assuming that the general conditions as
housing market continue (see Section 4.3.2.2, Housing), this increase in demand is
perceptible strain on the existing market. By 2004, the expected housing demand as
in-migration under Alternative B (Ten-Year Plan) would amount to approximately 180
approximately 0.3 percent of total available housing units. The projected decline
INEL, however, would more than offset the potential increases in demand for housing
Alternative B, resulting in an overall decrease in housing demand of about 1,130 u
current housing stock.

5.3.3.3 Community Services and Public Finance.

The expected population in-migration of
640 persons anticipated under Alternative B (Ten-Year Plan) by 2004 represents an i
percent in the total regional population. It is unlikely that such a small change
generate any discernible impact on community services and public finance within the
effects of the decline in projected baseline INEL activity could result in an overa
about 3,920 persons under Alternative B, a 1.4 percent decline in total regional po
of this magnitude is not expected to be sufficient to notably affect community serv
the region of influence.

5.3.4 Socioeconomic Impacts from Alternative C (Minimum Treatment, Storage, and

Disposal)

The impacts from Alternative C (Minimum Treatment, Storage, and Disposal) on
earnings, population and housing, and community services in the region of influence
following subsections. The projects with the greatest socioeconomic impacts under
the Waste Immobilization Facility and the High-Level Tank Farm New Tanks Project.

described in Appendix C, Information Supporting the Alternatives.

5.3.4.1 Employment and Earnings.

Implementation of Alternative C (Minimum Treatment, Storage, and Disposal) is expected to generate about 550 direct jobs in the region employment year (1996), representing a 6.4 percent increase over the 1995 baseline approximately 8,620 (Table 5.3-1). By 2004, however, direct employment would decre (a 3.6 percent decrease from baseline), due primarily to the phaseout of the Expend Secondary employment generated under Alternative C is expected to range from an inc jobs in 1996 to a loss of about 520 jobs in 2004. The total employment impact (dir region of influence is estimated to range from an increase of about 1,330 jobs in 1 830 jobs in 2004 (Figure 5.3-1). Total employment impacts expected under Alternati than 1.3 percent of total regional employment in any given year of the study period employment impacts of this size would generate any long-term adverse effects on the region.

Direct earnings, or payrolls, generated under Alternative C (Minimum Treatmen Disposal) would amount to an increase of $15.0 million in 1996 and a decrease of $1 (Appendix F, Section F-1, Table F-1-4). Total earnings generated in the region of be an increase of $29.0 million in 1996 and a decrease of $29.5 million in 2004. S employment impacts, earnings are expected to vary considerably within this range ov

Employment and earnings impacts expected under Alternative C (Minimum Treatme Disposal) would initially offset projected declines in baseline INEL employment and 1999, employment losses expected under Alternative C would compound projected basel overall employment losses expected in the region of influence by 2004 amount to abo 4,350 total jobs.

5.3.4.2 Population and Housing.

Population in-migration associated with the implementation of Alternative C (Minimum Treatment, Storage, and Disposal) may amount to about 560 peak employment year, an increase that represents less than 0.3 percent of the tota (Table 5.3-2). By 2004, however, Alternative C could result in the out-migration o 0.5 percent decrease in regional population.

Under projected baseline employment conditions at the INEL, the number of dir jobs in the region of influence could fall by 3,520 over the ten-year period from 1 elimination of these jobs could induce the relocation of a number of these workers in the possible out-migration of approximately 4,560 persons by 2004. Through the the implementation of Alternative C (Minimum Treatment, Storage, and Disposal) woul potential population decline, generating an overall out-migration of approximately magnitude of the total population effect would depend to a large extent on the futu comparable employment opportunities within the region relative to the availability and to a variety of subjective criteria.

During the peak employment period, implementation of Alternative C (Minimum T Storage, and Disposal) could result in a temporary increase in housing demand of ab representing approximately 0.2 percent of the current housing stock in the region o the general conditions associated with the current housing market continue (see Sec this small, temporary increase in demand should easily be accommodated. By 2004, t migration expected under Alternative C could reduce the demand for housing in the r approximately 420 units, representing approximately 0.6 percent of total available current housing preferences and current vacancy rates of 2.1 percent for homeowner- 4.6 percent for rental housing, the decline in housing demand anticipated under Alt vacancy rates for owner-occupied and rental units of 2.7 percent and 5.3 percent, r projected baseline activity at the INEL could reduce the demand for housing by an a 2004, resulting in an overall decrease in demand of about 1,730 units, or 2.4 perce stock.

5.3.4.3 Community Services and Public Finance.

The population decrease of about 1,470 persons expected under Alternative C (Minimum Treatment, Storage, and Disposal) by decline of less than one percent in the total regional population. It is unlikely

regional population would generate any discernible impact on community services and the region of influence. The effects of the decline in baseline INEL activity, how overall population decrease of about 6,030 persons under Alternative C, a 2.2 perce population. School enrollments could decline by approximately 2.4 percent, accompa decreases in demand for other community services. Similarly, revenues received by within the region of influence may decrease slightly as a result of the projected d activity.

5.3.5 Socioeconomic Impacts from Alternative D (Maximum Treatment, Storage, and

Disposal)

The impacts from Alternative D (Maximum Treatment, Storage, and Disposal) on earnings, population and housing, and community services in the region of influence The projects with the greatest socioeconomic impacts under Alternative D would be t Facility; Fuel Receiving, Canning/Characterization, and Shipping Project and the Sp Project. These projects are described in Appendix C, Information Supporting the Al

5.3.5.1 Employment and Earnings.

Implementation of Alternative D (Maximum Treatment,
Storage, and Disposal) is expected to generate about 930 direct jobs in the region employment year (2000), representing a 10.8 percent increase over the 1995 baseline approximately 8,620 (Table 5.3-1). By 2004, direct employment would amount to abou percent increase from baseline. Secondary employment generated under Alternative D about 1,340 jobs in the peak year and fall to about 1,220 jobs by 2004. The total plus secondary) in the region of influence is estimated to range from an increase o to 2,080 jobs in 2004 (Figure 5.3-1). Total employment impacts expected under Alte less than 2.2 percent of total regional employment in any given year of the study p employment impacts of this size would generate any long-term adverse effects on the region.

Direct earnings, or payrolls, generated under Alternative D (Maximum Treatmen Disposal) would amount to $27.7 million in 2000, decreasing to $24.1 million in 200 F-1, Table F-1-4). Total earnings generated in the region of influence are estimat 2000, decreasing to $46.3 million by 2004. Similar to the estimated employment imp expected to vary within this range over the study period.

The positive employment and earnings impacts expected under Alternative D (Ma Storage, and Disposal) would tend to offset the magnitude of the effects of project INEL employment and earnings. Baseline employment at the INEL is expected to stead ten-year study period, resulting in a loss of approximately 1,370 direct jobs and 2 2004. The overall effect of Alternative D would reduce these job losses to about 5 by 2004.

5.3.5.2 Population and Housing.

Population in-migration associated with the implementation
of Alternative D (Maximum Treatment, Storage, and Disposal) may amount to about 1,2 the peak employment year, an increase that represents less than 0.5 percent of the (Table 5.3-2). By 2004, population increases would decline to approximately 970 pe increase in regional population.

Under projected baseline employment conditions at the INEL, the number of dir jobs in the region of influence could fall by 3,520 over the ten-year period from 1 elimination of these jobs could induce the relocation of a number of these workers in the possible out-migration of approximately 4,560 persons by 2004. Through the workers, the implementation of Alternative D (Maximum Treatment, Storage, and Dispo the effects of this potential population decline, reducing the overall out-migratio persons. The degree of offset depends to a large extent on whether the persons los projected baseline conditions possess the skills required to fill the new jobs gene

During the peak employment period, implementation of Alternative D (Maximum T Storage, and Disposal) could result in a temporary increase in housing demand of ab representing approximately 0.5 percent of the current housing stock in the region o housing preferences and current vacancy rates of 2.1 percent for homeowner-occupied percent for rental housing, the increase in housing demand anticipated under Altern

vacancy rates for owner-occupied and rental units to 1.6 percent and 4.1 percent, r the general conditions associated with the current housing market continue (see Sec this increase in demand is unlikely to place perceptible strain on the market. By demand associated with population in-migration under Alternative D (Maximum Treatme Disposal) would amount to approximately 280 units, representing approximately 0.4 p available housing units. The projected decline in baseline activity at the INEL, h offset the potential increases in demand for housing expected under Alternative D, decrease in housing demand of 1,030 units, or 1.4 percent of the current housing st

5.3.5.3 Community Services and Public Finance.

The expected population in-migration of about 970 persons anticipated under Alternative D (Maximum Treatment, Storage, and represents an increase of less than 0.5 percent in the total regional population. change in regional population would generate any discernible impact on community se finance within the region of influence. The effects of the decline in projected ba result in an overall population decrease of about 3,590 persons under Alternative D total regional population. Again, an impact of this magnitude is not expected to b affect community services and public finance in the region of influence.

5.4 Cultural Resources

This section discusses the potential impacts of the four environmental restor management alternatives on cultural resources; that is, archaeological and historic cultural or religious importance to local Native Americans, and paleontological loc Site.

5.4.1 Methodology

The methodology for identifying, evaluating, and mitigating impacts to cultur been established through Federal laws and regulations, including the National Histo Act as amended (NHPA 1966), the Archaeological Resource Protection Act (ARPA 1979), American Graves Protection and Repatriation Act (NAGPRA 1990), and the American Ind Religious Freedom Act (AIRFA 1918). A project affects a significant resource when i property's characteristics, including relevant features of its environment or use t significant according to criteria used for the National Register of Historic Places those listed in the "Protection of Historic Property" (CFR 1986). Impacts to cultur value to Native Americans, such as sacred areas or hunting and gathering areas, sho through consultation with the affected Native American groups. Such consultation is assessing impacts to archaeological sites and when encountering human remains.

Potential impacts are assessed by (a) identifying project activities that cou indirectly affect significant resources, (b) identifying the known or expected signi areas of potential impact, and (c) determining whether a project activity would hav adverse effect, or an adverse effect on significant resources (CFR 1986).

Both direct and indirect impacts due to the proposed alternatives were evalua INEL site, direct impacts to archaeological resources are usually those associated disturbance from construction activities. Direct impacts to existing historic struc demolition, modification, or deterioration of the structures; isolation from or alt property's setting; or the introduction of visual, auditory, or atmospheric element character or that alter the property's setting. Direct impacts to traditional resou through land disturbance, vandalism, or by changing the environmental setting of tr sacred areas. Impacts may result from pollution, noise, and contamination that may hunting and gathering areas or the visual or auditory setting of sacred areas. Dire archaeological sites as traditional resources may result from vandalism due to incr sites. Because these sites and structures have not been formally evaluated, they ar potentially eligible for nomination to the National Register of Historic Places. In cultural resources may also occur due to an overall increase in activity at the INE bring a larger construction workforce in closer proximity to significant sites.

Until construction plans are finalized, it is impossible to determine the tot sensitive sites that would be affected by each alternative. However, it is possible

the number of known sites that may be affected and the historic structures that may impacts as a result of modification or demolition under the four proposed alternati provides this preliminary listing, along with detailed information on acreage, surv structures affected by projects for each alternative.

5.4.2.Cultural Resource Impacts from Alternative A (No Action)

Alternative A activities include the construction of new facilities and the m existing facilities that would disturb 16 hectares (40 acres) of land and may affec 6 structures. In areas that have not been subject to intensive cultural resource su (18 acres) have been surveyed, 9 hectares (22 acres) have not], there is a potentia impacts to archaeological, Native American, and paleontological resources under thi Proposed structural modifications may also adversely affect historically significan would require consultation with the Idaho State Historic Preservation Office. A sig of Agreement between DOE, the Advisory Council on Historic Preservation, and the St Preservation Office (DOE 1993) outlines mitigation procedures for eight structures affected by this alternative within the Auxiliary Reactor Area I, II, and III compl potentially eligible for nomination to the National Register of Historic Places. Im alteration in the setting of archaeological or historic resources through the intro noise, air emissions, or night lights are unlikely for most projects, since these a place within or immediately adjacent to existing facilities where similar activitie

Table 5.4-1. Potential impacts to cultural resources at the Idaho National Engine project and alternative.

Project name	Alternativea	Acres disturbedb	Surveyed	Numb site
Ongoing Projects				
Test Area North Pool Fuel Transfer	ABD	0.8	Yes	0
Remediation of Groundwater Contamination	ABCD	3.0	Yes	0
Pit 9 Retrieval	ABCD	5.2	Unknownd	Unkn
Vadose Zone Remediation	ABCD	2.1	Unknownd	Unkn
Auxiliary Reactor Area-II Decontamination and Decommissioning (D&D)	ABCD	6.5	Yes	0
Boiling Water Reactor Experiment-V D&D	ABCD	0.2	Yes	0
High-level Tank Farm Replacement upgrade phase)	ABCD	2.8	Yes	0
Transuranic Storage Area Enclosure and Storage Project	ABCD	12.4	Unknownd	Unkn
Waste Characterization Facility	ABCD	2.1	Unknownd	Unkn
Waste Handling Facility	ABCD	0.3	Yesd	Unkn
Health Physics Instrument Lab	ABCD	1.3	Yes	0
Radiological and Environmental Sciences Laboratory Replacement	ABCD	2.8	Yes	0
Spent Nuclear Fuel Projects				
Expended Core Facility Dry Cell Expansion Project	BD	0.0	(g)	0
Increased Rack Capacity for CPP-666	BD	0.0	(g)	0
Additional Increased Rack Capacity (CPP-666)	BD	0.0	(g)	0
Dry Fuel Storage Facility; Fuel Recieving, Canning/Characterization, and Shipping	B	18.5	Unknown	Unkn
	C	0.0	(g)	0
	D	30.0	Unknown	Unkn
Fort St. Vrain Spent Nuclear Fuel Reciept & Storage	BD	0.0	(g)	0
Spent Fuel Processing	D	0.0	(g)	0
Experimental Breeder Reactor II Blanket Treatment	BD	0.0	(e)	0
Electrometallurgical Process	BCD	0.0	(g)	0

Demonstration Decontamination and Decommissioning Projects				
Central Liquid Waste Processing Facility D&D	BD	0.0	(g)	0
Engineering Test Reactor D&D	BD	5.0	Yes	0
Materials Test Reactor D&D	BD	2.8	Yes	0
Fuel Processing Complex D&D (CPP-601)	BD	0.6	Yes	0
Fuel Receipt/Storage Facility (CPP-603) D&D	BD	0.5	Yes	0
Headend Processing Plant D&D (CPP-640)	BD	0.0	(g)	0
Waste Calcine Facility, D&D	BD	0.5	Yes	0
High-Level Waste Projects				
Tank Farm Heel Removal Project	BCD	10.0	Yes	0
Waste Immobilization Facility	BCD	0.8	Yes	0
High-level Tank Farm New Tanks	CD	20.0	Yes	0
New Calcine Storage	D	0.5	Yes	0
Radioactive Scrap/Waste Facility	BCD	0.0	(g)	0
Transuranic Waste Projects				
Private Sector Alpha-Contaminated Mixed Low-Level Waste (MLLW) Treatment	BD	200	Unknown	Unkn
Radioactive Waste Management Complex Modifications to Support Private Sector Treatment of Alpha-Contaminated MLLW	BD	1.0	Unknownd	Unkn
Idaho Waste Processing Facility	BD	40.0	Unknownd	Unkn
Shipping/Transfer Station	C	5.0	Unknownd	Unkn
Low-Level Waste Projects				
Waste Experimental Reduction Facility Incineration	BD	0.0	(g)	0
Mixed Low-Level Waste Treatment Facility	D	200	Unknownd	Unkn
Mixed/Low-Level Waste Disposal Facility	B	200	Unknownd	Unkn
	D	400	Unknownd	Unkn
Mixed Low-Level Waste Projects				
Nonincinerable Mixed Waste Treatment	BD	0.0	(g)	0
Remote Mixed Waste Treatment Facility	BD	1.0	Yesd	Unkn
Sodium Processing Project	BD	0.03	Yes	0
Greater-Than-Class-C Projects				
Greater-than-Class-C Dedicated Storage	BD	1.7	Yes	0
Hazardous Waste Projects				
Hazardous Waste Treatment, Disposal, and Storage Facility	D	5.0	Unknownd	Unkn
Infrastructure Projects				
Industrial/Commercial Landfill Expansion	BCD	280.0	Partiallyd	Unkn
Gravel Pit Expansion	B	20.12	Yesd	22
	D	99.55	Yesd	22
Central Facilities Area Clean Laundry and Respirator Facility	BD	0.0	(g)	0
Technology Development Projects				
Calcine Transfer Project (Bin Set #1)	BD	0.5	Yes	0
Plasma Hearth Process Project	BD	0.0	(g)	0

a. A = Alternative A (No Action); B = Alternative B (Ten-Year Plan); C = Alternati Storage, and Disposal), D = Alternative D (Maximum Treatment, Storage, and Disposal
b. To convert from acres to hectares, multiply by 0.4047.
c. Where present, sites and structures are not evaluated and are assumed to be pot
d. Archaeologically sensitive area; known sites in vicinity.
e. These structures have been evaluated and are eligible for the National Register
f. There are known sites in the project vicinity; exact project location is unknow
g. Survey not required because no new ground disturbance is necessary.

Visual setting, noise, air quality, or water quality are seen by the Shoshone important Native American resources. Disturbance of 0.8 hectares (2 acres) associat

construction of a new facility outside of the Radioactive Waste Management Complex these resources. This area has a potential for containing cultural resources, plant wetland resources, and development would change the visual setting. These effects w under Alternative A (No Action) because of the small acreage (a total of two acres) outside of the existing facilities and the minimal release of contaminants. There w a potential loss of plant and animal diversity, displacement of animals, and exposu although the level of exposure would be so low that no effect would be expected. So occur during construction of the facility, as well as the release of dust particles intentional discharge of radioactive or chemical liquid effluents to the subsurface resources above allowable levels, as required under applicable Federal and State re

As discussed in Section 5.5, Aesthetic and Scenic Resources, Alternative A (N involves the use of 0.8 hectares (2 acres) outside the existing facility boundaries (10.4 acres) within the Radioactive Waste Management Complex. The proposed new and structures are nOt expected to adversely affect the visual setting. Construction of facilities and demolition of existing facilities would produce fugitive dust that m temporarily in localized areas. Such activities would be of limited duration, howev would follow standard construction practices to minimize both erosion and dust. The visibility degradation due to facility emissions was analyzed using worst-case cond in Section 5.7, Air Resources. Under adverse conditions, contrast reduction due to was shown to be imperceptible; however, the analysis of color shift indicated the p degradation with project emissions as proposed. Potential visual impacts must, ther defined and resolved before projects can proceed. The use of additional emissions c possibly relocation of projects may be required to reduce potential impacts below a As the visual setting, particularly in the Middle Butte area located in the souther site, is seen by the Shoshone-Bannock to be an important Native American resource, Shoshone-Bannock would be consulted before any project is developed that could have resources of importance to the tribes.

Impacts of other air emissions, including radionuclides, criteria air polluta pollutants, have been analyzed as discussed in Section 5.7, Air Quality. The impact emissions, including cumulative emissions from other regional sources, would be wel applicable standards for protection of the public and a small percentage of the nat dose. Cumulative emissions of nonradiological pollutants would result in impacts we and National Ambient Air Quality Standards designed to protect public health and we be below all standards for the Prevention of Significant Deterioration.

5.4.3 Cultural Resource Impacts from Alternative B (Ten-Year Plan)

Impacts to cultural resources under Alternative B (Ten-Year Plan) would be si under Alternative A (No Action), with the following additions: facility expansion, construction, and gravel pit expansion would affect about 333 hectares (823 acres) structures would be modified, decommissioned, or demolished. A total of 26 hectares been surveyed, and 22 sites that may be affected by the project have been identifie 307 hectares (758 acres) have not been surveyed. Additional projects associated wit that are not yet specified may also cause additional ground disturbance. In all are disturbance has the potential to affect archaeological, traditional, and paleontolo the surface of the ground or buried beneath recent sediments. In locations that hav surveyed, many areas of concern can be identified; but in unsurveyed locations, the would not be known until field work is completed. Potential impacts may occur due t the setting of a traditional, archaeological, or historic resource through the intr noise, air emissions, or night lights. Although most of these activities would take immediately adjacent to existing facilities currently engaged in similar activities proposed for areas outside of existing facilities. If significant archaeological or traditional resources are in proximity, the additional noise, pollution, contaminat adversely affect these resources.

Visual setting, noise, air quality, or water quality are seen by the Shoshone important Native American resources. New facilities would be constructed and gravel on 195 hectares (481 acres) outside of existing facilities. Ground disturbance and setting would occur in the vicinity of the Idaho Chemical Processing Plant, the Rad Management Complex, Test Area North, the Central Facilities Area, and the Naval Rea Some facilities would contain permanent generators and night lights, creating a vis intrusion. Areas with sensitive plant and water sources are found near the Idaho Ch Plant, the Radioactive Waste Management Complex, and Test Area North. Any of these particularly the area near the Radioactive Waste Management Complex and Test Area N

high potential for containing plant, animal, and wetland resources. There is a pote and animal diversity, displacement of animals, and*exposure to radionuclides, altho exposure would be so low that no effect would be expected. Soil erosion could occur construction of the facilities, as well as the release of dust particles. There wou discharge of radioactive or chemical liquid effluents to the subsurface or natural above allowable levels, as required under applicable Federal and State regulations. larger acreage disturbed and the larger number of facilities to be constructed outs facilities (three), effects due to Alternative B (Ten-Year Plan) would be much grea Alternative A (No Action).

As discussed in Section 5.5, Aesthetic and Scenic Resources, Alternative B (T involves the use of about 195 hectares (481 acres) outside existing facility bounda development within facility boundaries. Although no final siting determination has facilities would likely be located within about two miles of existing site faciliti mile from any public roads. The proposed new and modified structures are not expect affect the visual setting. Construction of the proposed facilities and demolition o would produce fugitive dust that might affect visibility temporarily in localized a would be of limited duration, however, and the 1NEL would follow standard construct minimize both erosion and dust. The potential for visibility degradation due to fac analyzed using worst-case conditions, as described in Section 5,7, Air Resources. U conditions, contrast reduction due to project emissions was shown to be imperceptib analysis of color shift indicated the potential for visual degradation with project proposed. Potential visual impacts must, therefore, be further defined and resolved can proceed. The use of additional emissions controls and possibly relocation of pr required to reduce potential impacts below acceptable criteria. As the visual setti the Middle Butte area located in the southern portion of the INEL site, is seen by Shoshone~Bannock to be an important Native American resource, the Shoshone-Bannock consulted before any project is developed that could have impacts to resources of i tribes.

Impacts of other air emissions, including radionuclides, criteria air polluta pollutants, have been analyzed as discussed in Section 5.7, Air Quality. The impact emissions, including cumulative emissions from other regional sources, would be wel applicable standards for protection of the public and a small percentage of the nat dose. Cumulative emissions of nonradiological pollutants would result in impacts we and National Ambient Air Quality Standards designed to protect public health and we below all standards for the Prevention of Significant Deterioration.

5.4.4.Cultural Resource Impacts from Alternative C (Minimum Treatment, Storage, and Disposal)

Impacts to cultural resources from Alternative C (Minimum Treatment, Storage, Disposal) could occur during ground disturbance within a 144-hectare (355-acre) are modification and dismantling of 11 structures. A total of 21 hectares (52 acres) ha but no sites are currently known to exist in the project areas. The remaining 123 h have not been surveyed. A signed Memorandum of Agreement among DOE, the Advisory Co on Historic Preservation, and the State Historic Preservation Office outlining miti protection of some structures within the Auxiliary Reactor Area complex (DOE 1993) applicable under this alternative. However, projects involving excavation or other could affect archaeological, paleontological, or traditional resources. Impacts du setting of a traditional, archaeological, or historic resource through the introduc noise, air emissions, or night lights are unlikely, since these activities will tak immediately adjacent to existing facilities where similar activities Occur.

Effects to Native American resources would be similar to Alternative A (No Ac Disturbance of 0.8 hectares (two acres) associated with the construction of a new f the Radioactive Waste Management Complex may affect these resources. This area has for containing cultural resources, plant, animal, and wetland resources, and develo change the visual setting. There would be a potential loss of plant and animal dive of animals, and exposure to radionuclides, although the level of exposure would be effect would be expected. Soil erosion could occur during construction of the facil release of dust particles. There would be no intentional discharge of radioactive o effluents to the subsurface or natural water resources above allowable levels, as r applicable Federal and State regulations. These effects would be miminal under Alte (Minimum Treatment, Storage, and Disposal) because of the small acreage [a total of (two acres)] to be disturbed outside of the existing facilities and the minimal rel

As discussed in Section 5.5, Aesthetic and Scenic Resources, Alternative C (M Treatment, Storage, and Disposal) involves the use of 0.8 hectares (two acres) outs facility boundaries and 4.2 hectares (10.4 acres) within the Radioactive Waste Mana The proposed new and modified structures are not expected to adversely affect the v Construction of the proposed facilities and demolition of existing facilities would that might affect visibility temporarily in localized areas. Such activities would duration, however, and the INEL would follow standard construction practices to min erosion and dust. The potential for visibility degradation due to facility emission worst-case conditions, as described in Section 5.7, Air Resources. Under adverse co reduction due to project emissions was shown to be imperceptible; however, the anal indicated the potential for visual degradation with project emissions as proposed. impacts must, therefore, be further defined and resolved before projects can procee additional emissions controls and possibly relocation of projects may be required t impacts below acceptable criteria. As the visual setting, particularly in the Middl in the southern portion of the INEL site, is seen by the Shoshone-Bannock to be an American resource, the Shoshone-Bannock would be consulted before any project is de could have impacts to resources of importance to the tribes.

Impacts of other air emissions, including radionuclides, criteria air polluta pollutants, have been analyzed as discussed in Section 5.7, Air Quality. The impact emissions, including cumulative emissions from other regional sources, would be wel applicable standards for protection of the public and a small percentage of the nat dose. Cumulative emissions of nonradiological pollutants would result in impacts we and National Ambient Air Quality Standards designed to protect public health and we be below all standards for the Prevention of Significant Deterioration.

5.4.5. Cultural Resource Impacts from Alternative D (Maximum Treatment, Storage, and Disposal)

Impacts to cultural resources from Alternative D (Maximum Treatment, Storage, Disposal) would disturb a total of 542 hectares (1,339 acres) of ground, 70 structu archaeological sites, with the potential for greater impacts to cultural resources due to the expanded scope of projects dealing with construction and modification of construction of new structures at several facilities. A minimum of 478 hectares (1, have not been surveyed may contain archaeological, traditional, and paleontological impacts may occur due to alteration in the setting of a traditional, archaeological through the introduction of additional noise, air emissions, or night lights. Altho activities would take place within or immediately adjacent to existing facilities w occur, some construction is proposed for areas outside of existing facilities. If s arcbaeological or historic sites or traditional resources are in proximity, the add pollution, contamination, or lighting may adversely affect these resources.

Effects to Native American resources would be similar to Alternative B (Ten-Y an increase in impacts due to an increase in construction outside of existing facil 393 hectares (972 acres) could be disturbed outside of existing facilities with the buildings and the expansion of gravel pits. Ground disturbance and change in the vi occur in the vicinity of the Idaho Chemical Processing Plant, the Radioactive Waste Complex, Test Area North, the Central Facilities Area, and the Naval Reactors Facil facilities would contain permanent generators and night lights, creating a visual a Areas with sensitive plant and water sources are found near the Idaho Chemical Proc Radioactive Waste Management Complex, and Test Area North. Any of these areas, but the area near the Radioactive Waste Management Complex and Test Area North, have a containing plant, animal, and wetland resources. There is a potential loss of plant diversity, displacement of animals, and exposure to radionuclides, although the lev would be so low that no effect would be expected. Soil erosion could occur during c the facilities, as well as the release of dust particles. There would be no intenti radioactive or chemical liquid effluents to the subsurface or natural water resourc levels, as required under applicable Federal and State regulations. Because of the disturbed and the larger number of facilities to be constructed outside of existing effects due to Alternative D (Maximum Treatment, Storage, and Disposal) would be mu than for the other alternatives.

As discussed in Section 5.5, Aesthetic and Scenic Resources, Alternative D (M Treatment, Storage, and Disposal) involves the use of about 393 hectares (972 acres facility boundaries with additional development within facility boundaries. Althoug determination has been made, facilities would likely be located within about two mi

facilities and at least half a mile from any public roads. The proposed new and mod are not expected to adversely affect the visual setting. Construction of the propos demolition of existing facilities would produce fugitive dust that might affect vis localized areas. Such activities would be of limited duration, however, and the INE standard construction practices to minimize both erosion and dust. The potential fo degradation due to facility emissions was analyzed using worst-case conditions, as Section 5.7, Air Resources. Under adverse conditions, contrast reduction due to pro was shown to be imperceptible; however, the analysis of color shift indicated the p degradation with project emissions as proposed. Potential visual impacts must, ther defined and resolved before projects can proceed. The use of additional emissions c possibly relocation of projects may be required to reduce potential impacts below a As the visual setting, particularly in the Middle Butte area located in the souther site, is seen by the Shoshone-Bannock to be an important Native American resource, Shosbone-Bannock would be consulted before any project is developed that could have resources of importance to the tribes.

Impacts of other air emissions, including radionuclides, criteria air polluta pollutants, have been analyzed as discussed in Section 5.7, Air Quality. The impact emissions, including cumulative emissions from other regional sources, would be wel applicable standards for protection of the public and a small percentage of the nat dose. Cumulative emissions of nonradiological pollutants would result in impacts we and National Ambient Air Quality Standards designed to protect public health and we below all standards for the Prevention of Significant Deterioration.

5.5 Aesthetic and Scenic Resources

This section discusses the potential effects of the four environmental restor management alternatives on aesthetic and scenic resources at the INEL site and the

5.5.1 Methodology

Potential impacts to aesthetic and scenic resources include (a) the addition structures and (b) the addition of pollutants that may alter the view. The impact alternatives focus on the effects of proposed construction activities on the INEL s design of some of the structures has yet to be determined, a more general analysis where construction specifications are known, a more detailed assessment is given. significant visual resource degradation due to structures is based on the extent of The definition of the degree of acceptable modification considers the nature, densi visual resources that contribute to the visual character of an area. If constructi disturbances associated with the alternative could result in a visual impact that i general setting, impacts would be considered significant.

Potential impacts to aesthetics and visual resources include factors resultin that would be detrimental to the available views, such as visibility degradation ca operating plants. Additional pollutants released into the atmosphere during both t operation of facilities have the potential to result in visual resource degradation causing discoloration. In particular, emissions of oxides of nitrogen and particul contrast, such as that of a dark object against the horizon, and/or cause a discolo objects. Visibility has been specifically designated as an air quality-related val of Significant Deterioration Amendments to the Clean Air Act. To determine impacts Craters of the Moon Wilderness Area, a nearby Class I area that includes the Crater Monument, a screening-level air quality analysis has been conducted in accordance w Environmental Protection Agency-developed methodology and criteria to determine if unacceptable visual degradation exists. The methodology for determining air qualit detail in Air Resources, Section 5.7.4.3.

5.5.2 Aesthetic and Scenic Resource Impacts from Alternative A (No Action)

Under Alternative A (No Action), most project activities would be conducted w boundaries. These projects are not expected to result in an adverse impact, as the be within the facility fenceline and similar to others in the vicinity. However, t Retrieval Enclosure and Storage Project consists of 0.8 hectares (2 acres) of new c existing facility boundaries. Another 4.2 hectares (10.4 acres) of this facility w

Radioactive Waste Management Complex, which is located approximately 6.4 kilometers Highway 20. Structure height would be similar to other storage areas-9 to 12 meter to the low building height and the distance from the highway and the Experimental B National Historic Landmark, no adverse impact is expected from this proposed action

The air quality analysis of contrast reduction due to project emissions was w criterion for views within the Craters of the Moon; however, the analysis of color for visual degradation associated with project emissions as proposed. The analysis with assumed controls on certain projects which, due to oxides of nitrogen emission to the excess color shift value. Emission control equipment to effect at least 70 nitrogen would be required on the Pit 9 Retrieval project thermal treatment facilit Management Complex in order to pass the screening-level analysis. Relocation of pr investigated. Potential visual impacts would be further defined and resolved durin before projects could proceed.

The visual setting, particularly in the Middle Butte area located in the sout site, is seen by the Shoshone-Bannock to be an aimportant Native American resource. Bannock would be consulted before any project were developed that could have impact importance to the tribes.

Construction of the proposed facilities and demolition of existing facilities dust that may affect visibility temporarily in localized areas. Such activities wo however, and the INEL would follow standard construction practices to minimize both

5.5.3 Aesthetic and Scenic Resource Impacts from Alternative B (Ten-Year Plan)

Alternative B (Ten-Year Plan) includes several decommissioning and decontamin construction of new facilities, and upgrading or replacement of buildings and infra projects listed in Alternative A (No Action). Although most projects are expected developed areas, four major projects proposed for construction would not be located These are the Gravel Pit Expansions, the Mixed Low-Level Waste Treatment Facility, Waste Processing Facility or the Private Sector Alpha-Mixed Low-Level Waste Treatme

In those instances where upgrading or replacement of buildings and infrastruc decontamination and decommissioning projects occur within an established facility a sensitivity of the proposed action would be low. For example, the decontamination the Fuel Processing Complex (Building CPP-601) would take place at its current loca Chemical Processing Plant facility area boundary. This facility area is in the vic rest area, and the Experimental Breeder Reactor-I (a National Historic Landmark), b from these locations [approximately 5 kilometers (3 miles)] that the planned activi noticeable to the public. The proposed new construction projects would be similar existing structures.

The projects located outside of fencelines are estimated to cover about 170 h completed. (Only three projects would actually be constructed-the Mixed Low-Level Facility, Gravel Pit Expansions, and either the Idaho Waste Processing Facility or Mixed Low-Level Waste Treatment Facility). Although no final siting determination projects would probably be located within about two miles of existing site faciliti from any public roads. The proposed 81-hectare (200-acre) Private Sector Alpha-Mix Treatment facility is not sited; however, a location was assumed for modeling. Are that are considered to have moderate visual sensitivity include the Experimental Br Goodale's Cutoff, a portion of the Oregon Trail that crosses the southwestern secti 4.4.1). A potential visual impact could occur if facilities not yet sited or any o outside of fencelines were to be located in these vicinities. However, because all located within the INEL site and would be similar in size and character to existing visual impact would be expected.

While the INEL site may be visible from the Craters of the Moon Wilderness Ar atmospheric conditions, the viewing distance of approximately 20 kilometers (12 mil impacts that might be caused by the siting and construction of the proposed facilit associated with the proposed activities.

As with Alternative A (No Action), the air quality analysis of contrast reduc emissions was well below the acceptable criterion for views within the Craters of t analysis of color shift indicated the potential for even greater visual degradation emissions as proposed. For Alternative B (Ten-Year Plan), more stringent oxides of controls of at least 90 percent would be required on the Pit 9 Retrieval project th Radioactive Waste Management Complex, the Waste Immobilization Facility incinerator Chemical Processing Plant, and the Idaho Waste Processing Facility. An additional be required on two boilers at the Radioactive Waste Management Complex in order to

level analysis. Relocation of projects would also be investigated. Potential visu defined and resolved during the air-permitting process before projects could procee

The visual setting, particularly in the Middle Butte area located in the sout site, is seen by the Shoshone-Bannock to be an important Native American resource. would be consulted before any project were developed that could have impacts to res the tribes.

Construction of the proposed facilities and demolition of existing facilities dust that may affect visibility temporarily in localized areas. Such activities wo however, and the INEL would follow standard construction practices to minimize both

5.5.4 Aesthetic and Scenic Impacts from Alternative C (Minimum Treatment, Storage, and

Disposal)

There are fewer projects proposed under Alternative C (Minimum Treatment, Sto than under Alternative B (Ten-Year Plan). All of the projects would be located nea buildings of similar structure except for 0.8 hectares (2 acres) in the Transuranic Storage Project, which is located adjacent to the Radioactive Waste Management Comp regard to construction projects, since no adverse impacts are associated with the p Alternative B, presumably the impacts would be even less under Alternative C.

As with the other alternatives, the air quality analysis of contrast reductio was well below the acceptable criterion for views within the Craters of the Moon, b the potential for visual degradation associated with project emissions as proposed. emission controls of approximately 70 percent would be required on the Pit 9 Retrie treatment facility and 90 percent on the Waste Immobilization Facility in order to analysis. Relocation of projects would also be investigated. Potential visual imp defined and resolved during the air-permitting process before projects could procee

The visual setting, particularly in the Middle Butte area located in the sout site, is seen by the Shoshone-Bannock to be an important Native American resource. would be consulted before any project were developed that could have impacts to res the tribes.

Construction of the proposed facilities and demolition of existing facilities dust that may affect visibility temporarily in localized areas. Such activities wo however, and the INEL would follow standard construction practices to minimize both

5.5.5 Aesthetic and Scenic Impacts from Alternative D (Maximum Treatment, Storage, and

Disposal)

Alternative D (Maximum Treatment, Storage, and Disposal) would implement the of treatment, storage, and disposal projects. The proposed projects include those B (Ten-Year Plan) or expanded versions of those projects. For example, under Alter Mixed Low-Level Waste Disposal Facility would include 160 hectares (400 acres) inst (200 acres) for Alternative B. The proposed Gravel Pit Expansion and the Dry Fuels also involve an expanded version of these projects relative to Alternative B. An a included under the Alternative B analysis is the proposed Mixed Low-Level Waste Tre facility would include about 81 hectares (200 acres) and be located outside of the Management Complex. Approximately 300 hectares (730 acres) of construction project outside of the fencelines under this alternative. (Refer to Chapter 3 for a comple proposed actions under Alternative D.) It is not expected, however, that the incre additional projects would affect the results of the impact analysis performed for A since no adverse impacts are associated with the proposed projects under Alternativ construction and siting, no adverse impacts are anticipated under this alternative.

As with the other alternatives, the air quality analysis of contrast reductio was well below the acceptable criterion for views within the Craters of the Moon, b the potential for visual degradation associated with project emissions as proposed. emission controls of approximately 90 percent would be required on the Pit 9 Retrie treatment facility, the Waste Immobilization Facility, and the Idaho Waste Processi 70 percent control on two boilers at the Radioactive Waste Management Complex would to pass the screening-level analysis. Relocation of projects would also be investi impacts would be further defined and resolved during the air-permitting process bef proceed.

The visual setting, particularly in the Middle Butte area located in the sout site, is seen by the Shoshone-Bannock to be an important Native American resource.

would be consulted before any project were developed that could have impacts to res the tribes.

Construction of the proposed facilities and demolition of existing facilities dust that may affect visibility temporarily in localized areas. Such activities wo however, and the INEL would follow standard construction practices to minimize both

5.6 Geology

This section discusses the potential effects of the four environmental restor management alternatives on geology at the INEL site.

5.6.1 Methodology

Impacts to geologic resources would be associated with (a) excavating surface facility construction sites and (b) using aggregate resources to construct and oper Information contained in this section is based on a review of available information INEL site.

5.6.2 Geologic Impacts from Alternatives

Proposed INEL environmental restoration and waste management activities would localized impacts on the geology of the INEL site for all alternatives evaluated. resources at the INEL site would be associated with disturbing or extracting surfac facilities and for use as fill for remediation activities, as needed. These impact the soil and rock of the INEL site, soil mounding and banking, and extracting aggre and borrow pits on the INEL site. A secondary impact to geology from construction would be the potential for increased soil erosion. Table 5.6-1 gives estimated ext INEL site gravel and borrow pits.

Other indirect impacts to geologic resources considered in this Environmental the consumption of fossil fuels, concrete, and other earth resources (Section 5.13, Laboratory Services) and fugitive dust emissions (Section 5.7, Air Resources).

Table 5.6-1. Estimated extraction volumes from gravel and borrow pits on the Idaho Laboratory (INEL) site by alternative.

Alternativeb
A (No Action)
B (Ten-Year Plan)
C (Minimum Treatment, Storage, Disposal)
D (Maximum Treatment, Storage, Disposal)

a. Refer to Appendix C, Information Supporting the Alternatives, for more informat pits at the INEL site.

b. See Chapter 3, Alternatives, for a description of alternatives identified in th Statement.

c. To convert from cubic meters to cubic yards, multiply by 1.31.

5.7 Air Resources

This section discusses the potential effects that the environmental restorati alternatives may have on regional air quality. In particular, it gives the results of construction and operation of facilities associated with each alternative in ter and nonradiological pollutant concentration levels. In addition to cumulative impa performed with respect to projects associated with specific waste management option alternative. Additional details on assessment methods, assumptions, and related in

Appendix F, Section F-3, Air Resources, and Belanger et al. (1995a).

5.7.1 Methodology

The assessments predict the maximum consequences at onsite and offsite locati release of contaminants from various categories of sources. The types of emissions radiological and nonradiological emissions as those assessed in the baseline cases Air Resources; namely, criteria pollutants (carbon monoxide, nitrogen dioxide, sulf and particulate matter), toxic air pollutants, and radionuclides. Volatile organic to the formation of ozone, are also assessed. The categories of sources assessed i (such as stacks at proposed facilities), fugitive sources (such as construction and mobile sources associated with INEL site activities.

5.7.1.1 Methodology for Radiological Consequences.

The method for estimating
radiological consequences of airborne radionuclide releases from alternative course detail in Appendix F, Section F-3, Air Resources. The principal components of the term estimation and dispersion modeling. Source terms for specific projects associ alternatives were estimated using conservative engineering calculations based on kn facility or activity. Typically, these evaluations considered the processes to be used, activities to be performed within the systems, and operating experience with projects, emissions estimates had previously been made and documented as part of an Assessment, Permit to Construct, or other action. In such cases, the previously es either used directly or were revised to reflect updated project definition. The di GENII computer code (Napier et al. 1988). This code is well-suited for application extensively tested, and conforms to applicable software quality assurance criteria. population data specific to the INEL site were incorporated into the model. The GE doses from all important pathways of exposure, including external and inhalation do contaminated air, external dose from deposition of radionuclides on ground surfaces contaminated food products. The ingestion pathway, however, is not a realistic exp workers and was not used for those assessments. Doses were assessed separately for added according to the association of projects with alternatives and waste stream o

As for baseline radiological assessment, conservative assumptions were applie underestimating the dose. These included adding of maximum doses calculated for se though the locations of maximum impact may be different.

5.7.1.2 Methodology for Nonradiological Consequences.

The consequences of criteria
pollutant and toxic air pollutant emissions from stationary sources were assessed u considered acceptable for regulatory compliance determination by Federal and State these methods were identical to those used in the baseline assessments described in Resources. One difference was the application of the Industrial Source Complex-2 (dispersion computer code (EPA 1992a) to assess both criteria and toxic air pollutan baseline assessment of toxics relied principally on the simpler, more conservative 1992b). Dispersion modeling using ISC-2 allows for a reasonable prediction of the facilities and therefore is suitable for use in this process.

Atmospheric visibility has been specifically designated as an air-quality-rel Prevention of Significant Deterioration Amendments to the Clean Air Act. To estima visibility impacts of proposed alternatives at Craters of the Moon Wilderness Area, computer code VISCREEN (EPA 1992c), developed by the U.S. Environmental Protection implements the "Level 1" analysis. This model gives conservative estimates of impa calculations and assumptions are used that yield results that would be larger than realistic input and modeling assumptions.) The model calculates contrast and color E) for two assumed plume-viewing backgrounds-the horizon sky and a dark terrain obj then compared with acceptable criteria for these parameters.

The nonradiological assessment did not include methods for quantifying impact formation because (a) emissions of volatile organic compounds (which are precursors below the significance level designated by the State of Idaho; (b) no simple, well-assess ozone formation potential (Wilson 1993); and (c) while the Idaho Division of

has no ozone monitoring data from the vicinity, it is not aware of problematic ozon (Andrus 1994).

5.7.1.3 Methodology for Mobile Source Impacts.

The ambient air quality impacts at offsite
receptor locations due to the INEL bus fleet operations, INEL fleet light- and heav owned vehicles, and heavy-duty commercial vehicles servicing the INEL site faciliti predicted using emission factors and a computerized methodology recommended by the Protection Agency. The CALINE-3 model, used to implement the U.S. Environmental Pr methodology, is considered a screening-level model designed to simulate traffic flo dispersion from traffic (Benson 1979). The model was used to predict maximum one-h concentrations of carbon monoxide and inhalable particulate matter. Regulatory-app adjustment factors were used to scale results for other applicable averaging times. selected within 3 meters (9.8 feet) from the edge of the roadway, in accordance wit Protection Agency guidance. Modeling was conducted for 1993 to quantify the impact and traffic serving the latest possible projects and activities on the INEL site, t planned for construction before 1995, and the projected impacts of alternatives.

5.7.1.4 Methodology for Fugitive Dust Impacts.

The impacts of existing and proposed
sources of fugitive dust were estimated using the U.S. Environmental Protection Age Fugitive Dust Model (FDM) (Winges 1991). Twenty-four hour and annual average conce calculated to correspond with ambient air quality standards. Inhalable particulate be 64 percent of total dust loading. This value was based on the U.S. Environmenta recommended value (35 percent) for aggregate handling and storage piles, adjusted f suppression by watering tends to preferentially remove larger sized particles.

5.7.2 Emission Rates

Air contaminant emission rates were estimated for each project proposed under environmental restoration and waste management alternatives. In some cases, the an estimates made previously (for example, as part of an Environmental Assessment). O based on knowledge of the materials used and activities performed and on experience having similar features or functions. Where applicable, the analysis used emission reference sources such as EPA (1993).

Many of the projects proposed under the various waste management options are some airborne emission of radionuclides. These releases would occur primarily thro points, such as stacks or vents, although some fugitive emissions might also result cleanup of contaminated soils or demolition of contaminated structures). Wherever would be minimized by measures such as confinement or filtration.

Estimates of the type and amount of airborne radionuclide emissions likely to courses of action are presented in Table 5.7-1. These estimates, which are listed stream, have been made on the basis of knowledge of the materials used and activiti experience with operating facilities that have similar features or functions. Thes types of emissions from proposed activities would be similar to those emitted by cu operations, although the quantities might vary substantially depending on the waste

Projected releases of criteria pollutants by alternative and waste stream are Volatile organic compounds, while not designated as criteria pollutants, are listed may lead to the formation of ozone, which is a criteria pollutant. Because of the analysts used a screening approach to reduce the number requiring assessment to onl that have the potential to result in concentrations approaching applicable standard screening method used was to assess only those toxic air

Table 5.7-1. Summary of radionuclide emissions at the Idaho National Engineering L

Waste or source group	Radionuclide emission rates (curies per year) Hydrogen-3/ carbon-14	Cobalt-60	Krypton-85	Xenon-131m/ xenon-133	Strontium-90a
Alternative A (No Action)					
Spent nuclear fue	9.6 y 102	0.0 y 100	0.0 y 100	0.0 y 100	2.9 y 10y2

Transuranic	0.0 y 100	0.0 y 100	0.0 y 100	0.0 y 100	0.0 y 100
Environmental restoration	0.0 y 100	0.0 y 100	0.0 y 100	0.0 y 100	0.0 y 100
Totalb	9.6 y 102	0.0 y 100	0.0 y 100	0.0 y 100	2.9 y 10y2
Alternative B (Ten-Year Plan)					
Spent nuclear fue	2.0 y 103	2.0 y 10y6	1.9 y 104	1.8 y 102	2.9 y 10y2
High-level wastec	4.2 y 102	0.0 y 100	0.0 y 100	0.0 y 100	9.4 y 10y4
Transuranic	0.0 y 100	1.7 y 10y5	0.0 y 100	0.0 y 100	3.5 y 10y4
Low-level	1.3 y 100	7.3 y 10y2	0.0 y 100	0.0 y 100	1.2 y 10y2
Greater-than-Clas	3.2 y 10y8	0.0 y 100	0.0 y 100	0.0 y 100	1.4 y 10y5
Mixed low-level	1.7 y 103	7.3 y 10y2	1.6 y 103	0.0 y 100	1.2 y 10y2
Hazardous	0.0 y 100	0.0 y 100	0.0 y 100	0.0 y 100	0.0 y 100
Environmental restoration	0.0 y 100	0.0 y 100	0.0 y 100	0.0 y 100	0.0 y 100
Totalb,c	4.1 y 103	7.3 y 10y2	2.1 y 104	1.8 y 102	4.2 y 10y1
Alternative C (Minimum Treatment, Storage, and Disposal)					
Spent nuclear fue	8.4 y 102	1.9 y 10y6	1.4 y 104	1.3 y 102	1.8 y 10y5
High-level wasted	4.2 y 102	0.0 y 100	0.0 y 100	0.0 y 100	1.6 y 10y1
Transuranic	0.0 y 100	0.0 y 100	0.0 y 100	0.0 y 100	0.0 y 100
Environmental restoration	0.0 y 100	0.0 y 100	0.0 y 100	0.0 y 100	0.0 y 100
Totalb,d	2.2 y 103	1.9 y 10y6	1.4 y 104	1.3 y 102	1.9 y 10y1
Alternative D (Maximum Treatment, Storage, and Disposal)					
Spent nuclear fue	5.1 y 103	3.9 y 10y6	5.2 y 105	1.8 y 102	8.7 y 10y2
High-level wasted	4.2 y 102	0.0 y 100	0.0 y 100	0.0 y 100	1.6 y 10y1
Transuranic	0.0 y 100	1.9 y 10y5	0.0 y 100	0.0 y 100	4.0 y 10y4
Low-level	1.3 y 100	2.2 y 10y1	0.0 y 100	0.0 y 100	2.6 y 10y2
Greater-than-Clas	3.2 y 10y8	0.0 y 100	0.0 y 100	0.0 y 100	1.4 y 10y5
Mixed low-level	1.7 y 103	2.2 y 10y1	1.6 y 103	0.0 y 100	2.6 y 10y2
Hazardous	0.0 y 100	0.0 y 100	0.0 y 100	0.0 y 100	0.0 y 100
Environmental restoration	0.0 y 100	0.0 y 100	0.0 y 100	0.0 y 100	0.0 y 100
Totalb,d	7.2 y 103	2.2 y 10y1	5.2 y 105	1.8 y 102	2.8 y 10y1

a. An equal amount of yttrium-90 is assumed to accompany all strontium-90 emission
b. Totals may differ from the sum of waste streams since some projects are associa
c. Total assuming Waste Immobilization Facility direct vitrification.
d. Total assuming Waste Immobilization Facility direct separation.

Table 5.7-2. Summary of criteria pollutant emission rates at the Idaho National En

Waste or source grou	Carbon monoxideb Max. hr. (g/hr)	Annual (kg/yr)	Nitrogen dioxide Max. hr. (g/hr)	Annual (kg/yr)	Sulfur dioxi Max. hr. (g/hr)
					Alterna
Transuranic	3,360e	17,950	10,330	44,500	415
Low-level w	122e	23	564	11	38
Mixed low-l waste	122l	23	564	11	38
Hazardous w	122e	23	564	11	38
Remediation	4,668	20,281	34,480	143,507	5,724
D&De	7,091	13,368	2,243	3,306	170
Infrastruct	14e	118	66	580	7
Totalf	15,254	51,741	47,683	191,904	6,353
					Alternative
Spent nucle5r fuel		0.17	25	0.82	0.26
High-level	0.044	0.39	190,000	1,630,000	130
Transuranic	19,027	48,251	66,215	116,149	14,542
Low-level w	14,919	21,225	51,349	24,960	14,455
Mixed low-l waste	15,001	21,482	53,549	31,810	14,473
Hazardous w	204e	280	2,764	6,861	56
Remediation	4,668	20,281	34,480	143,507	5,724

D&De	17,027	31,968	5,449	9,306	426
Infrastruct14e		118	66	580	7
Totalf	41,275	102,800	299,398	1,908,704	21,545
				Alternative C	(Minimum Trea
High-level	1,300	420	190,000	1,650,000	6.5
Transuranic3,600e		17,950	10,330	44,500	415
Low-level w122e		23	564	11	38
Mixed low-l122l waste		23	564	11	38
Hazardous w122e		23	564	11	38
Remediation4,668		20,281	34,480	143,507	5,724
D&De	7,091	13,368	2,243	3,306	170
Infrastruct14e		118	66	580	7
Totalf	16,554	52,161	237,683	1,841,904	6,359
				Alternative D	(Maximum Treatment
Spent nucle5r fuel		0.17	25	0.82	0.26
High-level	1,300	420	190,000	1,650,000	6.5
Transuranic20,046		50,899	68,980	117,230	14,641
Low-level w20,022		24,220	73,146	28,349	15,871
Mixed low-l20,104 waste		24,477	75,346	35,199	15,889
Hazardous w204e		280	2,764	6,861	56
Remediation4,668		20,281	34,480	143,507	5,724
D&De	17,027	31,968	5,449	9,306	426
Infrastruct14e		118	66	580	7
Totalf	47,677	106,215	321,195	1,932,063	22,838

a. Only those sources with projected criteria pollutant emissions are listed.
b. Max. hr. = maximum hourly; kg/yr = kilograms per year; g/hr = grams per hour.
c. Volatile organic compounds (VOCs) are not designated as criteria pollutants; ho
d. No projected emissions reported.
e. D&D = decontamination and decommissioning; includes fugitive emissions associat
f. Totals may differ from the sum of waste streams since some projects are associa that all projects operate over the same period of time.

pollutants that were either (a) included in the baseline assessment and emitted by emitted by proposed projects in a cumulative quantity that exceeds the screening le prescribed by the State of Idaho (IDHW 1994), even if the toxic air pollutant was n baseline. The emission rates of toxic air pollutants considered in this assessment

Table 5.7-3.

A visual comparison of maximum hourly and annual average emission rates for t is presented in Figure 5.7-1. As can be seen, these emissions are dominated by nit which are primarily attributable to the Waste Immobilization Facility, a high-level the Idaho Chemical Processing Plant proposed under Alternatives B (Ten-Year Plan), Treatment, Storage, and Disposal), and D (Maximum Treatment, Storage, and Disposal) these emissions, including potential means for reduction, is discussed in Sections Subsection 5.19.4 of Section 5.19, Mitigation.

5.7.3 Air Resource Impacts from Alternatives Due to Radiological Sources

This section describes the effects that the proposed alternatives would have quality in the Eastern Snake River Plain. Sources of airborne radionuclide emissio associated with the alternative actions are described, emissions are estimated, and prevailing conditions are assessed and described.

5.7.3.1 Radiological Impacts.

Radiation doses associated with emissions from environmental restoration and waste management alternatives have been calculated for (a) a worker predicted radioactivity level, (b) the maximally exposed individual (MEI) at an off for definition), and (c) the entire population (adjusted for future growth) within radius of each source of emission within the INEL site. These doses, which are pre

represent the maximum amount of radiation dose received as a result of radioactivit one-year period.

Projects associated with Alternative A (No Action) projected to have radiolog the spent nuclear fuel dry cask storage project and radioactive waste characterizat activities at the Radioactive Waste Management Complex (RWMC). The

Table 5.7-3. Maximum hourly and annual average emissions of toxic air pollutants a Engineering Laboratory site by alternative.

Toxic air pollutant	Emission rate Grams per hour	Kilograms per year
Alternative A (No Action)		
Ammonia	1.1 y 102	1.6 y 100
Asbestos	1.1 y 10y1	4.4 y 10y1
Benzene	1.6 y 101	1.2 y 102
Beryllium	9.8 y 10y3	3.8 y 10y2
Cadmium compounds	1.4 y 10y11	4.1 y 10y11
Carbon tetrachloride	3.4 y 101	2.4 y 102
Chloroform	2.2 y 100	9.6 y 100
Chromium compounds	1.3 y 10y1	1.2 y 100
Formaldehyde	1.5 y 102	1.3 y 103
Hydrochloric acid	3.6 y 101	1.1 y 102
Hydrofluoric acid a	3.0 y 100	6.9 y 100
Mercury	9.3 y 10y1	3.6 y 100
Methylene chloride	1.1 y 103	2.0 y 103
Nickel	1.5 y 100	1.3 y 101
Nitric acid	1.1 y 102	1.9 y 102
Polychlorinated biphen	9.0 y 10y9	1.8 y 10y8
Perchloroethylene	2.4 y 100	1.2 y 101
Sulfuric acid	3.4 y 101	6.5 y 101
Trichloroethylene	6.9 y 100	4.3 y 101
Trichloro-trifluoroeth	4.2 y 10y1	9.9 y 10y1
Alternative B (Ten-Year Plan)		
Ammonia	1.1 y 102	1.6 y 100
Arsenic	8.9 y 10y2	4.9 y 10y1
Asbestos	2.9 y 10y1	4.4 y 10y1
Benzene	6.0 y 101	1.9 y 102
Beryllium	5.6 y 10y2	1.8 y 10y1
Cadmium compounds	2.5 y 10y1	1.3 y 100
Carbon tetrachloride	3.8 y 101	2.4 y 102
Chloroform	2.2 y 100	9.6 y 100
Chromium compounds	1.1 y 100	6.9 y 100
Formaldehyde	3.4 y 102	2.0 y 103
Hydrochloric acid	4.5 y 103	1.6 y 104
Hydrofluoric acid a	1.4 y 102	1.1 y 103
Mercury	6.6 y 102	4.4 y 102
Methylene chloride	1.1 y 103	2.0 y 103
Nickel	6.9 y 100	4.3 y 101
Nitric acid	1.1 y 102	1.9 y 102
Polychlorinated biphen	3.7 y 101	3.0 y 100
Perchloroethylene	5.9 y 100	1.2 y 101
Sulfuric acid	3.4 y 101	6.5 y 101
Trichloroethylene	1.9 y 101	5.5 y 101
Trichloro-trifluoroeth	4.3 y 100	4.0 y 100

Toxic air pollutant	Emissio Grams per hou
Alternative C (Minimum Treatmen	
Ammonia	1.1 y 1
Asbestos	1.1 y 1
Benzene	1.6 y 1
Beryllium	9.8 y 1
Cadmium compounds	3.4 y 1
Carbon tetrachloride	3.4 y 1
Chloroform	2.2 y 1
Chromium compounds	1.3 y 1
Formaldehyde	1.5 y 1
Hydrochloric acid	3.6 y 1
Hydrofluoric acid a	1.2 y 1
Mercury	2.8 y 1
Methylene chloride	1.1 y 1
Nickel	1.5 y 1
Nitric acid	1.1 y 1
Polychlorinated biphenyl	9.0 y 1
Perchloroethylene	2.4 y 1
Sulfuric acid	3.4 y 1
Tributyl phosphate	1.1 y 1
Trichloroethylene	6.9 y 1
Trichloro-trifluoroethan	4.2 y 1
Alternative D (Maximum Treatmen	
Ammonia b	1.8 y 1
Arsenic	2.3 y 1
Asbestos	3.2 y 1
Benzene	1.2 y 1
Beryllium	6.0 y 1
Cadmium compounds	4.5 y 1
Carbon tetrachloride	3.8 y 1
Chloroform	2.2 y 1
Chromium compounds	1.1 y 1
Formaldehyde	4.6 y 1
Hydrochloric acid	4.9 y 1
Hydrofluoric acid a	1.8 y 1
Mercury	7.6 y 1
Methyl isobutyl ketone	2.7 y 1
Methylene chloride	1.1 y 1
Nickel	6.9 y 1
Nitric acid	1.1 y 1
Polychlorinated biphenyl	4.3 y 1
Perchloroethylene	6.4 y 1
Sulfuric acid	3.4 y 1
Tributyl phosphate	8.6 y 1
Trichloroethylene	1.2 y 1
Trichloro-trifluoroethan	4.8 y 1

a. Hydrofluoric acid is not listed as a toxic air pollutant by IDHW (1994), but is
b. Includes emissions of ammonium hydroxide.

Figure 5.7-1. Comparison of criteria and toxic air pollutant emission rates at the

Table 5.7-4. Cumulative dose from airborne emissions at the Idaho National Enginee

Source group	Dose to maximally exposed worker (millirem per year) Baselineb	Incrementc	Cumulative	Dose to maxim (millirem per Baselineb	In
Alternative A (No Action)					
Spent nuclear fuel	0.32	0.00033	0.32	0.05	0.
Transuranic waste	0.32	0.000042	0.32	0.05	0.
Environmental restoration	0.32	0.014	0.33	0.05	0.
Totald	0.32	0.014	0.33	0.05	0.
Alternative B (Ten-Year Plan)					
Spent nuclear fuel	0.32	0.0033	0.32	0.05	0.
High-level waste	0.32	0.0021	0.32	0.05	0.
Transuranic waste	0.32	0.11	0.43	0.05	0.
Low-level waste	0.32	0.026	0.35	0.05	0.
Greater-than-Class-C waste	0.32	0.00019	0.32	0.05	0.
Mixed low-level waste	0.32	0.076	0.4	0.05	0.
Hazardous waste	0.32	2.4 y 10y8	0.32	0.05	5.
Environmental restoration	0.32	0.014	0.33	0.05	0.
Totald	0.32	0.14	0.46	0.05	0.
Alternative C (Minimum Treatment, Storage, and Disposal)					
Spent nuclear fuel	0.32	0.00007	0.32	0.05	0.
High-level waste	0.32	0.00014	0.32	0.05	0.
Transuranic waste	0.32	0.000042	0.32	0.05	0.
Environmental restoration	0.32	0.014	0.33	0.05	0.
Totald	0.32	0.014	0.33	0.05	0.
Alternative D (Maximum Treatment, Storage, and Disposal)					
Spent nuclear fuel	0.32	0.0042	0.32	0.05	0.
High-level waste	0.32	0.0033	0.32	0.05	0.
Transuranic waste	0.32	0.13	0.45	0.05	0.
Low-level waste	0.32	0.10	0.42	0.05	0.
Greater-than-Class-C waste	0.32	0.00019	0.32	0.05	0.
Mixed low-level waste	0.32	0.10	0.42	0.05	0.
Hazardous waste	0.32	2.4 y 10y8	0.32	0.05	5.
Environmental restoration	0.32	0.014	0.33	0.05	0.
Totald	0.32	0.17	0.49	0.05	0.

a. Highest population dose between the years 2000 and 2010.
b. Location of maximum onsite baseline dose is Test Reactor Area; dose includes em
c. Incremental dose specified is for highest predicted area (not necessarily the s
d. Totals may differ from the sum of sources since some projects are associated wi for different years or locations.

doses for Alternative A would result from emissions from projects associated with t nuclear fuel and transuranic waste and from environmental restoration activities. Alternative A would be a very small fraction of that received from natural backgrou below applicable standards.

Projects associated with Alternative B (Ten-Year Plan) projected to have radi include spent nuclear fuel and high-level waste activities at the Idaho Chemical Pr waste processing and mixed and low-level waste treatment (assumed to be located at Radioactive Waste Management Complex), mixed low-level waste incineration at the Wa Reduction Facility, treatment of nonincinerable mixed waste at the Special Power Ex area, spent fuel conditioning and mixed low-level and hazardous waste treatment at Laboratory-West, and storage of greater-than-Class-C forms of low-level waste at Te addition, the projects specified above for Alternative A (No Action) are also inclu doses for Alternative B are due mainly to transuranic waste processing and are some for Alternative A. The estimated dose to the maximally exposed offsite individual (0.63 millirem per year when the baseline dose is added), which is still very low w standards and the natural background dose. The dose to the maximally exposed worke year (0.46 millirem per year including baseline), which is a small fraction of the 5,000 millirem per year. (The offsite dose can be higher than the worker dose sinc any dose by the food ingestion pathway.)

Doses resulting from airborne emissions from projects associated with Alterna Treatment, Storage, and Disposal) are essentially the same as Alternative A (No Act worker dose and slightly higher than Alternative A for offsite dose. This small in inclusion of the Waste Immobilization Facility with Alternative C.

The type and number of projects assumed for Alternative D (Maximum Treatment,

Disposal) are similar to Alternative B (Ten-Year Plan). Three important difference assumption that processing of spent nuclear fuel at the Idaho Chemical Processing P Alternative D but not in Alternative B, (b) increased processing of transuranic and either of two proposed incineration facilities-the Idaho Waste Processing Facility Alpha-Contaminated Mixed Low-Level Waste Treatment Facility, and (c) the addition o Level Waste Treatment Facility. These activities would increase the maximum offsit about 0.79 millirem per year (0.84 millirem, including baseline). Worker and colle would also be somewhat higher than those for Alternative B. Nevertheless, these do low with respect to applicable standards and the natural background dose. The rela doses for the four alternatives is illustrated by the comparisons presented in Figu

5.7.3.2 Regulatory Compliance Evaluation.

In all cases assessed, the dose to the maximally exposed worker would be well below radiation dose limits set for protection of work dose would result from Alternative D (Maximum Treatment, Storage, and Disposal) and millirem per year. When added to the baseline dose (that is, the dose of 0.32 mill and projected emissions, as reported in Section 4.7, Air Resources), the cumulative millirem per year remains a small fraction of the annual occupational dose limit. respect to offsite dose limits, which are much more stringent than occupational lim

The highest dose estimated for the maximally exposed individual is associated (Maximum Treatment, Storage, and Disposal). This dose (0.79 millirem per year), wh baseline dose of 0.05 millirem per year, remains well below the dose limit of 10 mi in the National Emission Standards for Hazardous Air Pollutants (NESHAP).

The baseline population dose as a result of existing INEL site facilities is maximum dose projected as a result of alternative courses of action would be 3.5 pe of which is due to large-scale incineration of transuranic wastes under Alternative Storage, and Disposal). The maximum cumulative population dose of about 3.8 person distributed over about 132,000 people(a), represents a very small fraction of the d receive over the same period of time from natural background sources (about 46,000 applicable standards exist for collective population dose; however, DOE policy requ from radioactivity in effluents be

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a. This number represents the current population of about 120,000 increased by 10 p account for future growth.

<u>**Figure 5.7-2. Cumulative dose for the maximally exposed offsite individual, worker**</u>

reduced to the lowest levels reasonably achievable. The radiological health effect doses are presented in Section 5.12, Health and Safety.

5.7.4 Air Resource Impacts from Alternatives Due to Nonradiological Sources

This section presents results of the air quality assessments for sources of n pollutants. Results are presented with the goal of facilitating comparisons of rel alternatives. The importance of the results as they apply to specific alternatives compliance aspects of predicted consequences are also discussed.

For both criteria and toxic air pollutants, consequences would be notably sim (Ten-Year Plan) and Alternative D (Maximum Treatment, Storage, and Disposal), despi differences in the alternatives in terms of spent nuclear fuel and other wastes to candidate alternatives and waste management options, the amount of emissions (hourl not always highly dependent on the volume of waste to be managed. Increases in pro life, for example, may offset increases in hourly or annual average emission rates. sometimes dominated by emissions from a single facility, which may be included in m alternative. With the exception of nitrogen dioxide emissions from high-level wast sources of nonradiological emissions and impacts would be associated with the manag low-level, and mixed low-level waste streams, and with remediation and decontaminat decommissioning activities.

5.7.4.1 Concentrations of Pollutants in Ambient Air at Offsite Locations.

Maximum
concentrations of criteria pollutants in ambient air (that is, at locations of publ

Table 5.7-5. Results are presented for the maximum levels predicted to occur at IN locations, along public roads, and at the Craters of the Moon Wilderness Area. In would be well within the National Ambient Air Quality Standards. At INEL site boun cumulative impacts (that is, the predicted concentrations from sources related to t added to the maximum baseline) differ little between alternatives. This is not due emissions from the alternatives would be similar, but rather that in all cases the small with respect to the maximum baseline. This condition is illustrated by the I presented in Figure 5.7-3. It should be

Table 5.7-5. Maximum concentrations of criteria pollutants at public access locati

Pollutant	Averaging time	Maximum baseline concentration (micrograms per cubic meter) Site boundary	Public roads	Craters of the Moon	S
Alternative A (No Action)					
Carbon monoxide	1-hour	362	614	134	3
	8-hour	104	284	28	1
Sulfur dioxide	3-hour	168	579	60	1
	24-hour	43	135	10	4
	Annual	2	6	0.3	2
Particulate matter	24-hour	50	80	10	5
	Annual	2	5	1	2
Nitrogen dioxide	Annual	1	4	0.2	2
Lead	Quarterly	0.0002	0.001	<0.0001	0
Alternative B (Ten-Year Plan)					
Carbon monoxide	1-hour	362	614	134	4
	8-hour	104	284	28	1
Sulfur dioxide	3-hour	168	579	60	1
	24-hour	43	135	10	4
	Annual	2	6	0.3	2
Particulate matter	24-hour	50	80	10	5
	Annual	2	5	1	2
Nitrogen dioxide	Annual	1	4	0.2	7
Lead	Quarterly	0.0002	0.001	<0.0001	0
Alternative C (Minimum Treatment, Storage, and Disposal)					
Carbon monoxide	1-hour	362	614	134	3
	8-hour	104	284	28	1
Sulfur dioxide	3-hour	168	579	60	1
	24-hour	43	135	10	4
	Annual	2	6	0.3	2
Particulate matter	24-hour	50	80	10	5
	Annual	2	5	1	2
Nitrogen dioxide	Annual	1	4	0.2	4
Lead	Quarterly	0.0002	0.001	<0.0001	0
Alternative D (Maximum Treatment, Storage, and Disposal)					
Carbon monoxide	1-hour	362	614	134	4
	8-hour	104	284	28	1
Sulfur dioxide	3-hour	168	579	60	1
	24-hour	43	135	10	4
	Annual	2	6	0.3	2
Particulate matter	24-hour	50	80	10	5
	Annual	2	5	1	2
Nitrogen dioxide	Annual	1	4	0.2	7
Lead	Quarterly	0.0002	0.001	<0.0001	0

a. Applicable standards are National Ambient Air Quality Standards.

Figure 5.7-3. Maximum estimated criteria pollutant impacts at the Idaho National E

noted that the scale of these graphs does not extend to 100 percent (which facilita sum of the maximum baseline plus alternative impacts is much less than 100 percent standards in all cases.

Concentrations at public road locations within the INEL site boundary could i from the baseline, especially if a major combustion or fugitive source is located r road. Increases in baseline concentrations at the Craters of the Moon would be ver although potential impacts on visibility in this area need further assessment (see

The concentration results reflect the cumulative impact of alternative source associated with the maximum baseline and the effects of projected increases to the into account. Since maximum baseline concentrations are much greater than baseline exist, these results are conservative and likely overstate the consequences that wo substantial margin. Background concentrations have not been added because (a) reli levels in the INEL environs are not available for most pollutants and (b) backgroun more than offset by the use of the maximum (as opposed to actual) baseline. Some p monitored onsite, but those results reflect INEL site facility contributions and ar background. (INEL site facility contributions are accounted for in the current ass dispersion modeling.) Concentrations of particulate matter have been monitored by Craters of the Moon (IDHW 1991). The maximum 24-hour result for total suspended pa 48 micrograms per cubic meter. Even if this concentration is taken into account, t would remain well below the standard.

Results of assessments for toxic air pollutants at offsite locations are pres carcinogenic (that is, capable of inducing cancer) and noncarcinogenic toxic air po 5.7-7, respectively. As described in Section 4.7.4.2.2, Offsite Conditions, toxic been recently promulgated by the State of Idaho for the control of toxic pollutants increments, however, apply only to new or modified sources and would only require t cumulative impacts for those sources that become operational after May 1, 1994. Th from baseline sources is not included when comparing toxic air pollutant impacts to

Table 5.7-6. Projected annual average ambient air impacts of carcinogenic air poll Idaho National Engineering Laboratory site boundary and public roads by alternative

Carcinogenic air pollutant	Standardb	Impact of alternative at INEL site boundary	Impact of alternative at public roads
	Concentration in -g/m3		
Alternative A (No Action)			
Arsenic	2.3 y 10y4	0.0 y 100	0.0 y 100
Asbestosc	1.2 y 10y4	2.0 y 10y6	1.9 y 10y6
Benzene	1.2 y 10y1	5.8 y 10y4	6.4 y 10y4
Beryllium	4.2 y 10y3	2.0 y 10y7	2.0 y 10y7
Cadmium compou	5.6 y 10y4	<1.0 y 10y8	<1.0 y 10y8
Carbon tetrach	6.7 y 10y2	2.4 y 10y3	2.2 y 10y3
Chloroform	4.3 y 10y2	8.9 y 10y5	8.3 y 10y5
Formaldehyde	7.7 y 10y2	6.3 y 10y3	6.3 y 10y3
Hexavalent chr	8.3 y 10y5	2.6 y 10y7	2.6 y 10y7
Methylene chlo	2.4 y 10y1	1.4 y 10y2	1.3 y 10y2
Nickel	4.2 y 10y3	6.0 y 10y5	5.9 y 10y5
Perchloroethyl	2.1 y 100	1.1 y 10y4	1.0 y 10y4
Polychlorinate biphenyls	1.0 y 10y2	<1.0 y 10y8	<1.0 y 10y8
Trichloroethyl	7.7 y 10y2	4.4 y 10y4	4.1 y 10y4
Alternative B (Ten-Year Plan)			
Arsenic	2.3 y 10y4	9.0 y 10y7	3.9 y 10y6
Asbestosc	1.2 y 10y4	2.0 y 10y6	2.0 y 10y6
Benzene	1.2 y 10y1	4.5 y 10y3	4.5 y 10y3
Beryllium	4.2 y 10y3	4.0 y 10y7	1.0 y 10y6
Cadmium compou	5.6 y 10y4	2.5 y 10y6	1.0 y 10y5

Carbon tetrach	6.7 y 10y2	2.4 y 10y3	2.2 y 10y3
Chloroform	4.3 y 10y2	8.9 y 10y5	8.3 y 10y5
Formaldehyde	7.7 y 10y2	5.0 y 10y2	4.9 y 10y2
Hexavalent chr	8.3 y 10y5	5.5 y 10y6	5.5 y 10y6
Methylene chlo	2.4 y 10y1	1.4 y 10y2	1.3 y 10y2
Nickel	4.2 y 10y3	1.3 y 10y3	1.2 y 10y3
Perchloroethyl	2.1 y 100	1.1 y 10y4	1.0 y 10y4
Polychlorinate biphenyls	1.0 y 10y2	1.5 y 10y5	3.0 y 10y5
Trichloroethyl	7.7 y 10y2	4.7 y 10y4	4.3 y 10y4
Alternative C (Minimum Treatment, Storage, Disposal)			
Arsenic	2.3 y 10y4	0.0 y 100	0.0 y 100
Asbestosc	1.2 y 10y4	2.0 y 10y6	1.9 y 10y6
Benzene	1.2 y 10y1	5.8 y 10y4	6.4 y 10y4
Beryllium	4.2 y 10y3	2.0 y 10y7	2.0 y 10y7
Cadmium compou	5.6 y 10y4	<1.0 y 10y8	<1.0 y 10y8
Carbon tetrach	6.7 y 10y2	2.4 y 10y3	2.2 y 10y3
Chloroform	4.3 y 10y2	8.9 y 10y5	8.3 y 10y5
Formaldehyde	7.7 y 10y2	6.3 y 10y3	6.3 y 10y3
Hexavalent chr	8.3 y 10y5	2.6 y 10y7	2.6 y 10y7
Methylene chlo	2.4 y 10y1	1.4 y 10y2	1.3 y 10y2
Nickel	4.2 y 10y3	6.0 y 10y5	5.9 y 10y5
Perchloroethyl	2.1 y 100	1.1 y 10y4	1.0 y 10y4
Polychlorinate biphenyls	1.0 y 10y2	<1.0 y 10y8	<1.0 y 10y8
Trichloroethyl	7.7 y 10y2	4.4 y 10y4	4.1 y 10y4
Alternative D (Maximum Treatment, Storage, and Disposal)			
Arsenic	2.3 y 10y4	3.2 y 10y6	6.1 y 10y6
Asbestosc	1.2 y 10y4	2.0 y 10y6	2.0 y 10y6
Benzene	1.2 y 10y1	4.6 y 10y3	4.5 y 10y3
Beryllium	4.2 y 10y3	4.0 y 10y7	1.0 y 10y6
Cadmium compou	5.6 y 10y4	8.2 y 10y6	1.6 y 10y5
Carbon tetrach	6.7 y 10y2	2.4 y 10y3	2.2 y 10y3
Chloroform	4.3 y 10y2	8.9 y 10y5	8.3 y 10y5
Formaldehyde	7.7 y 10y2	5.0 y 10y2	4.9 y 10y2
Hexavalent chr	8.3 y 10y5	6.0 y 10y6	6.0 y 10y6
Methylene chlo	2.4 y 10y1	1.4 y 10y2	1.3 y 10y2
Nickel	4.2 y 10y3	1.3 y 10y3	1.2 y 10y3
Perchloroethyl	2.1 y 100	1.1 y 10y4	1.1 y 10y4
Polychlorinate biphenyls	1.0 y 10y2	1.7 y 10y5	3.5 y 10y5
Trichloroethyl	7.7 y 10y2	4.7 y 10y4	4.3 y 10y4

a. Includes contributions from projected increases to baseline not associated with
b. Acceptable ambient concentration for carcinogens (AACCs) listed in Rules for th (IDHW 1994).
c. Asbestos AACC is listed in IDHW (1994) as 4.0 y 10y6 fibers per milliliter; a 0.003 micrograms per 100 fibers is used here to convert the AACC to units of microg

Table 5.7-7. Projected incremental impact of noncarcinogenic toxic air pollutant e National Engineering site boundary and public roads by alternative.

Noncarcinogenic air pollutant	Standardb	Concentration in -g/m3 Average annual concentration at INEL site boundary	Average annual concentration at public roads	S i p o

Alternative A (No Action)			
Ammoniac 1.8 y 102	1.1 y 10y5	6.7 y 10y5	<
Freond 7.6 y 104	1.1 y 10y4	1.9 y 10y4	<
Hydrochloric a7.5y 100	4.2 y 10y4	6.0 y 10y4	<
Hydrofluoric a2.5 y 101	2.4 y 10y5	1.3 y 10y4	<
Mercury 1.0 y 100	1.7 y 10y5	1.7 y 10y5	<
Methyl isobuty2.05 y 103	0.0 y 100	0.0 y 100	<
Nitric acid 5.0 y 101	1.3 y 10y3	1.2 y 10y3	<
Sulfuric acid 1.0 y 101	2.6 y 10y4	8.5 y 10y4	<
Tributyl phosp2.5 y 101	0.0 y 100	0.0 y 100	<
Trivalent chro5.0 y 100	4.9 y 10y6	4.8 y 10y6	<
Alternative B (Ten-Year Plan)			
Ammoniac 1.8 y 102	1.1 y 10y5	6.7 y 10y5	<
Freond 7.6 y 104	1.1 y 10y4	1.9 y 10y4	<
Hydrochloric a7.5y 100	4.4 y 10y2	9.2 y 10y2	<
Hydrofluoric a2.5 y 101	1.5 y 10y3	3.6 y 10y3	<
Mercury 1.0 y 100	7.7 y 10y4	1.4 y 10y3	<
Methyl isobuty2.05 y 103	0.0 y 100	0.0 y 100	<
Nitric acid 5.0 y 101	1.3 y 10y3	1.2 y 10y3	<
Sulfuric acid 1.0 y 101	2.6 y 10y4	8.5 y 10y4	<
Tributyl phosp2.5 y 101	1.1 y 10y3	2.7 y 10y3	<
Trivalent chro5.0 y 100	1.0 y 10y4	1.0 y 10y4	<
Alternative C (Minimum Treatment, Storage, Disposal)			
Ammoniac 1.8 y 102	1.1 y 10y5	6.7 y 10y5	<
Freond 7.6 y 104	1.1 y 10y4	1.9 y 10y4	<
Hydrochloric a7.5y 100	4.2 y 10y4	6.0 y 10y4	<
Hydrofluoric a2.5 y 101	1.2 y 10y3	3.0 y 10y3	<
Mercury 1.0 y 100	2.7 y 10y4	6.9 y 10y4	<
Methyl isobuty2.05 y 103	0.0 y 100	0.0 y 100	<
Nitric acid 5.0 y 101	1.3 y 10y3	1.2 y 10y3	<
Sulfuric acid 1.0 y 101	2.6 y 10y4	8.5 y 10y4	<
Tributyl phosp2.5 y 101	0.0 y 100	0.0 y 100	<
Trivalent chro5.0 y 100	4.9 y 10y6	4.8 y 10y6	<
Alternative D (Maximum Treatment, Storage, and Disposal)			
Ammoniac 1.8 y 102	9.2 y 10y4	1.9 y 10y3	<
Freond 7.6 y 104	1.1 y 10y4	1.9 y 10y4	<
Hydrochloric a7.5y 100	4.9 y 10y2	9.3 y 10y2	<
Hydrofluoric a2.5 y 101	1.4 y 10y3	3.3 y 10y3	<
Mercury 1.0 y 100	8.0 y 10y4	1.5 y 10y3	<
Methyl isobuty2.05 y 103	1.3 y 10y2	2.6 y 10y2	<
Nitric acid 5.0 y 101	1.3 y 10y3	1.2 y 10y3	<
Sulfuric acid 1.0 y 101	2.6 y 10y4	8.5 y 10y4	<
Tributyl phosp2.5 y 101	3.0 y 10y5	6.1 y 10y5	<
Trivalent chro5.0 y 100	1.1 y 10y4	1.1 y 10y4	<

a. Includes contributions from projected increases to baseline not associated with
b. Acceptable ambient concentration for noncarcinogens (AACs) listed in Rules for Idaho (IDHW 1994).
c. Includes emissions of ammonium hydroxide.
d. Modeled as 1,1,2-trichloro-1,2,2-trifluoroethane.
e. Hydrofluoric acid is not listed as a toxic air pollutant by IDHW (1994) but is which is listed.

In all cases, the incremental impacts of carcinogenic and noncarcinogenic air well below the applicable standards. Incremental impacts would be about 1 percent all noncarcinogenic substances. Carcinogenic substances would also be below allowa cases. The highest levels are projected for formaldehyde and nickel; however, thes extremely conservative assumptions regarding the expansion of combustion sources fo Waste Management Complex Modifications to Support Private Sector Treatment of Alpha Mixed Low-Level Waste project under Alternatives B (Ten-Year Plan) and D (Maximum T Storage, and Disposal).

5.7.4.2 Concentrations of Pollutants at Onsite Locations.

Onsite concentrations of toxic
air pollutants are presented in Table 5.7-8. These levels reflect maximum predicte
eight-hour period to which workers might be exposed. These results are compared wi
standards recommended by either the American Conference of Governmental Industrial
Occupational Safety and Health Administration, whichever is lower. The incremental
locations of toxic air pollutant emissions would be well below occupational exposur
When the cumulative effect of maximum baseline levels is considered, the highest pr
(near gasoline storage tanks at the Central Facilities Area) is slightly above the
However, this condition would be due almost entirely to maximum baseline emissions.

5.7.4.3 Regulatory Compliance Evaluation.

The Clean Air Act and the State of Idaho have
established ambient air quality standards for designated criteria air pollutants.
modifications must demonstrate that project emissions would not cause an establishe
standard to be exceeded. While cumulative annual emission rates associated with ma
exceed the threshold level to be designated as major according to the State of Idah
Air Pollution in Idaho (IDHW 1994), the impact of each criteria pollutant has been

In addition to the comparison of ambient air standards presented in Section 5
been performed for (a) potential for ozone formation, (b) Prevention of Significant
consumption, (c) degradation of visibility at Craters of the Moon Wilderness Area,
vegetation and impacts due to secondary growth, (e) stratospheric ozone

Table 5.7-8. Highest predicted concentrations of toxic air pollutants on the Idaho alternative.

Toxic air pollutant	Baselineb	A	B	C
	Maximum 8-hour concentrationa (micrograms per cubic meter)			
				Carcin
Arsenic	2.8 y 10y1	0.0 y 100	1.4 y 10y3	0.0 y 100
Asbestosd	(e)	5.3 y 10y4	5.3 y 10y4	5.3 y 10y4
Benzene	3.1 y 103	1.1 y 10 0	1.6 y 100	1.1 y 100
Beryllium	(e)	4.6 y 10y5	2.8 y 10y4	4.6 y 10y5
Cadmium compounds	(e)	0.0 y 100	3.4 y 10y3	1.8 y 10y7
Carbon tetrachloride	2.5 y 102	1.4 y 100	1.4 y 100	1.4 y 100
Chloroform	1.7 y 101	4.6 y 10y2	4.6 y 10y2	4.6 y 10y2
Formaldehyde	5.7 y 101	2.2 y 100	9.3 y 100	2.2 y 100
Hexavalent chromium	2.4 y 100	2.9 y 10y5	8.0 y 10y4	2.9 y 10y5
Methylene chloride	3.2 y 100	1.1 y 101	1.1 y 10 1	1.1 y 101
Nickel	4.1 y 101	6.7 y 10y3	1.8 y 10y1	6.7 y 10y3
Perchloroethylene	4.3 y 102	5.4 y 10y2	5.4 y 10y2	5.4 y 10y2
Trichloroethylene	4.0 y 101	2.4 y 10y1	2.4 y 10y1	2.4 y 10y1
				Noncarc
Ammonia	9.7 y 102	2.3 y 102	2.3 y 102	2.3 y 102
Hydrochloric acid	1.1 y 102	9.9 y 10y2	3.1 y 101	9.9 y 10y2
Hydrofluoric acid	(e)	0.0 y 100	2.5 y 10y1	2.5 y 10y1
Lead	(e)	7.0 y 10y3	5.8 y 100	7.0 y 10y2
Mercury	3.0 y 100	4.4 y 10y3	3.2 y 100	5.8 y 10y2
Methyl isobutyl ketone	(e)	0.0 y 100	0.0 y 100	0.0 y 100
Nitric acid	7.7 y 102	1.0 y 100	1.0 y 100	1.0 y 100
Sulfuric acid	(e)	1.4 y 10y1	1.4 y 10y1	1.4 y 10y1
1,1,2-trichloro-1,2,2-trifluoroeth	(e)	1.0 y 102	1.0 y 102	1.0 y 102
Trivalent chromium	6.3 y 100	5.5 y 10y4	1.5 y 10y2	5.5 y 10y4
Tributyl phosphate	(e)	0.0 y 100	2.4 y 10y1	2.4 y 10y1

a. A = Alternative A (No Action); B = Alternative B (Ten-Year Plan); C = Alternati
Alternative D (Maximum Treatment, Storage, and Disposal).
b. Baseline includes projected increases.
c. Occupational exposure limits are 8-hour, time-weighted averages established by
Hygienists (ACGIH) or Occupational Safety and Health Administration (OSHA); the

d. Value reported for asbestos standard is mass equivalent of most restrictive Nat of 0.1 fibers per cubic centimeter.
e. Baseline was not assessed for this toxic air pollutant.

depletion, (f) acidic deposition, and (g) global warming. These analyses are summa subsections.

5.7.4.3.1 Ozone Formation-In addition to the previously mentioned criteria pollutants,

the Clean Air Act designates ozone as a criteria air pollutant and establishes a Na Standard (NAAQS) of 235 micrograms per cubic meter for a one-hour averaging period. other criteria pollutants, is not emitted directly from facility sources but is for photochemical reactions involving nitrogen oxides and volatile organic compounds, r nonmethane hydrocarbons. Therefore, the regulation of ozone is effected by the con ozone-producing compounds or precursors, that is, nitrogen oxides and volatile orga Idaho Division of Environmental Quality has no ozone monitoring data from the vicin problematic ozone levels in the area (Andrus 1994). The State, therefore, does not projected increases in ambient ozone concentrations under application procedures fo sources, unless a new or modified major facility will result in a net increase in v 100 tons per year or greater (IDHW 1994). Part of the reason for the lack of requ emittant levels is because no simple, well-defined methods exist to evaluate ozone (Wilson 1993).

Emissions of volatile organic compounds have been estimated to establish the detailed ozone generation modeling. The maximum cumulative emission rates for the restoration and waste management alternatives range from 9 tons per year [for Alter 18 tons per year [Alternative D (Maximum Treatment, Storage, and Disposal)]. The m below the threshold emission level of 100 tons per year for which analyses are requ 40-ton-per-year threshold for designation as a major source. Therefore, ozone prec organic compounds are expected to be a small contribution to ozone generation and n been conducted.

5.7.4.3.2 Prevention of Significant Deterioration Increment

Consumption-Prevention of Significant Deterioration (PSD) regulations require that projects or modifications, together with minor sources that become operational afte Deterioration baseline dates are established, be assessed for their incremental con ambient pollutant levels. A proposed major project, together with the sum of other emissions increases that occur after the specified baseline date in the same impact an increase in attainment pollutants above an allowable increment. The baseline da regulation or the submittal of a permit application. Increments have been establis times associated with nitrogen dioxide, sulfur dioxide, and particulate matter.

The INEL site is in a Class II area as designated by Prevention of Significan regulations. Previous Prevention of Significant Deterioration permits for INEL sit portion of the available Class I and II increments (see Section 4.7, Air Resources, Proposed project emissions associated with each alternative would contribute to fur consumption. The amount of increment consumption for existing (baseline) sources a restoration and waste management alternatives at the Craters of the Moon Wilderness assessed, and the results are presented in Table 5.7-9. These results indicate tha would not exceed 76 percent of the allowable increment for 3-hour sulfur dioxide co amounts for all other averaging times and pollutants. This maximum would occur und Year Plan) and D (Maximum Treatment, Storage, and Disposal), with slightly lesser i amounts for other alternatives. Sixty-eight percent of the 24-hour increment for s consumed with Alternative D, with slightly lesser increment consumption for Alterna All other short-term increments would be less than 50 percent. On an annual basis, for Class I areas would be 16 percent or less for all pollutants. The maximum Clas consumption (Table 5.7-10) would be about 50 percent for 24-hour respirable particu alternative, with lower values for all other pollutants and averaging times. Annua Class II areas would be 33 percent or less for all pollutants and alternatives.

5.7.4.3.3 Visibility Degradation-Conservative visibility screening analysis indicates

that a potential exists for visual impacts at the Craters of the Moon Wilderness Ar evaluations show no potential for objectionable impact, the criterion for acceptabl exceeded for each alternative as proposed. This excess shift (delta E) would be du dioxide emissions. The Waste Immobilization Facility at the Idaho Chemical Process treatment project (Pit 9 Waste Retrieval) at the Radioactive Waste Management Compl the criterion alone. In combination with other projects, the Idaho Waste Processin been sited but was modeled at the reference location approximately

Table 5.7-9. Prevention of significant deterioration (PSD) increment consumption a emissions from baseline and proposed sources, listed by alternative.

Pollutant	Averaging time	Allowable PSD incrementb (-g/m3)	Alternative A (No Action)		Alternative B (Ten-Year Plan)	
			Increment consumption (-g/m3)	Percent of allowable	Increment consumption (-g/m3)	P a
Sulfur dioxide	3-hour	25	15	60	19	7
	24-hour	5	2.3	46	3.3	6
	Annual	2	0.09	5	0.11	6
Respir-able	24-hour	8	1.1	14	1.3	1
parti-culates	Annual	4	0.02	< 1	0.03	<
Total suspended	24-hour	10	1.1	11	1.3	1
particu-lates	Annual	5	0.02	<1	0.03	<
Nitrogen dioxide	Annual	2.5	0.05	2	0.39	1

a. Source: Belanger et al. (1995b).
b. All increments specified are State of Idaho standards except those for respirab by the U.S. Environmental Protection Agency.
c. Data on particulate size are not available for most sources. For purposes of c it is conservatively assumed that all particulates emitted are of respirable size (

Table 5.7-10. Prevention of Significant Deterioration (PSD) increment consumption Idaho National Engineering Laboratory site by emissions from baseline and proposed alternative.

Pollutant	Averaging time	Allowable PSD incrementb (-g/m3)	Maximum predicted concentration at site boundary (-g/m3)	Maximum predicted concentration along public roads (-g/m3)	Amount of PSD increment consumedc (-g/m3)	P P i c
			Alternative A (No Action)			
Sulfur	3-hour	512	46	80	80	1
dioxide	24-hour	91	8.4	24	24	2
	Annual	20	0.58	1.9	1.9	9
Respirable	24-hour	30	4.1	15	15	4
particu-lates	Annual	17	0.11	0.9	0.9	5
Total suspended	24-hour	37	4.1	15	15	4
particulates	Annual	19	0.11	0.9	0.9	5

Nitrogen dioxide	Annual	25	1.1	1.1	1.1	4
			Alternative B (Ten-Year Plan)			
Sulfur dioxide	3-hour	512	135	147	147	2
	24-hour	91	29	32	32	3
	Annual	20	0.99	2.4	2.4	1
Respirable particu-lates	24-hour	30	7.4	15	15	5
	Annual	17	0.32	0.92	0.92	5
Total suspended particulates	24-hour	37	7.4	15	15	41
	Annual	19	0.32	0.92	0.92	5
Nitrogen dioxide	Annual	25	5.9	8.2	8.2	33
			Alternative C (Minimum Treatment, Storage, and Disposal)			
Sulfur dioxide	3-hour	512	46	81	81	1
	24-hour	91	8.4	24	24	2
	Annual	20	0.56	1.9	1.9	1
Respirable particu-lates	24-hour	30	4.1	15	15	5
	Annual	17	0.12	0.91	0.91	5
Total suspended particulates	24-hour	37	4.1	15	15	4
	Annual	19	0.12	0.91	0.91	5
Nitrogen dioxide	Annual	25	2.7	5.3	5.3	2
			Alternative D (Maximum Treatment, Storage, and Disposal)			
Sulfur dioxide	3-hour	512	142	152	152	3
	24-hour	91	30	33	33	3
	Annual	20	0.99	2.4	2.4	1
Respirable particu-lates	24-hour	30	8.8	15	15	5
	Annual	17	0.32	0.92	0.92	5
Total suspended particulates	24-hour	37	8.8	15	15	4
	Annual	19	0.32	0.92	0.92	5
Nitrogen dioxide	Annual	25	5.9	8.2	8.2	3

a. Source: Belanger et al. (1995b).
b. All increments specified are State of Idaho standards except those for respirab by the U.S. Environmental Protection Agency.
c. The highest value of either the site boundary or public road locations is used.
d. Data on particulate size are not available for most sources. For purposes of c it is conservatively assumed that all particulates emitted are of respirable size (one to two miles west of the Radioactive Waste Management Complex) and boilers asso Waste Characterization Facility and the Radioactive Waste Management Facility Modif Private Sector Treatment of Alpha-Contaminated Mixed Low-Level Waste would contribu the total. The potential for visibility degradation would be lessened by use of em reduce nitrogen dioxide emissions or by relocation of projects to areas more distan Moon. Also, the use of more refined visibility models such as PLUVUE-2 (in place o screening methods) could result in lower predicted impacts. Emission controls woul refined modeling still predicts visibility impacts and may, in fact, be required by visibility degradation criteria are not exceeded.

Further screening analyses have been performed to evaluate the level of nitro reduction required for the cumulative impacts of each alternative to pass the scree shift. Analyses were performed both with a minimum (70 percent on each of the afor and maximum (70 percent on the two boilers and 90 percent on all others) level of c screening analysis, the maximum level of control would be required for cumulative e acceptable level of visibility degradation at the Craters of the Moon under Alterna (Minimum Treatment, Storage, and Disposal), and D (Maximum Treatment, Storage, and Alternative A (No Action) would achieve an acceptable level of visibility degradati control scenario. For comparison, the screening results for the uncontrolled, min control cases are depicted in Figure 5.7-4.

5.7.4.3.4 Impacts to Soils and Vegetation and Impacts Due to Secondary

Growth-Due to the projected minor increase in ambient criteria pollutant concentrat local soils or vegetation, including the local sagebrush vegetation community, graz agricultural areas, are expected. Similarly, the alternatives would be associated employee population and would not result in any air quality impacts due to general industrial, or other growth.

5.7.4.3.5 Stratospheric Ozone Depletion-The 1990 amendments to the Clean Air

Act address the protection of stratospheric ozone through a phaseout of the product

Figure 5.7-4. Summary of modeling results for visual degradation at the Craters of

stratospheric ozone-depleting substances. While environmental restoration and wast alternatives do not involve production or use of ozone-depleting substances, waste release some substances of concern. A review of projected emissions indicates that substances identified are carbon tetrachloride, chloroform, freon, and methyl chlor emitted under each alternative. The combined annual emissions would be about 290 k each alternative and would be due almost entirely to environmental remediation acti would be extremely small compared with global loading and can be considered to have

5.7.4.3.6 Acidic Deposition-Emissions of sulfur and nitrogen compounds and, to a

lesser extent, other pollutants, including volatile organic compounds, contribute t acidic deposition. Under Alternative D (Maximum Treatment, Storage, and Disposal), compounds from proposed projects could reach levels of up to 95,700 kilograms (100 emissions of nitrogen compounds could reach almost 2 million kilograms (about 2,100 However, these emission rates are likely overstated, because controls would be inco projects to meet the Best Available Control Technology requirements of State and Fe Nevertheless, emissions of these levels are not expected to contribute significantl precipitation in the region, nor will they have effects over greater distances, suc associated with large utility power plants.

5.7.4.3.7 Global Warming-Emissions of carbon dioxide, methane, nitrous oxides, and

chlorofluorocarbons (commonly known as greenhouse gases) are associated with potent global warming. Project alternatives would result in emissions of greenhouse gases of fossil fuels (carbon dioxide and methane) and management of certain waste stream amounts of chlorofluorocarbons. New or increased use of chlorofluorocarbons is not currently no requirements that limit emissions of carbon dioxide or methane from th project alternatives. In terms of the global emission of these gases, emissions as implementation of these alternatives are exceedingly small and would not have any d

5.7.5 Air Resource Impacts from Alternatives Due to Mobile Sources

The ambient air quality impacts at offsite receptor locations due to the INEL INEL fleet light- and heavy-duty vehicles, privately owned vehicles, and heavy-duty servicing the INEL site facilities have been predicted. For the most part, alterna increases in employment, which can be absorbed by the existing bus fleet. Alternat minor increase in service vehicles and employee vehicles, especially during constru cumulative impacts (in other words, baseline plus alternative impacts) are predicte Main Gate. These maximum impacts would be just a few (approximately 5 to 30) perce standards and are due almost entirely to existing traffic conditions. The alternat or very little impact on traffic volume at the INEL site and provide only a small i air quality impacts.

5.7.6 Air Resource Impacts from Alternatives Due to Construction

Construction activities would occur intermittently throughout the period of i primary impact related to construction activities would be the generation of fugiti respirable particulate matter. While dust generation would be mitigated by the app high levels of particulates could still occur in localized areas. Emissions of oth construction-related combustion equipment may also result in impacts to air quality assessed, taking into account the proposed construction schedule, in order to estim The impacts reported below are for the highest single year over the period 1995 thr

For any of the alternatives, annual average concentrations of particulate mat total particulates) would not exceed one and three percent of the applicable standa site boundary and public road locations, respectively. Over shorter periods (24-ho respirable and total particulate levels would be one percent or less of the standar However, it is typical of major construction activities to intermittently produce r fugitive dust in the vicinity of the activity. For each of the alternatives assess associated facilities is estimated to result in short-term, localized levels of par applicable standards.

The maximum 24-hour levels of particulate matter at the highest predicted pub would be approximately the same for Alternatives A (No Action), B (Ten-Year Plan), Treatment, Storage, and Disposal). These are 210 micrograms per cubic meter for re 330 micrograms per cubic meter for total suspended particulates. These values exce primary air quality standards of 150 micrograms per cubic meter for respirable part primary standard of 260 micrograms per cubic meter for total suspended particulates (Maximum Treatment, Storage, and Disposal), the maximum impacts are estimated at 39 cubic meter for respirable particulates and 610 micrograms per cubic meter for tota

All levels of other criteria pollutants are predicted to be a small fraction Alternative D (Maximum Treatment, Storage, and Disposal), carbon monoxide levels ar exceed three and eight percent of the standards at the INEL site boundary and publi respectively. All other criteria pollutant levels are one percent or less of appli boundary locations and three percent or less of the standards at public roads. Imp are slightly less.

5.8 Water Resources

This section discusses potential environmental consequences to water resource the INEL site boundaries under each of the four environmental restoration and waste during the implementation period (1995 to 2005) and beyond. Because conclusions on fate and transport are based in part on past contamination and existing plume migra of contaminant transport has been done through 2035. Modeling beyond the implement assurance to the conclusions reached.

Each alternative was evaluated with respect to its impacts on water quality (subsurface water) and water use. Computer modeling of vadose zone and saturated zo transport shows that existing plumes would not greatly affect the regional groundwa contaminants would migrate offsite in concentrations above U.S. Environmental Prote water standards. Additional technical details on assessment methods, assumptions, in Appendix F, Section F-2, Geology and Water.

5.8.1 Methodology

The methodology used to assess the impacts to water resources from treatment, practices and environmental restoration activities identified under the alternative studies and technical information with computer modeling to evaluate aquifer contam predict future trends in water quality during the implementation period. The steps modeling were (a) a literature review to determine the source terms, (b) a determin contours, (c) an evaluation of the subsurface geology, (d) the development of a con selection of appropriate codes, (f) a calibration of the codes, (g) a computer simu purposes, and (h) a parameter sensitivity analysis. The assessment includes an eva volumes of liquid effluent discharges and airborne releases, associated waste manag subsequent effect on water resources.

The primary assumption used to evaluate consequences to water resources under alternatives was that no future intentional discharge of radioactive liquid effluen natural water resources would occur exceeding the standards established in DOE Orde Protection of the Public and the Environment" (DOE 1993). Environmental restoratio

management projects proposed under the alternatives have been reviewed to identify and water usage. No project would intentionally discharge radioactive liquid efflu rather would use other technologies, such as waste evaporators or lined evaporation radioactive discharges directly to the Snake River Plain Aquifer from existing oper of radioactive waste was discontinued in 1985. Some trace quantities of radioactiv zone still exist via infiltration ponds; however, samples collected from these disc radionuclide concentrations are below the U.S. Environmental Protection Agency Prim Standards (Bennett 1994). Efforts are being made to eliminate sources by implement upgrades or repairs, as applicable. Liquid effluent discharges from INEL site acti subsurface via infiltration ponds are monitored for the presence of radioactive and determined suitable for land disposal, as required under applicable Federal and Sta 1993).

Any liquid effluents from spent nuclear fuel facilities proposed under the al contained in tanks, sumps, or lined evaporation basins; and, under normal operating discharges to the soil or directly to the aquifer would not occur. Some existing s leakage. However, these pools are being phased out during the implementation perio

Analysis was performed to determine the consequences from a hypothetical leak nuclear fuel storage facility proposed for construction under the alternatives (Arn would be similar in design to the Fluorinel and Storage Facility at the Idaho Chemi type of facility would be built using state-of-the-art technologies, including leak monitoring equipment. Monitoring and surveillance are performed daily and weekly. leakage to the environment of 1.9 y 10-2 cubic meters (5 gallons) per day left unde volume is more than that which would be detected with monitoring equipment and surv and analysis is for comparison purposes only and should not be construed as a plann

Based on the bounding accident scenario for high-level waste tank failure, th resources are expected to be negligible from this leakage rate (see Section 5.14, F release of hazardous or radioactive materials as a result of accidents is discussed of this EIS.

Constant process monitoring and mass-balance and design to current standards, wall confinement of all vessels and piping, would be included in design and operati limit potential operational releases from a new spent nuclear fuel processing facil operational releases postulated would result from degraded equipment. Design data nuclear fuel processing facility have not evolved sufficiently to allow for detaile operational releases to groundwater.

5.8.2 Water Resource Impacts from Alternative A (No Action)

Under Alternative A (No Action), environmental restoration and waste manageme including existing spent fuel-related facilities, would continue, but under the ass discharge of hazardous or radioactive wastes to the vadose zone, as specified under regulations. The evaluation of water resources consequences for Alternative A invo from past activities and predicting what might occur in the future.

5.8.2.1 Surface Water.

No direct impacts would result to the Big and Little Lost Rivers and Birch Creek from continuation of existing activities and normal operations at the I effluent discharges (with the exception of cooling water and storm water) are not d natural surface water bodies. Commingling of operational liquid effluents with sto separating process water from storm water and directing process water to onsite tre systems. As of 1993, any previous detections of contaminants in water samples coll Little Lost Rivers and Birch Creek have not exceeded U.S. Environmental Protection Drinking Water Standards (Mann 1994). Wastewaters discharged via land disposal sys monitored to ensure that any levels of contaminants present are suitable for land a under Federal and State requirements [for example, DOE Order 5400.5, "Radiation Pro and the Environment" (DOE 1993), and State land application permit requirements]. wastewater discharges to the ground surface and percolation ponds are currently und proposed to be finalized in 1995. Additionally, release limits are currently being negotiation as part of the State wastewater land application permit process.

The INEL site flood diversion system, which diverts flow from the Big Lost Ri areas (along with associated dikes, culverts, and bridges constructed at the facili prevent flooding from the Big Lost River into facility areas. Gates also control t

Playa 2 to Playa 3 (Bennett 1990). However, in localized areas where the plain is water depths with low flow velocities could occur under maximum flood conditions co hypothetical failure of Mackay Dam (Koslow and Van Haaften 1986).

The local basin snowmelt study [Appendix A of Koslow and Van Haaften (1986)] potential for flooding from heavy rains and snowmelt runoff at the INEL site facili combined rain and snowmelt occurring every 25 years was determined to produce appro centimeters per day (2.74 inches per day) of available water. This runoff could be with properly installed culverts, channels, and the use of flood control basins.

Floodwaters outside the banks of the Big Lost River channel would spread and areas on the flood plain. Pumping of these ponded waters to other settling basins reduce the impact of standing water.

5.8.2.2 Subsurface Water.

Under Alternative A (No Action), negligible impacts would result to subsurface water resources from potential future sources of contamination compared previous practices (for example, deep well injection) that have been discontinued b the impacts to be negligible indicate the following:

- Projects would not intentionally discharge radioactive liquid effluent currently, there are no radioactive discharges directly to the Snake Ri (Lehto 1993, DOE 1993)

- Only contaminant concentrations below U.S. Environmental Protection Age contaminant levels and DOE derived concentration guides would migrate b site boundary, resulting in negligible impact to the quality of groundw site (Arnett and Rohe 1993, Golder 1994)

- Adverse effects to groundwater quality have occurred in localized areas (that is, contaminant plumes), but downgradient groundwater monitoring these plumes have not affected the regional quality of water (Golder 19 plumes are generally decreasing in size (Bishop 1993)

- Computer modeling of vadose zone and saturated zone contaminant transpo contaminant plumes with concentrations above the primary maximum contam would continue to decrease at least through 2030 and the overall qualit would be improving (Arnett and Rohe 1993)

- Groundwater quality monitoring data by independent agencies show that i management and disposal practices have resulted in the further reductio existing in water resources and improved water quality (Golder 1994)

- Water use at the INEL site would have a minimal effect on the quality o aquifer.

The remainder of this section gives more details on the modeling, analyses, monitor information that supports the conclusion of negligible impacts to subsurface water

Modeling performed by Arnett and Rohe (1993, 1994) for predicting contaminant considered the following radionuclides: tritium, iodine-129, and strontium-90. Th considered because they appear to have had the greatest impact on the aquifer from activities and are the main constituents within contaminant plumes. These contamin (for example, cesium-137), are also present in the vadose zone in substantial quant Processing Plant and the Test Reactor Area were considered because they are the two have contributed to the plumes in the aquifer. Isolated radionuclide contamination facilities but has not been detected consistently in monitoring wells to constitute transport modeling was performed for the period from 1990 through 2035 (30 years be implementation period) or until the contaminant dropped below the U.S. Environmenta maximum contaminant level in the aquifer (Arnett and Rohe 1993, 1994).

The vadose zone has a beneficial effect on consequences to water resources be contaminants from the regional aquifer by sorption and restricted migration pathway sediments and sedimentary interbeds sorb some radionuclides and allow them to decay zone. Results of a simple vadose zone transport model are presented in Arnett and incorporated into the aquifer transport model as input data.

A brief summary of the results will help illustrate what effects vadose zone

the future. Modeling was performed for potential transport of contaminants from th beneath the deactivated radioactive waste pond at the Test Reactor Area and the per the percolation ponds at the Idaho Chemical Processing Plant. In addition, dischar waste pond was included in the model and treated as a continuing source at the Test effluent discharges were assumed to continue at the Idaho Chemical Processing Plant amount of water entering and exiting the perched water zones took a few years to re amount in equals amount out). The amounts of tritium released from the vadose zone increased from 1962 to the mid-1970s and decreased slightly from the mid-1970s to t Reactor Area. Discharges of tritium and iodine-129 at the Idaho Chemical Processin since 1984. Assuming no new radioactive liquid effluent waste discharges, the code areas that levels of iodine-129 and tritium would continue to migrate from the vado would decrease over time due to natural dispersion/dilution and radioactive decay. water in the perched water zones beneath the Idaho Chemical Processing Plant percol migrated to the aquifer and only very small quantities (1 y 10-4 curies per day) of would continue to enter the aquifer after 2010. The same results are predicted for perched zones but here discharges of effluents meeting the DOE standards would cont water zones would remain and existing contaminants would continue to migrate into t quantities.

Strontium-90 is not predicted to migrate to the regional aquifer in significa source because of retardation within the vadose zone. Predictions in studies by Ar the same as those of Robertson (1977). Tritium was predicted to migrate from the v whereas strontium-90 would not migrate.

Predictions of groundwater modeling indicate that current plumes will continu concentrations within the plume would continue to decrease and decay with time. By maximum concentrations of tritium would be reduced by one-half and fall below the c contaminant level. By 2010, the maximum concentration in the plume is predicted to the maximum contaminant level. Iodine-129 behaves similarly to tritium but has a m The predicted plume does not have a large decrease in concentration by 2030, but it offsite, except for very small concentrations less than 1 picocurie per liter (the The existing strontium-90 plume resulted from previous releases directly to the aqu Chemical Processing Plant disposal well. (Routine injection well use was discontin transport modeling predict that by 2000, strontium-90 would decrease slightly in co remain relatively stationary because of retardation. By 2030, the highest levels o plume would decrease in concentration to approximately one-half of the maximum cont strontium-90. By 2030, the plume front is predicted to migrate approximately one k beyond the 1990 position, far short of the INEL site boundary. In summary, modelin Rohe (1993) show that iodine-129 is the only radionuclide predicted to migrate past Iodine-129 concentrations are predicted at low concentrations below the maximum con dose would not exceed the nominal value of 4 millirem per year used to determine ma levels for man-made beta-gamma activity.

Arnett and Rohe (1993) performed a study similar to Robertson (1974) to evalu migration of tritium and strontium-90 through 2000. The results by Robertson (1974 could migrate southward and extend about 1 mile south of the INEL site boundary by below U.S. Environmental Protection Agency maximum contaminant levels. Predictions using estimates of contaminant releases to the aquifer for the period beyond 1972 i miles south of the Idaho Chemical Processing Plant, but not offsite. Results repor (1993) are consistent for strontium-90, but not for tritium. Most of the tritium d however, to estimated versus actual tritium discharges used for the 1971-1990 perio unavailable to Robertson in 1974. Results are consistent in the sense that neither contamination in excess of maximum contaminant levels. Field monitoring observatio decreasing concentrations of tritium, iodine-129, and strontium-90 within the conta past seven years and are consistent with the prediction of continued decrease in pl

Organic contamination is a concern at Test Area North and the Radioactive Was Complex. Water sampling performed by the U.S. Geological Survey at the Radioactive Complex after 1980 has shown that the perched water zones beneath the Subsurface Di some level of organic contamination; however, radionuclides have not been detected detection limits (Cecil et al. 1991). Contaminant migration modeling of volatile o Dames & Moore (1993) shows a potential for the migration of carbon tetrachloride, t trichloroethane, and 1,1,1-trichloroethane, with peak concentrations to the aquifer modeling was performed under conservative conditions because the mitigation effects program were not incorporated. Vapor vacuum extraction wells used to remove volati from the subsurface have been installed and tested at the Radioactive Waste Managem positive results (Sisson and Ellis 1990). However, full-scale remediation efforts

the extraction system operational, volatile organic compounds would pose a negligib groundwater or vadose zone.

Test Area North also has volatile organic compounds within the subsurface, re disposal of organic-rich sludge into the Test Area North injection well (TSF-05). removed from the well in 1990. A modeling study was performed by Schafer-Perini (1 potential for residual contaminant migration. This study was based on two alternat the residual sludge would consist of a constant infinite source or (b) that the amo limited and free to migrate and act as a dissolved source. Results under the two a the organics would be likely to migrate a minimum of 12 kilometers (7.5 miles) sout the model grid by 2024 and would continue to migrate southward at about 0.33 meters day). The difference in the assumptions is that concentrations would be higher und everywhere in the plume. The radionuclides were not affected by the choice of assu not migrate very far and would never be in concentrations above the maximum contami 90 would continue to have elevated concentrations but would not migrate more than 1 away from Test Area North. Organics could pose a problem, but a planned remediatio and treat the groundwater to remove the source of contamination to the extent possi is exposed to groundwater contaminated above Federal drinking water standards. Eve action were taken, the location of Test Area North relative to the regional aquifer unlikely that contamination would ever reach the INEL site boundary at concentratio Environmental Protection Agency maximum contaminant levels.

A preliminary scoping risk assessment of radioactive waste disposal practices from 1952 to 1996 is currently being performed as part of a Comprehensive Environme Compensation, and Liability Act investigation. Results of the preliminary risk ass contaminants would not reach the INEL site boundary exceeding Federal primary drink through 2005 (Loehr et al. 1994).

A radiological performance assessment was also conducted for low-level waste Radioactive Waste Management Complex from 1984 through present operations and proje disposed through 2020 (Maheras et al. 1994). The results of the assessment indicat pathway exposure occurring by 2060 at the INEL site boundary would be less than 0.6 (Maheras et al. 1994). No significant impacts are expected to occur within the imp EIS

Other facilities at the INEL site contain some levels of contamination above levels (for example, chromium at Test Reactor Area), but the contaminants are isola areas and do not occur consistently in monitoring wells. Radionuclides of chromium cobalt-60 have also been detected above maximum contaminant levels in isolated area sorbed in the soil or subsurface sediments and would not migrate to the saturated z of contamination impact the local ground and vadose water near the INEL site facili threat to the regional aquifer system.

Although no contamination of the aquifer can be attributed to air emissions, an effect of flushing contaminants that have settled to the ground out of air emiss zone. Any subsequent effect to the aquifer would be negligible for the following r

- Because the annual precipitation is 22 centimeters (8.62 inches) per ye rate is 125 centimeters (49.0 inches) per year, very little of the prec aquifer during the summer and fall. Increased filtration would occur a during the spring. However, the amount of water reaching the aquifer w Robertson et al. (1974) estimates that overall only 15 percent of the a would recharge the aquifer.

- The vadose zone ranges from approximately 61 meters (200 feet) to 270 m and has a large capacity for sorbing contaminants (Cecil et al. 1992). isotopes that have short half-lives, most of the radioactivity may deca through the vadose zone.

- The wide area distribution of radionuclides resulting from atmospheric precipitation would result in concentrations of contaminants in precipi maximum contaminant levels at land surface.

- Under highly unsaturated conditions with low moisture content in the va migration is very slow and would require several decades to reach the a radioactive decay.

The increased consumption of water from the Snake River Plain Aquifer under A Action) would be 106,900 cubic meters (28.2 million gallons) per year above average

(Hendrickson 1995). Of this total, 99,000 cubic meters (26 million gallons) would Remediation of Groundwater Contamination Project. Since total consumption of water averages 7.36 million cubic meters (1.94 billion gallons) per year, the increased u increase above the average annual consumption. This increase would have a negligib River Plain Aquifer. Given that 1.77 billion cubic meters (470 billion gallons) (R water flow under the INEL site each year, the total volume of water consumed under only be 0.42 percent of that passing under the site. The total consumption of wate much less than the INEL site's consumptive use water right of 43 million cubic mete per year.

5.8.3 Water Resource Impacts from Alternative B (Ten-Year Plan)

Impacts to water resources would essentially be the same for Alternative B (T Alternative A (No Action) except for water consumption. Water consumption under A the greatest of any alternative through the implementation period (2005). The incr estimated at 298,600 cubic meters (79 million gallons), which represents an increas average annual consumption (Hendrickson 1995). Most of this increase would be asso Immobilization Facility and the Idaho Waste Processing Facility. The total increas a negligible impact on the quantity of water in the Snake River Plain Aquifer. Giv meters (470 billion gallons) (Robertson et al. 1974) of water flow under the INEL s volume of water consumed under this alternative would only be 0.43 percent of that site.

Continued shipments of spent nuclear fuel would not affect the quality of wat is stored in contained storage pools or above-grade and below-grade dry storage con the environment. Additional activities under Alternative B would not discharge liq subsurface above levels suitable for land application; therefore, any impacts would

5.8.4 Water Resource Impacts from Alternative C (Minimum Treatment, Storage and

Disposal)

Impacts to surface and subsurface water would be the same for Alternative C (Storage, and Disposal) as for Alternatives A (No Action) and B (Ten-Year Plan), wit consumption. Less water would be used than for either Alternatives B (Ten-Year Pla Treatment, Storage, and Disposal). A total of 158,600 cubic meters (41.9 million g consumed above average annual water consumption, representing an increase of 2.1 pe 1995). Most of this increase would be associated with the Waste Immobilization Fac billion cubic meters (470 billion gallons) (Robertson et al. 1974) of water flow un the total volume of water consumed under this alternative would only be 0.42 percen the site. The effects on the quantity of water in the aquifer would be negligible.

The impacts to the saturated zone, vadose zone, and surface water would be ne effluents would not be discharged to the surface or subsurface above levels suitabl Other wastewater disposal methods that could degrade groundwater beyond designated controlled by Federal and State regulations.

5.8.5 Water Resource Impacts from Alternative D (Maximum Treatment, Storage and

Disposal)

Impacts to water resources would be the same for Alternative D (Maximum Treat Disposal) as for Alternatives A (No Action), B (Ten-Year Plan), and C (Minimum Trea Disposal) with the exception of water consumption. Alternative D represents the se water consumed of all the alternatives-254,000 cubic meters (67.0 million gallons) (Hendrickson 1995). The increased water usage represents only a 3.4 percent increa water consumption and is negligible when compared with volume of water in the aquif increase would be associated with the Waste Immobilization Facility and the Spent F Given that 1.77 billion cubic meters (470 billion gallons) (Robertson et al. 1974) INEL site each year, the total volume of water consumed under this alternative woul that passing under the site.

The impacts to the saturated zone, vadose zone, and surface water would be ne effluents would not be discharged to the surface or subsurface above levels suitabl Other wastewater disposal methods that could degrade groundwater beyond designated controlled by Federal and State regulations.

5.9 Ecology

This Section discusses the potential effects of the four environmental restor management alternatives on ecology at the INEL site and the surrounding area. Techn this section is provided in Rope et al. (1993). Effects from the alternatives are t section for ease of comparison.

5.9.1 Methodology

Potential effects on biological resources from each alternative were qualitat The potentially affected areas (sites and facilities to be used, constructed, or re Surrounding habitat where effluents, emissions, light, or noise may be present) wer Chapter 3, Alternatives, Appendix C, Information Supporting the Alternatives, and S Ecological Resources. Biological attributes found or that may be found on the site and characteristics were discussed in Section 4.9, Ecology.

The assessment of potential effects is based on an evaluation of the location relation to the location of the biological attributes. Information about the potent developed from studies evaluating effects from similar types of activities on biota found at the INEL site. Also, the potential effects associated with Alternative A (the basis of comparison for the other alternatives.

Disturbance of various types (for example, earthmoving and noise) would const primary source of impacts such as loss of productivity, displacement of individuals fragmentation. Table 5.9-1 summarizes land disturbance associated with general acti alternative.

5.9.2 Ecological Impacts from Alternative A (No Action)

A variety of general activities would occur under Alternative A (No Action) t biological resources. Sources of disturbance that may affect ecological resources i change of habitat from construction of new facilities; mortality from land clearing operations; mortality from vehicular traffic; human presence; noise; night lights;

<u>Table 5.9-1. Acres disturbed by alternative from proposed projects to manage or con</u>
radionuclides and hazardous contaminants and wastes. A potential beneficial effect activities would be revegetation of disturbed areas once any remediation activities

Approximately 16 hectares (40 acres) would be disturbed under Alternative A (Action)-2 hectares (S acres) of undisturbed habitat and 14 hectares (35 acres) of p habitat. All but 0.8 hectares (2 acres) of the 2 hectares (S acres) of previously u would be within the fence lines or boundaries of existing facilities and currently 14 hectares (35 acres) of previously disturbed habitat would be within the boundari facilities. The projects with the largest land disturbance under Alternative A woul Transuranic Storage Area Enclosure and Storage Project, the Auxiliary Reactor Area Decontamination and Decommissioning Project, and the Pit 9 Retrieval Project. These described in Appendix C, Information Supporting the Alternatives.

The potential short-term effects of the disturbance of the 2 hectares (5 acre undisturbed habitat would include a loss of plant productivity, localized loss of b displacement of animals occupying the areas, and direct mortality of less mobile sp nesting birds) and species using burrows. The plant productivity and localized biod be the result of the loss of species common to the shrub-steppe vegetation that cov of the INEL site. The majority of animal species that would be displaced include in and small mammals. Displaced/dispersing animals tend to have low survivorship (Emle Ralls et al. 1986), especially if surrounding areas are at or near carrying capacit the previously listed animals plus nesting birds and their nests may occur during l activities. An additional potential effect would be the establishment of Russian th which are non-native annual species. These species, less desirable than native spec establish in undisturbed native vegetation and competitively exclude less vigorous are important food or cover sources for insects, small mammals, and birds.

The potential short-term effects of the disturbance of the 14 hectares (35 ac disturbed habitat would be similar to the effects discussed for the 2 hectares (5 a undisturbed habitat with the exception that biodiversity loss, plant productivity l

displacement, and animal mortality would be less. This is because previously distur less diverse, primarily dominated by landscaped vegetation (such as lawns), Russian cheatgrass, or non-native, perennial crested wheatgrass. These vegetation types are provide less cover and food for animals compared with undisturbed native vegetation

Other potential short-term effects include increased traffic noise, human pre removal of contaminated ponds, and deposition of radionuclide air emissions from wa and remediation operations (see Section 5.9.2.3 for discussion of potential effects mortality associated with increased vehicle traffic would be small because the incr trips and miles anticipated under Alternative A (No Action) would be similar (a max two per day) to the current traffic levels. Potential mortality associated with inc would be the smallest for this alternative because it involves the smallest number train. Train collisions with wildlife can involve individuals or large numbers of a the tendency of large game animals to bed down on the tracks in winters with high s accumulation. No, or limited, effects to plants and animals are anticipated from hu noise, or night lights. About eight new generators would be used during the day and used at night on seven projects. All generators and noise sources (both night and d noise levels similar to existing sources. Also, all activities would be within or i to existing activities that have existing night lights, noise, human presence, and Therefore, exposure of animal populations near facilities to these disturbances and would increase slightly under Alternative A. In addition, species using areas near (hawks, songbirds, small mammals, elk, and pronghorn) demonstrate tolerance to huma and activities. Night lights may serve as an attractant to insects and, thus, to no such as bats. Conversely, some nocturnal small mammal species may alter activity pe displaced from areas adjacent to night lights. This effect may alter success of hun predators such as owls. Ponds and lagoons that are removed may reduce availability water or food sources for bats, birds, rodents, and small mammals. However, removal ponds would reduce the likelihood of exposure to contaminants.

Long-term effects of construction and operation would include loss of plant a productivity on the 16 hectares (40 acres) occupied by facilities, attraction or av and effects to habitat immediately surrounding facilities. These potential long4erm surrounding facilities would be from noise, human presence, night lights, and depos emissions from operations. With the exception of air emissions, effects associated disturbance would be localized to areas immediately surrounding the new activities would affect biota in the same manner as described for potential short-term effects

5.9.2.1 Protected, Candidate, and Sensitive Species.

It is not likely that Federal protected and candidate species and State and agency sensitive species would be aff Alternative A (No Action). Preactivity surveys would be conducted on areas before i projects to ensure that impacts to protected species would not occur and that appro would be implemented as needed (see Section 5.19, Mitigation).

5.9.2.2 Wetlands.

Wetlands and aquatic resources likely would not be affected under Alternative A (No Action). Based on recent surveys (Hampton et al. 1995), no jurisd wetlands are known to exist on or near any of the facilities. However, an area nort Reactor Area is being evaluated as a potential jurisdictional wetland. See Section for additional steps to ensure that no adverse effects would occur to jurisdictiona

5.9.2.3 Radloecology.

Under Alternative A (No Action), biota would continue to be exposed to radionuclides and contaminants in water and soil that would not be treat remediated. This exposure would continue beyond the year 2035. In addition, short-t may increase because of contaminant resuspension during soil removal and treatment stripper, bioremediation) operations. However, soil removal and treatment operation long-term contaminant exposure levels for biota in some locations of the INEL site. areas at the site are small, relative to the INEL as a whole, and are not increasin contamination levels (Morris 1993a, b). As discussed in Section 4.9, Ecology, obser individual small animals have been noted at small isolated areas on the INEL site;

on population were observed. Therefore, effects to populations are not likely under (No Action).

With respect to Federal endangered and candidate species, it is unlikely that peregrine falcon, northern goshawk, burrowing owl, ferruginous hawk, long-billed cu pygmy rabbit are consuming harmful concentrations of radiological contaminants thro This is because these species rarely use areas near exposed contaminants. It is unk individuals of the other candidate species (Townsend's western big-eared bat, long-small-footed myotis) use contaminated areas for a sufficiently long time or consume amount of prey to receive radiation doses that would have a measurable effect on th survey of these species is underway at the INEL site. Removal of contaminated ponds would have a beneficial effect of further minimizing the potential for Townsend's b exposed to contaminants.

5.9.3 Ecological Impacts from Alternative B (Ten-Year Plan)

Generally, potential nonradiological and radiological effects to biota from A Year Plan) are similar in nature, but larger in scale, to those described under Alt Action). About 333 hectares (823 acres) would be disturbed under Alternative B, 233 (577 acres) of undisturbed habitat and 100 hectares (246 acres) of previously distu minimize the potential short-term effects of the disturbances described above, abou (232 acres) of the 333 hectares (823 acres) to be disturbed would be revegetated. C would be a long-term net loss of 239 hectares (591 acres). The majority of the long loss would be from the construction and operation of a new facility (either the Pri Alpha-Contaminated Mixed Low-Level Waste Treatment Facility or the Idaho Waste Proc Facility) several kilometers from existing facilities and the expansion of the land new facilities would encompass about 81 hectares (200 acres), while the landfill ex encompass about 113 hectares (280 acres).

When possible, revegetation would be accomplished using native perennial gras Plant productivity and diversity on revegetated areas that were part of the 64 hect (158 acres) of previously disturbed habitat probably would become more productive a compared with the preexisting habitat. Previously undisturbed habitat that would be probably would not provide cover, food, or biodiversity similar to undisturbed habi first three to five years after seeding. Cover probably would be similar to undistu about five years after reseeding. Composition of plant species (and, therefore, div food supplies) would continue to be lower compared with undisturbed habitat ten yea reseeding. This is because slower growing seeded species such as some shrub species competitive forb species require more time to become established. In addition, many undisturbed areas would not be part of the seed mixture because commercial seed is

Over a longer period, diversity and animal food supplies may more closely app native vegetation. Animal species probably would reestablish in reseeded areas as v occurred. Animal species preferring open areas and using annual plants would be the reestablish in revegetated areas. As seeded species became productive, species requ cover or perennial grasses and shrubs would begin to use the areas. Similar to the community, the reestablished animal communities may remain less diverse than undist communities. In addition, revegetation of the 94 hectares (232 acres) would limit t Russian thistle, cheatgrass, and other less desirable species to establish or domin communities.

An additional potential effect that may be a result of Alternative B (Ten-Yea not be associated with Alternative A (No Action) would be habitat fragmentation res construction and operation of the two facilities outside of existing facilities (se Fragmentation probably would alter the movement of individual mobile species such a elk in, and through, the area. Effects of fragmentation from the proposed facilitie not eliminate or severely restrict movements of animals. Historical data show that continue to use and move through areas immediately adjacent to developed areas simi proposed facilities (Rope et al. 1993). Also, habitat adjacent to new facilities ma species because of human presence, night lighting, or noise. After construction is additional habitat disturbance would not occur and human activity and presence woul surrounding undisturbed habitat.

Potential mortality associated with vehicular traffic would be similar to Alt more trucks per day compared with Alternative A). The number of rail shipments per alternative could be up to 6 times that for Alternative A (assuming 100 percent rai increasing the likelihood of train/wildlife collisions.

Other sources of potential effects would include the addition of about 20 tem

7 permanent generators during the day, 24 night lights, and the addition of 2 artif sources. These additions (with the exception of two generators and two night lights the boundaries of existing facilities where similar facilities are present. The pon and have no vegetation surrounding them to minimize access and to make them less at wildlife.

5.9.3.1 Protected, Candidate, and Sensitive Species.

Implementation of Alternative B
(Ten-Year Plan) likely would not affect protected, candidate, or sensitive species. for the new two, 81-hectare (200-acre) area facilities would not affect protected, sensitive species. As discussed in Section 5.9.2.1, locations of existing facilitie species. However, Preactivity surveys would be conducted before construction to ide protected or sensitive resources in the specific areas proposed for the facilities. relocating the facilities, would be considered and Implemented as needed based on t surveys and appropriate consultation with the U.S. Fish and Wildlife Service.

5.9.3.2 Wetlands.

Potential wetlands and aquatic resources would not be affected under
Alternative B (Ten-Year Plan). Currently, no Juflsdictional wetlands are known to e any of the facilities. However, an area north of the Test Reactor Area is being eva potential Jurisdictional wetland. Projects that would disturb habitat (especially o boundaries) would be evaluated to determine if Jurisdictional wetlands are present. be modified to avoid affecting any identified wetlands. If avoidance is not possibl consult with the U.S. Corps of Engineers to obtain permits and develop any needed m (for example, construction of new wetlands, enhancement of existing wetlands).

5.9.3.3 Radioecology.

During the remediation period, potential radionuclide exposure and
uptake by plants and animals in and near affected areas may increase compared with and uptake. Potential long-term exposure and uptake would be lower compared with Al (No Action) as additional sites and facilities are remediated. A positive efl~ct of Year Plan) would be that radionuclide uptake and accumulation by animals and plants toward background levels after cleanup activities have taken place. Biotic populati communities exposed to current radionuclide levels do not appear to be different in species composition compared with populations in similar nearby habitat that are no elevated radionuclides (Morris 1993b).

5.9.4 Ecological Impacts from Alternative C (Minimum Treatment, Storage, and DiSposal)

Effects to biological resources would be similar to those described under Alt (Ten-Year Plan); however, the scale of impact would be lower (see Section 5.9.3). A 144 hectares (355 acres) would be diSturbed under Alternative C (Minimum Treatment, Disposal), 49 hectares (122 acres) of previously undisturbed habitat and 94 hectare previously disturbed habitat. About 94 hectares (232 acres) would be revegetated un alternative. Consequently, there would be a long-term net loss of 50 hectares (123 new artificial water sources would be created, fewer than twenty new night lights w and three temporary and two permanent generators would be operated during the day. with the largest land disturbance under Alternative C would be the Industrial/Comme Expansion Project. This project is described in Appendix C, Information Supporting

Potential mortality associated with vehicular traffic would be similar to Alt (four more trucks per day compared with Alternative A). The number of yearly train Alternative C (assuming 100 percent rail transport) could be as much as 6 times tha Alternative A, thereby increasing the likelihood of train/wildlife collisions.

5.9.5 Ecological Impacts from Alternative D (Maximum Treatment, Storage, and Disposal)

Effects to biological resources including protected species and wetlands woul

those described under Alternative B (Ten-Year Plan), but larger in scale because of area disturbed. About 542 hectares (1,339 acres) of land would be disturbed under A (Maximum Treatment, Storage, and Disposal), 430 hectares (1,062 acres) of undisturb 112 hectares (277 acres) of previously disturbed habitat. To minimize the potential of the disturbance described above, about 94 hectares (232 acres) of the 542 hectar be disturbed would be revegetated. Consequently, there would be a long-term net los 448 hectares (1,107 acres). The majority of the long-term loss of the 448 hectares would be from construction and operation of either the Private Sector Alpha-Contami Low-Level Waste Treatment Facility or the Idaho Waste Processing Facility and the M Low-Level Waste Treatment and Disposal facilities, all three to be located several existing facilities. Additional acres to be disturbed are primarily associated with gravel pits [about 40 hectares (100 acres)] and the expansion of the landfill [abou (280 acres)]. Alternative D has the largest increase in both vehicular and rail shi 20 more trucks per day (assuming no transport by rail) as compared with Alternative expected, resulting in a slightly higher potential wildlife mortality to individual trucks. Rail shipments could increase by a maximum of 12 times (assuming 100 percen transport) over Alternative A, increasing the likelihood of train/wildlife collisio and large numbers of animals potentially bedded down on the tracks. The number and effects would be similar to those described in Alternative B (Ten-Year Pian) except would be greater. Mitigations would be used as needed (see Section 5.19, Mitigation

5.10 Noise

This section discusses the potential effects of the four environmental restor management alternatives on noise at the INEL site and in the surrounding area.

5.10.1 Methodology

As discussed in Section 4.10, noises generated on the INEL site do not propag that impact the general population. Therefore, INEL noise impacts for each alterna generated during the transportation of personnel and materials to and from the site communities. These noises are largely a function of the size of the workforce. Th workforce is expected to decrease from the 8,620 job level in 1995 for all alternat the year 2004 (see Section 5.3, Socioeconomics). Approximately one-half of the tot at the INEL site and one-half is stationed in facilities in Idaho Falls. The incre construction workers during some years for Alternatives B (Ten-Year Plan) and D (Ma Storage, and Disposal) were not considered relevant to noise impacts, since these w private vehicles to and from work, and, as mentioned in Section 4.10, buses are the roadway noise.

Roadway, aircraft, and railroad noises have been considered. The roadway no noises caused by busing personnel to and from site work stations and transporting w fuel by truck.

5.10.2 Noise Impacts from Alternatives

Because the operations workforce stationed at the INEL site is expected to be for all years for all alternatives, the overall noise level resulting from site tra be generally lower than the baseline. The lower noise level would probably not be individual in most cases. Because there is no evidence of substantial resistance t is no anticipated impact on noise due to personnel transportation. The number of t spent nuclear fuel under any alternative is expected to be, at most, a few per day and Transportation). These trucks would be virtually undetectable from a noise per would not represent an environmental impact compared with the several hundred buses that travel to and from the INEL each day.

With regard to aircraft noises, the modest changes in the workforce for each insufficient to change the combined number of aircraft landings in the Idaho Falls Likewise, regional freight trains would not be expected to increase or decrease in alternative. Rail shipments of spent nuclear fuel, regardless of alternative, are traffic on the Mackay Branch of the Union Pacific System that traverses the INEL si via the Scoville spur.

In summary, no environmental impact due to noise is expected from any of the

considered.

5.11 Traffic and Transportation

Environmental restoration and waste management activities included in the sc Environmental Impact Statement involve the transportation of hazardous and radioact within the boundaries of the INEL (onsite) and on highways and rail systems outside of the INEL (offsite). Hazardous materials include commercial chemical products and wastes that are nonradioactive and are regulated and controlled based on their chem main categories of radioactive materials are associated with environmental restorat management activities: spent nuclear fuel, transuranic wastes, mixed low-level wast wastes. High-level wastes are stored at the INEL, but shipments of high-level waste within the timeframe of this EIS.

This section summarizes the methods of analysis, potential impacts, and miti related to transportation of these materials under normal (incident-free) and accid impacts are presented by alternative and include doses and health effects. Impacts on wildlife are discussed in Section 5.9, Ecology, of this EIS.

5.11.1 Methodology

The effects discussed in this Section are presented for the entire shipping years for waste and 40 years for spent nuclear fuel. Because the shipment schedule fuel is not known, it is not possible to isolate the impacts for the period 1995 th However, the impacts over 40 years would bound the potential impacts over 10 years alternative.

This Section summarizes the methods of analysis used in determining the envi consequences of transporting these materials under normal (incident-free) and accid

5.11.1.1 Methodology for Incident-Free Transportation.

Radiological impacts were determined for two groups of people during normal, incident-free transportation: (a (b) general population. For truck shipments, the crewmen were the drivers of the sh shipments, the crewmen were workers in close proximity to the shipping containers d inspection or classification of railcars. The general population was persons within (800 meters) of the transport link (off-link), persons sharing the transport link (at stops. Off-link doses, on-link doses, and doses at stops were evaluated for offs Because the general population does not reside on the INEL and the INEL facilities from major roads, no off-link doses or doses at stops were calculated for onsite sh on-link doses were evaluated for onsite shipments because the general population do the majority of the roads on the INEL. Radiological impacts were calculated using t computer code (Neuhauser and Kanipe 1992) and the RISKIND computer code (Yuan et al

Each category of material to be transported was assigned a dose rate based o characteristics, and all shipments were made by exclusive use vehicle. Remote-handl waste and remote-handled low-level waste were assigned a dose rate of 5 millirem pe feet (1 meter) from the shipping container (DOE 1990); contact-handled transuranic contact-handled low-level waste were assigned a dose rate of 1 millirem per hour at (1 meter) from the shipping container (DOE 1990); and spent nuclear fuel was assign 14 millirem per hour at 3.28 feet (1 meter) from the shipping container. A dose rat per hour at 3.28 feet (1 meter) from the shipping container yielded a dose rate of hour at 6.56 feet (2 meters) from the edge of the transport vehicle, the regulatory exclusive use vehicle (Madsen et al. 1986). A dose rate of 1 millirem per hour at 3 was used for naval-type spent nuclear fuel shipments, which was based on measured d previous naval spent nuclear fuel shipments.

The calculation of the doses was based on the development of unit risk facto factors provide an estimate of the dose to an exposure group from transporting one radioactive material over a unit distance of travel in a given population density z and urban). Unit risk factors have units of person-rem per kilometer and may be com routing information, such as the shipment distances in various population density z

number of shipments, to determine the dose for a series of shipments between a give destination. Using RADTRAN 4, unit risk factors were developed based on travel with suburban, and urban population zones. Truck routes were determined using the HIGHWA computer code (Johnson et al. 1993a), and train routes were determined using the IN computer code (Johnson et al. 1993b). Table 5.11-1 contains the route data for wast Appendix I of Volume 1 of this EIS contains the route data for spent nuclear fuel. chosen to be representative and to conform to Department of Transportation routing

Table 5-11.1. Transportation distances between facilities for waste shipments.

Routes		Miles	Percent rural	Percen suburba
		Truck routes		
INEL	Rocky Flats, Golden, CO	730.0	90.2	8.4
INEL	Waste Isolation Pilot Plant, Carlsbad, NM	1396.0	90.5	8.3
INEL	Engineering Technology Engineering Center, Ventura County, CA	965.0	77.2	15.8
INEL	Inhalation Toxicology Research Institute, Albuquerque, NM	1121.0	22.7	9.7
INEL	PANTEX, Amarillo, TX	1472.0	29.8	8.6
INEL	Argonne National Laboratory-East, Argonne, IL	1586.0	91.2	2.2
INEL	Los Alamos National Laboratory, Los Alamos, NM	1142.0	22.2	9.8
INEL	Sandra National Laboratory, Albuquerque, NM	1172.0	82.7	9.8
INEL	Nevada Test Site, NV	716.0	82.9	13.6
INEL	Hanford Site, WA	603.0	91.3	7.6
INEL	Private Sector Facility, (Southeastern United States)	2513.0	81.4	17.3
	Train routes			
INEL	Rocky Flats, Golden CO	736.2	27.4	10.9
INEL	Waste Isolation Pilot Plant, Carlsbad, NM	1447.1	91.1	2.0
INEL	Engineering Technology Engineering Center, Ventura County, CA	1005.6	84.2	10.1
INEL	Inhalation Toxicology Research Institute, Albuquerque, NM	1250.0	90.2	7.8
INEL	PANTEX, Amarillo, TX	1154.6	92.1	6.6
INEL	Argonne National Laboratory-East, Argonne, IL	1561.2	29.4	2.2
INEL	Los Alamos National Laboratory, Los Alamos, NM	1182.0	91.9	7.1
INEL	Sandra National Laboratories, Albuquerque, NM	1250.0	90.8	7.2
INEL	Nevada Test Site, NV	756.1	92.8	5.9
INEL	Hanford Site, WA	675.6	91.7	6.9
INEL	Private Sector Facility (Southeastern United States)	2661.1	21.4	15.6

guidelines. The unit risk factors for waste shipments are presented in Tables 5.11- unit risk factors for spent nuclear fuel shipments are presented in Appendix I of V EIS.

Radiological doses were converted to cancer fatalities using risk conversion 5.0 x 10^-4 fatal cancers per person-rem for members of the public and 4.0 x 10^-4 person-rem for workers. These risk conversion factors are from Publication 60 of th Commission on Radiological Protection (ICRP 1991).

Incident-free nonradiological fatalities were also estimated using unit risk risk factors account for the fatalities associated with exhaust emissions, but the estimate the impacts must be doubled to reflect the round trip distance because the

whether or not the shipment contains radioactive material. Two sets of data were ev from the Non-radiological Impacts of Transporting Radioactive Material (Rao et al. data from the Motor Vehicle-Related Air Toxics Study (EPA 1993). In Rao et al. (198 nonradiological unit risk factor for trucks was 1.0 x 10^-7 fatalities per kilomete nonradiological unit risk factor for trains was 1.3 x 10^-7 fatalities per kilomete factors are applicable only in urban areas. In EPA (1993), the unit risk factor was 7.2 x 10^-11 fatalities per kilometer; this unit risk factor is applicable in all a suburban, and urban). Based on the routes analyzed in this EIS, the unit risk facto (1982) were found to overestimate impacts by about 20 to 30 times relative to the u from EPA (1993). Therefore, the unit risk factors from Rao et al. (1982) were used estimate of the incident-free nonradiological fatalities presented in this EIS. It the unit risk factors from Rao et al. (1982) account for all fatalities, not just c effects of chronic exposure to diesel exhaust emissions have been followed in occup workers, but these data are insufficient to make a correlation between the effects experienced (EPA 1993). Therefore, these impacts were not estimated in this EIS.

Maximum individual doses were calculated using the RISKIND computer code (Yu 1993). The maximum individual doses for the routine transport offsite were estimate transportation workers, as well as members of the general population. For rail ship general population scenarios were (a) a railyard worker who might be working at a d feet (10 meters) from the shipping container for two hours, (b)a resident who might

Table 5.11-2. Incident-free unit risk factors for truck and rail shipments of remot transuranic waste and low-level waste.

		Unit risk factors (person-rem per kilome	
Mode	Exposure group	Rural	Suburban
Truck			
	Occupational	7.4 x 10^-5	1.6 x 10^-4
	General population		
	Off-link(b)	4.4 x 10^-8	5.8 x 10^-6
	On-link(c)	1.8 x 10^-6	5.2 x 10^-6
	Stops	4.3 x 10^-5	4.3 x 10^-5
	General population total	4.5 x 10^-5	5.4 x 10^-5
Rail			
	Occupational(d)	3.6 x 10^-6	3.6 x 10^-6
	General population		
	Off-link(b)	6.1 x 10^-8	1.2 x 10^-5
	On-link(c)	2.4 x 10^-8	3.0 x 10^-7
	Stops(e)	1.7 x 10^-6	1.7 x 10^-6
	General population total	1.8 x 10^-6	1.4 x 10^-5

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a. The methodology, equations, and data used to develop the unit risk factors are (1986) and Neuhauser and Kanipe (1992). Cashwell et al. (1986) contains a detailed of unit risk factors.
b. Off-link general population was persons within 800 meters (2,625 feet) of the ro
c. On-link general population was persons sharing the road or railway.
d. The nonlinear component of incident-free rail dose for crew workers because of r classifications is 0.0040 person-rem per shipment. Ostmeyer (1986) contains a detai rail exposure model.
e. The nonlinear component of incident-free rail dose for the general population be inspections and classifications is 0.0031 person-rem per shipment. Ostmeyer (1986) explanation of the rail exposure model.

Table 5.11-3. Incident-free unit risk factors for truck and rail shipments of conta transuranic waste, low-level waste, and mixed low-level waste.

Unit risk factors (person-rem per kilomet

Mode	Exposure group	Rural	Suburban	Urban
Truck				
	Occupational	1.5 x 10^-5	3.3 x 10^-5	5.4 x
	General population			
	Off-link(b)	8.8 x 10^-9	1.2 x 10^-6	7.7 x
	On-link(c)	3.6 x 10^-7	1.0 x 10^-6	1.1 x
	Stops	8.6 x 10^-6	8.6 x 10^-6	8.6 x
	General population total	9.0 x 10^-6	1.1 x 10^-5	2.7 x
Rail				
	Occupational(d)	7.2 x 10^-7	7.2 x 10^-7	7.2 x
	General population			
	Off-link(b)	1.2 x 10^-8	2.3 x 10^-6	2.1 x
	On-link(c)	4.7 x 10^-9	6.1 x 10^-8	1.7 x
	Stops(e)	3.4 x 10^-7	3.4 x 10^-7	3.4 x
	General population total	3.6 x 10^-7	2.7 x 10^-6	2.1 x

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a. The methodology, equations, and data used to develop the unit risk factors are (1986) and Neuhauser and Kanipe (1992). Cashwell et al. (1986) contains a detaile of unit risk factors.
b. Off-link general population was persons within 800 meters (2,625 feet) of the r
C. On-link general population was persons sharing tile road or railway.
d. The nonlinear component of incident-free rail dose for crew workers because of classifications is 0.00080 person-rem per shipment. Ostmeyer (1986) contains a det rail exposure model.
C. The nonlinear component of incident-free rail dose for the general population b inspections and classifications is 0.00062 person-rem per shipment. Ostmeyer (1986 explanation of the rail exposure model.

(30 meters) from the rail line where the shipping container was being transported, who could be living 656.2 feet (200 meters) from a rail stop where the shipping con for 20 hours. For train shipments, the maximum exposed transportation worker was an a railyard who spent a time and distance-weighted average of 0.16 hours inspecting, repairing railcars (Wooden 1986).

For offsite truck shipments, the three scenarios for the general population who might be caught in traffic and located 3.28 feet (1 meter) away from the surfac container for one-half hour, (b)a resident who might be living 98.4 feet (30 meters highway used to transport the shipping container, and (c) a service station worker working at a distance of 65.6 feet (20 meters) from the shipping container for two hypothetical maximum exposed individual radiological doses were accumulated over th period. However, for the situation involving an individual who might be caught in t truck, the radiological exposures were only calculated for one event because it was unlikely that the same individual would be caught in traffic next to all containers For truck shipments, the maximum exposed transportation worker is the driver, who w drive shipments for up to 2,000 hours per year.

The hypothetical maximally exposed individual scenarios for the general popu above were not applicable for Onsite shipments for two r ons. First, there is esse during the onsite shipments and an obstruction, if encountered, would be safely avo Second, there are no residents or businesses onsite. Two alternate scenarios were d were: (a) a site employee in a disabled vehicle along the transport route, located from the container, and (b)a site employee traveling behind the slow-moving transpo entire trip. These scenarios were considered to be single-event occurrences.

5.11.1.2 Methodology for Onsite Transportation Accident Analysis.

The onsite
transportation accident analysis considers the impacts of accidents during the tran nuclear fuel and radioactive waste by truck, which is the primary mode of transport analysis addresses only shipments within the boundaries of the INEL that originate facility and terminate at another INEL facility. The onsite portions of offsite shi or terminate at the INEL are included in the offsite transportation accident analys

Within the boundaries of the INEL, spent nuclear fuel is transported in spec

casks that have been approved by the DOE. In most cases, these casks have not been transport of spent nuclear fuel over public highways and, therefore, use of these c onsite. Onsite transportation of radioactive wastes is normally conducted using U.S Transportation Type A containers. In some cases, transuranic wastes are required to onsite using a U.S. Department of Transportation Type B container, for example, the shipping container.

A maximum reasonably foreseeable assessment was performed for potential spen and radioactive waste transportation accidents. Impacts are assessed for areas with (80-kilometer) radius. Because of the extensive land area occupied by the INEL and between facilities, the potential impacts to surrounding communities from an onsite accident are highly dependent on where the accident occurs.

Because it is not possible to predict where on the INEL an accident might oc specific public areas that might be affected, the accident analysis assesses impact rural and suburban population areas. The generic rural population area has an avera density of six persons per square kilometer and is typical of most areas within 30 (48 kilometers) of the geographical center of the INEL site. The generic suburban p has an average population density of 7.19 persons per hectare and bounds the most d areas within 50 miles (80 kilometers) of the INEL.

The consequences of the maximum reasonably foreseeable onsite transportation calculated using the RISKIND computer code (Yuan et al. 1993). Consequences were as both neutral and stable atmospheric conditions. Neutral conditions are typical of a that result in good dispersion and dilution of atmospheric contaminants. Stable atm conditions occur less than 5 percent of the time and result in low dispersion and d atmospheric contaminants. Calculated radiation doses were used to estimate the pote cancers in the exposed populations using risk factors developed by the Internationa Radiological Protection (ICRP 1991).

The maximum reasonably foreseeable onsite transportation accidents are extre events, with estimated probabilities of occurrence ranging from 1 x 10^-7 to 3.9 X The impacts of maximum reasonably foreseeable accidents are represented by an estim obtained by multiplying the consequences (fatal cancers) by the probability of the

5.11.1.3 Methodology for Offsite Transportation Accident Analysis.

For offsite
spent nuclear fuel and radioactive waste transportation accidents, accident risk as performed using methodology developed by the U.S. Nuclear Regulatory Commission for the probabilities and consequences from a spectrum of unlikely accidents. Although to predict where along the transport route such accidents might occur, the accident used route-specific information for accident rates and population densities. Radiat population zones (rural, suburban, and urban) were weighted by the accident probabi "dose risk" using the RADTRAN 4 computer code. To represent the maximum reasonably foreseeable impacts to individuals and populations should an accident occur, radiol were calculated for an accident of maximum reasonably foreseeable severity in each using the RISKIND computer code.

Accident analyses for spent nuclear fuel and radioactive waste shipments are similarly except for the methodology used in the assessment of accident severity ca conditional probabilities, and radioactive material release characteristics. For sp shipments, the methodology contained in a U.S. Nuclear Regulatory Commission report known as the Modal Study (Fischer et al. 1987) was used. For radioactive waste ship methodology derives from NUREG-0170 (NRC 1977). Accident rates, atmospheric conditi population density zones, and health risk conversion factors are the same for both

Differences in spent nuclear fuel types translate into different radioactive characteristics under accident conditions; thus, analyses were performed for each o representative spent nuclear fuel types. Characterization data for the representati types were developed based on published reports and computer calculations using the computer code (Croff 1980). Similarly, an important variable in the assessment of i radioactive waste transportation accidents is the type and amount of radioactive an material in radioactive waste. Transuranic waste characterization data were derived Supplement Environmental Impact Statement for the Waste Isolation Pilot Plant (DOE Low-level waste characterization data were derived from DOE waste management databa computational models (Cornelius 1993). The radiological component of mixed low-leve characterized the same as low-level waste. The nonradiological component of mixed l was characterized based on data from the DOE Integrated Data Base (DOE 1992).

Accident severity categories for all potential spent nuclear fuel transporta

radioactive waste transportation accidents are described in the Modal Study (Fische NUREG-0170 (NRC 1977), respectively. Severity is a function of the magnitudes of th forces (impact) and thermal forces (fire) to which a cask may be subjected during a accident severity scheme takes into account all reasonably foreseeable transportati nuclear fuel transportation accidents are grouped into 20 accident severity categor high-probability events with low consequences to low-probability events with high c accident severity scheme for radioactive waste shipments is similar, but-only eight are assigned. Each accident severity category is assigned a conditional probability probability, given that an accident occurs, that the accident will be of the indica

Radioactive material releases from transportation accidents were calculated release fractions (the fraction of the radioactivity in the shipment that could be severity of accident) to each accident severity category for each chemically and ph radioisotope. Representative release fractions were developed for each of the repre nuclear fuel types based on the Modal Study and other published reports. Release fr transuranic waste were derived from the Waste Isolation Pilot Plant Supplemental En Impact Statement (DOE 1990), which based its analysis on the accident severity mode NUREG-0170. Representative release fractions for low-level and mixed low-level was derived from NUREG-0170 and recommended values from Elder et al. (1986).

Radioactive material released to the atmosphere is transported by wind. The dispersion, or dilution, of the radioactive material concentrations in the air depe meteorological conditions at the time of the accident. Neutral meteorological condi frequently occurring atmospheric stability conditions in the United States and, the likely to be present in the event of an accident involving a spent nuclear fuel or shipment. For accident risk assessment, neutral weather conditions (Pasquill Stabil assumed (Doty et al. 1976). For the accident consequence assessment, doses were ass both neutral (Class D) and stable (Class F) atmospheric conditions, representing th consequences and a worst-case weather situation, respectively.

Radiological doses were calculated for an individual located near the scene for populations within 50 miles (80 kilometers) of the accident. Three population d (rural, suburban, and urban) were assessed. Dose calculations considered a variety pathways, including inhalation and direct exposure (cloudshine) from the passing cl from contaminated crops, direct exposure (groundshine) from radioactivity deposited and inhalation of resuspended radioactive particles from the ground. Human health e result from the radiation doses received were estimated using risk factors recommen International Commission on Radiological Protection (ICRP 1991).

The transportation of spent nuclear fuel and radioactive waste also results accident risks, such as injuries or fatalities sustained by physical impact with th Nonradiological fatal accident risks for truck transportation were calculated for e transport route, using state-specific accident fatality rates for interstate highwa areas (Saricks and Kvitek 1991). Accident fatality risks for rail transportation we nationwide average rate of 2.64 x 10^-8 fatalities per rail-kilometer (Cashwell et

5.11.1.4 Methodology for Hazardous Material Transportation Accident Analysis. This section describes the analysis of the maximum reasonably foreseeable accident for the planned transportation of hazardous materials to and from the INEL during the period covered by this EIS. The information in this section has been summarized from Wierman (1994). The accident analysis assesses only truck transportation because all of the hazardous materials transported to or from the INEL are transported by truck.

The accident scenario postulates a truck
accident leading to a breach of chemical containers and release of chemicals to the resulting spill either evaporates (liquid spill) or escapes directly to the atmosph Extenuating circumstances, such as an accompanying fire or explosion, are not analy accident consequences are assessed for rural, suburban, and urban population densit

The HIGHWAY computer code was used to generate distances, population densiti correlation of distance and population densities. The probability of a releasing ac based on the type of region the truck is traveling through and the type of truck. A study conducted in California matched accident data and corresponding exposures (sh selected sites statewide to generate accident involvement rates by category of high configuration. The probability of hazardous material release given an accident was evaluation of Highway Patrol accident reports from the State of Missouri. The accid contained data identifying whether each vehicle involved in an accident was carryin materials, what type(s) of material were carried, and whether or not a hazardous ma occurred.

In the maximum reasonably foreseeable case truck accident scenario, the haza of interest is nitric acid, because it has the capability to affect the largest num population due to the relatively high toxicity of nitric acid and the large quantit transported. The release is modeled as a total release of the nitric acid inventory [15,900 liters (4,200 gallons)].

The consequences of the offsite hazardous material transportation accidents terms of Emergency Response Planning Guidelines. Emergency Response Planning Guidel been developed to provide estimates of concentration ranges above which one could r anticipate observing adverse effects as described in the definitions for Emergency Guideline-1, Emergency Response Planning Guideline-2, and Emergency Response Planni Guideline-3. The Emergency Response Planning Guidelines are the maximum airborne co below which it is believed that nearly all individuals could be exposed for up to o adverse health effects or perceiving a clearly defined objectionable odor (Emergenc Planning Guideline-1), (b)without experiencing or developing irreversible or other effects or symptoms that could impair their abilities to take protective action (Em Planning Guideline-2), or (c) without experiencing or developing life-threatening h (Emergency Response Planning Guideline-3).

5.11.1.5 Methodology for Regional Traffic Impact Analysis.

Transportation by road
of people and materials that are required because of increased construction and ope due to the various alternatives could impact the regional traffic system around the increases in traffic accidents, injuries, and fatalities. These impacts, such as in mileage, accidents, and traffic congestion, are measured using the level of service

The level-of-service concept is defined as a qualitative measure describing opera conditions within a traffic stream and their perception by motorists and passengers is defined for each roadway or section of roadway in terms of speed and travel time maneuver, traffic interruptions, comfort and convenience, and safety. The six level defined below (TRB 1994).

- Level-of-Service A represents free flow. Individual users are virtual the presence of others in the traffic stream. Freedom to select desir maneuver within the traffic stream is extremely high. The general lev and convenience provided to the motorist, passenger, or pedestrian is
- Level-of-Service B is in the range of stable flow, but the presence o the traffic stream begins to be noticeable. Freedom to select desired relatively unaffected, but there is a slight decline in the freedom t the traffic stream from Level-of-Service A. The level of comfort and provided is somewhat less than at Level-of-Service A because the pres in the traffic stream begins to affect individual behavior.
- Level-of-Service C is in the range of stable flow, but marks the begi range of flow in which the operation of individual users becomes sign by interactions with others in the traffic stream. The selection of s affected by the presence of others, and maneuvering within the traffi substantial vigilance on the part of the user. The general level of c convenience declines noticeably at this level.
- Level-of-Service D represents high-density, but stable, flow. Speed a maneuver are severely restricted, and the driver or pedestrian experi poor level of comfort and convenience. Small increases in traffic flo cause operational problems at this level.
- Level-of-Service E represents operating conditions at or near the cap speeds are reduced to a low, but relatively uniform, value. Freedom t within the traffic stream is extremely difficult, and it is generally forcing a vehicle or pedestrian to "give way" to accommodate such man Comfort and convenience levels are extremely poor, and driver or pede frustration is generally high. Operations at this level are usually u small increases in flow or minor perturbations within the traffic str breakdowns.
- Level-of-Service F is used to define forced or breakdown flow. This c wherever the amount of traffic approaching a point exceeds the amount traverse the point. Queues form behind such locations. Operations wit are characterized by stop-and-go waves, and they are extremely unstab may progress at reasonable speeds for several hundred feet or more, t to stop in a cyclic fashion. Level-of-Service F is used to describe t

conditions within the queue, as well as the point of the breakdown. I noted, however, that in many cases, operating conditions of vehicles discharged from the queue may be quite good. Nevertheless, it is the arrival flow exceeds discharge flow which causes the queue to form, a Service F is an appropriate designation for such points.

For purposes of evaluating impacts of increased traffic and usage, the capac in terms of vehicles per hour for a given level of service is first established usi TRB (1985). The level of service based on existing traffic flow is then established service is then calculated, based on the number of shipments of waste, spent nuclea construction materials, and the number of workers associated with each alternative. service are then compared to determine if the capacity of the highway is exceeded o service has changed.

5.11.2 Traffic and Transportation Impacts from Alternatives

This section summarizes the impacts on traffic and transportation for the va environmental restoration and waste management alternatives being considered.

5.11.2.1 Shipment.

The waste shipments associated with Alternatives A through D are summarized in Table 5.11-4. For Alternative A (No Action), no transuranic waste wou transported to the INEL, but the INEL potentially would transport transuranic waste

Table 5.11-4. Shipments of radioactive waste and hazardous materials for Alternativ

waste would be transported back to the INEL. No offsite shipment of mixed low-level expected to occur. The INEL would continue to make periodic shipments of hazardous offsite disposal facilities, and shipments of bulk hazardous chemicals used by INEL continue.

For Alternative B (Ten-Year Plan), offsite shipments of low-level waste and waste would be the same as Alternative A (No Action). Increased transuranic waste s would occur with Rocky Flats and Argonne National Laboratory-East shipments to the shipments of INEL waste to and from offsite treatment facilities, and potentially i to the Waste Isolation Pilot Plant. The INEL would make increased shipments of haza offsite disposal facilities as a result of increased environmental restoration acti bulk hazardous chemicals to the INEL would be similar to Alternative A.

For Alternative C (Minimum Treatment, Storage, and Disposal), the INEL poten transport all stored transuranic waste to the Waste Isolation Pilot Plant and the H INEL would transport stored low-level and mixed low-level waste to the Nevada Test Shipments of hazardous waste for offsite disposal and shipments of bulk hazardous c INEL would be similar to Alternative A (No Action).

For Alternative D (Maximum Treatment, Storage, and Disposal), the INEL would increased shipments of transuranic, low-level, and mixed low-level waste from vario Increased shipments of transuranic waste to private-sector treatment facilities wou Shipments of hazardous waste to offsite disposal facilities and shipments of bulk h to the INEL site would be similar to Alternative B (Ten-Year Plan).

The spent nuclear fuel shipments associated with Alternatives A through D ar

Table 5.11-5. Alternative A addresses impacts under No Action. Under Alternative B, addressed separately under 1992/1993 Planning Basis and Regionalization by fuel typ addresses impacts separately under Centralization at the Hanford Site, Savannah Riv Ridge Reservation, or the Nevada Test Site, and Alternative D addresses impacts und at the INEL (see Volume 1 of this EIS). Heiselmann (1995) and Attachment A to Appen Volume I of this EIS contain detailed descriptions of the shipments that occur for

Table 5.11-5. Shipments of spent nuclear fuel for Alternatives A through D (1995 to

test specimen shipments.

For Alternative B, the Navy would resume shipments of spent nuclear fuel fro to the INEL and shipments of irradiated test specimens from the INEL to offsite loc Fort Saint Vrain Spent nuclear fuel in storage in Colorado and all commercial-type stored at the West Valley Demonstration Project in New York would be transported to The INEL site would receive shipments of some of the DOE research and test reactor

fuel stored at other DOE sites with a greater amount received under Alternative B, fuel type. In addition, the INEL site would receive spent nuclear fuel shipments fr domestic university and foreign research reactors and other non-DOE U.S. government

For Alternative C (Minimum Treatment, Storage, and Disposal), all spent nucl currently stored at the INEL site would be transported offsite to one of four DOE s Savannah River Site, Oak Ridge, or Nevada Test Site. No shipments of spent nuclear made to the INEL site.

For Alternative D (Maximum Treatment, Storage, and Disposal), all spent nucl currently stored at other DOE sites, Fort Saint Vrain, university, and foreign rese other non-DOE U.S. government reactors would be transported to the INEL.

5.11.2.2 Incident-Free Transportation.

The impacts of incident-free transport of waste (transuranic, low-level, and mixed low-level) are summarized in Table 5.116, and th spent nuclear fuel are summarized in Tables 5.11-7 and 5.11-8. For truck shipments be seen that Alternative D (Maximum Treatment, Storage, and Disposal) yielded the l doses (1,700 person-rem occupational, 940 person-rem general population), and Alter Action) yielded the smallest collective doses (120 person-rem occupational, 66 pers population). Alternatives B (Ten-Year plan) and C (Minimum Treatment, Storage, and yielded lower collective doses, 870 and 180 person-rem occupational and 460 and 100 general population, respectively. For Alternative D, approximately one cancer fatal Train shipments yielded doses that were much less than truck shipments, ranging fro person-rem for workers and 4.1 to 58 for the general population. Nonradiological fa

Table 5.11-6. Cumulative doses and fatalities from incident-free transport of waste

five times the number of total cancer fatalities for train shipments.

For spent nuclear fuel, it can be seen that Alternative C (Centralization at yielded the largest collective doses (1000 person-rem occupational, 2,400 Person-re population). Alternative A (No Action) yielded the smallest collective doses (4.9 p occupational, 0.43 person-rem general population). Alternative B (1992/1993 Plannin Regionalization by fuel type) yielded approximately equal collective doses; 270 and (occupational) and 590 and 810 person-rem (general population).

5.11.2.3 Onsite Transportation Accidents.

Tables 5.11-9 and 5.11-10 summarize the bounding impacts for onsite transportation of spent nuclear fuel and radioactive wa

The maximum reasonably foreseeable onsite spent nuclear fuel transportation involves the inadvertent shipment of a short-cooled fuel element (fuel out of the r days) from the Advanced Test Reactor to the Idaho Chemical Processing Plant. For th occur, errors must occur to allow loading the wrong fuel element into the shipping surveys of the loaded cask must fail to detect abnormally high radiation levels. In transport vehicle must break down or roll over during the short transit between the Reactor and the Idaho Chemical Processing Plant. Finally, operators must fail to ma cooling water inside the cask. The probability of this accident is, therefore, extr an annual frequency on the order of one in one million years for neutral meteorolog million years for stable meteorology. Because the estimated number of spent nuclear is expected to be the same for all alternatives, the annual frequency and consequen maximum reasonably foreseeable accident are identical for all alternatives. Table 5 the fatal cancer risk for the population within 50 miles (80 kilometers) is on the million years for a rural population zone and about one in 90,000 years for a subur zone.

Onsite transuranic waste shipments are expected to be dominated by shipments INEL Radioactive Waste Management Complex and Argonne National Laboratory-West as p characterization and certification program required for shipments of INEL transuran Waste Isolation Pilot Plant. The maximum reasonably foreseeable accident is suffici

Table 5.11-9. Maximum reasonably foreseeable accident doses and health effects for

Table 5.11-10. Maximum reasonably foreseeable accident doses and health effects for

for Type B containers, the probability of the maximum reasonably foreseeable accide unlikely, with an annual frequency on the order of one accident in 200,000 years fo

meteorology to one accident in two million years for stable meteorology. Because th number of onsite transuranic waste shipments is expected to be approximately the sa alternatives, the annual frequency and consequences of the maximum reasonably fores are identical for all alternatives. Table 5.11-10 shows that the fatal cancer risk within 50 miles (80 kilometers) is on the order of one in 500 million years for a r and about one in four million years for a suburban population zone.

Onsite low-level and mixed low-level waste shipments are expected to be domi shipments of routine operational waste from INEL facilities to INEL treatment, stor facilities. Some variability in the number of shipments, and consequently the proba is seen as a result of environmental restoration and decontamination and decommissi Total waste shipment mileage for Alternatives B (Ten-Year Plan) and D (Maximum Trea Storage, and Disposal) is about 40 percent higher than Alternatives A (No Action) a Treatment, Storage, and Disposal). Consequently, the maximum reasonably foreseeable doses are the same for all alternatives, but the annual frequencies are highest for D. The results shown in Table 5.11-10 reflect the higher accident frequencies for D. Table 5.11-10 shows that the fatal cancer risk for the population within 50 mile is on the order of one in two million years for a rural population zone and about o for a suburban population zone.

5.11.2.4 Offsite Transportation Accidents.

Tables 3.11-11 and 5.11-12 summarize accident risks for offsite transportation of radioactive wastes and spent nuclear f all alternatives. Tables 5.11-13 and 5.11-14 summarize maximum reasonably foreseeab consequences for the radioactive waste and spent nuclear fuel shipments under all a

5.11.2.5 Hazardous Material Transportation Accidents.

Table 5.11-15 shows the results of the analysis of the maximum reasonably foreseeable-case truck accident s alternatives. Meteorological conditions were specified at 50 and 95 percent to deve each Emergency Response Planning Guideline using the EPIcode. The probability of a accident is summed over shipments originating with each contractor for each populat

Table 5.11-11. Accident risks for offsite transport of waste for Alternatives A thr

Table 5.11-14. Maximum reasonably foreseeable accident doses and health effects for

Table 5.11-15. Summary of releasing accident probability and consequences for nitri

		Meteorological conditions	
Population area	Probability and affected population	Neutral	Stable
Rural population	Probability of releasing accident	0.00047	0.000047
	Emergency Response Planning Guideline-1 maximum affected population	11	0
	Emergency Response Planning Guideline-2 maximum affected population	1	0
	Emergency Response Planning Guideline-3 maximum affected population	1	0
Suburban population	Probability of releasing accident	0.00025	0.000025
	Emergency Response Planning Guideline-1 maximum affected population	683	28,420
	Emergency Response Planning Guideline-2 maximum affected population	81	1,626
	Emergency Response Planning Guideline-3 maximum affected population	38	668
Urban population	Probability of releasing accident	0.000047	0.0000047
	Emergency Response Planning Guideline-1 maximum affected population	3,445	143,338

Emergency Response Planning Guideline-2 maximum affected population	410	8,203
Emergency Response Planning Guideline-3 maximum affected population	190	3,368

shows the probability per year of a particular population being exposed to a certai maximum affected population is the maximum number of receptors to all possible acci

In this assessment, it has been assumed that anyone residing within an Emerg planning Guideline contour would experience an adverse effect. In other words, 100 probability of effect was assumed. This is a conservative assumption, because the a levels have incorporated uncertainty factors to account for sensitive human subpopu likely that only a portion of the exposed population would experience adverse effec

5.11.2.6 Regional Traffic Impacts.

Using the methodology described in Section 5.11.1.5
and TRB (1994), the baseline level of service for the road system surrounding the I Service A or free flowing (Lehto 1994). This was based on data for U.S. Highway 20, highway with the highest use around the INEL and a likely route for materials that the INEL. In addition, the peak number of vehicles per hour would have to increase to transform U.S. Highway 20 from Level-of-Service A to Level-of-Service B. The pea vehicles per hour on U.S. Highway 20 would have to increase from 122 to 2,126 to ex capacity of the highway.

Using the shipment counts outlined in Lehto (1994), the increased movements and people due to all alternatives would increase the maximum number of vehicles pe which is still within the range of Level-of-Service A and would result in no change service associated with U.S. Highway 20. This maximum number of vehicles per hour i with Alternative D (Maximum Treatment, Storage, and Disposal). In addition, the num vehicles per hour would have to increase by a factor of over 10 to exceed the capac highway. Based on these results, the impacts to the regional traffic system around be minimal for all alternatives.

5.12 Health and Safety

The purpose of this section is to present the potential health effects to bot a result of the environmental restoration and waste management alternatives under c The potential health effects in this section are estimated to result from operation 2005.

This section provides estimates of health impacts to workers and the public f radioactive and nonradioactive contaminants to the atmosphere and groundwater. It illness, and occupational fatalities based on observed rates for DOE and its contra to workers are estimated using the average dose rate per year for INEL employees. the health effects methodology is contained in Appendix F, Section F-4, Health and

Radiation exposure and its consequences are topics of interest to the general facilities. For this reason, this EIS places more emphasis on the consequences of on other topics, even though the effects of radiation exposure under most of the ci this EIS are small. This subsection explains basic concepts used in the evaluation to provide the background for later discussions of impacts.

The effects on people of radiation that is emitted during disintegration (dec substance depends on the kind of radiation (alpha and beta particles, and gamma and amount of radiation energy absorbed by the body. The total energy absorbed per uni referred to as absorbed dose. The absorbed dose, when multiplied by certain qualit take into account different sensitivities of various tissues, is referred to as eff the context is clear, simply dose. The common unit of effective dose equivalent is

An individual may be exposed to ionizing radiation externally, from a radioac body, and/or internally, from ingesting or inhaling radioactive material. The exte the internal dose. An external dose is delivered only during the actual time of ex radiation source. An internal dose, however, continues to be delivered as long as the body, although both radioactive decay and elimination of the radionuclide by or processes decrease the dose rate with the passage of time. The dose from internal 50 years following the initial exposure.

The maximum annual allowable radiation dose to the members of the public from

DOE-operated nuclear facilities is 100 millirem per year, as stated in DOE Order 54 facilities covered by this EIS operate well below this limit. It is estimated that United States receives a dose of about 300 millirem (0.3 rem) per year from all sou natural and medical sources of radiation. For perspective, a chest x-ray results i millirem, while a diagnostic hip x-ray results in an approximate dose of 83 millire an acute (short-term) dose of approximately 600,000 millirem before there is a high death (NAS/NRC 1990).

Radiation can also cause a variety of ill-health effects in people. The most ill-health effect to depict the consequences of environmental and occupational radi induction of latent cancer fatalities. This effect is referred to as latent cancer many years for cancer to develop and for death to occur, and cancer may never actua

The collective (or population) dose to an exposed population is calculated by doses received by each member of the exposed population. This total dose received population is measured in person-rem. For example, if 1,000 people each received a (0.001 rem), the collective dose would be 1,000 persons y 0.001 rem = 1.0 person-re same collective dose (1.0 person-rem) would result from 500 people each of whom rec 2 millirem.

The factor that this EIS uses to relate a dose to its effect is 0.0004 latent rem for workers and 0.0005 latent cancer fatalities per person-rem for individuals population. The latter factor is slightly higher because of the presence of indivi that may be more sensitive to radiation than workers (for example, infants).

These concepts may be applied to estimate the effects of exposing a populatio example, in a population of 100,000 people exposed only to background radiation (0. latent cancer fatalities per year would be inferred to be caused by the radiation (per year y 0.0005 latent cancer fatalities per person-rem = 15 latent cancer fatali

Sometimes, calculations of the number of latent cancer fatalities associated do not yield whole numbers, and, especially in environmental applications, may yiel For example, if a population of 100,000 were exposed as above, but to a total dose collective dose would be 100 person-rem, and the corresponding estimated number of would be 0.05 (100,000 persons y 0.001 rem y 0.0005 latent cancer fatalities/person cancers).

How should one interpret a noninteger number of latent cancer fatalities, suc is to interpret the result as a statistical estimate. That is, 0.05 is the average expected if the same exposure situation were applied to many different groups of 10 groups, no one (zero people) would incur a latent cancer fatality from the 1 millirem dose each member would have received. In a small fraction of the groups result; in exceptionally few groups, two or more fatal cancers would occur. The av over all the groups would be 0.05 fatal cancers (just as the average of 0, 0, 0, an likely outcome is zero latent cancer fatalities.

These same concepts apply to estimating the effects of radiation exposure on Consider the effects, for example, of exposure to background radiation over a lifet cancer fatalities" corresponding to a single individual's exposure over a (presumed 0.3 rem per year is the following:

1 person y 0.3 rem/year y 72 years y 0.0005 latent cancer fatalities/person-r
= 0.011 latent cancer fatalities.

Again, this should be interpreted in a statistical sense; that is, the estimated ef exposure on the exposed individual would produce a 1.1-percent chance that the indi cancer caused by the exposure. Said another way, this method estimates that about population might die of cancers induced by the radiation background.

The dose-to-risk conversion factors presented above and used in this EIS to r exposures to latent cancer fatalities are based on the 1990 Recommendations of the Commission on Radiation Protection (ICRP 1991). These conversion factors are consi by the U.S. Nuclear Regulatory Commission in its rulemaking Standards for Protectio (FR 1991). In developing these conversion factors, the International Commission on reviewed many studies, including Health Effects of Exposure to Low Levels of Ionizi and Sources, Effects and Risks of Ionizing Radiation. These conversion factors rep estimates for relating a dose to its effect; most other conversion factors fall wit associated with the conversion factors that are discussed in NAS/NRC (1990). The c where the dose to an individual is less than 20 rem and the dose rate is less than greater than 20 rem, the conversion factors used to relate radiation doses to laten doubled. At much higher doses, prompt effects, rather than latent cancer fatalitie concern. Unusual accident situations that may result in high radiation doses to in special cases.

In addition to latent cancer fatalities, other health effects could result fr occupational exposures to radiation. These effects include nonfatal cancers among and genetic effects in subsequent generations. For clarity and to allow ready comp from other sources, such as those from chemical carcinogens, this EIS presents esti only in terms of latent cancer fatalities. The nonfatal cancers and genetic effect consequences of radiation exposure, and in some respects less serious. Further dis provided in Appendix F, Section F-4, Health and Safety, of this EIS.

5.12.1 Health Effects to the Public and Workers from Releases to the Environment

In general, health impacts are estimated for releases of radioactive and nonr to air and groundwater. The impact analysis and discussion focuses on those contam pathways that have the potential to contribute to adverse environmental consequence are no permanent surface waters on the INEL and no surface drainage from the INEL t Therefore, Volume 2 of this EIS does not include a detailed analysis of this exposu

Health risks from air emissions to workers and the public are estimated by m worst-case emission scenarios for the various alternatives. These health effects a with baseline health effects originally presented in Section 4.12 of this EIS. The used to postulate maximum potential exposure levels in the onsite and offsite envir evaluation. Health effects calculated using this type of information provide an ex "worst-case" estimate of potential health effects.

Health risks from water for onsite workers were made using either modeled gro (described in Appendix F of this EIS) or, where current levels represent the highes levels, drinking water distribution sample data reported by Anderson and Peterson-W effects estimates from offsite groundwater contaminants were calculated using the h or reported groundwater concentrations. These concentration estimates are based on Section 5.8, Water Resources, of this EIS.

5.12.1.1 Health Effects Resulting from Atmospheric Releases.

For routine airborne releases from facilities, health effects were assessed for the following three cate (a) the maximally exposed individual located at the INEL site boundary, (b) the pop (80 kilometers) of the operating facilities, and (c) the maximally exposed onsite w

5.12.1.1.1 Radiological Health Risk-The human health risk associated with

radiological air emissions is assessed based on risk factors contained in 1990 Reco International Commission on Radiological Protection (ICRP 1991). The measure of im evaluating potential radiation exposures is risk of fatal cancers. Population effe radiation dose (in person-rem) and the estimated number of fatal cancers in the aff maximum individual effects are reported as individual radiation dose (in millirem) probability of fatal cancer.

For the calculation of health effects from exposure to airborne radionuclides provided in Section 5.7 of this EIS were multiplied by the appropriate risk factor risk for individuals is expressed as the increased lifetime risk of developing fata public is expressed as the number of estimated fatal cancers in the affected popula individual and the public, the estimated risk, as presented in this section, is cal that is, the total radiation dose received during the ten-year period from 1995 to of the health effects methodology is contained in Appendix F, Section F-4, Health a

Tables 5.12-1 and 5.12-2 provide summaries of the ten-year dose, risk factor, increased lifetime risk of developing fatal cancer based on the exposure associated and the baseline exposure (Sections 4.7 and 4.12 of this EIS). These data are pres exposed onsite worker, the maximally exposed individual at the site boundary, and t population for the period from 1995 to 2005. Incremental doses are those that resu conducted under the alternatives. Baseline doses result from other activities at t permitted sources of the INEL release pollutants to the maximum allowed by operatin regulation.

INEL Worker. The risks to an INEL worker at the location of highest do radionuclide emissions would vary between the alternatives. As shown in Table 5.12 would be for Alternative D (Maximum Treatment, Storage, and Disposal)-about one occ

for fatal cancer. The minimum risk would be for Alternative A (No Action)- about 1 for fatal cancer.

Maximally Exposed Individual. As shown in Table 5.12-1, the risk to th exposed individual in the vicinity of the INEL would be highest for Alternative D (Storage, and Disposal). The fatal cancer risk would be about 1 occurrence in 238,0 very low, are somewhat higher than the other alternatives because of the release of with spent nuclear fuel processing on a large scale. The risk to the maximally exp lowest for Alternative A (No Action)-about 1 occurrence in 1 million.

Public. As shown in Table 5.12-2, the risk of a fatal cancer effect am surrounding population would be highest for Alternative D. For this alternative, b exposure, there would be 0.02 fatal cancers expected over the next 70 years. The Alternative A. For this alternative, based on the total ten-year exposure, there expected over the next 70 years.

Table 5.12-1. Ten-year dose and resulting lifetime fatal cancer risk for maximally alternative.

	Baseline ten-year dose (millirem)a	Risk of fatal cancerb	Incremental ten-yea dose (millirem)c	Risk of fatal c
			Alternative A	(No Acti
Site worker	3.2 y 100	1.3 y 10-6	1.4 y 10-1	5.6 y 1
Offsite individual	5.0 y 10-1	2.5 y 10-7	9.2 y 10-1	4.6 y 1
			Alternative B	(Ten-Yea
Site worker	3.2 y 100	1.3 y 10-6	1.4 y 100	5.6 y 1
Offsite individual	5.0 y 10-1	2.5 y 10-7	5.8 y 100	2.9 y 1
		Alternative C	(Minimum Treatment,	Sto
Site worker	3.2 y 100	1.3 y 10-6	1.4 y 10-1	5.6 y 1
Offsite individual	5.0 y 10-1	2.5 y 10-7	1.1 y 100	5.5 y 1
		Alternative D	(Maximum Treatment,	Sto
Site worker	3.2 y 100	1.3 y 10-6	1.7 y 100	6.8 y 1
Offsite individual	5.0 y 10-1	2.5 y 10-7	7.9 y 100	4.0 y 1

a. Location of maximum onsite baseline dose is Test Reactor Area; dose includes em and foreseeable facilities, but not from temporary operations or natural background

b. Estimated increased lifetime chance of developing fatal cancer from ten-year do

c. Incremental dose specified is for highest predicted area (not necessarily the s

Table 5.12-2. Ten-year population dose and estimated resulting fatal cancers by Id

	Ten-year dose (person-rem)	Total fatal cancersb	Ten-year dose (person-rem)	Total fatal cancersb	T d (
	Alternative Ac		Alternative Bd		
Baseline	3.0 y 100	1.5 y 10-3	3.0 y 100	1.5 y 10-3	3
Increment	3.7 y 100	1.9 y 10-3	2.6 y 101	1.3 y 10-2	4
Cumulative	6.7 y 100	3.4 y 10-3	2.9 y 101	1.5 y 10-2	7

a. Cumulative radiation dose (person-rem) to the population within 50 miles (80 ki

b. Total number of fatal cancers over the lifetime of all individuals in the expos

c. Alternative A (No Action).

5.12.1.1.2 Nonradiological Health Risk-An assessment has been performed to

estimate the potential effects on human health associated with each of the environm waste management alternatives. All of the risks presented in this section are cumu risks associated with the maximum baseline, foreseeable increases to the baseline, pollutants, carcinogens, and noncarcinogenic toxic air pollutants were evaluated fo

utilizing the methodology outlined in Appendix F, Section F-4, Health and Safety, o

Estimated onsite levels of toxic air pollutants reflect maximum predicted lev eight-hour period to which site workers might be exposed. These results are compar standards recommended by either the American Conference of Governmental Industrial Occupational Safety and Health Administration, whichever is lower. The results ind hazard quotients for carcinogenic and noncarcinogenic toxic air pollutants, with th from any alternative are less than 1. As described in Section 4.12 of this EIS, th quotient for benzene is approximately 1. Benzene contributions from Alternative D Storage, and Disposal), the highest of the alternatives, represent a very small inc percent) to the baseline hazard quotient. The hazard quotients of all other toxic 1.

Hazard quotients, at the site boundary and public roads, associated with the presented in Table 5.12-3. The air concentrations producing these hazard quotients 4.7, Table 4.7-8 and Section 5.7, Table 5.7-7, of this EIS. The locations of these dependent on different points and times of release, so that no individual could be chemicals at once. The hazard quotients for these chemicals are less than one for alternatives. This indicates that no adverse health effects are projected as a res emissions.

Lifetime cancer risks from offsite concentration of carcinogenic air pollutan 5.12-4. The human health risk for carcinogens is assessed for individuals offsite estimated carcinogen air concentrations. The offsite cancer risk is less than 2.0 This corresponds to about 1 occurrence in 500,000 of developing cancer. For each al (greater than 90 percent) of the total risk is attributable to emissions

Table 5.12-3. Hazard quotients from noncarcinogenic toxic air pollutants at the si roads on the Idaho National Engineering Laboratory site by alternative.

Toxic air pollutant	Location	Baseline hazard quotient	Hazard quotient (alternative + basel		
			Alternative Ab	Alternative Bc	Alternativ Cd
Ammonia	Public road	0.03	0.03	0.03	0.03
	Site boundary	<0.01	<0.01	<0.01	<0.01
Freon	Public road	<0.01	<0.01	<0.01	<0.01
	Site boundary	<0.01	<0.01	<0.01	<0.01
Hydrochloric acid	Public road	0.13	0.13	0.14	0.13
	Site boundary	0.01	0.01	0.02	0.01
Hydrofluoric acid	Public road	NA	<0.01	<0.01	<0.01
	Site boundary	NA	<0.01	<0.01	<0.01
Mercury	Public road	0.04	0.04	0.04	0.04
	Site boundary	0.01	0.01	0.01	0.01
Methyl isobutyl	Public road	NA	NA	NA	NA
ketone	Site boundary	NA	NA	NA	NA
Nitric acid	Public road	0.01	0.01	0.01	0.01
	Site boundary	0.01	0.01	0.01	0.01
Sulfuric acid	Public road	NA	<0.01	<0.01	<0.01
	Site boundary	NA	<0.01	<0.01	<0.01
Toluene	Public road	0.10	0.10	0.10	0.10
	Site boundary	<0.01	<0.01	<0.01	<0.01
Tributyl phosphate	Public road	NA	NA	<0.01	NA
	Site boundary	NA	NA	<0.01	NA
Trivalent chromium	Public road	0.01	0.01	0.01	0.01
	Site boundary	<0.01	<0.01	<0.01	<0.01

a. Highest predicted eight-hour concentrations.

b. Alternative A (No Action).

c. Alternative B (Ten-Year Plan).

d. Alternative C (Minimum Treatment, Storage, and Disposal).

e. Alternative D (Maximum Treatment, Storage, and Disposal).

Table 5.12-4. Estimated lifetime cancer risk for offsite individuals from carcinog alternative.

Toxic air pollutant	Total baseline cancer riskb	Total cancer risk (alterna Alternative Ac
Arsenic	3.9 y 10-7	3.9 y 10-7
Asbestos	0.0 y 100	4.6 y 10-10
Benzene	2.4 y 10-7	2.5 y 10-7
Beryllium	0.0 y 100	4.8 y 10-10
Cadmium compounds	0.0 y 100	1.8 y 10-11
Carbon tetrachloride	9.0 y 10-8	1.3 y 10-7
Chloroform	9.2 y 10-9	1.1 y 10-8
Formaldehyde	1.6 y 10-7	2.4 y 10-7
Hexavalent chromium	7.2 y 10-7	7.2 y 10-7
Methylene chloride	2.8 y 10-9	9.4 y 10-9
Nickel	1.1 y 10-5	1.2 y 10-5
Perchloroethylene	5.3 y 10-8	5.3 y 10-8
Polychlorinated biphenyls	NA	NA
Trichloroethylene	1.6 y 10-9	2.4 y 10-9
Total	1.3 y 10-5	1.3 y 10-5

a. Based on continuous exposure to the highest predicted concentration at the INEL

b. Includes foreseeable increases to the baseline.

c. Alternative A (No Action).

d. Alternative B (Ten-Year Plan).

e. Alternative C (Minimum Treatment, Storage, and Disposal).

f. Alternative D (Maximum Treatment, Storage, and Disposal).

associated with the maximum baseline. The incremental impacts due to the alternati additions to the baseline.

For all criteria pollutants, both onsite and offsite, the calculated hazard q offsite, were less than one. This indicates that no additional adverse health effe criteria pollutant emissions from any of the alternatives. For carcinogenic emissi alternatives, calculated hazard quotients, both onsite and offsite, were less than adverse health effects are expected as a result of criteria pollutant emissions fro

5.12.1.2 Health Effects Resulting from Groundwater Releases.

This section summarizes potential health effects to both onsite and offsite populations due to radionuclide noncarcinogenic chemicals in water. More detailed information on concentrations of contained in Section 5.8, Water Resources, of this EIS. Discussion of health effec contained in Appendix F, Section F-4, Health and Safety.

5.12.1.2.1 Potential Health Effects to the Worker-Estimates of potential health

effects for onsite workers were made using either modeled groundwater data (describ Appendix F, Section F-4, of this EIS) or, where current levels represent the highe levels, drinking water distribution sample data reported by Anderson and Peterson-W

The highest average radionuclide concentration in a site drinking water distr at the Central Facilities Area (Anderson and Peterson-Wright 1993). The radionucli at a concentration of approximately 16,000 picocuries per liter. This concentratio highest projected tritium concentration to reach a drinking water distribution syst Environmental Protection Agency drinking water standard of 20,000 picocuries per li decrease because of changes in facility procedures, dilution in the aquifer, and ra

Consumption of this water for 50 years would result in an estimated dose equi 14 millirem, with a corresponding estimated fatal cancer risk of about 1 occurrence

Iodine-129, at a concentration of 0.75 picocuries per liter (maximum contamin 1 picocurie per liter), is projected to reach Well No. 2 at the Central Facilities Consumption of this water for 50 years would result in an estimated dose equivalent 2.7 millirem, with a corresponding estimated fatal cancer risk of about 1 occurrenc

Groundwater with a strontium-90 concentration of 1.5 picocuries per liter (ma level of 8 picocuries per liter) and an iodine-129 concentration of 0.65 picocuries reach Well No. 2 at the Central Facilities Area in the year 2030. Consumption of t would result in an estimated dose equivalent of 5.1 millirem, with a corresponding of about 1 occurrence in 489,000.

Trichloroethylene at concentrations above the U.S. Environmental Protection A projected to reach Test Area North drinking water supply wells. The maximum concen milligrams per liter is projected to occur at the Water Reactor Research Test Facil year 2024. However, if concentrations exceed maximum contaminant levels, then eith would be installed or the well would no longer be used for drinking water. Trichlo in drinking water below the maximum contaminant level (0.005 milligrams per liter) incidence of cancer risk of less than 1 occurrence in 1 million.

For all reported noncarcinogenic chemical contaminants, the calculated hazard ratio of contaminant to reference dose) were less than 1. This indicates that no a expected as a result of these contaminants.

5.12.1.2.2 Potential Health Effects to the Public-For the public, health effects

were estimated using an iodine-129 concentration of 0.00083 picocuries per liter, m boundary in 1992 (Mann 1994). Consumption of this water for the lifetime of an ind an estimated dose equivalent of 0.012 millirem, with a corresponding estimated fata occurrence in 170 million.

5.12.2 Occupational Health and Safety

All of the activities to be performed by workers under each of the alternativ currently performed at the INEL. Some of the workers involved in the alternatives activities that may expose them to radiation and other workplace hazards at levels averages. However, other workers will be engaged in activities that are much less all alternatives, the potential hazards encountered in the workplace will be simila at the INEL. Furthermore, these hazards will be mitigated by occupational and radi operating under the same regulatory standards and limits that currently apply at th the average radiation dose and the number of reportable cases of injury and illness proportional to the number of workers at the INEL under each alternative.

The estimated occupational impacts reported in this section are based on the occupational radiation dose rates and injury/illness and workplace fatality inciden 4.12, Health and Safety, of this EIS. These rates have been applied to the estimat under each alternative as presented in Appendix F-1, Socioeconomics, Tables F-1-2 a A more complete discussion of health and safety analysis methods appears in Appendi Health and Safety.

5.12.2.1 Radiological Exposure and Health Effects.

Estimated radiological impacts to workers are presented in Table 5.12-5. The average dose rate per year for each emp monitoring data for the INEL over the period 1987 to 1991 (Appendix F). The table those workers involved in activities under each alternative (incremental workforce) engaged in other activities (baseline workforce). Negative values in Table 5.12-5 employment relative to 1995 levels.

The measures of impact in Table 5.12-5 are: (a) average annual collective do (b) total collective dose to the workforce over the time period addressed by this E total number of excess fatal cancers expected over the lifetimes of the workers due during the period covered by this EIS.

Table 5.12-5. Estimated radiological impacts to workers at the Idaho National Engin

There is a potential for small increments of additional radiation dose to som to atmospheric emissions from INEL facilities or drinking water from production wel maximum potentials for impacts from atmospheric releases are presented in Table

5.12-1. Impacts from onsite drinking water supplies are presented in Section 5.12. to workers exposed by these pathways cannot be estimated precisely but will be much maximum potential amounts reported above. These exposure pathways are not expected significant contribution to the values presented in Table 5.12-5.

Collective radiation dose and resulting health effects are expected to be les alternatives. This is because, for all alternatives, total employment at the INEL the current number of about 11,000. Furthermore, the total average workforce at th from 1995 to 2005 is similar for all alternatives so that the differences in radiol workforce are small.

5.12.2.2 Nonradiological Occupational Hazards.

Estimated nonradiological impacts to workers are presented in Table 5.12-6. The rates for injury and illness and occupa on observed rates for DOE and its contractors over the period from 1988 to 1992 (Ap Health and Safety, of this EIS). The table distinguishes between those workers inv each alternative and those INEL workers engaged in other activities. The table als estimates of potential hazards to construction workers under each alternative. Thi work is considerably more hazardous than other activities under the alternatives.

The measures of impact in Table 5.12-6 are: (a) average annual cases of repo illness, (b) average annual number of fatalities, (c) total cases of reportable inj period addressed by this EIS (1995 to 2005), and (d) the total number of occupation period covered by this EIS. Negative values in Table 5.12-6 indicate a reduction i levels.

There is a potential for small increments of additional exposure to toxic mat emissions from INEL facilities or drinking water from production wells on the site.

Table 5.12-6. Estimated nonradiological impacts to workers at the Idaho National (annual averages and totals for the years 1995 through 2005).

	Baseline workers	Alternative Ac			Alternative Bd		
		Incrementa non-constructiong	Increment construct	All workers	Incremental non-construction	Incremental construction	All wor
Annual average workers	7,650	-245	125	7,530	51	436	8,13
Annual average injury/illness	245	-7.8	7.8	245	1.6	27	273
Annual average fatalities	0.24	-0.01	0.01	0.25	0.00	0.05	0.29
Total injury/illness	2,448	-78	78	2,447	16	270	2,7
Total fatalities	2.5	-0.08	0.14	2.5	0.02	0.48	2.9

a. Numbers in this table may not add exactly because of rounding effects.

b. Incremental workers are INEL employees participating directly in proposed activities under each alternative. Baseline workers are employees engaged in other

c. Alternative A (No Action).

d. Alternative B (Ten-Year Plan).

e. Alternative C (Minimum Treatment, Storage, and Disposal).

f. Alternative D (Maximum Treatment, Storage, and Disposal).

g. Negative values indicate a decrease in employment from 1995 levels.

maximum potentials for these impacts are presented in Sections 5.12.1.1.2 and 5.12. average impact to workers exposed by these pathways cannot be estimated precisely, smaller than the maximum potential amounts reported above. These exposure pathways make a significant contribution to the values presented in

Table 5.12-6.

The number of reportable injury and illness cases is expected to be less than alternatives. This is because, for all alternatives, total employment at the INEL the current number of about 11,000. For those injuries and illnesses of an occupat proportions of different types of health impacts are expected to apply to all alter trauma disorders, 48 percent; skin disorders, 30 percent; respiratory conditions, 1 impacts, 11 percent.

The total average workforce at the INEL for the period from 1995 to 2005 is s alternatives so that the differences in impacts from nonradiological hazards to the of the differences are a result of the different proportion of construction workers

5.13 Idaho National Engineering Laboratory Services

This section discusses the potential effects of the four environmental restor management alternatives on utilities and energy and security and emergency services consumption of water, electrical energy, and fossil-based fuels and wastewater disc and the Idaho Falls support facilities is considered.

5.13.1 Methodology

To determine the potential impacts of the alternatives on the INEL site utili the projected usage rates for water, electricity, fuel, and wastewater treatment an by new facilities were evaluated and compared. In addition, the total demands, com new facilities, were compared with supply capabilities. Since increased use of ser with new buildings, the total number of new buildings and the total area occupied b in Figure 5.13-1 for each alternative. The project descriptions given in Appendix distribution by alternative (given in Chapter 3, Alternatives) were used to evaluat increases in demand. The potential impact on Idaho Falls facilities depends on any these facilities.

5.13.2 Idaho National Engineering Laboratory Services Impacts from Alternative A (No

Action)

Alternative A (No Action) encompasses 12 new projects. Nine projects include operation of 13 new buildings on the INEL site, having about 50,000 square meters (floor space, and three projects include substantial construction of other facilitie vaults. The estimated increases in utility and energy usage rates resulting from t megawatt-hours per year of electricity, 106,900 cubic meters (28.2 million gallons) million liters (1.0 million gallons) per year of wastewater discharge (sewage water These represent small increases ranging from 0.7 percent to 10 percent above the ba system capabilities and usage limits (see Section 4.13, Idaho National Engineering

Figure 5.13-1. Total area of new buildings at the Idaho National Engineering Labor

Fossil fuel usage would increase by 910,000 liters (240,000 gallons) of heati (96,000 gallons) of diesel fuel, and 1,190,000 liters (314,000 gallons) of propane 1995). These increases in heating oil and diesel fuel are less than 8 percent abov usage increases by over 200 percent to support building heating for new projects. fossil fuels at the INEL site should support these usage levels.

The primary construction materials are concrete and steel. The buildings and projects for Alternative A (No Action) are estimated to include about 25,000 cubic yards) of concrete. The amount of steel is not defined but is considered recyclabl decommissioned.

Alternative A (No Action) is not expected to require increases in INEL site f emergency services.

5.13.3 Idaho National Engineering Laboratory Services Impacts from Alternative B

(Ten-Year Plan)

Alternative B (Ten-Year Plan) encompasses 41 new projects. Seventeen project construction and operation of 23 new buildings on the INEL site, having about 83,00 (890,000 square feet) of floor space, and six projects include substantial construc estimated increases in utility and energy usage rates above baseline resulting from megawatt-hours per year of electricity (46 percent increase), 298,600 cubic meters year of water (5 percent increase), and 7.2 million liters (1.9 million gallons) pe (1 percent increase) (Hendrickson 1995). The increase in usage rate for electricit baseline usage but is within the contracted supply level. Increases in water and w less and are very moderate increases, well within INEL site capabilities.

Fossil fuel usage would increase by 5,485,000 liters (1,449,000 gallons) of h liters (293,000 gallons) of diesel fuel, and 2,700,000 liters (713,000 gallons) of (Hendrickson 1995). These increases in usage rates range from increases of 20 perc percent for heating oil, and 480 percent for propane. The large increase in propan heating and incineration. Fossil fuel supply to the INEL site is adequate to meet

The quantity of concrete estimated for construction of Alternative B (Ten-Yea facilities is 60,000 cubic meters (78,500 cubic yards).

Alternative B (Ten-Year Plan) may result in the need for expanded INEL site f security, and emergency services.

5.13.4 Idaho National Engineering Laboratory Services Impacts from Alternative C

(Minimum Treatment, Storage, and Disposal)

Alternative C (Minimum Treatment, Storage, and Disposal) encompasses 19 new p projects include construction and operation of 14 new buildings on the INEL site, h meters (610,000 square feet) of floor space, and three projects include substantial facilities. The estimated increases above baseline in utility and energy usage rat projects are 62,000 megawatt-hours per year of electricity (30 percent increase), 1 million gallons) per year of water (2.5 percent increase), and 5.8 million liters (of wastewater discharge (1 percent increase) (Hendrickson 1995). These usage rates Alternatives A (No Action) and B (Ten-Year Plan) and are within system capabilities

Fossil fuel usage would increase by 1,210,000 liters (320,000 gallons) of hea (110,000 gallons) of diesel fuel, and 1,246,000 liters (329,000 gallons) of propane 1995). The increase in heating oil is about 11 percent above baseline, diesel fuel baseline, and propane use increases about 220 percent to support facility heating. similar to increases associated with Alternative A (No Action) and are expected to capability.

The construction associated with Alternative C (Minimum Treatment, Storage, a projects is expected to require about 35,000 cubic meters (45,800 cubic yards) of c

Alternative C (Minimum Treatment, Storage, and Disposal) is not expected to r INEL site fire, security, or emergency services.

5.13.5 Idaho National Engineering Laboratory Services Impacts from Alternative D

(Maximum Treatment, Storage, and Disposal)

Alternative D (Maximum Treatment, Storage, and Disposal) includes all of the Alternative B (Ten-Year Plan) plus five additional projects with three additional n the scope of three of the projects is expanded under Alternative D to accommodate t materials. The new buildings constructed on the INEL would have 116,000 square met feet) of floor space. Accordingly, Alternative D increases in usage rates above ba estimated to be 114,000 megawatt-hours per year of electricity (55 percent increase (67 million gallons) per year of water (3.9 percent increase), and 10.6 million lit year of wastewater discharge (2 percent increase) (Hendrickson 1995). These usage maximum increases for all the alternatives and, when added to the baseline usage ra existing system capabilities and use limits.

Fossil fuel usage would increase by 6,255,000 liters (1,653,000 gallons) of h liters (323,000 gallons) of diesel fuel, and 2,732,000 liters (720,000 gallons) of (Hendrickson 1995). Alternative D (Maximum Treatment, Storage, and Disposal) heati percent above baseline, diesel fuel usage is 21 percent above baseline, and propane above baseline. These increases are comparable to Alternative B (Ten-Year Plan) an supply capability.

The construction associated with Alternative D (Maximum Treatment, Storage, a projects is expected to require about 100,000 cubic meters (130,000 cubic yards) of

Alternative D (Maximum Treatment, Storage, and Disposal) may result in the ne INEL site fire protection, security, and emergency services.

5.13.6 Summary of Impacts from Alternatives

Alternative D (Maximum Treatment, Storage, and Disposal) would put the greate site services. For Alternative D, electrical consumption was estimated to be 114,0 year, which is an increase of about 55 percent above baseline usage. The expected expected increase) is about 322,000 megawatt-hours per year, which is just over 82 supply and 29 percent of system capacity; thus, the existing INEL site electrical s the electrical load for Alternative D. All the other alternatives create less elec could be accommodated without exceeding about 82 percent of contracted supply for a

The corresponding increases in water usage and wastewater discharge for Alter Treatment, Storage, and Disposal) were less than about 5 percent above baseline. A increases in electrical usage, water usage, and wastewater discharge for all four a graphically in Figure 5.13-2.

<u>Figure 5.13-2. A summary of peak utility usage increases above baseline at the Ida</u>

The corresponding increases in fossil fuel usage are also shown graphically i fossil fuel usage increases for Alternatives A (No Action) and C (Minimum Treatment Disposal) are very comparable, as are those for Alternatives B (Ten-Year Plan) and Storage, and Disposal).

The facilities at the INEL site are the major consideration in evaluating the utilities and energy; however, some minor impact could also be expected from staff facilities. City of Idaho Falls services and natural gas supplies accommodate curr the overall INEL workforce is expected to decline, no staff increases in Idaho Fall there would be no negative impact on city services or natural gas supplies. The Ci fire, police, and emergency services to the INEL facilities in town and would not b alternatives.

5.14 Facility Accidents

A potential exists for accidents at facilities associated with the treatment, radioactive and hazardous materials. Accidents can be categorized into events that example, minor spills), events a facility was designed to withstand, and events a f withstand. These categories are termed abnormal, design basis, and beyond design b respectively. Summarized here are consequences of possible facility accidents in t member of the public at the nearest site boundary, for the collective population wi miles), for workers, and for the environment. Details of assessments of the accide al. (1995). Section 5.11 (Traffic and Transportation) summarizes the assessment of

An accident is a series of unexpected or undesirable "initiating" events lead radioactive or hazardous materials within a facility or to the environment. This a events that can lead to a facility accident in three broad categories: external in natural phenomena initiators. External initiators originate outside the facility a the facility to confine radioactive or hazardous material. These initiators may be explosions nearby, or caused by events at nearby facilities. Internal initiators o example, equipment failures or human error) and usually are the result of the facil and terrorist activities (that is, intentional human initiators) may be classified initiators. Natural phenomena initiators include weather-related (for example, flo seismic events. For this analysis, initiators are defined in terms of those events indirectly, a release of radioactive or hazardous materials within a facility or to bypass of confinement.

The historical record of accidents at the INEL is summarized in the following to assess potential future events are summarized in Section 5.14.2. Evaluations of alternative are summarized in Sections 5.14.3 through 5.14.6. A summary comparison by alternative is given in Section 3.3, Comparison of Impacts.

5.14.1 Historical Perspective

Many of the INEL actions proposed under the alternatives are continuations or practices. Injuries, illnesses, and the potential for increased cancer risk for wo

5.12, Health and Safety. Most historical accidents, such as the April 15, 1994, re Argonne National Laboratory-West, are less severe than the postulated accidents dis discussed below, the primary historical cause of fatalities to INEL workers has bee risks to the public from INEL accidents have been analyzed in detail and have been (DOE-ID 1991).

Consequences of accidents can involve fatalities, injuries, or illnesses. Fa (immediate), such as in construction accidents, or latent (delayed), such as cancer exposure. While public comments received in scoping meetings for Volume 2 of this concerns about potential accidents, the historical record shows DOE facilities have record. Figure 5.14-1 illustrates the rate of worker fatalities at the INEL (Mille in the overall DOE complex (DOE 1993b) as well as national-average rates compiled f groups by the National Safety Council (NSC 1993) and Idaho averages compiled from S Hendrix (1994). All statistics apply to the period 1983 through 1992. The worker the INEL is very low compared to the rates from industry groups such as agriculture comparable to those for trade and services groups. None of the INEL fatalities in from exposure to radiation or hazardous material. While past accident rates are no future rates, the historical record reflects DOE's emphasis on safe operations.

For accidents involving radiation exposure, a total of three prompt worker fa the 40-year history of INEL facilities. These workers were killed by a steam explo nuclear criticality (uncontrolled chain reaction) in an experimental reactor (Stati No. 1) in 1961. The workers were manually moving reactor control elements when the The dose from this accident to an individual at the nearest site boundary has been 3 millirem (DOE-ID 1991). A number of nonfatal accidental radiation exposures have workers. Neither prompt nor delayed fatalities are known to have occurred to membe radiation exposure accidents at the INEL.

Figure 5.14-1. Comparison of fatality rates among workers in various industry grou

cleanup. Irreversible impacts to the environment have been negligible.

5.14.2 Methodology

Possible accidents involving spent nuclear fuel and waste management and envi operations at the INEL were analyzed for Volume 2 of this EIS. To obtain a perspec accidents, the approach was to

- Summarize accidents that have occurred at the INEL (historical accidents)
- Review previous accident analyses for spent nuclear fuel, waste management, restoration activities
- Identify potential internal, external, and natural phenomena events that co other than those previously analyzed
- Perform independent analyses of the accidents with the greatest consequence

To characterize potential impacts at INEL facilities and operations, accident frequencies are reported for each proposed alternative. Three broad frequency rang events with frequencies greater than 10-3 per year, design (or evaluation) basis ac the range from 10-6 to 10-3 per year, and beyond design basis events with frequenci 10-6 per year. Within each frequency range, a bounding accident is determined so t foreseeable accident within a frequency range would be expected to have smaller con Appendix F-5, Facility Accidents). The results are point estimates of maximum reas accidents by frequency category rather than a cumulative assessment of all possible category.

Possible causes, assumptions, likelihood of occurrence, and consequences are bounding accident within each frequency category analyzed. Some accidents in the a basis frequency ranges are based on existing analyses (for example, facility safety these analyses generally evaluate only consequences to an individual at the nearest health risks are unavailable for most such events. For accidents for which indepen performed, as reported in Slaughterbeck et al. (1995), population health risks were in this section. Fatal cancer effects are reported for these accidents; other heal cancer and hereditary effects from radiation exposure occur at a rate approximately a given exposure than fatal cancer (ICRP 1991). Ecological impacts are assessed qu the analyses, including supporting references, are given in Slaughterbeck et al. (1

Most of the accidents analyzed herein relate to existing INEL facilities or p existing facilities. These evaluations are appropriate to characterize accident im provide meaningful comparisons among different sites. Because some of the existing that recently has been removed from INEL reactors, accidents for existing facilitie associated with fuel that could be transported to Idaho from other DOE facilities, research reactors.

5.14.2.1 Accident Screening and Selection Process.

Many types of postulated events could lead to an accidental release of radioactive or hazardous material or both. events have the potential for only local (within the INEL site boundaries) conseque a release that would have consequences for a member of the public at the nearest si

Internal and external initiators associated with a wide range of activities n existing safety analyses were considered. For example, potential radiological acci construction activities associated with constructing new facilities or modifying ex under the various alternatives) were postulated. Typically, events involved in the facilities would act as external initiators while events involved in modifying exis internal initiators. Examples of construction or industrial-type events considered impacts or puncture events, equipment failure, terrorism, and human error. The pot acts of terrorism are believed to be bounded by the consequences of the evaluated a

The INEL site has nine major operating areas within the site boundaries. The

Table 5.14-1. Each area was screened for quantities of spent nuclear fuel, radioac material (including materials in inventory) that have the potential for being invol and thus worthy of consideration.

- Spent nuclear fuel or irradiated fuel is stored in substantial quantities a Processing Plant, Argonne National Laboratory-West, Test Reactor Area, Test Naval Reactors Facility. Some spent nuclear fuel remains at the Auxiliary Burst Facility but is scheduled to be removed to the Idaho Chemical Process No spent nuclear fuel is located in other areas.

- High-level waste is stored in substantial quantities at the Idaho Chemical form of liquids (liquid waste storage tanks), solid calcines (calcine stora and calcine waste (New Waste Calcining Facility), and residual high-level c efficiency particulate air filters (Atmospheric Protection System). Only s are located in other areas.

- Transuranic waste is stored in large quantities at the Radioactive Waste Ma only. Other areas may have small quantities insufficient to result in cons

Table 5.14-1. Idaho National Engineering Laboratory locations with sufficient quan a member of the public under accident conditions.

Spent nuclear fuel, waste, and activity types	Idaho National Engineering Laboratory locationsa ICPP	ANL-W	TRA	TAN	RWMC	
Spent nuclear fuel	Yes	Yes	Yes	Yes	No	
High-level waste	Yes	No	No	No	No	
Transuranic waste	No	No	No	No	Yes	
Low-level waste	No	No	No	No	Yes	
Mixed low-level waste	No	Yes	No	No	Yes	
Hazardous waste and toxic material	Yes	Yes	No	Yes	No	Ye
Decontamination and decommissioning	Yes	Yes	Yes	No	No	
Remediation	No	No	No	No	Yes	

a. Location acronyms:
ANL-W - Argonne National Laboratory-West
ARA - Auxiliary Reactor Area
CFA - Central Facilities Area

ICPP - Idaho Chemical Processing Plant
IRC - INEL Research Center
NRF - Naval Reactors Facility
PBF - Power Burst Facility
RWMC - Radioactive Waste Management Complex
TAN - Test Area North
TRA - Test Reactor Area

- Low-level waste is stored in substantial quantities at the Radioactive Wast Complex and at the Auxiliary Reactor Area/Power Burst Facility area.

- Mixed low-level waste is stored in substantial quantities at the Argonne Na West (contaminated sodium reactor coolant), Radioactive Waste Management Co Auxiliary Reactor Area/Power Burst Facility area (Mixed Low-Level Waste Fac

- Hazardous waste and material is stored in substantial quantities at the Ida Plant (chlorine, acids), Argonne National Laboratory-West (chlorine, sodium (depleted uranium), Central Facilities Area (Hazardous Waste Storage Facili Center (various chemicals), and Auxiliary Reactor Area/Power Burst Facility facilities).

- Decontamination and decommissioning activities with potential for consolida quantities of radioactive and hazardous materials could occur at the Idaho Plant (Fuel Processing Complex, CPP-601, and Waste Calcining Facility), Arg Laboratory-West (Central Liquid Waste Processing), Test Reactor Area (Engin Reactor and Materials Test Reactor), and Auxiliary Reactor Area (Auxiliary

- Remediation activities with potential for consolidation of substantial quan hazardous materials will occur at the Radioactive Waste Management Complex retrieval). Other remediation activities may occur as future site investig

Initiating events were defined in three broad categories: external initiator natural phenomena initiators. External initiators originate outside the facility a the facility to maintain confinement of radioactive or hazardous material. These m explosions nearby, or caused by events at co-located facilities. Internal initiato failures or human error) originate within a facility and are a result of operating phenomena initiators include weather-related and seismic events. All types of init terms of those events that cause or may lead to a release of materials by failure o confinement.

Seismic events (see Section 4.6.3) were found to be the most likely common-ca potential to cause releases at more than one facility and involve more than one was individual impacts presented herein for seismically initiated accidents could be ad the screening methods focused on facilities with the largest inventories rather tha summing impacts from the assessed seismic accidents could be misleading and was not were found where an accident in one facility could cause an accident in a co-locate

Each facility area was screened for initiating events with the potential to c worker, the environment, and the public at the nearest site boundary. Only those l substantial quantities of materials and listed in Table 5.14-1 were considered. Th results are summarized in Table 5.14-2 for the six waste and material types and two restoration activities. Accidents with bounding consequences from this table were below.

5.14.2.2 Analysis of Accident Consequences.

For health effects to occur, an accident must involve (a) a direct radiation exposure such as in a criticality, or (b) a loss of and/or radioactive material and a release of some fraction of the material to the i the latter, the material must then be transported to human beings. Emergency Prepa 1993c) and Protective Action Guides (EPA 1991) can be invoked to reduce human expos where time is available to take action. The quantities of materials that reach peo materials interact with human beings are important factors in determining health ef

In determining the consequences (radiological and toxicological) associated w maximum reasonably foreseeable accidents, the following definitions were used:

- Facility Worker. The facility worker is defined as an individual located 1 downwind of the facility location where the release occurs.

Table 5.14-2. Potential initiating events for accidents at the Idaho National Engi

Spent nuclear fuel, waste, and activity types			
Spent nuclear fuel	High-level waste	Transuranic waste	Low-level waste
		Abnormal Eventsa	
-Fuel handling acc	Upsets with localized impacts onlyb	Upsets with localiz-impacts onlyb	-WWSB fire -RWMC SDA fire
		Design Basis Accidents	
-Fuel handling criticality -HFEF seismic -Cask failure	-NWCF stack release -APS seismic stack failure -HLW tank seismic -Calcine bin seismic -APS filter fire stack release -HLW tank criticality -HLW tank fire/ explosion -NWCF seismic or fire/explosion	-RWMC TSA explosion -RWMC TSA seismic -RWMC WCF vent release -RWMC lava flow -RWMC TSA fire	-RWMC TSA explosi -RWMC TSA seismic -WERF seismic -RWMC WCF vent release -WERF stack relea -WERF fire/explos -RWMC lava flow -RWMC TSA fire
		Beyond Design Basis Accid	
-ICPP 603 seismic drain criticality -Aircraft impact	-Aircraft impact	-Aircraft impact -RWMC external fire/explosion -RWMC criticality	-Aircraft impact -RWMC external fire/explosion -RWMC criticality

a. Abnormal events are in the frequency range of 10-3 per year or greater. Design
the range of 10-7 to 10-6 per year.
b. Family of incidents involving spills, drops, seal failures, etc. that could hav
Definition of acronyms:

ANL-W - Argonne National Laboratory-West
APS - Atmospheric Protection System
CFA - Central Facilities Area
HFEF - Hot Fuel Experimental Facility
HLW - high-level waste
HWSF - Hazardous Waste Storage
ICPP - Idaho Chemical Processin
IRC - INEL Research Center
NWCF - New Waste Calcining Faci
RWMC - Radioactive Waste Manage

Table 5.14-3. Impacts from selected maximum reasonably foreseeable radiological ac
Engineering Laboratory sitea - Alternative A (No Action).

Accident	Frequency (events/yr)	Facility worker dose (rem)c	Dose at nearest public access (rem)d	Dose to MEIe (r
				Spent Nuclear Fuel Ac
Fuel-handling accident, pin breach, venting of noble gases and iodine (bounded by HFEF fuel-handling accident)	1 y 10-2	(f)	(f)	2.0 y 1
Uncontrolled chain reaction (criticality) accident at ICPP	g1 y 10-3	9.7 y 10-2	1.4 y 10-3	1.0 y 1
Severe seismic event, cell breach, and fuel melting at ANL-W HFEF	1 y 10-5	6.2 y 10-1	6.5 y 10-1	5.0 y 1
Aircraft crash into HFEF ANL-W	1 y 10-7	4.6 y 100	3.2 y 10-1	5.0 y 1

				High-Level Waste Acc
ICPP main stack toppling	3 y 10-4	8.3 y 102	2.8 y 10-1	9.1 y 1
Severe seismic event, calcine storage bin failure	1 y 10-5	1.2 y 100	2.3 y 10-2	7.6 y 1
Fire in ICPP atmospheric protection system filters	3y 10-5	1.3 y 10-3	8.2 y 10-5	1.2 y 10
ICPP New Waste Calcining Facility explosion	3 y 10-6	(f)	(f)	2.0 y 1
Aircraft crash into calcine bin set	2 y 10-7	4.1 y 100	3.0 y 10-1	1.1 y 1
				Transuranic Waste Acc
Explosion at RWMC TSA	2 y 10-4	(f)	(f)	2.0 y 1
Lava flow over RWMC	2 y 10-5	Evacuate	Evacuate	9.4 y 1
Fire in RWMC TSA	4 y 10-6	(f)	(f)	1.0 y 1
Aircraft impact at RWMC TSA	1 y 10-7	(f)	(f)	6.0 y 1
				Mixed Low-Level/Low-Level W
Fire in RWMC SDA	1 y 10-3	(f)	(f)	4.0 y 1
Design basis fire at WERF Waste Storage Building	1 y 10-3	(f)	(f)	2.8 y 1
Beyond design basis fire at WERF Waste Storage Building	1 y 10-7	(f)	(f)	1.4 y 1
				Environmental Remediation/Decontaminati
Pit 9 fire/vent release	2 y 10-3	(f)	(f)	5.1 y 1
Pit 9 design basis fire	9 y 10-5	(f)	(f)	8.0 y 1
Pit 9 earthquake and release	1 y 10-5	(f)	(f)	3.3 y 1

a. Accidents involving hazardous materials for Alternative A (No Action) are summa
b. Fatal cancer risk = dose y accident frequency y (5.0 y 10-4 fatal cancers/rem) doses y20 rem, the ICRP-60 conversion factor (ICRP 1991) is doubled, or 1.0 y 10-3. cancers in the population if the accident occurs.
c. A facility worker is defined as a worker located 100 meters (328 feet) from the
d. Member of the public on a highway at the nearest point to the facility within t
e. MEI = maximally exposed hypothetical individual whose residence is located at t
f. The safety analysis report utilized for this accident does not provide this inf orders specifically required this information. As demonstrated by the dose to the are assumed to be less than or comparable to the consequences from the spent nuclea doses calculated.
g. Frequency lowers to 1 y 10-4 per year when all CPP-603 fuel is moved to the Flu
h. A high-level waste tank failure with complete draining was evaluated to determi radionuclide, strontium-90, was calculated to reach a peak concentration in the aqu tank failure. The current drinking water standard for strontium-90 is 8 picocuries in Slaughterbeck et al. (1995).
i. The dose to a facility worker is from a puff release of respirable particles.

Definition of acronyms:
ANL-W - Argonne National Laboratory-West
HFEF - Hot Fuel Examination Facility
ICPP - Idaho Chemical Processing Plant
MEI - maximally exposed individual at the nearest site boundary
RWMC - Radioactive Waste Management Complex
SDA - Subsurface Disposal Area
TSA - Transuranic Storage Area
WERF - Waste Experimental Reduction Facility
- Nearest Public Access. The nearest public access is the location of the ne

where members of the public could be present.

- Maximally Exposed Individual (MEI). The MEI is defined as a hypothetical i the nearest site boundary from the facility location where the release occu
- Offsite Population. The offsite population is defined as the collective su within an 80-kilometer (50-mile) radius of the INEL facility and within the the wind blowing in the most populous direction.

The ways radioactive material reaches human beings, how it is absorbed and re and the resulting health effects have been studied in great detail. The Internatio Radiological Protection has made specific recommendations for quantifying these hea organization is the recognized body for establishing standards for protecting worke effects of radiation exposure. Health effects include acute damage (up to and incl effects, including cancers and genetic damage. An INEL-developed computer code, RS estimates potential radiation doses to maximally exposed individuals or population releases of radionuclides. This code, which is adapted to INEL conditions, uses we and engineering principles as the basis for the various calculational steps. The c accepted standards for this kind of computer software.

For hazardous materials, several government agencies recommend quantifying he threshold values of concentrations in air or water that cause short-term effects. consequences of exposure to hazardous materials are not as well understood as those potential health effects reported here for hazardous materials are more qualitative materials. EPIcode- (Homann 1988) was the computer code chosen for most releases o materials.

5.14.3 Impacts from Alternative A (No Action)

Impacts from accidents under Alternative A (No Action) are described in this from these impacts under other alternatives are evaluated in subsequent sections.

5.14.3.1 Spent Nuclear Fuel.

Spent nuclear fuel is managed at the following facility areas at the INEL site: Idaho Chemical Processing Plant, Naval Reactors Facility, Test Reac Reactor Area/Power Burst Facility, Argonne National Laboratory-West, and Test Area irradiated nuclear fuels (whether "spent" or "in-process") are managed in associati operations at the Advanced Test Reactor in the Test Reactor Area and the Experiment the Argonne National Laboratory-West facility area(a). In-process fuels include fu recycled to return to reactor systems. For this analysis, both spent and in-proces assessment. Fuels within reactors were considered only after discharge to storage, areas. Maximum reasonably foreseeable accidents associated with transporting, rece storing naval spent nuclear fuel at the Naval Reactors Facility have been identifie Appendix D of Volume 1 of this EIS.

In November 1993, DOE issued a report (DOE-ID 1993) discussing vulnerabilitie various spent nuclear fuel-related facilities across the DOE complex. One INEL fac Underwater Fuel Storage Facility, was identified as requiring immediate management unnecessary increases in worker exposures, cleanup costs, and postulated accidents. already been initiated to stabilize inventories of spent nuclear fuel in CPP-603 an 666, these activities will continue for several years after the scheduled 1995 Reco Therefore, postulated accident scenarios associated with stabilizing and relocating fuel inventories were considered in determining potential accident initiators and t foreseeable radiological accidents summarized in this EIS.

Activities historically associated with spent nuclear fuel at the INEL site i Section 5.11), handling, inspection, storage, and reprocessing. Handling includes within facility areas, cutting and removing nonfuel components attached to fuel ele cask unloading. Inspections include destructive and nondestructive testing and cha for research and development of improved fuels. Handling and inspection activities

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a. Continued operation of the Experimental Breeder Reactor-II in support of Integra was assumed when environmental impacts analysis for this EIS performed (see Chapter However, since that time, funding for Integral Fast Reactor research has been curta operations have ceased.

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underwater and dry environments. Storage of spent nuclear fuel occurs underwater i dry storage casks, and underground in dry storage vaults. All of these activities, ongoing and apply to Alternative A (No Action). New activities include handling an degraded fuel in CPP-603 and removal of fuels from pool storage at Test Area North.

Using existing safety analysis reports and independent calculations, accident screening process were assessed for risks to the public, workers, and the environme fuel present, storage configuration (wet/dry), and cooling time in the various fuel facilities, the accidents given in Table 5.14-3 were determined to have maximum rad within the abnormal, design basis, and beyond design basis frequency categories (se listed in the table are the estimated frequency of occurrence, exposures to hypothe nearest public access and nearest site boundary, point estimates of the annualized contracting a fatal cancer during his or her lifetime as a result of this radiation of risk and the expected number of fatal cancers to members of the public for each most populous wind direction from the accident. The estimates for fatal cancers ar percent) and conservative (95 percent) meteorological conditions. The average con defined as that for which more severe conditions with respect to accident consequen the time. The conservative condition (95 percent) is defined as weather conditions atmospheric dispersion of contaminants, which are not exceeded more than five perce

Radiation doses that a hypothetical member of the public at the nearest site as a result of the spent nuclear fuel accidents are illustrated in Figure 5.14-2 al accidents involving other radioactive waste streams. Each symbol represents the do accident from Table 5.14-3. Illustrated for perspective is the natural background natural radiation (NAS/NRC 1990). Slaughterbeck et al. (1995) lists doses in nearb

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a. For these analyses, point estimate of risk (fatal cancers per year) is defined a (events per year) multiplied by the resulting dose (person-rem), and then multiplie that the dose causes a fatal cancer (fatal cancers per person rem).

<u>**Figure 5.14-2. Potential radiation exposures from accidents to individual at neare**</u>

The incremental risk of the hypothetical individual developing a fatal cancer exposures is illustrated in Figure 5.14-3. For reference, the figure shows the ann cancer from all other causes (NAS/NRC 1990) and the DOE National Safety Policy Goal 1991), as derived in Slaughterbeck et al. (1995). The policy states that the cance population within one mile of the site boundary of a DOE nuclear facility should no sum of all cancer fatality risks resulting from all other causes. This goal repres and accident aiming point for DOE facilities and does not represent an acceptance c the goal allows the reader to see the contribution of the maximum foreseeable accid Excess cancer fatality rates in the population from the analyzed accidents are illu

From an assessment of a maximum reasonably foreseeable accident for an expose workers, the risk of cancer fatalities as a result of an earthquake-induced critica Hot Shop is about 8.1 y 10-5 per year (Slaughterbeck et al. 1995). If a criticalit unshielded area, fatal doses could occur up to 40 meters from the source. Table 5. secondary environmental impacts of accidents (that is, impacts other than possible

<u>**Figure 5.14-3. Risk of fatal cancer to individual at nearest Idaho National Engine**</u>

<u>**Figure 5.14-4. Excess fatal cancers in exposed population from radiation accidents**</u>

<u>**Table 5.14-4. Assessment of potential secondary impacts of accidents at the Idaho N**</u>

5.14.3.2 High-Level Waste.

High-level waste results as a byproduct of the reprocessing of spent nuclear fuel. During the past several decades at the INEL, fuel reprocessing at th Plant produced high-level waste in a liquid form that is stored in underground tank been immobilized through a high-temperature calcine process that converts the liqui stored in bins inside concrete storage vaults. Both the liquid and granular solid granular solid is less susceptible to leakage than liquid. Although reprocessing o has terminated, inventories of liquid and granular high-level waste remain. The ac potential for release of both the liquid and granular high-level waste forms. The high-level waste to granular calcine is ongoing and applies to Alternative A (No Ac

associated with upgrades to underground storage tanks could result in construction

Using existing safety analysis reports and independent calculations, the acci screening process were assessed for risks to the public, workers, and the environme consider high-level waste tank explosions as reasonably foreseeable because the che generate hydrogen or other explosive gases. On the basis of the quantity of high-l handling in the calcine process, the accidents with airborne releases given in Tabl have bounding radiological consequences within the abnormal, design basis, and beyo categories (Appendix F-5). Impacts from these accidents are illustrated in Figures For an earthquake-caused collapse of the main stack at the Idaho Chemical Processin cancer to a population of 50 workers is estimated to be 1.1 y 10-2 per year (Slaugh near the source of the release have a potential risk of injury or death.

A high-level waste tank failure with complete draining was evaluated to deter groundwater. Assuming no other liquid discharges to the tank failure area, infiltr over approximately 200 years, and the concentration of the limiting radionuclide, s peak concentration of 2 picocuries per liter 300 years after tank rupture. The cur contaminant level for strontium-90 is 8 picocuries per liter.

Table 5.14-4 lists the potential secondary environmental impacts of accidents than possible human health effects). The hazardous constituents of high-level wast (Slaughterbeck et al. 1995) and found to be bounded by the hazardous material relea Section 5.14.3.5.

5.14.3.3 Transuranic Waste.

Transuranic waste is stored and buried at the Radioactive Waste Management Complex at the INEL site. Transuranic waste activities under Alternativ continued storage and characterization, and continued retrieval of stored and burie Isolation Pilot Plant is available, retrived and stored waste that is certified to acceptance criteria would be shipped to the Waste Isolation Pilot Plant. If the Wa unavailable, the total inventory of transuranic waste would change very little in t however, the storage configuration would change for some waste. The waste retrieve remediation activities at Pit 9 would change from disposed of to stored status. On transuranic waste present and storage configuration (stored or buried), the acciden determined to have maximum reasonably foreseeable consequences (see Appendix F-5). from these accidents are illustrated in Figures 5.14-2, 5.14-3, and 5.14-4. Hazard waste are evaluated in Section 5.14.3.5.

For a fire at the Radioactive Waste Management Complex, the risk of fatal can population of 20 exposed workers is estimated to be 7.7 y 10-4 per year (Slaughterb near the source of the release have a potential risk of injury or death. Table 5.1 impacts of accidents (that is, economics and land use, biotic and water resources, defense capability, and environmental contamination).

5.14.3.4 Mixed and Low-Level Waste.

Under Alternative A (No Action), low-level waste would continue to be buried at the Radioactive Waste Management Complex, and mixed low-le continue to be stored at the Mixed Waste Storage Facility and the Waste Experimenta Storage Building in the Power Burst Facility area. On the basis of the quantity of level waste present and the storage configuration, the accidents given in Table 5.1 maximum radiological consequences within the abnormal, design basis, and beyond des categories (Appendix F-5). Radiological impacts from these accidents are illustrat and 5.14-4. Worker risk of fatal cancers is less than that for the materials consi source of the release have a potential risk of injury or death. No secondary impac mixed or low-level waste accidents. The hazardous constituents of mixed low-level (Slaughterbeck et al. 1995) and found to be bounded by the releases considered in S

5.14.3.5 Hazardous Materials.

The scope of the accident assessment of hazardous materials includes hazardous wastes and hazardous constituents of radioactive waste streams. Action), hazardous waste would continue to be stored at the Hazardous Waste Storage and Radioactive Mixed Waste Staging Area, and the Hazardous Chemical/Radioactive Wa addition, for the purposes of accident analysis, materials that are not considered

Resource Conservation and Recovery Act, but are toxic to humans, are also assessed
materials at the INEL include chlorine, sodium, acids and bases, laboratory chemica
used at Test Area North for the manufacture of military tank armor. Hazardous cons
streams involve materials such as cadmium in high-level waste and mercury in transu

On the basis of the screening of threshold quantities of toxic and flammable
1994) and the quantities of materials present and their storage configuration, the
were determined to have maximum reasonably foreseeable consequences. Also listed i
estimated frequency of occurrence, and maximum exposure to a hypothetical individua
boundary in terms of percentage of Emergency Response Planning Guide Level 3 values
Response Planning Guide 3 values represent the concentration where, without evacuat
or develop life-threatening health effects. Concentrations that a hypothetical mem
site boundary could be exposed to as a result of accidents are illustrated in Figur
nearest public access and in nearby communities are given in Slaughterbeck et al. (
fatalities to an estimated population of 100 exposed workers as a result of a chlor
Laboratory-West is estimated to be 1.0 y 10-3 per year (Slaughterbeck et al. 1995).
range from minor irritation to eyes and lungs to death. No secondary impacts would
accidents.

5.14.3.6 Environmental Remediation and Decontamination and Decommissioning.

Approved environmental remediation and decontamination and decommissioning projects
Alternative A (No Action). Activities would include remediation of Pit 9 and the v
Waste Management Complex and decontamination and decommissioning of the Auxiliary R
Boiling Water Reactor Experiment-V.

Table 5.14-5. Impacts from selected maximum reasonably foreseeable accidents invol
at the Idaho National Engineering Laboratory for Alternative A (No Action).

Accident	Frequency (events/yr)	MEI chemical concentrationa (mg/m3)	MEI chemical co (percentage of
Chlorine release at Argonne National Laboratory-West (ANL-W)c	1 y 10-5	20	35
Chlorine release at Central Facility Area (CFA)c	1 y 10-4	6.0	10
Chlorine release at Idaho Chemical Processing Plant (ICPP)c	5 y 10-6	4.2	7
Nitric acid release at ICPPc	1 y 10-5	0.12	0.05
Lava flow over Radioactive Waste Management Complex (RWMC)d	2 y 10-5	Mercury: 3.0 Nitric acid: 20 Phosgene gas: 0.10	Mercury: 30 Nitric acid: 6 Phosgene gas:
Fire in depleted uranium at Test Area Northc	1 y 10-7	0.20	1
Handling accident involving existing quantities of sulfur dioxide at INEL Research Centerc	1 y 10-4	13	33

a. MEI - maximally exposed individual at the nearest site boundary.
b. ERPG3 - Emergency Response Planning Guide Level 3 (immediately dangerous to lif
c. Hazardous materials in inventory.
d. Hazardous constituents of transuranic and products of combustion.

Figure 5.14-5. Potential maximum hazardous chemical concentrations at nearest Idah

Based on quantities of radioactive material present, the accidents given in T
determined to have bounding consequences within the abnormal, design basis, and bey
frequency categories. Impacts from these accidents are illustrated in Figures 5.14
excess fatal cancers in the exposed population were not calculated in the source do
al. 1995), excess fatal cancers would be similar to those of the other waste stream
the maximum exposed individual at the nearest site boundary. No secondary impacts
would be expected.

5.14.4 Impacts from Alternative B (Ten-Year Plan)

Secondary impacts are shown in Table 5.14-4. Worker risks are similar to tho Alternative A (No Action); workers near the source of releases have a potential ris accident impacts from several Alternative B (Ten-Year Plan) projects are evaluated.

5.14.4.1 Spent Nuclear Fuel.

The incremental risk of accidents over those assessed in Alternative A (No Action) (Section 5.14.3.1) would be related to construction activ additional offsite spent nuclear fuel shipments (including Fort St. Vrain fuels) at increased quantity of relatively long-cooled fuel would be managed and stored in th (FAST) Facility (CPP-666) basins, the CPP-749 Underground Storage Facility, and a p storage/canning and characterization facility at the Idaho Chemical Processing Plan estimated changes in spent fuel-handling activities under Alternative B, the freque accident is increased by a factor of 4.8. The offsite consequences would not incre Alternative A. For a criticality accident at the CPP-603 Underwater Fuel Storage F handling accident associated with degraded spent nuclear fuel, the estimated freque Alternative A (1 y 10-3 or 0.001 events per year) is based on the number of handlin relocating the CPP-603 spent nuclear fuel inventories to CPP-666. Because handling relocating spent nuclear fuel from CPP-603 to CPP-666 are unaffected by proposed ch inventories under the different alternatives, the estimated frequency for this even

Adding storage racks to CPP-666, as proposed under this alternative, would al storage capacity at the INEL site. The increased handling of spent fuel necessary the probability of a mechanical damage or criticality accident. The construction a likelihood of an industrial accident and worker injury or death. For analysis purpo Argonne National Laboratory-West were assumed to continue as in Alternative A (No A of the short-cooled fuel handled at this facility, the Alternative A accidents woul design basis and beyond design basis accident frequency categories under Alternativ The bounding accident characteristics within each frequency category that differ fr Alternative A (Section 5.14.3.1) are summarized in Table 5.14-6. The Alternative B spent nuclear fuel and other radioactive waste streams are illustrated in Figures 5

5.14.4.2 High-Level Waste.

The frequency of construction accidents and minor radiological accidents would increase as a result of proposed actions. However, the consequence with high-level waste facilities under Alternative B (Ten-Year Plan) are bounded by Alternative A (No Action).

One Alternative B project includes technology selection for processing sodium and calcined high-level waste. Accidents associated with current storage of sodium with calcining activities bound chosen technologies because the chosen technology w requirements and best available treatment technologies. The resultant waste form w the current high-level waste form stored at the INEL site.

5.14.4.3 Transuranic Waste.

Construction accidents and minor radiological accidents could occur as a result of proposed actions under Alternative B (Ten-Year Plan). Additio would be received for storage. The frequency of a fire in the Radioactive Waste Ma transuranic storage area is assumed to increase by approximately a factor of five o handling requirements. The consequences of a lava flow accident would increase by percent on the basis of the projected change in inventory of transuranic waste at t Management Complex.

5.14.4.4 Mixed and Low-Level Waste.

Under Alternative B (Ten-Year Plan), additional mixed and low-level waste would be generated on the INEL site by proposed projects and decommissioning activities. The frequency of fires in mixed waste storage and Management Complex subsurface disposal area is estimated to increase by

Table 5.14-6. Characteristics of radiological accidents at the Idaho National Engi
Alternative B (Ten-Year Plan) that differ from those under Alternative A (No Action

Accident	Frequency (events/yr)	Facility worker dose (rem)c	Dose at nearest public access (rem)d	Dose to ME (rem)e
				Spent Nuclear Fuel Acci
Fuel handling acciden fuel pin breach, venting of noble gases and iodine (bounded by HFEF fuel handling accident)	4.8 y 10-2	(f)	(f)	2.0 y 10-3
			High-Level Waste Accidents - No Ch	
				Transuranic Waste Accid
Lava flow over RWMC	2 y 10-5	Evacuate	Evacuate	1.0 y 10-1
Fire in RWMC TSA	2 y 10-5	(f)	(f)	1.0 y 10-6
			Mixed Low-Level/Low-Level Was	
Fire in RWMC SDA	2 y 10-3	(f)	(f)	4.0 y 10-4
Design basis fire at WERF Waste Storage Building	2 y 10-3	(f)	(f)	2.8 y 10-3
		Environmental Remediation/Decontamination and Decommi		

a. Accidents involving hazardous materials for Alternative A are summarized in Tab
b. Fatal cancer risk = dose y accident frequency y (5.0 y 10-4 fatal cancers per r if dose is <20 rem (ICRP 1991). For doses y20 rem, the ICPR-60 conversion factor i Numbers in parentheses indicate total number of fatal cancers in the population if
c. A facility worker is defined as a worker located 100 m (330 ft) from the point
d. Member of the public on a highway at the nearest point to the facility within t
e. MEI = maximally exposed hypothetical individual whose residence is located at t
f. The safety analysis report utilized for this accident does not provide this inf developed before DOE orders specifically required this information. As demonstrate the MEI, consequences to the public from this accident are less than or comparable from the spent nuclear fuel and high-level waste accidents in Table 5.14-3 with cal doses.

Definition of acronyms:
HFEF - Hot Fuel Examination Facility
MEI - maximally exposed individual at the nearest site boundary
RWMC - Radioactive Waste Management Complex
SDA - Subsurface Disposal Area
WERF - Waste Experimental Reduction Facility
TSA - Transuranic Storage Area

Figure 5.14-6. Potential radiation exposures from accidents to individual at neare

Figure 5.14-7. Risk of fatal cancer to individual at nearest Idaho National Engine

Figure 5.14-8. Excess fatal cancers in exposed population from radiation accidents

a factor of two on the basis of projected waste-handling requirements. Accidents w and construction accidents could occur as a result of proposed actions, for example incineration of low-level and mixed low-level waste at the Waste Experimental Reduc

5.14.4.5 Hazardous Materials.

The consequences of maximum reasonably foreseeable accidents associated with hazardous waste or chemicals would be the same under Alte Plan) as those analyzed under Alternative A (No Action). Lower consequence acciden result of proposed actions.

5.14.4.6 Environmental Remediation and Decontamination and Decommissioning. The incremental risk of

accidents over those assessed in Alternative A (No Action) would be related to expanded environmental remediation and decontamination and decommissioning activities (including construction) on the basis of current plans.

However, accidents associated with environmental remediation at Pit 9 at the Radioactive Waste Management Complex would bound consequences of accid activities on the INEL site. Therefore, the consequences of maximum reasonably for associated with environmental remediation and decontamination and decommissioning a same under Alternative B (Ten-Year Plan) as those analyzed under Alternative A (No

5.14.5 Impacts from Alternative C (Minimum Treatment, Storage, and Disposal)

Secondary impacts are shown in Table 5.14-4. Worker risks are similar to tho Alternative A (No Action); workers near the source of releases have a potential ris accident impacts from several Alternative C (Minimum Treatment, Storage, and Dispos evaluated.

5.14.5.1 Spent Nuclear Fuel.

The incremental risk of accidents over those assessed in Alternative A (No Action) (Section 5.14.3.1) would be related to the eventual shipm of spent nuclear fuel stored at the INEL. During the shipment phase, the additiona may increase the frequency (8.6 times Alternative A), but not the offsite consequen accidents. The decrease in total spent nuclear fuel at the INEL would decrease the associated with storing spent nuclear fuel. For analysis purposes, operations at A Laboratory-West were assumed to continue as in Alternative A, and because of the sh at this facility, Alternative A accidents would continue to bound the design basis accident frequency categories under Alternative C (Minimum Treatment, Storage, and bounding accidents within each frequency category that differ from those specified characteristics (Section 5.14.3.1) are summarized in Table 5.14-7. The Alternative for spent nuclear fuel and other radioactive waste streams are illustrated in Figur 11. After shipment of all spent nuclear fuel offsite, only impacts associated with operations would continue.

5.14.5.2 High-Level Waste.

The consequences of maximum reasonably foreseeable accidents associated with high-level waste facilities would be the same under Alternative C (Storage, and Disposal) as those analyzed under Alternative A (No Action). Lower

Table 5.14-7. Characteristics of radiological accidents at the Idaho National Engi Alternative C (Minimum Treatment, Storage, and Disposal) that differ from those und

Accident	Frequency (events/yr)	Facility worker dose (rem) c	Dose at nearesDose to public access (rem) d	MEIe (rem)	Offsite p dose (per 95% meteo
				Spent Nuclear Fuel Acci	
Fuel-handling accident, pin breach, venting of noble gases and iodine (bounded by HFEF fuel- handling accident)	8.6 y 10-2	(f)	(f)	2.0y 10-3	(f)
			High-Level Waste Accidents - No Ch		
				Transuranic Waste Accid	
Fire in RWMC TSA	4 y 10-5	(f)	(f)	1.0 y 10-6	(f)

Mixed Low-Level/Low-Level Was

Design basis fire at WE2 y 10-3 Waste Storage Building	(f)	(f)	2.8 y 10-3	(f)

Environmental Remediation/Decontamination and Decommi

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a. Accidents involving hazardous materials for Alternative A are summarized in Tab
b. Fatal cancer risk = dose y accident frequency y (5.0 y 10-4 fatal cancers per r doubled, or 1.0 y 10-3 (ICRP 1991). Numbers in parentheses indicate total number o
c. A facility worker is defined as a worker located 100 m (330 ft) from the point
d. Member of the public on a highway at the nearest point to the facility within t
e. MEI = maximally exposed hypothetical individual whose residence is located at t
f. The safety analysis report used for this accident does not provide this informa MEI, consequences to the public from this accident are less than or comparable to t doses.

Definition of acronyms:
HFEF - Hot Fuel Examination Facility
MEI - maximally exposed individual at the nearest boundary
RWMC - Radioactive Waste Management
SDA - Subsurface Disposal Area

Figure 5.14-9. Potential radiation exposures from accidents to individual at neare

Figure 5.14-10. Risk of fatal cancer to individual at nearest Idaho National Engin

Figure 5.14-11. Excess fatal cancers in exposed population from radiation accident

consequence accidents and construction accidents could occur as a result of propose for example, replacement of high-level waste tanks. Replacement tanks would upgrad high-level waste storage at the INEL site. Ultimately, the risk of accidents would tanks would be constructed in accordance with current design requirements, and woul as double wall confinement, leak detection, and seismic-resistant design. The cons increase the likelihood of an industrial accident and worker injury or death. Anot selection of technologies for processing sodium-bearing liquid waste and calcined h discussed under Alternative B.

5.14.5.3 Transuranic Waste.

Under Alternative C (Minimum Treatment, Storage, and Disposal), the majority of transuranic waste stored at the INEL site would be trans storage location. The increased handling necessary to retrieve, package, and trans the INEL site would increase the frequency of fires approximately ten-fold. After wastes offsite, only impacts associated with INEL-generated transuranic wastes woul

5.14.5.4 Mixed and Low-Level Waste.

Under Alternative C (Minimum Treatment, Storage, and Disposal), all stored and newly generated mixed low-level waste/low-level waste offsite for treatment, storage, and disposal. The increased handling necessary to low-level waste/low-level waste from the INEL site would approximately double the f basis fire in the Waste Experimental Reduction Facility Waste Storage Building. Fo only those quantities staged for offsite shipment from operating facilities would r

5.14.5.5 Hazardous Materials.

The frequency and consequences of maximum reasonably foreseeable accidents associated with hazardous wastes and hazardous materials in i same under Alternative C (Minimum Treatment, Storage, and Disposal) as those analyz A (No Action). Under Alternative C, mixed waste with hazardous constituents stored Waste Management Complex would be transported offsite, eventually eliminating that material.

5.14.5.6 Environmental Remediation and Decontamination and Decommissioning.

The frequency and consequences of accidents associated with environmental remediati decontamination and decommissioning activities would be the same under Alternative Treatment, Storage, and Disposal) as those analyzed under Alternative A (No Action)

5.14.6 Impacts from Alternative D (Maximum Treatment, Storage, and Disposal)

Secondary impacts are shown in Table 5.14-4. Worker risks are similar to tho Alternative A (No Action); workers near the source of releases have a potential ris accident impacts from several Alternative D (Maximum Treatment, Storage, and Dispos evaluated.

5.14.6.1 Spent Nuclear Fuel.

The incremental risk of accidents over those assessed in Alternative A (Section 5.14.3.1) would be related to two factors: (a) receipt of a relatively long-cooled spent nuclear fuel, and (b) processing of spent nuclear fuel additional handling necessary to receive and store spent nuclear fuel would be appr under Alternative A. The fuel received would be managed at a new dry storage/canni facility at the Idaho Chemical Processing Plant. The additional fuel-handling and be expected to increase by 20 times the frequency, but not the consequences, of fue Stabilization of the fuel for long-term storage would be performed in a new Waste I the Idaho Chemical Processing Plant. Consequences of potential accidents at the Wa Facility are bounded by spent nuclear fuel activities involving short-cooled fuel a

Fuel processing would take place in the Fluorinel and Storage (FAST) facility Fuel Processing Restoration Facility (CPP-691). Processing would consist of dissol an acid solution, and processing the dissolved fuel to immobilize radionuclides for the basis of accidents previously analyzed in EG&G Idaho (1993), bounding accidents processing are nuclear criticality, dissolver hydrogen explosion, and accidental di fuel.

For analysis purposes, operations at Argonne National Laboratory-West were as as in Alternative A (No Action), and because of the short-cooled fuel handled at th accidents would continue to bound the design-basis and beyond-design-basis accident under Alternative D (Maximum Treatment, Storage, and Disposal). The bounding accid within each frequency category that differ from those specified in Alternative A (S summarized in Table 5.14-8. The Alternative D accident consequences for spent nucl radioactive waste streams are illustrated in Figures 5.14-12, 5.14-13, and 5.14-14.

5.14.6.2 High-Level Waste.

Because of spent fuel processing activities, additional high-level waste would be generated and processed at the Idaho Chemical Processing Plant under (Maximum Treatment, Storage, and Disposal). However, the frequency and consequence associated with high-level waste facilities would be bounded by those analyzed unde Action) because existing calcine facilities would continue to be used, and because upgrades to liquid waste management facilities under Alternative D. Several exampl involving high-level waste (selection of technologies for processing sodium-bearing high-level waste and replacement of high-level waste tanks) were discussed briefly (Ten-Year Plan) and C (Minimum Treatment, Storage, and Disposal), respectively.

5.14.6.3 Transuranic Waste.

The incremental risk of accidents over those assessed in Alternative A (No Action) would be related to the receipt of DOE complex-wide waste treatment, storage, and preparation for shipping for disposal at the Waste Isolatio

Table 5.14-8. Characteristics of radiological accidents at the Idaho National Engi D (Maximum Treatment, Storage, and Disposal) that differ from those under Alternati

Accident	Frequency (events/yr)	Facility worker dose (rem)c	Dose at nearesDose to MEI public access (rem)d	(rem)e	Offs dose 95%
				Spent Nuclear Fuel	
Fuel handling accident, fuel pin breach, venting of noble gases and iodine (bounded by HFEF fuel handling accident)	2.0 y 10-1	(f)	(f)	2.0 y 10-3	(f)
Inadvertent nuclear criticality during processing	g1 y 10-3	9.1	4.9 y 10-2	2.8 y 10-2	5.6
Dissolver hydrogen explosive	1 y 10-5	(f)	(f)	6.3 y 10-4	h8.1
Inadvertent dissolution of 30-day cooled fuel	1 y 10-6	(f)	(f)	3.0 y 10-2	h2.9
			High-Level Waste Accidents - No		
				Transuranic Waste A	
Lava flow over RWMC	2 y 10-5	Evacuate	Evacuate	1.1 y 10-1	1.2
Fire in RWMC TSA	4 y 10-5	(f)	(f)	1.0 y 10-6	(f)
			Mixed	Low-Level/Low-Level	
Fire in RWMC SDA	1 y 10-2	(f)	(f)	4.0 y 10-3	(f)
Design basis fire at WERF Storage Building	1 y 10-2	(f)	(f)	2.8 y 10-3	(f)
		Environmental	Remediation/Decontamination and Dec		

a. Accidents involving hazardous materials for Alternative A (No Action) are summa
b. Fatal cancer risk = dose y accident frequency y (5.0 y 10-4 fatal cancers per r
is <20 rem (ICRP 1991). For doses y20 rem, the ICPR-60 conversion factor is double
1.0 y 10-3. Numbers in parentheses indicate total number of fatal cancers in the p
c. A facility worker is defined as a worker located 100 m (330 ft) from the point
d. Member of the public on a highway at the nearest point to the facility within t
e. MEI = maximally exposed hypothetical individual whose residence is located at t
f. The safety analysis report utilized for this accident does not provide this inf
DOE orders specifically required this information. As demonstrated by the dose to
consequences to the public from this accident are less than or comparable to the co
the spent nuclear fuel and high-level waste accidents in Table 5.14-3 with calculat
g. Idaho Chemical Processing Plant has experienced three inadvertent criticalities
the last one 14 years ago. The frequency shown is based on modern facility design
h. The safety analysis report utilized for this accident used a population of 100,
conditions and wind direction, the projected maximum sector within 50 miles of the
Definition of acronyms:
HFEF - Hot Fuel Examination Facility
MEI - maximally exposed individual at nearest site boundary
RWMC - Radioactive Waste Manage
SDA - Subsurface Disposal Area

Figure 5.14-12. Potential radiation exposures from accidents to individual at near

Figure 5.14-13. Risk of fatal cancer to individual at nearest Idaho National Engin

Figure 5.14-14. Excess fatal cancers in exposed population from radiation accident

Pilot Plant transuranic waste inventory at the INEL site would be increased by appr frequency of fires is assumed to increase by no more than a factor of ten because n the increased handling and storage of waste. The frequency of a lava flow event wo assessed under Alternative A, but the consequences are assumed to increase by a fac Alternative D (Maximum Treatment, Storage, and Disposal) because of the increased i

5.14.6.4 Mixed and Low-Level Waste.

The incremental risk of accidents over those assessed in

Alternative A (No Action) would be related to the receipt of DOE complex-wide waste and disposal. The annual mixed low-level waste/low-level waste volume managed at t increased approximately ten-fold. Waste would be managed by additional inventory t facilities. The frequency of fires is assumed to increase by no more than ten-fold associated with the increased handling and storage of waste. No increase in conseq facilities with the same maximum capacity as assumed under Alternative A would be u consequence of a fire at the Subsurface Disposal Area at the Radioactive Waste Mana assumed to increase ten-fold on the basis of the receipt of additional offsite ship decontamination and decommissioning activities. Accidents associated with incinera Experimental Reduction Facility are the same for this alternative as those consider Year Plan) analyses for low-level and mixed low-level waste streams.

5.14.6.5 Hazardous Materials.

The incremental risk of accidents over those assessed in
Alternative A (No-Action) would be related to two factors: (a) increased inventory Chemical Processing Plant in support of spent fuel processing, and (b) receipt of a containing hazardous constituents. Additional chemicals at the Idaho Chemical Proc fuel processing would be hydrofluoric acid and anhydrous ammonia. As discussed in volume of transuranic waste containing hazardous constituents at INEL would increas frequency of a lava flow event would be the same as that assessed under Alternative consequences are assumed to increase by 20 percent under Alternative D (Maximum Tre Disposal). The bounding accident characteristics that differ from those specified 5.14.3.5) are summarized in Table 5.14-9.

Table 5.14-9. Characteristics of hazardous material accidents at the Idaho Nationa under Alternative D (Maximum Treatment, Storage, and Disposal) that differ from tho (No Action).

Accident	Frequency (events/year)	MEIa chemical concentration (mg/m3)	MEI chemical co (percentage of
Lava flow over Radioactive Waste Management Complex	2 y 10-5	Mercury: 3.6 Nitric acid: 24 Phosgene gas: 0.12	Mercury: 36 Nitric acid: 7 Phosgene gas: 4
Hydrofluoric acid spill at Idaho Chemical Processing Plant	1 y 10-5	0.078	0.2
Anhydrous ammonia release at Chemical Processing Plant	1 y 10-6	82	12

a. MEI - maximally exposed individual at the nearest site boundary.
b. ERPG3 - Emergency Response Planning Guide Level 3 (immediately dangerous to lif

5.14.6.6 Environmental Remediation and Decontamination and Decommissioning.

The
frequency and consequences of accidents associated with environmental remediation a decommissioning activities would be the same under Alternative D (Maximum Treatment Disposal) as those analyzed under Alternative A (No Action).

5.15 Cumulative Impacts and Impacts

from Connected or Similar Actions

Evaluation of cumulative impacts is necessary to develop an understanding of implementation of the alternatives. A cumulative impact is the result of the incre proposed action added to all other past, present, and reasonably foreseeable future actions may include DOE projects not associated with the Spent Nuclear Fuel or Envi and Waste Management (ER&WM) Programs and any offsite projects conducted by governm businesses, or individuals.

Table 5.15-1 lists additional onsite and offsite projects to be assessed. Th largest anticipated future offsite projects identified by the appropriate county ag

Commerce, and local development groups and are commensurate with the level of reaso development within the communities surrounding the INEL. These projects also repre sources of impacts not associated with the proposed actions.

In most cases, cumulative impacts are obtained by combining impacts caused by those caused by other past, present, and reasonably foreseeable future actions. Ho impacts are population-specific and are not appropriate to combine. For example, e cancers for workers as a result of radiological exposures from all facilities at th quantitatively to estimate excess fatal cancers derived from INEL operations; howev inappropriate to combine estimated excess fatal cancers for workers at another loca radiological emissions, such as in Pocatello, Idaho, with those estimated at INEL b populations are almost entirely independent of one another.

Evaluation of cumulative impacts is important because a significant impact ca small actions that, by themselves, do not have significant impacts. Nonhealth-rela

Table 5.15-1. Other projects to be included for assessment of cumulative impacts.

Project	Description
At the Idaho National Engineering Laboratory	
Test Area North-616 Liquid Waste Treatment Support Facility	Facility consists of a one-story cas building (11 y 14 y 4.5 meters high; basement and mechanical penthouse on into an evaporator pit, valve-operat control room, and a vestibule. Base cooling tower; heating/ventilating r facility operated from 1958 to 1970; and decommissioning (D&D) would begi then, facility is in surveillance an environmental assessment.
Test Train Assembly Facility	Located in the basement of the Mater this facility would include removal contaminated shielding water (MTR-60 decontamination of canal walls, floo canal is 2.5 meters (8.0 feet) wide, level, and 37 meters (121.5 feet) lo the reactor building]. Water depth feet). The canal contains irradiate removed prior to D&D. Canal would b level reaches 0.10 rem (10 millirem) be responsibility of D&D project. De in Fiscal Year 1999.
Power Burst Facility	D&D of facility including capping of (4.6 acres)] and remediation of two reactor (in shutdown mode), the Wast for treatment of low-level waste (co of combustible waste), and the Mixed status under the Resource Conservati remains candidate for the site of Bo program should become revitalized.
Underground Storage Tank Upgrade (Argonne National Laboratory-West)	Replacement of two emergency support meet current underground storage tan involve less than 0.8 hectare (2 acr
Fuel Cycle Facility Water Storage and Delivery Improvements (Argonne National Laboratory-West)	Upgrade of existing water system wit in accordance with DOE Order 6431. than 2 hectares (5 acres) of previou
Site Utilities Upgrade (Argonne National Laboratory-West)	General repair on steam condensate s utilities, and communication service hectares (10 acres) of previously di
Experimental Breeder Reactor-II/FCF	Improve fuel handling capabilities o

External Fuel Handling Upgrade (Argonne National Laboratory-West)	Cycle Facility. Improvements would acres) of previously disturbed land.
Fuel Handling and Plant Support (Argonne National Laboratory-West)	Improve fuel handling capabilities f Improvements would involve less than disturbed land.
Offsite	
Housing Development, Idaho Falls	300-unit single family housing devel 61 hectares (150 acres) of vacant la
Business Park, Rexburg	20 hectares (50 acres) of vacant lan facilities are planned for an expans park for 30-40 businesses.
Manufacturer, Pocatello	Existing manufactured home factory t to between 140 and 150 employees. E acres) in Pocatello Airport Industri
Food, Machinery, and Chemical Corp., Pocatello	FMC phosphate manufacturing plant to 4 to 3 within the next two years; 25
Target Department Store, Idaho Falls	Opening of Target discount store and development planned on vacant land n

cumulative impacts are summarized in Table 5.15-2 and discussed in Sections 5.15.1 5.15.9. Transportation-related cumulative health effects and occupational and publ effects are discussed in Sections 5.15.7 and 5.15.8.

5.15.1 Land Use

Implementation of any of the alternatives would contribute to the cumulative space land use. As discussed in Section 5.2, Land Use, the maximum amount of space disturbed on the INEL site would be 1,339 acres (542 hectares) under Alternative D Storage, and Disposal). A list of activities that are unrelated to the alternative place at the INEL and in nearby communities is presented in Table 5.15-1. While ex not available, over 200 acres (80 hectares) of vacant land in nearby communities ar development. It is unknown what types of land uses currently exist on this vacant potentially disturb previously disturbed land are scheduled to take place on more t the INEL site. None of these other activities would create irreversible or irretri except for a project at the Power Burst Facility that would cap a currently existin [approximately 5 acres (2 hectares)] containing buried radioactive items.

Combining the acreage of onsite and offsite projects, less than 1,500 acres (undeveloped land would be disturbed. The five-county region (Bingham, Bonneville, Clark counties) in which the INEL site is situated contains approximately 795,000 a of land classified as barren. In addition, approximately 791,500 acres (320,000 he forest or wetland, and another 2,945,700 acres (1,192,000 hectares) are classified 1986, Bonneville County 1976, Butte County 1976, Clark County 1994, Jefferson Count County 1990). Combined, these acreages make up more than 75 percent of the land us disturbance of undeveloped land that would take place as a result of activities at offsite activities would represent about 0.03 percent of the five-county land uses

Table 5.15-2. Nonhealth-related cumulative impacts by resource area and alternative

Discipline	Alternative A (No Action)
Land use/ amount of land not available for other use	Small compared to regional land uses
Socioeconomics/ change in number of total jobs	Overall decrease o 4,808

Cultural resources/minimum number of potentially historic structures/archaeological sites disturbedb		6 structures and 0 sites
Air resourcesc		Below applicable standards
Water resources/water usage		Negligible
Ecological resources/acreage loss		285
Waste management/waste volume total pending dispositionf	High-leveld,e	12,100 m3
	Transuranicg	67,000 m3
	Mixed low-level	17,000 m3
	Low-levelg	46,000 m3
	Hazardouse	12,000 m3
	INELg industrial	540,000 m3

a. Treatment, storage, and disposal.
b. Numbers for archaeological sites potentially impacted would be expected to incre surveys are conducted for onsite and offsite projects on acreage previously unsurve
c. See Health and Safety (Section 5.15.8 and associated table) for cumulative healt
d. High-level waste includes both liquid and calcine forms. Liquid high-level wast which would increase these reported totals by some degree. Numbers represent all h
e. Numbers represent total volume stored onsite.
f. Derived in Freund (1994), Morton and Hendrickson (1995).
g. Numbers do not include existing dispositioned waste stored or buried onsite.

5.15.2 Socioeconomics

The cumulative impact on regional employment under implementation of any of t would be an overall decline during the ten-year timeframe of this EIS (see Table 5. implementation of any of the alternatives would generate temporary increases in emp region surrounding INEL, primarily due to construction activities. The magnitude o on regional employment under implementation of any of the alternatives is not expec notably affect the socioeconomic resources of the region.

Alternatives B (Ten-Year Plan) and D (Maximum Treatment, Storage, and Disposa to generate moderate employment increases through fiscal year 2004, while Alternati (Minimum Treatment, Storage, and Disposal), which include phaseout of the Expended ultimately result in employment declines.

Based on currently available data, it is expected that additional employment larger offsite projects planned to occur in the communities surrounding INEL (Table implementation, the offsite projects could contribute approximately 280 jobs to the However, the expected future declines in baseline employment at the INEL would more increases associated with Alternatives B (Ten-Year Plan) and D (Maximum Treatment, Disposal) and the offsite projects. The level of the cumulative employment effect jobs under Alternative A (No Action), representing a 4.1-percent decline in total r

loss of 1,167 jobs under Alternative D, representing a 1.0-percent decline in total

The magnitude of the cumulative effect on regional employment under implement alternatives is not expected to be sufficient to adversely affect the socioeconomic Potential population declines associated with the cumulative effect on regional emp represent less than 2 percent of the total regional population. It is unlikely tha size would generate any notable long-term adverse impacts to housing, community ser in the region. Further discussion regarding potential impacts to population and co found in Section 5.3, Socioeconomics.

5.15.3 Cultural Resources

The types of cumulative impacts on cultural resources are the same for all al under each of the alternatives, when combined with associated offsite activities (s reduce the number of cultural resources in southeastern Idaho. However, surveying, archaeological and historic sites and structures at the INEL site would increase sc region's cultural resources; although stabilizing prehistoric resources may adverse to the Native American groups because it interrupts the natural deterioration of si these groups. The unchecked deterioration of both structures and historical docume the INEL site could have a long-term adverse impact on these resources. Long-term due to the loss of traditional resources. Cumulative impacts associated with Alter and Alternative D (Maximum Treatment, Storage, and Disposal) have the greatest pote Alternative A (No Action) would have the least impact.

5.15.4 Air Resources

The cumulative impacts of radiological and nonradiological air emissions have each of the four alternatives (see Section 5.7, Air Resources) and for individual w within each alternative. These impacts are assessed for emissions from maximum ope facilities, construction and operation of new facilities, demolition activities ass and decommissioning of existing facilities, environmental restoration activities, a vehicular traffic and heavy equipment operation within the INEL.

For radiological emissions, all impacts at onsite and offsite locations are w standards and are a small fraction of the dose received from natural background sou an offsite individual is associated with Alternative D (Maximum Treatment, Storage, about 0.0008 rem (0.8 millirem) per year. When added to the maximum baseline dose millirem) per year, this dose remains well below the dose limit of 0.01 rem (10 mil the National Emissions Standards for Hazardous Air Pollutants. This dose is consid the cumulative emissions from existing and proposed sources at the INEL, as well as origin (notably, the Food, Machinery and Chemical Corp. phosphorus plant in Pocatel releases polonium-210 and other naturally occurring radionuclides in airborne efflu dose to the collective population is about 4 person-rem per year, about half of whi incineration of transuranic waste under Alternative D (Maximum Treatment, Storage, risks related to radiological doses from the airborne pathway are discussed in Sect

Cumulative nonradiological impacts are expressed in terms of concentrations o pollutants in ambient air (that is, locations to which the public has access, such boundary and along public roads traversing the site) and general deterioration of e boundary locations, the highest predicted concentrations of criteria pollutants [fr Treatment, Storage, and Disposal)] remain well below applicable air quality standar public road locations within the INEL boundary could increase significantly from cu a major project or combustion source is located relatively close to a public road, applicable standards. Offsite levels of toxic air pollutants are below applicable

The incremental impacts at onsite locations of toxic air pollutant emissions occupational standards in all cases. However, when the cumulative effect of maximu considered, the highest predicted level of benzene (near gasoline storage tanks at is slightly above the occupational exposure limit.

Cumulative impacts related to ozone formation and stratospheric ozone depleti levels considered "significant" by State or Federal standards. The potential for visibility at Craters of the Moon Wilderness Area has been found to exist under wor conditions (see Section 5.7.4.3, Regulatory Compliance Evaluation). If confirmed b these impacts would be averted by more extensive use of emission control equipment nitrogen dioxide emissions or by relocation of specific projects to onsite location of the Moon. Potential visual impacts would be further defined and resolved during

before projects could proceed.

5.15.5 Water Resources

Cumulative impacts to water quality are the same for all alternatives. Past resulted in some adverse impacts to water resources, but primarily in isolated area boundaries. These impacts are observed in the tritium, strontium-90, and iodine-12 of the plumes have concentrations above the U.S. Environmental Protection Agency's standards. Future predictions beyond the timeframe of this EIS show that concentra plumes would decrease with time and, by 2035, only iodine-129 would be present abov contaminant levels. No contaminants are predicted to migrate past the INEL site bo concentrations exceeding the maximum contaminant levels. Compared to previous prac projects under the alternatives and reasonably foreseeable future actions listed in result in concentrations above the U.S. Environmental Protection Agency's maximum c beyond the INEL site boundaries, and impacts are expected to have a minimal effect

The INEL's contribution to the cumulative impact on regional water quality as nonradiological contamination is far less than contributions from other commercial, agricultural activities (such as pesticides and fertilizer use), which have impacte water supplies in the communities surrounding the INEL site (IDHW 1994). Therefore the INEL to the cumulative impact on regional groundwater quality is expected to be

Water usage from all INEL operations and proposed projects would have a negli quantity of water in the aquifer. Given that 1.77 billion cubic meters (470 billio under the INEL site every year (Robertson et al. 1974), the maximum cumulative incr approximately 0.43 percent of the volume of water passing under the INEL site.

5.15.6 Ecological Resources

The types of cumulative impacts on ecological resources would be the same for However, the scale of the impacts could vary because of the differences in scale am Section 5.9, Ecology). At least an additional 8 hectares (20 acres) of previously disturbed on the INEL site from activities not associated with the proposed action, (200 acres) of habitat would be disturbed in nearby communities. Therefore, the mi habitat and vegetation for each alternative would be 105 hectares (260 acres) under Action), 333 hectares (823 acres) under Alternative B (Ten-Year Plan), 233 hectares Alternative C (Minimum Treatment, Storage, and Disposal), and 631 hectares (1,560 a Alternative D (Maximum Treatment, Storage, and Disposal). Other potential effects, productivity and reduced biodiversity on the disturbed acres, would include additio animals from the disturbed habitat and habitats in close proximity. Some habitat f however, it should be limited because the new construction would be contiguous or w residential, or commercial areas. Potential impacts from traffic would be slightly transport could result in 2 to 20 more vehicles per day (assuming no transport by r Rail shipments for all alternatives could increase over current levels, thereby inc collisions with wildlife.

5.15.7 Transportation

5.15.7.1 Radiological Impacts.

The cumulative impacts of the transportation of radioactive material consist of impacts from (a) historical shipments of waste and spent nuclea the alternatives evaluated in this EIS, (c) reasonably foreseeable actions that inc radioactive material, and (d) general radioactive materials transportation that is action. Table 5.15-3 lists these existing and reasonably foreseeable activities as cumulative impact of transportation. The assessment of cumulative transportation i the cumulative impacts of offsite transportation, because offsite transportation yi general population than does onsite transportation. The collective dose to the gen was the measure used to quantify cumulative transportation impacts. This measure o because it can be directly related to estimates of cancer fatalities using a cancer of the difficulty in identifying a maximally exposed individual for shipments that over the U.S. over an extended period of time, 1953 through 2005 (53 years).

Collective doses from historical shipments of waste and spent nuclear fuel to

summarized in Maheras (1994). The historical waste shipments consisted of shipment generators to the INEL Radioactive Waste Management Complex from 1957 through 1993.

Table 5.15-3. Other activities to be included for assessment of cumulative impacts

Activity	Description
	Existing activities
Historical shipments to INEL	Historical shipments of radioactive waste spent nuclear fuel, and test specimens to
General transportation	Nation-wide shipment of radioactive mater medical, industrial, fuel cycle, and disp purposes
Reasonably foreseeable activities	
Geological repository	Shipments of commercial spent nuclear fue defense high-level waste to a geologic re
Waste Isolation Pilot Plant	Shipments of transuranic waste to the Was Isolation Pilot Plant at Carlsbad, New Me (including a 5-year test phase and 20-yea phase)
Submarine reactor compartments	Shipments of reactor compartments from Pu Sound Naval Shipyard to Hanford
Return of cesium-137 isotope capsules	Shipments of isotope capsules to the Hanf
Uranium billets	Shipment of low-enriched uranium billets Hanford Site to the United Kingdom

These data were linearly extrapolated back to 1954, the year that transuranic waste Radioactive Waste Management Complex from the Rocky Flats Plant, because data for 1 were not available.

The historical shipments of spent nuclear fuel to the INEL site consisted of nuclear fuel and test specimens from 1957 through 1995 (see Attachment A to Appendi this EIS). No extrapolation of naval shipments was necessary because a detailed re all shipments. Historical spent nuclear fuel also consisted of shipments of other the INEL besides naval shipments, such as research reactor spent nuclear fuel, comm and Three Mile Island core debris. Data for these shipments were available for 197 linearly extrapolated back to 1953, the start of operations at the Idaho Chemical P data for 1953 through 1972 were not available.

For workers, historical offsite shipments of waste and spent nuclear fuel to collective dose of 110 person-rem or 0.044 cancer fatalities. For the general popu shipments of waste and spent nuclear fuel to the INEL site yielded a collective dos 0.030 cancer fatalities.

There were considerable uncertainties in these historical estimates of collec the population densities and transportation routes used in the dose assessments wer 1990 and the U.S. highway and rail system as it existed in 1993. Using census data historical collective doses because the U.S. population has continuously increased these assessments. Basing collective dose estimates on the U.S. highway and rail a result in slightly underestimated doses for shipments that occurred in the 1950s an portion of the transport routes would have been on noninterstate highways where the been slightly closer to the road. Data were not available that correlated transpor densities for the 1950s, 1960s, and 1970s; so it was necessary to use more recent d estimates. By the 1970s, the structure of the interstate highway system was largel shipments would have been made on interstates.

Shipment data were linearly extrapolated for years when data were unavailable in uncertainty. However, this technique was validated by linearly extrapolating th 1973 through 1989 to estimate the number of shipments that took place over 1964 thr contained in SAIC 1991). The 1973-through-1989 time period corresponded to the tim were available for the Idaho Chemical Processing Plant. The data in SAIC (1991) co because only shipment counts were presented for 1964 through 1982 and no origins or listed for years prior to 1983. Based on the data in SAIC (1991), linearly extrapo through 1989 overestimated the shipments for 1964 through 1972 by 20 percent when c shipment counts for 1964 through 1972.

Collective doses for waste shipments associated with all alternatives are sum Traffic and Transportation, of this volume of the EIS. For truck shipments, the co would range from 120 person-rem (Alternative A, No Action) to 1700 person-rem (Alte Treatment, Storage, and Disposal), or 0.048 to 0.68 cancer fatalities. Collective population would range from 66 person-rem (Alternative A) to 940 person-rem (Altern 0.47 cancer fatalities.

For train shipments, the collective dose to workers would range from 3.2 pers to 48 person-rem (Alternative D), or 0.0013 to 0.019 cancer fatalities. Collective population would range from 4.1 person-rem (Alternative A) to 58 person-rem (Altern 0.029 cancer fatalities.

Collective doses for spent nuclear fuel shipments associated with all alterna Section 5.11, Traffic and Transportation, of this volume of the EIS. For truck shi to workers would range from 1.5 person-rem (Alternative A) to 1000 person-rem (Alte Centralization at Savannah River), or 0.0006 to 0.4 cancer fatalities. Collective population would range from 0.34 person-rem (Alternative A) to 2400 person-rem (Alt Centralization at Savannah River), or 0.00017 to 1.2 cancer fatalities. (See Volum discussion of the Centralization Alternative discussed in this section.)

For train shipments, the collective dose to workers would range from 1.5 pers to 150 person-rem (Alternative 5, Centralization at Nevada Test Site), or 0.0006 to Collective dose to the general population would range from 0.34 person-rem (Alterna rem (Alternative 5, Centralization at Savannah River), or 0.00017 to 0.095 cancer f

Transportation impacts may also result from reasonably foreseeable projects. projects that would involve transportation of radioactive material are (a) shipment defense high-level waste to a geologic repository and (b) proposed shipments of tra Waste Isolation Pilot Plant, located in Carlsbad, New Mexico. The U. S. DOE is pre Yucca Mountain, Nevada, site to determine its suitability for a geologic repository nuclear fuel and defense high-level waste; therefore, the geologic repository was a Yucca Mountain, Nevada, for the transportation cumulative impacts analysis.

Based on the transportation dose assessments presented in DOE (1986), the wor for truck shipments to a repository was 8,600 person-rem or 3.4 cancer fatalities. general population from truck shipments to a repository was 48,000 person-rem or 24 worker collective dose for train shipments to a repository was 750 person-rem or 0. collective dose to the general population from train shipments to a repository was cancer fatalities.

Based on the transportation dose assessments presented in DOE (1990), the wor from truck shipments to the Waste Isolation Pilot Plant was 1,900 person-rem or 0.7 collective dose to the general population from truck shipments to the Waste Isolati 1,500 person-rem or 0.75 cancer fatalities. The worker collective dose from train Isolation Pilot Plant was 180 person-rem or 0.072 cancer fatalities. The collectiv population from train shipments to the Waste Isolation Pilot Plant was 990 person-r fatalities. These collective doses included the 5-year Test Phase and the 20-year

There are also other reasonably foreseeable projects that involve limited tra material: (a) shipments of submarine reactor compartments from the Puget Sound Nava Hanford Site for burial, (b) return of cesium-137 isotope capsules to the Hanford S uranium billets from the Hanford Site to the United Kingdom. Doses for these propo summarized in Table 5.15-4.

There are also general transportation activities that take place that are unr evaluated in this EIS or to reasonably foreseeable actions. Examples of these acti radiopharmaceuticals to nuclear medicine laboratories and shipments of commercial l waste to commercial disposal facilities. The U. S. Nuclear Regulatory Commission e shipments based on a survey of radioactive materials transportation published in 19 Categories of radioactive material evaluated in NRC (1977) included (a) limited qua medical, (c) industrial, (d) fuel cycle, and (e) waste. The U. S. Nuclear Regulato that the annual collective worker dose for these shipments was 5,600 person-rem or annual collective general population dose for these shipments was estimated to be 4 cancer fatalities. Because comprehensive transportation doses were not available, estimates were

Table 5.15-4. Cumulative transportation-related radiological collective doses and 2005).

Categorya	Collective occupational dose (person-rem)	Collective general population do (person-rem)
Historical		
Waste (1954-1995)	47	28
DOE spent nuclear fuel (1953-1995)	56	30
Naval spent nuclear fuel (1957-1995)	6.2	1.6

Alternatives A-D		
Waste shipments for Alternatives A-D		
Truck (100 percent)	120-1700	66-940
Train (100 percent)	3.2-48	4.1-58
Spent nuclear fuel shipments for Alternatives A-D		
Truck (100 percent)	1.5-1000	0.34-2400
Train (100 percent)	1.5-150	0.34-190
Reasonably Foreseeable Actions		
Geologic Repositoryc		
Truck	8,600	48,000
Train	750	740
Waste Isolation Pilot Plantd		
Test Phase	110	48
Disposal Phase		
Truck	1800	1500
Train	68	940
Submarine Reactor Compartmentse	(b)	0.053
Return of Cesium-137 Isotope Capsulesf	0.42	5.7
Uranium Billetsg	0.5	0.014
General Transportation		
1953-1982	170,000	130,000
1983-2005	39,000	42,000
Summary		
Historical	110	60
Waste shipments for Alternatives A-D		
Truck (100 percent)	120-1700	66-940
Train (100 percent)	3.2-48	4.1-58
Spent nuclear fuel shipments for Alternatives A-D		
Truck (100 percent)	1.5-1000	0.34-2400
Train (100 percent)	1.5-150	0.34-190
Reasonably foreseeable actions		
Truck	11,000	50,000
Train	820	1700
General transportation (1953-2005)	210,000	170,000
Total collective dose	220,000	220,000
Total cancer fatalities	88	110

a. LLW = low-level waste; MLLW = mixed low-level waste; TRU = transuranic waste.
b. Information not available.
c. Reference: DOE (1986).
d. Reference: DOE (1990).
e. Reference: USN (1984).
f. Reference: DOE (1994).
g. Reference: DOE (1992).

used to estimate transportation collective doses for 1953 through 1982 (30 years). included spent nuclear fuel and radioactive waste shipments.

Based on the transportation dose assessments in NRC (1977), the cumulative tr collective doses for 1953 through 1982 were 170,000 person-rem for workers and 130, the general population. These collective doses correspond to 68 cancer fatalities fatalities for the general population.

In 1983, another survey of radioactive materials transportation in the U.S. w al. 1985). This survey included U.S. Nuclear Regulatory Commission and Agreement S U.S. DOE. Both spent nuclear fuel and radioactive waste shipments were included in al. (1991a,b) used the survey by Javitz et al. (1985) to estimate collective doses The transportation dose assessments in Weiner et al. (1991a,b) were used to estimat 1983 through 2005 (23 years). The interval 1995 through 2005 corresponds to the in associated with the ER&WM activities evaluated in this EIS.

Weiner et al. (1991a) evaluated eight categories of radioactive material ship industrial, (b) radiography, (c) medical, (d) fuel cycle, (e) research and developm and (h) other. Based on a median external exposure rate, an annual collective work rem and an annual collective general population dose of 1400 person-rem were estima doses correspond to 0.56 and 0.7 cancer fatalities/year for workers and the general Over the 23-year time period from 1983 through 2005, the collective worker and gene would be 32,000 person-rem or 13 and 16 cancer fatalities for workers and the gener respectively.

Weiner et al. (1991b) also evaluated six categories of radioactive material s industrial, (b) radiography, (c) medical, (d) research and development, (e) unknown a median external exposure rate, an annual collective worker dose of 290 person-rem general population dose of 450 person-rem were estimated. These collective doses c 0.23 cancer fatalities/year for workers and the general population, respectively. from 1983 through 2005, the collective worker dose would be 6,700 person-rem and th collective dose would be 10,000 person-rem or 2.7 and 5 cancer fatalities for worke population, respectively.

Like the historical transportation dose assessments, the estimates of collect transportation also exhibited considerable uncertainty. For example, data for 1975 transportation activities from 1953 through 1982. This approach probably overestim amount of radioactive material that was transported in the 1950s and 1960s was less was shipped in the 1970s. For example, in 1968, the shipping rate for radioactive estimated to be 300,000 packages/year (Patterson 1968); in 1975 this rate was estim packages/year (NRC 1977). However, because comprehensive data that would enable a transportation dose assessment to be made were not available, the dose estimates de Nuclear Regulatory Commission were used.

The total worker and general population collective doses are summarized in Ta collective worker doses from all types of shipments (historical, the alternatives, actions, and general transportation) were estimated to be 220,000 person-rem (88 ca period of time 1953 through 2005 (53 years). Total general population collective d to be 220,000 person-rem (110 cancer fatalities). The majority of the collective d general population was due to general transportation of radioactive material. The fatalities from 1953 through 2005 was estimated to be 200. Over this same period o approximately 16,000,000 people will die from cancer, based on 300,000 cancer death The transportation-related cancer deaths are 0.0013 percent of this total.

5.15.7.2 Vehicular Accident Impacts.

Fatalities that involved the shipment of radioactive materials were surveyed for 1971 through 1993 using the Radioactive Material Incide (Cashwell and McClure 1992), which includes accident data from the U. S. Department S. Nuclear Regulatory Commission, U. S. Department of Energy, and state radiation c 1971 through 1993, 21 vehicular accidents involving 36 fatalities occurred. These resulted from vehicular accidents and were not associated with the radioactive natu radiological fatalities due to transportation accidents have ever occurred in the U of time, over 1,000,000 persons were killed in vehicular accidents in the U. S.

For all alternatives, 0.35 to 4.8 vehicular accident fatalities were estimate year time period from 1995 through 2005, approximately 400,000 people will be kille in the U.S.

5.15.8 Health and Safety

A number of potential exposure pathways exist by which radioactive materials could affect workers onsite or could be transported to offsite environments. The a principal pathway by which radioactive materials released on the INEL site could re the public.

A summary of the health effects from these individual exposure pathways is pr 5. The health effects from radiation exposure are presented as the estimated numbe affected population. The health effects for chemical carcinogens are presented as lifetime cancers in the affected population. For exposure to noncarcinogenic chemi presented as estimated fatalities. It is important to note that with the exception exposures, these data are estimations derived from modeling analysis. Occupational calculated from actual dosimeter measurements of INEL personnel. The methodology f calculations and a summary of results are provided in Appendix F, Section F-4, Heal numerical results for these calculations are tabulated in Section 5.12, Health and

Although highly unlikely, it is possible that an individual could simultaneou exposure from more than one of the environmental pathways listed in Table 5.15-5. maximally exposed onsite worker could also reside at the site boundary and theoreti highest onsite and offsite chemical and/or radionuclide concentrations. However, a individual were exposed to both maximum modeled onsite and offsite radiation doses, cumulative dose over the ten-year period would range from approximately 0.0047 rem Alternative A (No Action) to 0.0133 rem (13.3 millirem) for Alternative D (Maximum and Disposal). These potential radiation doses would be in addition to natural bac averages about 0.35 rem (350 millirem) per year [3.5 rem (3500 millirem) over 10 ye

Table 5.15-5. Health-related cumulative impacts by alternative.

	Pathway	Type of impact	Alternative A (No Action)	Alternative (Ten-Year P
Radiologicala				
Public	Atmospheric	Estimated excess fatal cancers	<1	<1
	Groundwater	Estimated excess fatal cancers	<1	<1
	Biotic	Estimated excess fatal cancers	<1	<1
Workersc	Atmospheric	Estimated excess fatal cancers	Negligible	Negligible
	Occupational exposures	Estimated excess fatal cancers	1	1
Nonradiologicala				
Public	Atmospheric (Carcinogens)	Estimated lifetime cancers	<1	<1

	Atmospheric (Noncarcino-gens)	Estimated adverse health effects	0	0
Workers	Atmospheric (Carcinogens)	Estimated lifetime cancers	<1	<1
	Atmospheric (Noncarcino-gens)	Estimated adverse health effects	0	0
	Routine workplace safe hazards	Estimated fatalities	3	3

a. Approximate numbers. See Section 5.12, Health and Safety, and Appendix F-4, Hea
b. Treatment, storage, and disposal.
c. Estimated excess fatal cancers calculated from dosimeter measurements.

This section provides a brief discussion of the historical radiation releases doses associated with the operation of the INEL. The cumulative impacts of occupat health are discussed in Sections 5.15.8.2 and 5.15.8.3, respectively. Detailed dis doses to the public through the air and water pathways are found in Section 5.12.1. occupational and offsite population doses are discussed in Section 5.15.7.

5.15.8.1 Historical Dose Perspective.

Historical offsite airborne radiation doses associated with the operation of the INEL were evaluated and summarized in the Idaho National Historical Dose Evaluation (DOE-ID 1991). The total amount of radioactivity releas activities is summarized in Figure 5.15-1. The total amounts of radioactivity show a wide variety of radionuclides associated with normal operations. Each radionucli results in a different radiation dose for each curie released. For this reason, th directly proportional to radiation dose or any other measure of environmental impac on the individual radionuclides released and resulting radiation dose appears in DO

While not directly related to radiation dose, the total amounts of radioactiv 5.15-1 provide a useful illustration of the historical patterns of radioactive rele Evaluation of these data indicates that the total amount of radioactivity associate releases at the INEL site was largest during the late 1950s and early 1960s and, si releases have decreased dramatically. For example, the largest release of radioac during the 1981-to-1991 timeframe was about one-tenth of the 1,500,000 curies relea historical peak year (DOE-ID 1991).

Estimated radiation doses from airborne releases over the operating history o always been within the radiation protection standards applicable at that time. Off and episodic releases during the late 1950s may have been as high as 9 percent of t standard [0.5 rem (500 millirem)] (DOE-ID 1991). Since 1985, when more restrictive place, offsite doses to a maximally exposed individual were only about 1 percent of dose standard [0.025 rem (25 millirem)]. Furthermore, doses from airborne releases history of the INEL site have been small compared to doses from sources of natural the vicinity of the INEL site (DOE-ID 1991).

<u>Figure 5.15-1. Annual quantity of radionuclides released at the Idaho National Eng</u>

Though historical records of accidents at the INEL are available, occupational dose and reported. Worker dose data are currently being collected and analyzed under a Occupational Safety and Health program. An assessment of the cumulative impacts of the health of INEL workers is not available at this time.

Liquid-borne radioactive effluents from the INEL have not, to this time, prod exposure to an offsite member of the public living in the vicinity of the INEL. In materials have been disposed of directly to the Snake River Plain Aquifer through i

practice was discontinued in 1984. Radiological and nonradiological effluents attr operations have not been detected in wells beyond the INEL site boundary nor has th dose to an offsite member of the public through the Snake River Plain Aquifer pathw

Some potential biotic pathways (animals and vegetation) also exist at the INE biotic pathway has been game animals that can assimilate some radioactivity onsite. probability of a hunter shooting one of these animals shortly after the animal migr The potential for radiation dose to people offsite through game animals, although u 0.01 rem (10 millirem) per hunting season (DOE-ID 1991).

5.15.8.2 Occupational Health.

The activities to be performed by workers under each of the alternatives are similar to those currently performed at each site. Therefore, the in the work place would be similar to those that currently exist. For these reason radiation dose and the number of reportable cases of injury and illness are anticip the number of workers employed under each alternative (see Appendix F-4, Health and pathway, by which radioactive materials released on the INEL site could affect work found to add negligible amounts to actual measured data.

Based on occupational radiation monitoring results, the average reportable ra worker is about 0.027 rem (27 millirem) per year [0.27 rem (270 millirem) over the EIS). In addition, there is a potential for small additional radiation dose due to INEL facilities. For the maximally exposed worker, the additional dose over the pe could range from 0.0033 rem (3.3 millirem) for Alternative A (No Action) to 0.0063 Alternative D (Maximum Treatment, Storage, and Disposal). These potential radiatio addition to natural background radiation which averages about 0.35 rem (350 millire (3500 millirem) over 10 years].

For each alternative, occupational radiation dose received by the entire INEL 10,000 workers) from 1995 to 2005 would result in about one fatal cancer. The natu fatal cancers in the same population from all other causes would be about 2,000.

For the evaluation of occupational health effects from chemical emissions, th concentration was compared with the applicable occupational standard. Modeled conc occupational standards were considered acceptable. As a result, no adverse health are projected as a result of normal chemical emissions.

Routine workplace safety hazards can also result in injury or fatality. Tota for INEL workers are comparable to those for DOE and its contractors, which average worked. For comparison, rates in private industry across the U.S. are 8.4 per 200,

For each alternative, about three fatalities would result in the entire INEL workers) from 1995 to 2005 due to workplace safety hazards. Estimates differ only alternatives because the total number of workers for all alternatives is similar.

These analyses indicate that the cumulative impacts of radiological health ef health effects, and workplace safety hazards to the INEL workforce would be similar combined occupational risks are less than those encountered by the average worker i

5.15.8.3 Public Health.

The airborne pathway is the principal pathway by which radioactive materials released on the INEL site can reach an offsite member of the public. The dose to the public in the vicinity of the INEL site due to atmospheric releases is For the maximally exposed member of the public, the additional radiation dose over 2005 could range from 0.0014 rem (1.4 millirem) for Alternative A (No Action) to 0. for Alternative D (Maximum Treatment, Storage, and Disposal). These potential radi addition to natural background radiation, which averages about 0.35 rem (350 millir (3500 millirem) over 10 years]. For each alternative, less than one fatal cancer w dose received by the population within 50 miles (80 km) of the INEL site from 1995 lifetime incidence of fatal cancers in the same population from all other causes wo a population of 120,000.

Other regional sources of atmospheric radioactivity have the potential to con dose of the public near the INEL. The primary source is emissions from phosphate p Pocatello, Idaho. These emissions have been evaluated by the U.S. Environmental Pr 1989). The number of fatal cancers in the population within 50 miles (80 km) of Po one over a ten-year period comparable to that covered in this EIS. The population impact of both facilities would be small.

In addition to radiation dose from atmospheric emissions, there is a potentia

public from exposure to carcinogenic chemicals released to the air. The highest ri
alternative are small compared to the risks from radioactive releases and imply les
the exposed population over the ten-year period covered in the EIS. There is no ba
evaluating risks from chemical exposure from other regional commercial, industrial,
such as combustion of diesel and gasoline fuels and agricultural uses of pesticides

The volume of surface water that flows from the INEL site to offsite areas is
liquid discharges from INEL operations to the intermittent streams in the vicinity.
impacts from the surface water pathway on public health is negligible.

Past disposal of radioactive effluents to surface infiltration ponds and deep
contamination to the Snake River Plain Aquifer. Effluent from these sources percol
bedrock or was directly injected into the Snake River Plain Aquifer. Based on anal
practices, the collective dose to an offsite member of the public through the Snake
pathway over the period 1995 to 2005 would be negligible. Currently,
radioactive liquid effluents are not discharged directly to the aquifer from operat
effluents to infiltration ponds is monitored for the presence of radioactive and ch
required under Federal and State regulations.

5.15.9 Waste Management

Table 5.15-2 presents, by waste stream for each alternative, the total volume
projected to be generated at or shipped to the INEL site that would be pending disp
timeframe of this EIS. The conversion of liquid high-level waste to calcine is sch
ten-year period of this EIS, but no provision to satisfy the requirement to cease t
storage tanks has been incorporated under Alternative A (No Action). Existing disp
buried onsite includes approximately 145,000 cubic meters (190,000 cubic yards) of
about 62,000 cubic meters (81,000 cubic yards) of transuranic waste (Pole et al. 19
of INEL industrial waste deposited previously in the INEL Landfill Complex is unkno
the Landfill Complex would provide adequate capacity for the next 30 to 50 years (s
Background). Furthermore, the capacity of the Landfill Complex may be prolonged as
onsite recycling program (see Chapter 2, Background). Without available treatment
Alternative A, it is anticipated that the permitted storage capacity for mixed low-
exceeded during the first year of the 10-year timeframe of the EIS. All other alte
construction for storage or shipping of mixed low-level waste; therefore, storage c

5.16 Adverse Environmental Effects Which Cannot Be Avoided

The construction and operation of facilities under any of the four alternativ
result in some adverse impacts to the environment. Changes in project design and o
example, sound engineering practices during construction) could eliminate, avoid, o
minimal levels (see Section 5.19, Mitigation); this section only includes discussio
potential mitigation measures could not reduce or avoid. These adverse effects are
each of the alternatives.

5.16.1 Cultural Resources

The unchecked deterioration of both structures and historical documents on nu
INEL site could have a long-term adverse impact on these resources. However, some
impacts could be avoided by preserving the historic value of the property through a
conducting limited rehabilitation on these structures. Adverse impacts related to
potentially significant historic structures could occur under Alternatives A (No Ac
Treatment, Storage, and Disposal). Under either of these alternatives, nine potent
structures could be affected. Impacts to eight structures have been addressed in a
Agreement between DOE, the Advisory Council on Historic Preservation, and the State
Office (DOE 1993). Adverse impacts may also occur to archaeological sites of impor
Americans and areas or resources of traditional or religious importance.

Unavoidable adverse impacts under Alternatives B (Ten-Year Plan) and D (Maxim
Storage, and Disposal) are the same as those described under Alternative A (No Acti
potentially important significant archaeological sites and an additional 70 potenti
structures could be affected. Although most adverse effects to sites can be mitiga
effects to sites that are important to Native American groups may remain adverse.

5.16.2 Aesthetic and Scenic Resources

Potential impacts related to visibility impairment at Craters of the Moon Wil of nitrogen dioxide emissions are associated with each alternative. These impacts and resolved during the air permitting process before projects could proceed.

5.16.3 Air Resources

Construction and remediation activities would result in short-term, elevated matter in localized areas. During the operational phases of specific projects, emi criteria pollutants, and toxic air pollutants may result in some degradation of air would be below applicable standards established for public health and welfare.

5.16.4 Water Resources

An unavoidable adverse impact of all alternatives would be that contaminant r include comprehensive remediation of all contaminated media and areas. Although Al Action) would use the least amount of water and would produce the least amount of w impacts for water resources would be slightly greater under Alternative A because o remediation projects that would be completed under this alternative.

5.16.5 Ecology

Unavoidable impacts to biota under Alternative A (No Action) would result fro approximately 16 hectares (40 acres) of terrestrial habitat: 2 hectares (5 acres) o hectares (35 acres) of previously disturbed habitat that is of low quality and limi or displacement of species would include those species that are less mobile such as insects, and rodents. An increase in the potential mortality from train/wildlife c anticipated. Nesting birds could also be adversely impacted if construction activi nesting seasons. Short-term adverse impacts could potentially include temporary el hazardous materials and radionuclides to biota during and immediately after soil re Residual radionuclides and hazardous materials from past activities, not part of th still be potentially consumed by animals and absorbed by plants. These materials m individual animals or plants, but have not historically resulted in measurable impa the INEL site.

Unavoidable adverse impacts to biota in previously disturbed habitat under Al Plan) would be similar to those described for Alternative A, but on a larger scale Ecology. Utilization of additional acreage increases the amount of habitat loss an would have the potential to increase habitat fragmentation on the INEL site.

Unavoidable adverse impacts to biota under Alternative C (Minimum Treatment, Disposal) would be similar to those described for Alternative A; about 94 hectares disturbed land would be cleared for construction activities. Of the total 144 hect disturbed, 49 hectares (122 acres) would be in previously undisturbed habitat.

Unavoidable adverse impacts under Alternative D (Maximum Treatment, Storage, would be similar to those described for Alternatives A and B; however, the scale wo 5.9, Ecology).

5.17 Relationship Between Short-Term Use of the Environment and

the Maintenance and Enhancement of Long-Term Productivity

Implementation of any of the alternatives would cause some adverse impacts to would permanently commit certain resources. However, under several of the alternat environment would be of short duration and offset by long-term enhancements to the productivity of the region. The following is a brief comparison of potential short alternative would have on the environment and the associated effects on the mainten long-term productivity of the environment.

5.17.1 Alternative A (No Action)

- General: Under Alternative A (No Action), short-term uses of resources no impact on long-term environmental productivity.
- Land Use: Environmental impacts under Alternative A include only a ver additional land disturbance. No effect on the long-term productivity o expected.
- Air Quality: Construction or remediation activities would result in sh levels of particulate matter and combustion by-products in the areas of Operational impacts have been assessed and shown to be within applicabl therefore, represent an acceptable short-term commitment of resources. visual impacts exists, but would be further defined and resolved during process. Impacts to air quality, as described in Section 5.7, would oc construction, operation, and remediation, but would not result in a lon resources beyond the life of the alternative. Implementing the measure 5.19.4 would reduce the impacts on air quality.
- Ecology: There would be a potential short-term productivity loss in ha INEL facilities. There would be a long-term loss of about 15 hectares that is widely dispersed and that is within and adjacent to existing in losses would be offset at least partially by a minor reduction in conta ecological resources, thereby increasing environmental productivity. U long-term environmental productivity would be enhanced the least compar alternatives.
- Environmental Restoration and Waste Management (ER&WM): Alternative A only short-term interim actions and does not provide for long-term disp management of waste or environmental cleanup as specified in the Federa Agreement and Consent Order. Therefore, these short-term interim actio little enhancement of the environment in the long-term.

5.17.2 Alternative B (Ten-Year Plan)

- General: Under Alternative B (Ten-Year Plan), short-term uses of resou greater than for Alternative A. However, because of remediation effort alternative, impacts would result in enhanced long-term productivity co Alternatives A and C.
- Land Use: Environmental impacts under Alternative B include land distu use category changes from open space to industrial uses. These land-us acreage within or adjacent to existing industrial facilities, therefore impacts. Subsequently, no effect on long-term productivity of the surr expected.
- Cultural Resources: Additional information gained during preactivity s archaeological, historical, or paleontological resources could be compi added to an existing database to improve the knowledge of area history. with affected Native Americans would provide information necessary for preservation of Native American resources. Increasing the historical k understanding of the area would provide a basis for the enhancement of of cultural resources in the region.
- Geology: In areas undergoing short-term uses, such as construction or activities, some soil loss would be expected. However, these activitie duration and soil loss would be minimized by implementing the measures 5.19.3. Therefore, no long-term effect on environmental productivity o surrounding these sites is expected.

- Air Quality: Construction or remediation activities would result in sh levels of particulate matter and combustion by-products in the areas of Operational impacts have been assessed and shown to be within applicabl therefore, represent an acceptable short-term commitment of resources. visual impacts exists, but would be further defined and resolved during process. Impacts to air quality, as described in Section 5.7, would oc construction, operation, and remediation, but would not result in a lon resources beyond the life of the alternative. Implementing the measure 5.19.4 would reduce the impacts on air quality.

- Ecology: The potential short-term productivity loss in habitats adjace would be offset by a reduction in contaminant exposure to ecological re increasing environmental productivity. There would be a long-term loss biodiversity associated with the approximately 239 hectares (591 acres) disturbed and used.

- ER&WM: All ER&WM actions started or scheduled in the next 10 years as Federal Facility Agreement and Consent Order would be completed. These enhance the long-term productivity of the area by decreasing the risk t surrounding biota through exposure to toxic and radioactive substances.

5.17.3 Alternative C (Minimum Treatment, Storage, and Disposal)

- General: Under Alternative C (Minimum Treatment, Storage, and Disposal uses of resources would be somewhat greater than for Alternative A but for Alternatives B and D. However, because of remediation efforts rela alternative, impacts would result in enhanced long-term productivity th Alternative A and less than for Alternatives B and D.

- Land Use: Environmental impacts under this alternative include only a additional land disturbance. No effect on long-term environmental prod

- Air Quality: Construction or remediation activities would result in sh levels of particulate matter and combustion by-products in the areas of Operational impacts have been assessed and shown to be within applicabl therefore, represent an acceptable short-term commitment of resources. visual impacts exists, but would be further defined and resolved during process. Impacts to air quality, as described in Section 5.7, would oc construction, operation, and remediation, but would not result in a lon resources beyond the life of the alternative. Implementing the measure 5.19.4 would reduce the impacts on air quality.

- Ecology: The potential short-term productivity loss in habitats adjace would be offset by a minor reduction in contaminant exposure to ecologi thereby increasing environmental productivity. There would be a long-t productivity and biodiversity associated with the disturbance and use o hectares (123 acres).

- ER&WM: To the extent that those cleanups of groundwater and soil alrea the Federal Facility Agreement and Consent Order would be completed to requirements under this alternative, there would be, in the long term, to onsite workers and biota through exposure to toxic and radioactive s because neither cleanups beyond those mandated nor major upgrades in wa would occur, these long-term enhancements on the productivity of the en less than those described under Alternative B (Ten-Year Plan).

5.17.4 Alternative D (Maximum Treatment, Storage, and Disposal)

- General: Under Alternative D (Maximum Treatment, Storage, and Disposal uses of resources would be greater than for Alternative A. However, be

efforts related to this alternative, impacts would result in enhanced l compared to Alternatives A, B, and C.

- Land Use: Environmental impacts under this alternative include land di use category changes from open space to industrial uses. No effect on productivity of the environment is expected.

- Cultural Resources: Additional information gained during preactivity s archaeological, historical, or paleontological resources could be compi added to an existing database to improve the knowledge and understandin Also, coordination with affected Native Americans would provide informa the preservation and protection of areas that hold cultural and religio them. Creating and/or improving these databases would provide a basis management of cultural resources in the region.

- Geology: In areas undergoing short-term uses, such as construction or activities, some soil loss would be expected. However, these activitie duration with soil loss minimized by implementing the measures outlined No long-term effect on productivity is expected.

- Air Quality: Construction or remediation activities would result in sh levels of particulate matter and combustion by-products in the areas of Operational impacts have been assessed and shown to be within applicabl therefore, represent an acceptable short-term commitment of resources. visual impacts exists, but would be further defined and resolved during process. Impacts to air quality, as described in Section 5.7, would oc construction, operation, and remediation, but would not result in a lon resources beyond the life of the alternative. Implementing the measure 5.19.4 would reduce the impacts on air quality.

- Ecology: The potential short-term loss in habitats adjacent to INEL fa offset by a reduction in contaminant exposure to ecological resources, environmental productivity. Also, there would be a long-term loss of p biodiversity associated with the disturbance and use of approximately 4 acres).

- ER&WM: Environmental restoration at all contaminated sites identified waste management actions would be completed under this alternative. Th would enhance the long-term environmental productivity of the area by d onsite workers and surrounding biota through exposure to toxic and radi However, some of the reduction in risk would be potentially offset by t and radioactive waste and spent nuclear fuel that would be disposed, tr INEL under this alternative.

5.18 Irreversible and Irretrievable Commitments of Resources

Irreversible and irretrievable commitments of resources for each alternative land, groundwater (areas of contamination), aggregate, and energy resources. Howev example, structural and stainless steel) and resources (for example, water use) are are not considered an irreversible and irretrievable commitment of resources. Thes would be caused by past activities, construction and operation of new storage or di potential remediation actions that would be identified through the comprehensive an Remedial Investigations/Feasibility Studies and the resulting Records of Decision.

Impacts on air quality are not considered irreversible and irretrievable comm Rather, these are potential impacts that could materialize and persist for the dura question.

Disposal of radioactive and/or hazardous wastes would cause irreversible and commitments of land resources under Alternatives B (Ten-Year Plan) and D (Maximum T and Disposal). Under Alternative D, mixed low-level waste and low-level waste disp and irretrievably commit approximately 162 hectares (400 acres) of previously open- waste treatment, storage, and disposal under the same alternative would irreversibl hectares (5 acres) of open-space land. Under Alternative B, mixed low-level waste

disposal would irreversibly and irretrievably affect 81 hectares (200 acres) of pre Services potentially lost from the commitment of these acreages would include lost lost wildlife productivity, and lost multiple-use or alternative-use opportunities would not undergo future decommissioning or decontamination and habitat reclamation A (No Action) and C (Minimum Treatment, Storage, and Disposal), there would be no l irreversibly or irretrievably committed to waste disposal facilities.

The aggregate resources (sand, gravel, pumice, and landscaping cinders) extra be irreversibly and irretrievably committed in support of INEL spent nuclear fuel a Aggregate would also be utilized during construction for concrete production, found road construction and maintenance. Aggregate demands would be highest under Altern Treatment, Storage, and Disposal) with an estimated volume of approximately 1,772,0 (2,317,000 cubic yards). Estimated aggregate demands commensurate with the level o activities proposed under Alternatives B, C, and A, would be 408,000; 285,000; and (534,000; 373,000; and 296,000 cubic yards), respectively.

As discussed in Sections 4.8, Water Resources, and 5.8, Water Resources, acti have resulted in the irreversible and irretrievable commitment of groundwater in th Aquifer that has been affected by chemical and radioactive contaminant plumes. How occur in localized areas within INEL site boundaries and are not expected to migrat boundaries within the timeframe of this EIS (see Section 5.8). Services lost from include limiting the locations and use of certain types of wells (for example, drin volume of water pumped from the aquifer by DOE for activities at the INEL site. Al the INEL site are monitored routinely to ensure that water withdrawn from the aquif appropriately, as specified under Federal and State regulations.

Commitment of energy and other resources would be greatest under Alternative Treatment, Storage, and Disposal). Alternative D would require (above the baseline about 127,700 megawatt-hours per year of electricity, 5.86 million liters (1.55 mil heating oil, 1.2 million liters (320,000 gallons) per year of diesel fuel, and 2.73 gallons) per year of propane. Construction associated with this alternative is est approximately 100,000 cubic meters (130,000 cubic yards) of concrete. All other al smaller demands on these resources, commensurate with the level of construction and proposed.

5.19 Mitigation

An overview of potential mitigation measures for the proposed activities outl presented in the following discussion.

5.19.1 Cultural Resources

Detailed specifications associated with proposed construction projects at INE completed for all proposed projects. This precludes identifying specific project i particular structures and facilities. Section 106 of the National Historic Preserv (NHPA 1966), requires a Federal agency head with jurisdiction over a Federal, feder assisted, or federally licensed undertaking to take into account the effects of the properties included in or eligible for the National Register of Historic Places and undertaking, to afford the Advisory Council on Historic Preservation a reasonable o the undertaking. Under the regulations of the National Historic Preservation Act, significant resources that would otherwise be found to be adverse may be reduced by value of a property through the conduct of appropriate scientific or historic resea buildings and structures when this work is supported by appropriate planning docume

Basic compliance under cultural resource law involves steps that would be ess all alternatives. These steps are to (a) initiate consultation process with the Id Office and representatives of the Shoshone-Bannock tribes and conduct a preactivity and evaluation of resources in danger of impact, (b) assess effects to these resour State Historic Preservation Office and the tribal representatives, (c) develop plan minimize any adverse effects, (d) consult with the Advisory Council on Historic Pre to the appropriateness of mitigation measures, and (e) implement mitigation measure cultural resource survey has not been performed in an area planned for ground distu proposed alternatives, consultation would be initiated with the Idaho State Histori the survey would be conducted prior to any disturbance. If cultural resources are evaluated according to National Register of Historic Places criteria. Whenever pos would be left undisturbed. If the impacts are determined to be adverse and it is n

resource undisturbed, then measures would be initiated to reduce impacts. In most an expanded data recovery program to collect significant information before it is l program might include archaeological excavation, study of archival materials, consu Native American tribes (where appropriate), and detailed drawings and photographs. would be developed in consultation with Native American tribes (where appropriate), Preservation Office, and the Advisory Council on Historic Preservation and would co standards and guidelines established for historic preservation activities by the Se

In situations where historically significant facilities on the INEL site are compliance process would be essentially the same as outlined above. In this contex leave these facilities intact, then historical information would be collected to ev structure for the National Register of Historic Places. Eligibility would be deter the State Historic Preservation Office and the Advisory Council on Historic Preserv include the development of a Memorandum of Agreement or Programmatic Agreement betw State Historic Preservation Office, and the Advisory Council on Historic Preservati provisions for historic documentation, development of a historic context for the fa historic photographs, plans, and records.

Some actions may affect areas of religious, cultural, or historic value to Na implemented a Working Agreement (DOE-ID 1992) to ensure communication with the Shos Tribe, especially relating to the treatment of archaeological sites during excavati Archeological Resources Protection Act (ARPA 1979) and the protection of human rema under the Native American Graves Protection and Repatriation Act (NAGPRA 1990) and religion under the American Indian Religious Freedom Act (AIRFA 1978). In keeping American policy (DOE 1990), DOE (1992), and procedures to be defined in the final C Management Plan, DOE would conduct Native American consultations during the plannin implementation of all proposed alternatives. If human remains are discovered, DOE that have expressed an interest in the repatriation of graves as required under the Protection and Repatriation Act, including the Shoshone-Bannock, Shoshone-Paiute, a Band of the Shoshoni Nation. These tribes would then have an opportunity to claim associated artifacts in accordance with the requirements of the Native American Gra Repatriation Act. The procedures for the repatriation of "cultural items," in acco American Graves Protection and Repatriation Act, will be described in the curation finalized by June 1996.

In addition to consultation, other measures would mitigate potential adverse American resources, in particular those effects to air, water, plants, animals, and measures include the following:

- Avoiding sensitive areas
- Placing facilities within existing areas of construction
- Revegetating with native plants of areas with ground disturbance
- Monitoring plants and animals within hunting or gathering areas for rad contamination
- Reducing noise and night lights outside of existing facilities
- Monitoring tanks, ponds, and runoff for contaminants
- Minimizing ground disturbance
- Using dust suppressors during construction
- Using filters and other air pollutant control equipment to reduce air c

Projects involving excavation or other ground disturbance could also adversel resources. Before construction or excavation begins, the area would be assessed as disturbing potentially important paleontological resources. Assessment may include surface surveys, consultation with knowledgeable individuals, or limited test excav disturbed areas. If the disturbance would take place within sensitive areas (for e deposits, playas), then ground disturbance would be monitored by a qualified profes plan for recovering, stabilizing, and curating important paleontological resources would be prepared before ground disturbing activities begin.

5.19.2 Aesthetic and Scenic Resources

Conservative, screening-level analyses have indicated that potential impacts degradation at Craters of the Moon Wilderness Area could result from facility emiss alternatives. If the application of refined modeling confirms the findings of the mitigative measures, such as the use of emissions controls, would be required to pr Alternatively, perceptible changes in the visual resource in this area could also b proposed sites of individual projects to areas more distant from Craters of the Moo southwest portion of the INEL). As changes in visual setting, particularly in the the southern portion of the INEL site, are seen by the Shoshone-Bannock to be an ad important Native American resource, the Shoshone-Bannock would be consulted before developed that could have impacts to resources of importance to the tribes. For a of the potential effects on the visual resource, refer to Section 5.7, Air Resource

5.19.3 Geology

Potential soil erosion in areas of ground disturbance could be mitigated thro surface disturbance and by utilizing engineering practices such as storm water runo sediment catchment basins, slope stability (for example, rip-rap placement), and so erosion protection (for example, covering of stockpiles). Furthermore, wind erosio dust) would be controlled by spraying disturbed areas with water and other methods section.

5.19.4 Air Resources

Controls to reduce radiological emissions and doses would be evaluated based specific process under evaluation and the types and amounts of radionuclides that m example, controls would include limiting iodine-129 emissions from spent nuclear fu processing by means such as filtration based on adsorption of gaseous forms of iodi zeolite filtering media. High-efficiency particulate air filters would be used ext of radionuclides that are particulates.

State of Idaho regulations dictate that any modification of a major facility significant emissions increases is considered a major modification and would be sub best available control technology to limit emissions. Best available control techn "emission standard based on the maximum control of emissions achievable through app processes or available methods, systems, and techniques (including fuel cleaning or fuel combination techniques) for control of such contaminants. The best available determined on a case-by-case basis, taking into account energy, environmental and e (IDHW 1994). Best available control technology must be designed for each pollutant significant emissions increase as defined in the State regulation. As a minimum, a equipment, administrative controls, changes in raw material feed, or design changes several proposed projects to reduce emissions of nitrogen dioxide, sulfur dioxide, Alternatives B (Ten-Year Plan), C (Minimum Treatment, Storage, and Disposal), and D Treatment, Storage and Disposal). Control of emissions of nitrogen dioxide and sul required for Alternative A (No Action). A listing of potential levels of control f contained in Belanger et al. (1995). Fugitive dust control methods would be simila Section 5.19.3. Mitigation of potential visual impacts is discussed in Sections 5.

5.19.5 Water Resources

The development of pollution prevention plans, such as the INEL Storm Water P Plan (DOE-ID 1993a, b) and the INEL Groundwater Protection Management Plan (Case et implementation of best management practices are important in preventing future sour resources. These practices develop standard procedures for handling waste material accidental discharges. Waste minimization techniques, best available technologies, (for example, double-liner systems) are also employed to prevent or minimize the po pollutants to the vadose zone or water resources. Existing monitoring and surveill tanks and ponds would also reduce impacts of inadvertent liquid release by restrict volume. An extensive site-wide groundwater monitoring network, vadose zone monitor

water monitoring program allow for early detection of contaminant migration. Conta organics) in the vadose zone and groundwater could be removed through treatment and state-of-the-art technologies, where feasible. For example, the volatile organic c program at the Radioactive Waste Management Complex is designed to extract volatile contaminants before they affect the regional environment. Remediation efforts have removed 640 kilograms (1411 pounds) of volatile organic material at the Radioactive Complex, and concentrations of organics and radionuclides in the Test Area North in after sludge removal in 1990. In addition, the natural decay of radionuclides and management practices would decrease the contaminant concentrations in the aquifer.

Best management practices and storm water monitoring have been implemented un Storm Water Pollution Prevention Program (DOE-ID 1993a, b) to reduce the potential discharges from commingling with storm water runoff under normal operations and dur water runoff from facility areas of concern would be monitored during snowmelt and that any contaminants present are identified. If problem areas are identified duri monitoring, additional best management practices would be implemented to further de natural surface water.

5.19.6 Ecology

Unavoidable impacts to biota would include disturbance of a limited amount of displacement of some animals (primarily small mammals, reptiles, and birds), and po elevated exposure levels to airborne radionuclides and hazardous materials.

The DOE would implement several actions to ensure that activities do not adve candidate, or sensitive species. If bald eagles or peregrine falcons are observed consult with the U.S. Fish and Wildlife Service to ensure that individual eagles an harassed or killed. Preactivity surveys would be conducted to determine if endange their habitat are present in the area. If candidate or sensitive species or import hibernacula, sage grouse mating grounds, or bat roosts) are observed during preacti evaluate the project design to determine if modifications would minimize potential practicable, modifications would be implemented.

Projects that would disturb habitat would be evaluated to determine if jurisd present. Activities would be modified to avoid affecting the wetland. If avoidanc would consult with the U.S. Army Corps of Engineers to obtain permits and develop a (for example, construction of new wetlands, enhancement of existing wetlands). Jur within or near remediation activities would be avoided and discussions with the U.S Engineers would identify any required mitigation. In addition, workers would be in locations so that inadvertent disturbance (for example, filling, dredging, or drain wetlands.

Other measures would include minimizing ground disturbance using temporary dr during facility removal to minimize erosion, grading, and seeding bare ground with long-term stability (see Section 5.19.3). A speed limit would be maintained to ens from vehicles would be limited. During remediation, potential increased exposure a radionuclides would be minimized by (a) using dust-suppression and containment meth resuspension, (b) removing buried contaminants as soon as possible after they are e erosion-control measures to minimize water-erosion movement of radionuclides. Afte of exposure to radionuclides would be diminished to acceptable levels that probably or chronic effects to biota (IAEA 1992).

5.19.7 Transportation

The possible impacts from transportation associated with the alternatives cou number of different ways. For example, the routes used for truck shipments would b Department of Transportation routing guidelines. These guidelines are designed to impacts associated with transportation. According to the guidelines, primary facto exposure from incident-free transport, (b) the risk to public health from an accide material, and (c) the economic risk from an accidental release of radioactive mater according to the guidelines, include (a) emergency response effectiveness, (b) evac location of special facilities such as schools or hospitals, and (d) traffic fatali radioactive nature of the cargo.

Impact mitigation would also be provided through the use of approved shipment shipments containing small amounts of radioactivity, such as low-level waste, Type sufficient. These containers are designed to withstand the rigors of normal transp

containing large amounts of radioactivity, such as spent nuclear fuel or transurani would be used. These containers are designed to withstand normal transport conditi accident conditions.

The U.S. Department of Transportation also has requirements that help to miti impacts. For example, there are requirements for drivers, packaging, labeling, mar There are also requirements that specify the maximum dose rate associated with radi shipments, which help to reduce incident-free transportation doses.

If an accident did occur, Federal, State, local, and tribal authorities are t response. For example, the Shoshone-Bannock Tribes, the State of Idaho, Bingham Co Memorial Hospital, Bannock Regional Medical Center, Pocatello Regional Medical Cent Company, Intermountain Gas Company, and DOE participated in a comprehensive, cooper Transportation Accident Exercise held in Idaho in 1992 (TRANSAX '92).

The U.S. Environmental Protection Agency has developed protective action guid actions that are designed to limit doses in the event of a nuclear incident. Use o would also minimize the impacts of transportation accidents involving radioactive m

The impacts that transportation has on hunting could potentially increase if result in additional game being killed due to vehicle-game collisions. The most si train collision with a herd of antelope during adverse weather conditions such as a measures could include distributing the deceased animals to hunters, relocating gam hunting permits, if necessary.

5.19.8 Health and Safety

Hazards would be minimized by best management practices and occupational and programs operating under the same regulatory standards and limits that currently ap

5.19.9 Idaho National Engineering Laboratory Services

Practices would be implemented to reduce inefficient use of utilities and ene would include using effective thermal insulation, installing state-of-the-art heati incorporating water conservation measures. Also, recycling of materials generated and decommissioning activities would be given appropriate consideration.

5.19.10 Accidents

Mitigation measures to minimize exposure and, therefore, dose that would affe results of the accident scenarios are discussed in this section. In general, limit emergency response.

INEL facilities employ emergency response programs to mitigate impacts of acc and the public in accordance with the 5500 series of DOE orders. These programs ty emergency planning, emergency preparedness, and emergency response. Each plan util specifically dedicated to assist the facility in emergency management. These resou

- INEL Warning Communications Center
- INEL Fire Department
- Facility emergency command centers
- DOE Emergency Operations Center
- County and State emergency command centers
- Medical, health physics, and industrial hygiene specialists
- Protective clothing and equipment (respirators, breathing air supplies,

The radiation doses estimated in this document for the various radiological a doses that would be received by the population if only limited protective actions w detailed plans for responding to accidents of the type described here, and the resp closely coordinated with State and local officials. INEL personnel are trained and actions to be taken if a release of radioactive or otherwise toxic material occurs. may result in personnel receiving lower exposures should an accident occur, limited training in estimating the exposure durations for workers.

An individual at the nearest public access highway is assumed to be exposed t resulting from the accident for no more than two hours because site security person from the affected area within two hours. For most of the postulated accidents, the exposed to the entire plume. However, in a few accidents where the assumed release individual would be exposed to only a portion of the plume prior to being evacuated

of certain roadways being inaccessible due to plume direction, accidents, or weathe

For the offsite population, the need for any protective action would be based radiation doses. The emergency response would be based on the guidance provided in guides developed by the U.S. Environmental Protection Agency. The underlying princ action guides is that under emergency conditions all reasonable measures would be t radiation exposure of the general public and emergency workers. In the absence of protective actions may be implemented when projected doses are lower than the range action guides.

Interdiction activities by INEL accident recovery personnel are expected to t accident to limit doses to offsite individuals at risk. This interdiction could li the maximally exposed individuals would derive much less than the assumed 10 percen locally grown crops and livestock.

5.20 Environmental Justice

In February 1994, Executive Order 12898, titled Federal Actions to Address En in Minority Populations and Low-Income Populations (FR 1994), was released to Feder order directs Federal agencies to incorporate environmental justice as part of thei agencies are specifically directed to identify and address, as appropriate, disprop human health or environmental effects of their programs, policies, and activities o low-income populations. In addition to describing environmental justice goals, Exe directs the Administrator of the U.S. Environmental Protection Agency to convene an Working Group on Environmental Justice (referred to below as the Working Group). T directed to provide guidance to Federal agencies on criteria for identifying dispro adverse human health or environmental effects on minority populations and low-incom Working Group is also directed to coordinate with each Federal agency to develop an strategy if a strategy is required by the proposed activities. At the time of this had not issued final guidance on the approach to be used in analyzing environmental the Executive Order. The Working Group has issued draft definitions of terms in th Federal Agencies on Terms in Executive Order 12898, dated November 28, 1994. These slight modifications, were used in the following analysis. Further, in coordinatio DOE is developing internal guidance for the implementation of the Executive Order, adopted. Because both DOE and the Working Group are still in the process of develo approach used in this analysis might depart somewhat from whatever guidance is even

This section provides an assessment of the area surrounding the INEL with res environmental restoration and waste management programs under all alternatives cons In addition, this assessment includes consideration of the management of spent nucl alternatives evaluated in Volume 1 of this EIS, which are integrated into the alter appropriate. This assessment includes potential adverse impacts resulting from bot associated transportation of materials. Based on this assessment, it is concluded considered under the proposed action results in disproportionately high and adverse effects on minority populations or low-income c the INEL or associated offsite transportation routes.

5.20.1 Public Comment Received on the Draft Environmental Impact Statement

Public comment received on the Draft EIS is addressed in Volume 3, Response t of this final EIS. Overall comment indicated a widespread concern about past and p human health and the environment. A small number of comments relating to environme the need for an expanded analysis in the final EIS, which was previously committed Draft EIS. The most specific comments were received from the U.S. Environmental Pr Office of Enforcement and Compliance Assurance and the Shoshone-Bannock Tribes on t Reservation. Environmental justice comments pertaining to Volume 2 of this EIS wer

- Although the Draft EIS includes discussions on socioeconomic impacts, i whether the alternatives would affect minority communities and low-inco (Sanderson 1994).

- The DOE must meet the requirements of Executive Order 12898 on environ and fully consider the comments of the Shoshone-Bannock Tribes on the D consider the impacts of its proposed actions on the Tribes, the Fort Ha and on other disadvantaged populations living in proximity to the INEL. the Indian Tribes are not just another "minority population," but are g

special relationship to the Federal government and its agencies, and ha to regulate others including the United States government (Tinno 1994,

All pertinent public comments relating to environmental justice have been considere which has been expanded over the discussions in the Draft EIS.

5.20.2 Community Characteristics

Demographic information obtained from the U.S. Bureau of Census was used to i populations and low-income communities in the zone of potential impact surrounding within a circle that has an 80-kilometer (50-mile) radius. This 80-kilometer (50-m because it was judged to encompass all of the impacts that may occur. This radius modeling and socioeconomic impact analysis used in this EIS. Transportation impact 800 meters (0.5 miles) of transportation routes for incident-free transportation be distance are negligible. For transportation accidents, an 80-kilometer (50-mile) r Demographic maps were prepared using 1990 census data available from the U.S. Burea 1992). Figures 5.20-1 and 5.20-2 illustrate census tract distributions for both mi income populations respectively for areas surrounding the INEL. These maps were ge analysis of 1990 United States Bureau of Census Tiger Line files, which contain po geographical features, and Summary Tape Files 3A (as processed by the U.S. Environm Agency), which contain demographic information. Data were resolved to the census t Census tracts are designated areas designed to encompass roughly 4,000 people per t generally range from 2,500 to 8,000 people.

An 80-kilometer (50-mile) radius circle appears on each map defining a zone o discussed above, this zone of potential impact relates to the analysis performed in diversity of locations of current and potential onsite environmental restoration an activities, the circle has been centered on a conservative location to identify the populations and low-income populations. The center is located in the southeast cor location of the Argonne National Laboratory-West.

Minority populations and low-income populations are defined as follows:

- Minority population: A group of people and/or community experiencing c conditions of exposure or impact that consists of persons of the United the U. S. Bureau of Census as Negro/Black/African-American, Hispanic, A Islander, American Indian, Eskimo, Aleut, and other nonwhite

<u>Figure 5.20-1. Minority population distribution within 80 kilometers (50 miles) of</u>

<u>Figure 5.20-2. Low-income population distribution within 80 kilometers (50 miles)</u>

persons, based on self-classification by the people according to the ra most closely identify. For the purposes of analysis, minority populati those census tracts within the zone of impact for which the percent min exceeds the average of all census tracts within the zone of impact or w minority population exceeds 50 percent for any given census tract. In dispersed populations, a minority population consists of a group that i percent minority.

- Low-income population: A group of people and/or community experiencing conditions of exposure or impact, in which 25 percent or more of the po characterized as living in poverty (FR 1993). The U.S. Bureau of Censu persons in poverty as those whose income is less than a "statistical po threshold for the 1990 census was a 1989 income of $12,674 for a family threshold is a weighted average based on family size and the age of the Table 5.20-1 presents the U.S. Census poverty thresholds (USBC 1992) us analysis.

5.20.2.1 Distribution of Minority Populations and Low-Income Populations Near the INEL.

According to the data, approximately 172,366 people reside within the 80-kilometer of the INEL. Of that total population, 7 percent, or approximately 11,722, are cla individuals. The area surrounding the INEL has a relatively small percentage of mi comparable DOE sites (see Appendix L to Volume 1 of this EIS). The minority compos

Hispanic, Native American, and Asian. The Fort Hall Indian Reservation of the Shos lies largely within 80 kilometers (50 miles) of the INEL. The spatial distribution residing in 37 census tracts within 80 kilometers (50 miles) of the INEL is shown i tracts that were bisected by the 80-kilometer (50-mile) radius circumference line w if 50 percent of the tract fell within the 80-kilometer (50-mile) radius. As indic tracts have been shaded according to the percentage of minority individuals within variations in the populations of census tracts, the geographical size of any partic necessarily proportional to the numerical population within that tract. Because of

Table 5.20-1. Poverty thresholds in 1989 by size of family and number of related c

Size of family unit	Weighted average threshold ($)	Related children under 18 years			
		None ($)	One ($)	Two ($)	Three ($)
One person (unrelated individual)	6,310				
Under 65 years	6,451	6,451			
65 years and over	5,947	5,947			
Two persons	8,076				
Household under 65 years	8,343	8,303	8,547		
Household 65 years and over	7,501	7,495	8,515		
Three persons	9,885	9,699	9,981	9,990	
Four persons	12,674	12,790	12,999	12,575	12,61
Five persons	14,990	15,424	15,648	15,169	14,79
Six persons	16,921	17,740	17,811	17,444	17,09
Seven persons	19,162	20,412	20,540	20,101	19,79
Eight persons	21,328	22,830	23,031	22,617	22,25
Nine or more persons	25,480	27,463	27,596	27,229	26,92

population surrounding the site, census tracts are relatively large in geographical population surrounding the INEL resides largely to the southeast of the site.

Of the total population, 14 percent, or approximately 23,416 individuals, fal low-income for purposes of this analysis. Figure 5.20-2 shows the spatial distribu individuals within 80 kilometers (50 miles) of the INEL. Census tracts containing lie largely southeast of the site.

5.20.3 Environmental Justice Assessment

This assessment of potential environmental justice impacts addresses waste ma environmental restoration programs at the INEL for the near term (1995 to 2005). I assessment includes the management of spent nuclear fuel at the INEL under all alte Volume 1 of this EIS which are integrated into the alternatives of Volume 2 as appr environmental justice analysis was based on a qualitative assessment of proposed pr reported in Section 5 of Volume 2 of the EIS to determine if there were identifiabl and adverse human health or environmental impacts on minority populations or low-in surrounding the INEL.

The following definitions were used for this assessment:

- Disproportionately high and adverse human health effects: Adverse heal measured in risks and rates that could result in latent cancer fataliti or nonfatal adverse impacts to human health. Disproportionately high a health effects occur when the risk or rate for a minority population or from exposure to an environmental hazard significantly exceeds the risk general population and, where available, to another appropriate compari

- Disproportionately high and adverse environmental impacts: An adverse impact is a deleterious environmental impact determined to be unaccepta generally accepted norms. A disproportionately high impact refers to a an impact) in a low-income or minority community that significantly exc larger community. In assessing cultural and aesthetic environmental im

be taken of impacts that uniquely affect geographically dislocated or d or minority populations.

In this assessment, DOE reviewed the proposed projects, facilities, and trans with the proposed alternatives in Volume 2 of this EIS. This review included poten each of the major disciplines evaluated for the alternatives, including land use, s resources, air resources, ecology, health and safety, facility operations, cultural which are the sciences pertinent to the identification of environmental impacts in effects, both normal facility operations and accident conditions were examined, wit evaluated in terms of the risk to the public. Likewise, the examination of transpo and potential accident conditions for both truck and rail transportation of materia pathways were evaluated with respect to subsistence consumption of fish, game, or n

As discussed in the following subsections, the potential radiological impacts operations and reasonably foreseeable accident conditions are small. In addition, the potential number of fatalities due to both radiological and nonradiological exp transportation is also small. Likewise, the probability of adverse impacts due to fish, game, or native plants is low.

5.20.3.1 Facility Operations.

As indicated in Section 5.7 of Volume 2, for the maximally exposed member of the public living offsite, the likelihood of contracting a fatal operations ranges between about 1 occurrence in 240,000 to 1 occurrence in 1,000,00 than one latent cancer fatality to the general public under any of the alternatives year period from 1995 to 2005.

Impacts from high consequence, low probability accident scenarios (Section 5. would be adverse should they occur; however, the impacts to specific population loc to meteorological conditions on the day of the accident. Whether or not such impac disproportionately high and adverse effects with respect to any particular segment and low-income populations included, would be subject to natural motive forces incl meteorological factors. Prevailing winds for the INEL are primarily from the south the Test Area North are frequently from the north and west-northeast. Local rivers mountain watersheds north and west of the INEL, but most surface water is diverted reaches the site boundaries. Groundwater in the underlying Snake River Plain Aquif south and southwest. As explained in the EIS, the risk to the public is defined as multiplied by the probability of occurrence. This risk represents the expected imp public. Based on this risk, no latent cancer fatalities are expected from reasonab accidents.

Because the impacts due to facility operations and reasonably foreseeable acc significant risk and do not constitute a reasonably foreseeable adverse impact to t no disproportionately high and adverse impacts would be expected for any particular surrounding population, minority and low-income populations included.

5.20.3.2 Transportation.

Transportation corridors associated with Volume 2 of the EIS can be classified as roughly 80 percent rural, 17 percent suburban, and 3 percent urban. available in Table 5.11-1 in Volume 2 to the EIS. As evaluated in Section 5.11 of free transportation, the total number of potential fatalities would be the sum of t exposure to radiation and vehicular emissions. Over the 10-year period between 199 estimated number of total potential fatalities because of waste shipments would ran shipments were made by truck, to from 0.02 to 0.3 if made by rail. Over the 40-yea and 2035, estimated potential fatalities because of spent nuclear fuel shipments ma between 0.1 to 1.7 and between 0.1 to 0.26 if made by rail.

When and where an accident occurred, if one in fact occurred, would be comple respect to the immediate and surrounding population, as well as the motive forces t impacts during the timeframe of occurrence. Although adverse impacts could occur i high consequence accident, any potential disproportionality with respect to any pop income populations included, is subject to the randomness of the combination of fac such impacts.

Over the 10-year period, the estimated cumulative risk of latent cancer fatal accidents would range from 1 in 1,300 to 1 in 340 if waste shipments were made by t of time, from 0.3 to 3.4 fatalities would occur from traffic accidents. By contras

made by rail, the cumulative risk of latent cancer fatalities would range from 1 in traffic accidents unrelated to waste shipment cargo would range between 0.003 to 0. from the maximum nonradiological chemical release accident involving a nitric acid Section 5.11.2.5) is also small. The cumulative risk of latent cancer fatalities b 2035 because of shipments of spent nuclear fuel by truck would range from 1 in 240, associated risk of traffic accident fatalities from 0.05 to 1.4. The corresponding shipments were made by rail would range from 1 in 240,000 to 1 in 700 for latent ca for traffic fatalities ranging from 0.05 to 1.2.

Because the impacts due to transportation of waste materials or spent nuclear rail under either incident-free or reasonably foreseeable adverse accidents present not constitute a reasonably foreseeable impact to the surrounding population, no di adverse impact would be expected for any particular segment of the surrounding popu low-income populations included.

5.20.3.3 Perspective.

To place the impacts in perspective with respect to risks encountered in everyday life, in 1990 there were approximately 510,000 cancer deaths in the United which about 64,000 were among the nonwhite population. This equates to roughly 1,1 which 142 would affect minority populations) in an area comparable to that included mile) radius around the INEL. Additionally, in 1992 there were about 40,000 traffi States, of which about 7,400 were among the nonwhite population. This equates to r fatalities (of which 16 would affect minority populations) in an area comparable to kilometer (50-mile) radius around the INEL. The risk of latent cancer fatalities a vehicular fatalities because of the activities proposed in this EIS would not appre even if all impacts were associated with minority and low-income populations.

5.20.3.4 Subsistence Consumption of Fish, Wildlife, or Native Plants.

The calculations
in this EIS estimate dose and risk from ingestion of radionuclides based on site-sp they assume a typical dietary pattern. Subsistence consumption of fish, wildlife, not explicitly addressed in this analysis. However, the calculations in this EIS i assumptions (see Appendix F of Volume 2) that bound the potential for ingestion of these special exposure pathways. In particular, these calculations assume that a v diet is based on locally grown produce and locally grazed livestock, both of which representing the highest calculated concentrations of radioactivity. Nevertheless, differences between the uptakes of grazed livestock and free-ranging game. No huma immediate vicinity of the INEL are known to subsist entirely on locally harvested f

Fishing and hunting are usually not allowed on the INEL. One exception is de were negotiated between the Idaho Department of Fish and Game and DOE (Hoff et al. hunter access to one-half mile inside the northern INEL boundaries. In addition to several game species, including elk and pronghorn antelope, that contribute to the live on and migrate through the INEL. This potential exposure pathway is small, as from the INEL contain elevated levels of contaminants. Data from game species, she the INEL, and locally grown foodstuffs and native plants around the INEL are routin radionuclides. Concentrations of radioactivity generally have been small, and they those observed at locations distant from the INEL where the principal likely source radionuclides is very small amounts of residual global fallout from past nuclear we monitoring programs are reported annually in INEL Site Environmental Reports (Hoff

If transportation associated with environmental restoration and waste managem INEL (including spent nuclear fuel management) were to increase wildlife losses bec with game, there might be a disproportionate impact to minority or low-income commu primarily on hunted game. However, the maximum potential increases in shipments of would be small additions to current rail and highway traffic, so the overall impact Potential mitigation measures for any resulting adverse impact to low-income or min distributing the deceased animals to hunters in the vicinity known to partially sub subsequent hunts, or relocating game if necessary.

5.20.3.5 Other Considerations.

In addition to the above, reviews of other technical disciplines

pursuant to the methodology in Section 5.20.3 did not indicate any significant adve land use, socioeconomics, water and air resources, ecology, cultural resources, or Therefore, no disproportionately high and adverse impacts were identified for any s Of particular interest are the following:

5.20.3.5.1 Socioeconomics-Depending upon the various alternatives evaluated, the total labor force involved in INEL environmental activities, including spent nuclea decrease by up to 500 jobs or increase by more than 900 jobs over the 10-year perio 2005. Affirmative action programs would distribute such effects proportionately am coordination of planning activities with local communities would be intended to avo on local community resources. DOE may also provide support to local agencies if ne localized impacts.

5.20.3.5.2 Land Use, Ecology, and Cultural Resources-None of the alternatives would have a significant adverse impact on land use, ecology, and cultural resource amount of previously undisturbed land that would be needed for use onsite (no offsi mitigative programs already in place. These programs include working closely under State of Idaho Historical Preservation Officer and the Shoshone-Bannock Tribal gove preservation of historic and cultural resources. Similarly, DOE is aware of sensit avoids wetlands and endangered plant or animal specie habitats. Disturbance of cer (which are not federally listed as threatened or endangered) is possible but not li foreseen environmental impacts, if any, to land use, ecological resources, or cultu be small under any of the alternatives.

5.20.3.5.3 Cumulative Impacts-Based on the analysis of the impacts for each of the disciplines analyzed in this EIS, along with the impact of other past, present, and future activities at the INEL, no reasonably foreseeable cumulative adverse impacts surrounding populations, minority populations and low-income populations included.

5.20.3.6 Impacts Because of Perception.

Potential adverse impacts may result from the public's perception of risk associated with nuclear industry activities in general particular. For example, a waste management or spent nuclear fuel management facil increase awareness of the nuclear industry, leading to concerns of potential advers local commerce, such as tourism and agriculture. From both a National Environmenta environmental justice perspective, both the character and the substance of these po discernable. Therefore, it is not possible to identify any quantifiably adverse or distribution of any impacts of such perceived risk.

To better understand and help mitigate unfounded perceptions, DOE is working general population's understanding of the potential impacts of INEL programs in gen alternatives considered in this EIS in particular, with emphasis on minority popula and Tribal governments.

5.20.4 Discussion of Related Issues Raised by the Shoshone-Bannock Tribes on the Fort

Hall Indian Reservation in Public Comment and Consultations

The EIS Project Office has reviewed the comments on the EIS received from the Tribes on the Fort Hall Indian Reservation, which lies largely within 80 kilometers To fully understand, evaluate, and consider these comments, consultations have take officials and appropriate INEL officials. In addition to addressing specific comme ongoing consultations are designed to promote a mutual understanding of INEL-relate the tribes, both within and beyond the scope of INEL environmental restoration and programs and spent nuclear fuel management activities addressed in this EIS. As di disproportionately high and adverse impacts have been identified to the Shoshone-Ba other segment of the population as a whole.

To date, these consultations have resulted in an increased awareness of triba nature, ties to the land, and religious beliefs. For the tribes, traditional resou American archaeological sites, which are important in the context of religious and features of the natural landscape, air, plant, water or animal resources that have Potential impacts to such resources on the INEL, once inhabited by the Shoshone-Ban concern to the tribes. These potential impacts may result from disturbing the land

environmental setting of sacred or traditional use areas. They may also result fro contamination. Actions that have a deleterious effect on the land, air, water, or Shoshone-Bannock Tribes to be adverse to their traditional way of life. Potential involving tribal representatives in discussions during the project planning stages locating new facilities in areas with similar visual settings, avoiding Native Amer traditional use and sacred areas, monitoring gathering areas and game animals for o restoring native vegetation to areas of ground disturbance per revegetation guideli 1989). If avoidance is not feasible, data recovery at archaeological sites (such a restoration of alternative hunting or gathering areas may be substituted after cons

Based on these consultations, a number of changes have been made to the EIS t the Fort Hall Indian Reservation and its socioeconomic activities and setting. In are working with the tribes to enhance their understanding of the potential impacts considered in this EIS as they specifically relate to the Fort Hall Indian Reservat exposures and impacts to the reservation from postulated facility and transportatio impact from normal operations. One of the results of consultations between the DOE Office and the Shoshone-Bannock Tribes is the preparation of a management agreement Idaho Operations Office, the Federal Advisory Council on Historic Preservation, the Tribes with respect to cultural resources at the INEL.

5.20.5 Conclusion

The overall review indicated that the potential impacts calculated for each d the proposed INEL environmental restoration and waste management alternatives, incl fuel management, are small and do not constitute a reasonably foreseeable adverse i population. Therefore, the impacts also do not constitute a disproportionately hig any particular segment of the population, minorities or low-income communities incl present an environmental justice concern.

In addition, the DOE is confident that continued consultation between the tri government will enhance the knowledge and expertise of both and promote both inform and effective mitigation of potential impacts from INEL operations.

PAGE TOC FIGURES TABLES PAGE