APPENDIX B Idaho National Engineering Laboratory Spent Nuclear Fuel Management Program

Department of Energy Programmatic
Spent Nuclear Fuel Management
and
Idaho National Engineering Laboratory
Environmental Restoration and
Waste Management Programs
Final Environmental Impact Statement
Volume I
Appendix B
idaho National Engineering Laboratory
Spent Nuclear Fuel Management Program
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1. INTRODUCTION

The U.S. Department of Energy (DOE) has prepared the Department of Energy Progr Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environment Restoration and Waste Management Programs Environmental Impact Statement (SNF and I to assist its management in making two decisions. The first decision, which is pro determine the management program for DOE spent nuclear fuel. The second decision i direction of environmental restoration, waste management, and spent nuclear fuel ma activities at the Idaho National Engineering Laboratory.

Volume 1 of the EIS, which supports the programmatic decision, considers the ef nuclear fuel management on the quality of the human and natural environment for pla through 2035. DOE has derived the information and analysis results in Volume 1 fro specific appendixes. Volume 2 of the EIS, which supports the INEL-specific decisio environmental impacts for various environmental restoration, waste management, and fuel management alternatives for planning years 1995 through 2005.

This Appendix B to Volume 1 considers the impacts on the INEL environment of th implementation of various DOE-wide spent nuclear fuel management alternatives. The Propulsion Program, which is a joint Navy/DOE program, is responsible for spent nav examination at the INEL. For this appendix, naval fuel that has been examined at t Facility and turned over to DOE for storage is termed naval-type fuel. This append management of DOE spent nuclear fuel including naval-type fuel. Naval spent nuclea examination is addressed in Appendix D; Section 5.16 of this appendix includes rele environmental consequences from Appendix D.

In addition to this introduction, Appendix B contains the following chapters:

- Chapter 2 - Background: Describes INEL spent nuclear fuel facilities, the framework for spent nuclear fuel management at the INEL, and the INEL spent management program.
- Chapter 3 - Spent Nuclear Fuel Management Alternatives: Describes the DOE- nuclear fuel management alternatives as the INEL would implement them, and summary comparison of potential environmental consequences for each alterna described in Chapter 5.
- Chapter 4 - Affected Environment: Describes the INEL site and the surround environment that DOE spent nuclear fuel management actions could affect.
- Chapter 5 - Environmental Consequences: Provides the results of environmen consequence analyses for each spent nuclear fuel management alternative.
- Chapter 6 - References

Volume 1 contains a list of acronyms and abbreviations and a glossary that is a appendix.

2. BACKGROUND

This chapter contains an overview of the Idaho National Engineering Laboratory and historic events related to spent nuclear fuel, a description of the regulatory actions evaluated in this document, and an overview of the current spent nuclear fu program at the INEL.

2.1 Overview

The following sections provide a general overview of the INEL including its his activities, and mission as they relate to spent nuclear fuel management and future

2.1.1 History of Spent Nuclear Fuel Activities

The U.S. Atomic Energy Commission, a predecessor of the U.S. Department of Ener established the INEL, formerly the National Reactor Testing Station, to build, test types of nuclear reactors, support plants, and associated equipment. Since its est (see Table 2-1), DOE and its predecessor agencies have built 52 reactors at the INE DOE programs at the site have included test irradiation services, uranium recovery enriched spent fuels, calcination of liquid radioactive waste, light-water-cooled r and research, operation of research reactors, environmental restoration, and storag solid transuranic wastes. In support of the DOE reactor research program and as pa nuclear fuel reprocessing program, the INEL has received spent nuclear fuel from mo sources, including naval reactors, university reactors, commercial reactors, and DO as well as fuels fabricated in the United States and irradiated in foreign reactors

The Experimental Breeder Reactor-I, now a National Historic Landmark, maintains in the history of nuclear power in the United States. In December 1951, this react usable electricity from a nuclear reactor. The Experimental Breeder Reactor-I also nuclear reactor could actually produce more fuel than it consumes.

Of special significance to spent nuclear fuel is the history of the Idaho Chemi Plant. From 1953 to 1992, this plant recovered usable uranium from spent nuclear f States government reactors. The plant operated for 39 years as a full-scale produc

Table 2-1. INEL spent nuclear fuel history.

Year	Event
1949	National Reactor Testing Station established
1951	Site reactor first to generate electricity from nuclear fission
1953	ICPPa began operation
1953	Test of first submarine nuclear reactor
1957	Expended Core Facility constructed
1965	DOE contract with Public Service Company of Colorado (Fort St. Vrain)
1974	Site became Idaho National Engineering Laboratory
1980	DOE contracted to receive Public Service Company of Colorado (Fort St. Vrain) spent nuclear fuel
1992	Decision to discontinue reprocessing of spent nuclear fuel at ICPPa announced
1992	DOE creates Office of Spent Fuel Management
1993	Court order of June 28, 1993 issued

a. ICPP = Idaho Chemical Processing Plant.

April 1992, DOE decided to phase out reprocessing for material recovery, resulting the reprocessing operation.

Spent naval nuclear fuel handling at the Naval Reactors Facility originated in construction of the Expended Core Facility. The original building contained a wate cells, which are connected to the water pit by transfer tunnels. The Expended Core spent nuclear fuel from operating naval ships and from prototype naval reactors. T support research and development for naval fuel quality improvement. Over the year additions and improvements at the Naval Reactors Facility site, including the const operation of three prototype reactors and facilities for training naval nuclear pow The Naval Nuclear Propulsion Program is placing the prototype reactors, which have of their useful lives, in layup. All training is expected to end before DOE issues Decision for this Environmental Impact Statement (EIS). Expended Core Facility act continuing. Appendix D describes the Naval Reactors Facility in more detail.

In 1965 the United States entered into a contract with Public Service Company o which the United States agreed to lease special nuclear material to Public Service Colorado for fuel at the Fort St. Vrain Nuclear Power Plant. In 1980, the United S Service Company of Colorado modified the 1965 contract, requiring DOE to accept ret Vrain spent nuclear fuel at the INEL. From 1980 to 1986, Public Service Company of approximately 120 shipments of Fort St. Vrain spent nuclear fuel to the INEL.

In 1974 the National Reactor Testing Station became the Idaho National Engineer The INEL mission broadened to include research and engineering for nonnuclear progr environmental restoration and waste management activities.

In the early 1980s, pursuant to the West Valley Demonstration Project Act (42 U a court order, DOE agreed to accept 125 special case commercial reactor spent nucle located at the state-owned Western New York Nuclear Service Center. DOE began a pr demonstrate the viability of a transportable spent nuclear fuel storage cask, with shipping the fuel to the INEL. Based on this, New York State Energy Research and D Authority, which has jurisdiction over the center, has allowed continued storage un U.S. Nuclear Regulatory Commission Certificates of Compliance, which have been issu remains at West Valley awaiting the Record of Decision for this EIS.

In addition to the naval and INEL-generated fuel on the site, some special-case fuel, such as fuel from university reactors, has been shipped directly to the Idaho Plant for storage. Damaged fuel from the 1979 Three Mile Island accident was shipp Test Area North for examination and storage as part of a research mission.

In 1990, DOE issued an Environmental Assessment and Finding of No Significant I Public Service Company of Colorado shipments of Fort St. Vrain spent nuclear fuel t State of Idaho challenged the adequacy of the Environmental Assessment and, in June United States District Court for the District of Idaho found for the State and orde this EIS. A DOE appeal of the order resulted in a December 1993 amendment that gov schedule and obligation for preparing the EIS.

2.1.2 Current Activities at Spent Nuclear Fuel-Related Facilities

Six major facility areas at the INEL (Figure 2-1) store spent nuclear fuel: Ar
Laboratory - West, Idaho Chemical Processing Plant, Naval Reactors Facility, Power
Figure 2-1. Major facility areas located at the Idaho National Engineering Labor
configurations. The total amount of spent nuclear fuel at the INEL accounts for ab
weight of heavy metal) of the spent nuclear fuel in the DOE complex (DOE 1993).

Table 2-2 lists the primary INEL spent nuclear fuel storage facilities, the typ
and the storage configurations. Figure 2-2 indicates the relative proportion of fu
The number and variety of wet and dry storage configurations currently in use at th
the result of the different purposes for the facilities (e.g., at-reactor storage,
development, reprocessing, and fuel research and development). The condition of th
fuel in storage is generally good with the notable exception of the fuel in the Und
Facility (CPP-603). The following paragraphs briefly describe each primary facilit
spent nuclear fuel.

The Argonne National Laboratory - West generates spent nuclear fuel as a result
development activities related to advanced reactor design. DOE has brought small q
nuclear fuel from other reactors to this facility to support these activities. Rea
National Laboratory - West are the Experimental Breeder Reactor II, the Transient R
Facility, the Zero Power Physics Reactor, and the Neutron Radiography Reactor. Sto
include both wet (including molten sodium) and dry configurations.

The Idaho Chemical Processing Plant historically received spent nuclear fuel fr
and offsite reactors for reprocessing (i.e., the recovery of uranium for reuse). H
to phase out reprocessing activities in 1992. The new mission for this facility ar
storage, plus research and development of technologies in support of the dispositio
fuel. The Idaho Chemical Processing Plant stores virtually all types of spent nucl
production reactor fuel [i.e., fuel from Hanford Site and Savannah River Site (SRS)
reactors]. It stores nonproduction aluminum-based spent nuclear fuel. This facili
dry storage configurations.

The Naval Reactors Facility includes the Expended Core Facility, which receives
naval spent nuclear fuel to support fuel development and performance analyses. In
Expended Core Facility removes structural support material from fuel assemblies bef
the fuel portion to the Idaho Chemical Processing Plant for interim storage.

Table 2-2. Major INEL spent nuclear fuel storage facilities.

Facility(a)	Storage Type(b)	Fuel Type(c) 1	2	3	4	5	6a
Argonne National Laboratory - West							
Experimental Breeder Reactor II	Liquid sodium						-
Hot Fuel Examination Facility	Dry						-
Neutron Radiography Reactor	Wet						-
Radioactive Scrap and Waste Facility	Dry						-
Transient Reactor Test Facility	Dry						
Idaho Chemical Processing Plant							
Underwater Fuel Storage Facilityd	Wet	-	-				-
Irradiated Fuel Storage Facility	Dry				-		
Fuel Storage Area/Fluorinel Dissolution Process Cell	Wet	-	-				-
Underground Storage Facility	Dry				-		
Naval Reactors Facility							
Expended Core Facility	Wet	-				-	
Expended Core Facility Rail Siding	Dry	-					
Power Burst Facility							
Power Burst Facility Storage Canal	Wet						-
Test Reactor Area							
Materials Test Reactor Canal	Wet					-	
Advanced Reactivity Measurement Facility	Wet		-				
Coupled Fast Reactivity Measurement Facility	Wet		-				
Advanced Test Reactor Canal	Wet		-				

Test Area North		-
Test Area North Pool	Wet	-
Test Area North Pad	Dry	

a. This table lists the major spent fuel storage facilities. Other facilities (e.g contain small quantities of spent nuclear fuel.
b. Wet storage involves water-filled pools. Dry storage involves a variety of conf buildings).
c. The spent fuel types are as follows:
   1. Naval-type fuel
   2. Savannah River Site production fuels and other aluminum-clad fuels
   3. Hanford Site production fuels
   4. Graphite fuels
   5. Special case commercial fuels
   6a. Experimental reactors - stainless steel-clad fuels
   6b. Experimental reactors - zirconium-clad fuels
   6c. Experimental reactors - other fuel configurations
d. Spent nuclear fuel storage at this facility will cease by December 31, 2000, as DOE and the State of Idaho.

Figure 2-2. Distribution of INEL SNF. The Power Burst Facility reactor was place of spent nuclear fuel from this facility remains in wet storage, in a storage pool condition, but it is small and uneconomical to use. DOE plans to remove the fuel f 1996.

DOE has used Test Area North for commercial reactor fuel research. The large T Hot Shop and Hot Cells have supported the Loss of Fluid Test and commercial nuclear including dry cask storage demonstration. Test Area North stores special case comm (including Three Mile Island Unit 2 core debris) and DOE experimental fuel similar nuclear fuel.

Test Reactor Area has historically operated a number of test reactors, but the Reactor and its associated Critical Facility are the only reactors now operating. fuel at this area is associated with the Test Reactor Area reactors, which utilized fuels. In addition, DOE stores small amounts of special case commercial, foreign, Facility spent nuclear fuel at Test Reactor Area in the Materials Test Reactor basi fuel in storage at the Test Reactor Area is in water-filled pools (DOE 1993).

2.1.3 Spent Nuclear Fuel Mission

The INEL spent nuclear fuel mission is to manage DOE-owned spent fuel cost-effe a way that protects the safety of INEL workers, the public, and the environment. A laboratory for the DOE Spent Nuclear Fuel Program, the INEL provides support to the Fuel Management and coordinates the development of an integrated program for DOE.

The main focus of near-term activities is the accurate quantification and chara DOE-owned spent nuclear fuel, identification of spent nuclear fuel management facil conditions, identification of safe interim storage for existing and new spent nucle identification of technologies and requirements to place DOE spent nuclear fuel in Long-term activities include the development of final waste acceptance criteria req stabilization technologies for alternate fuel disposition, construction of faciliti meet waste disposal requirements, processing of the fuel to a final waste form, and the waste form for disposition.

2.2 Regulatory Framework for Spent Nuclear Fuel Management

This section summarizes State of Idaho laws and regulations that apply to spent management at the INEL. Volume 1, Section 7.2, provides summary information for Fe regulations, Executive Orders, and DOE Orders. Volume 2, Chapter 2, provides infor National Environmental Policy Act reviews related to site-specific decisions that h environmental impacts. Volume 2, Chapter 7, provides information on regulatory per INEL holds or for which it has applied.

The Idaho Environmental Protection and Health Act (Idaho Code, Title 39, Chapte establishes general provisions for the protection of the environment and public hea the Idaho Department of Health and Welfare and its Division of Environmental Qualit consolidating all state public health and environmental protection activities in on Act authorizes the Department to promulgate standards, rules, and regulations relat quality, noise reduction, and solid waste disposal; and grants authority to issue r collect fees, establish compliance schedules, and review plans for the construction public water treatment and disposal facilities.

The Idaho Water Pollution Control Act (Idaho Code, Title 39, Chapter 36) author Department of Health and Welfare to protect the waters of Idaho. This law contains on the prevention of water pollution and the provision of financial assistance to m

The Idaho Department of Health and Welfare is also responsible for the enforcem implementation of the Hazardous Waste Management Act of 1983, as amended (Idaho Cod Chapter 44), which provides for the protection of health and the environment from t improper or unsafe management of hazardous wastes and for the establishment of a tr manifesting system for these wastes. This program is intended to be consistent wit stringent than, the Federal regulations established under the Resource Conservation (RCRA). At this time, Idaho has primacy over hazardous and mixed waste regulations through July 1, 1990, by the U.S. Environmental Protection Agency. The Hazardous W Management Act sets forth requirements for the development of plans that address th hazardous wastes; unauthorized treatment, storage, release, use, or disposal of the requirements for hazardous waste facilities. Under the authority of this Act, the Health and Welfare has promulgated rules and regulations on the transportation, mon and record keeping of hazardous wastes.

Several INEL facilities have air quality permits from the State, and operate in permit conditions. Permit applications are currently pending with the State for pr modified emission sources. In April 1991 DOE submitted an inventory of all potenti radioactive and criteria pollutant emission sources to the State. The inventory co necessary for the State to issue the INEL a Permit to Operate.

The Idaho Department of Health and Welfare, Division of Environmental Quality, Bureau, conducts annual inspections of the INEL to determine if the operating porti in compliance with the Rules for the Control of Air Pollution in Idaho. The most r were in January 1994. In addition, pursuant to 40 CFR Part 61.94(H), DOE submits t annual report documenting compliance with National Emission Standards for Hazardous at the INEL.

2.3 Spent Nuclear Fuel Management Program at the INEL

In 1992 the Secretary of Energy directed the Assistant Secretary for Environmen and Waste Management to develop an integrated, long-term spent nuclear fuel managem In response to this request, DOE created the Office of Spent Fuel Management (EM-37 which has strategic programmatic responsibilities, has designated the INEL as the p organization for the DOE Spent Nuclear Fuel Program. In this role, the INEL provid support to the Office of Spent Fuel Management and develops site communication and the national program.

As identified in the Spent Fuel Working Group Report on Storage of the Departme Nuclear Fuel and Other Reactor Irradiated Nuclear Materials and Their Environmental Health Vulnerabilities, Volume I (DOE 1993), some of the current storage facilities inadequate for extended interim storage, and additional storage facilities or modif necessary. In February 1994, DOE issued, Plan of Action to Resolve Spent Nuclear F Vulnerabilities, Phase I (DOE 1994a), followed by a Phase II Plan in April 1994 (DO Phase III Plan in October 1994 (DOE 1994c), which identified specific corrective ac the spent nuclear fuel vulnerabilities. At the INEL, many of the corrective action completed or are currently underway. The spent nuclear fuel storage pools at Test Burst Facility, and the Underwater Fuel Storage Facility do not comply with new fa requirements. The INEL plans to move spent nuclear fuel from the CPP-603 Underwate Facility by December 31, 2000. To stabilize this fuel for storage, the INEL also p canning equipment in the Irradiated Fuel Storage Facility hot cell. This equipment operation by late 1995. To the extent of its existing capability, DOE could consol fuel at the Power Burst Facility, the Idaho Chemical Processing Plant, and the Test Idaho Chemical Processing Plant as a result of implementing the management alternat Chapter 3. These activities and other planned actions for which National Environme review will be completed before the Record of Decision of this EIS were analyzed un Action Alternative (see Chapter 3).

Each of the specific INEL spent nuclear fuel Plan of Action projects could resu worker exposures, and other potential environmental impacts. The potential environ that could result from each project or corrective action item were not analyzed ind collectively enveloped by the spent nuclear fuel management activities reported and alternative. Successful completion of the corrective actions would significantly r environmental, safety, and health risks associated with spent fuel storage at INEL.

The INEL has provided support in the development of dry at-reactor storage of s commercial spent nuclear fuel in accordance with the requirements of the Nuclear Wa 1982 and its 1987 amendments. Dry-storage demonstrations and research at the INEL the granting of NRC licenses to several utilities for the construction and operatio facilities at reactor sites. Research at these facilities is demonstrating the tec economics of adding dry storage capacity in metal or concrete spent fuel storage ca

3. SPENT NUCLEAR FUEL MANAGEMENT ALTERNATIVES

Chapter 3 describes the alternatives for spent nuclear fuel management as they National Engineering Laboratory (INEL) and summarizes and compares potential enviro consequences for each alternative. Chapter 5 contains full descriptions of the con implementing the alternatives.

3.1 Description of Alternatives

DOE has identified five spent nuclear fuel management alternatives:

Alternative 1 - No Action
Alternative 2 - Decentralization (2a, 2b, and 2c)
Alternative 3 - 1992/1993 Planning Basis
Alternative 4 - Regionalization (4a and 4b)
Alternative 5 - Centralization (5a and 5b)

Table 3-1 summarizes the actions that would result from the implementation of t at the INEL. For each alternative, this table summarizes the proposed transportati storage, research and development, and naval-type fuel examination activities. For and 5, it identifies a number of options.

The analysis of each alternative considers, as appropriate, existing and projec fuel inventories, existing spent nuclear fuel wet and dry storage facilities, the c facilities and associated stabilization facilities to achieve interim management ob relocation of the spent nuclear fuel as appropriate to proposed interim storage fac

Table 2-2 lists existing spent nuclear fuel storage facilities with associated fuel. Table 3-2 lists the potential facilities and projects required for specific based the potential environmental consequences for each alternative on the existing facilities and projects listed in Tables 2-2 and 3-2, respectively.

Table 3-1. Summary of spent nuclear fuel management alternatives at the Idaho Nat
Table 3-1. (Page 2) Table 3-1. (Page 3) Table 3-2. Potential spent nuclear fu

The alternatives involving the interim storage of naval spent nuclear fuel at s INEL include a transition period, which would start on June 1, 1995, and continue f 3 years. During this period, approximately 80 shipments of naval spent nuclear fue Expended Core Facility for examination and subsequent shipment to the Idaho Chemica Plant for storage. After this transition period, DOE would phase out the Expended that the worker total at the facility would decline to about 10 by 2001. Appendix transition period.

3.1.1 Alternative 1: No Action

Table 3-1 lists the basic actions expected under this alternative. This altern restricted to the minimum actions necessary for the continued safe and secure manag nuclear fuel. Table 3-3 lists the existing inventory of spent nuclear fuel at the is not a status quo condition in terms of spent nuclear fuel receipts (unlike Alter operations would continue in accordance with the 1992/1993 planning basis). Rather maintain spent nuclear fuel close to defueling or current storage locations with mi upgrades or replacements.

DOE would continue the operation of the following existing spent nuclear fuel-r the Fuel Storage Area/Fluorinel Dissolution Process Cell; CPP-603 Underwater Fuel S (until 2000); Irradiated Fuel Storage Facility; Underground Storage Facility; Power storage canal; Advanced Test Reactor canal; Advanced Reactivity Measurement Facilit

Reactivity Measurement Facility; Materials Test Reactor canal; Test Area North Pool Argonne National Laboratory - West Hot Fuel Examination Facility, Radioactive Scrap Facility, Transient Reactor Test Facility, Zero Power Physics Reactor, and Neutron Reactor pool. Table 2-2 lists the type(s) of storage and spent nuclear fuels assoc

3.1.1.1 Transportation. Under this alternative, the INEL would neither receive nor ship spent

nuclear fuel except for naval spent fuel during a transition period. DOE would con Advanced Test Reactor canal spent nuclear fuel to the Idaho Chemical Processing Pla DOE could transfer other spent nuclear fuel at the INEL site (e.g., Test Reactor Ar Pad, Power Burst Facility storage canal, Experimental Breeder Reactor-II, and Naval

Table 3-3. Spent nuclear fuel inventory for each alternative by 2035 (metric tons

Fuel Type	1. No Action(d)	2. Decentralization	3. 1992/1993 Planning Basis	4a. Regionalization by Fuel Type	4 R b (
Naval-type	10.23	N/Cf	+55.00	+55.00	+
Aluminum-clad	2.91	11.02	+12.09	-2.91	+
Hanford	None	None	None	None	+
Graphite	11.60	N/C	+16.00	+16.01	+
Special case commercial	122.88	+0.03	+26.69	+33.63	+
Stainless-steel-clad	77.43	+1.08	+1.19	+19.08	+
Zircaloy-clad	49.09	+0.67	+0.670	+28.90	+
Other	0.01	+0.82	+0.82	+1.69	+
Net increase (+)/ decrease (-)	-	+13.62	+112.47	+151.41	+
TOTAL	274.14	287.76	386.61	425.55	2

a. Source: Wichmann (1995).
b. To convert metric tons to tons, multiply by 1.10. Heavy metals are uranium, plu
c. The values may not sum exactly due to rounding.
d. The No-Action Alternative represents the present inventory and projections and s determining the net increase or decrease for each type of spent nuclear fuel for
e. Regionalization 4b(2), Regionalization by Geography (Elsewhere), assumes all spe the INEL go to the Nevada Test Site or Hanford Site. Inventories for 4b(2) woul Alternative 5a.
f. N/C = No change from the No-Action Alternative.

Propulsion Program prototype reactors at the Naval Reactors Facility) to the Idaho Processing Plant to the extent of its storage capability.

3.1.1.2 Stabilization. Due to the deteriorated condition of some of the fuel in the CPP-603

Underwater Fuel Storage Facility, additional canning and characterization capabilit necessary to stabilize this fuel for safe transport and subsequent storage. DOE ha installation and operation of new fuel canning and characterization equipment in th Storage Facility, which could provide these capabilities, by late 1995. (The insta equipment would be a minor upgrade and would have a smaller extent than similar act under Alternatives 3, 4, and 5.) DOE could perform other required stabilization of at the INEL in either the Remote Analytical Laboratory or the Fluorinel Dissolution

3.1.1.3 Storage. DOE has identified the CPP-603 Underwater Fuel Storage Facility as one of

five complex-wide spent nuclear fuel storage facilities that exhibit the greatest v to selected criteria and, therefore, has selected this facility for priority attent of the August 9, 1993, agreement between the Secretaries of the Department of Energ Department of the Navy and the Governor of Idaho to phase out storage operations in

CPP-603 facility, one goal of this and the other alternatives would be to remove sp underwater storage in the North and Middle Basins of the CPP-603 facility by the en from the South Basin of this facility by the end of 2000 (DOE 1993a). DOE would re material to the Fuel Storage Area at the Idaho Chemical Processing Plant.

At the Argonne National Laboratory-West, the spent nuclear fuel stored at the H Examination Facility and the Radioactive Scrap and Waste Facility, primarily Experi Reactor-II fuel and blanket elements, would remain in dry storage until its potenti Fuel Cycle Facility. At the Experimental Breeder Reactor-II site, DOE would use dr exception of the Neutron Radiography Reactor pool fuel. The Test Area North Pool F project would continue, resulting in the relocation of Test Area North spent pool c storage at the Idaho Chemical Processing Plant by 1998. The dry cask storage requi is not related to the Dry Fuels Storage Facility.

DOE would start no new projects to increase spent nuclear fuel storage capacity sufficient storage capacity to meet No-Action storage needs. The planning of spent projects such as the Dry Fuels Storage Facility and Additional Increased Rack Capac Storage Area would stop.

3.1.1.4 Research and Development. There would be only limited spent nuclear fuel

research and development. Existing spent nuclear fuel management research and deve would continue. Existing facilities such as the Process Improvement Facility, the Laboratory, and the Pilot Plant Facility would support continuing research and deve

3.1.1.5 Naval-Type Fuel Examination. After a transition period, DOE would cease

shipments of naval spent nuclear fuel to the INEL and would phase out the Expended DOE would make onsite shipments of the "library fuel" (a representative sampling of types maintained for reference purposes) and the spent nuclear fuel that originated at the Naval Reactors Facility to the Idaho Chemical Processing Plant.

3.1.2 Alternative 2: Decentralization

Under this alternative, DOE could transport fuel for safety or research and dev activities. In addition, DOE could undertake actions for safety it deemed desirabl essential, and could perform spent nuclear fuel treatment and research and developm Table 3-3, the anticipated spent nuclear fuel inventory for this alternative would the inventory for Alternative 1, with the increase consisting primarily of aluminum steel-clad spent nuclear fuel from university and foreign research and experimental

3.1.2.1 Transportation. This alternative assumes that the INEL would accept primarily

limited shipments of spent nuclear fuel from offsite sources into the Fuel Storage university reactors) after the Record of Decision for this EIS (1995). Onsite tran the Fuel Storage Area to the Storage Facility or the Irradiated Fuel Storage Facili consolidate the spent nuclear fuel in the Advanced Test Reactor and in the Material Power Burst Facility canals at the Idaho Chemical Processing Plant for canning, cha storage.

As in the No-Action Alternative, there would be a transition period during whic Nuclear Propulsion Program would ship naval spent nuclear fuels to the Expended Cor examination and subsequent shipment to the Idaho Chemical Processing Plant for stor Section 3.1.2.5 describes the transportation of naval spent fuels that would occur period.

3.1.2.2 Stabilization. DOE would use the canning and characterization equipment identified in

Section 3.1.1.2 to stabilize spent nuclear fuel removed from the CPP-603 Underwater Facility for interim underwater storage.

3.1.2.3 Storage. As in Alternative 1, DOE would transfer the spent nuclear fuel in the

CPP-603 Underwater Fuel Storage Facility to the Fuel Storage Area by 2000. DOE wou use the Underground Storage Facility and the Irradiated Fuel Storage Facility for e fuel inventory and transfers of other spent nuclear fuel based on safety analyses. or increase fuel storage capacity at the INEL as required.

The Test Area North Pool Fuel Transfer project would result in the relocation o Test Area North spent nuclear fuel into dry storage at a pad at the Idaho Chemical

3.1.2.4 Research and Development. The development of technology for the disposition of

spent nuclear fuel would continue. Research and development activities would inclu pilot plant testing, continued repository performance assessments and waste accepta development, and the characterization of spent nuclear fuel. Shipments of samples nuclear fuel assemblies to offsite DOE facilities would be necessary.

3.1.2.5 Naval-Type Fuel Examination. DOE would consider three options for naval reactor

spent nuclear fuel receipt and shipment. Under options 2a and 2b, DOE would stop s spent nuclear fuel to the INEL and would shut down the Expended Core Facility. Opt enable the continued receipt of naval-type fuel for examination at the Expended Cor return to the originating shipyards for storage in transport casks. Chapter 3 of A describes these options. As with Alternative 1, each option would require approxim transition period. During this period, DOE would transport spent nuclear fuel in s the Expended Core Facility, unload the containers, and use them to support addition defueling.

3.1.3 Alternative 3: 1992/1993 Planning Basis

This alternative is consistent with DOE plans at the INEL before the injunction nuclear fuel shipment to the INEL; it assumes a 40-year planning horizon for the co transportation, receipt, stabilization, and storage of spent nuclear fuel. As with would continue the maintenance and operation of existing spent nuclear fuel-related some consolidation of INEL facilities could occur. DOE would send newly generated fuel to either the INEL or the Savannah River Site. DOE would assess the construct facilities to accommodate current and projected spent nuclear fuel management requi

The amount of spent nuclear fuel at the INEL under this alternative would be gr either Alternative 1 or 2 (see Table 3-3) because this alternative assumes that the manage, before stabilization and disposal, its present inventory (see Alternative 1 receipts of DOE spent nuclear fuel, including the following:

- Naval-type spent nuclear fuel
- Approximately half of the aluminum-clad spent nuclear fuel from university research and experimental reactors
- All Training Reactor Isotopics General Atomics (TRIGA) spent nuclear fuels Hanford Site and approximately half of that from foreign, DOE, and universi
- Fort St. Vrain spent nuclear fuel from Public Service of Colorado
- Special case commercial pressurized water reactor and boiling water reactor fuel from the DOE facility in West Valley, New York
- Miscellaneous spent nuclear fuel types from such DOE sites as Los Alamos, N and Oak Ridge, Tennessee, and from university reactors and other locations

3.1.3.1 Transportation. DOE would consolidate the spent nuclear fuel in the Test Reactor

Area (Advanced Test Reactor canal, Materials Test Reactor canal, and Coupled Fast R Measurements Facility and Advanced Reactivity Measurement Facility canal) and the P Facility at the Idaho Chemical Processing Plant for canning and dry storage.

The INEL would receive and temporarily store new spent nuclear fuels in the Fue Transfers could occur from the Fuel Storage Area to the Underground Storage Facilit Fuel Storage Facility or, when available, the dry storage vaults at the proposed Dr Facility.

At present, DOE is transferring spent nuclear fuel from the Advanced Test React Idaho Chemical Processing Plant. DOE would maintain this canal for the storage and its recyclable fuel assemblies until the reactor no longer had a mission. The Expe Reactor-II spent nuclear fuel in storage would remain at Argonne National Laborator Alternative 2, the Test Area North Pool Fuel Transfer project would result in the r contents of the Test Area North spent nuclear fuel pool to dry storage at a pad at Processing Plant.

3.1.3.2 Stabilization. DOE would complete a new Canning and Characterization Facility with

appropriate inspection, stabilization, and packaging equipment to stabilize new rec fuel and to prepare fuel currently in underwater storage for dry storage. This fac integral part of the Dry Fuels Storage Facility that DOE would complete under this the Dry Fuels Storage Facility is in service, DOE would use the canning and charact equipment described under Alternative 1 to stabilize spent nuclear fuel removed fro Underwater Fuel Storage Facility for interim underwater storage.

3.1.3.3 Storage. As with Alternative 2, DOE would upgrade or increase dry fuel storage

capacity at the INEL as required. DOE would complete the Fuel Storage Area increas Capacity project in 1997. Coupled with stringent fuel management and, if necessary storage of some aluminum fuel in stainless steel racks, this project would allow th to accept all of the project spent nuclear fuel receipts until the Additional Incre project would be completed in 2001. The Additional Increased Rack Capacity project Fuel Storage Area to accept the projected spent nuclear fuel receipts until the Dry Facility project would become available in 2005. The INEL would receive the Fort S nuclear fuel in the Irradiated Fuel Storage Facility on a space-available basis or in the Dry Fuels Storage Facility. Modifications to the Irradiated Fuel Storage Fa equipment would be necessary to accept the new Fort St. Vrain shipping casks.

DOE would continue to use the Underground Storage Facility and the Irradiated F Facility for current inventory and for transfers of other fuel inventories based on Based on these safety analyses, upgrades would be limited to those required for fac improvements and for making transfers safely.

3.1.3.4 Research and Development. Spent nuclear fuel research and development would

continue as planned, with the construction of a Technology Development Facility. T Electrometallurgical Process Demonstration Project at Argonne National Laboratory - Facility would continue. In addition, Argonne National Laboratory would implement Blanket Processing project under this alternative. The Dry Fuels Storage Facility demonstrate technology for the dry storage of selected DOE highly enriched uranium

3.1.3.5 Naval-Type Fuel Examination. The practice of transporting spent nuclear fuel from

naval reactors to the Expended Core Facility at the INEL would resume. After an ex would transfer such fuel to the Idaho Chemical Processing Plant for interim storage disposition. Under this alternative, the Naval Nuclear Propulsion Program would co Expended Core Facility Dry Cell Construction project.

3.1.4 Alternative 4: Regionalization

This alternative assumes that DOE would base the spent nuclear fuels shipped be and the receipt of fuels from other locations primarily on either geography or fuel offers two options for the redistribution of existing and new spent nuclear fuel:

- Option 4a assumes that DOE would base the spent nuclear fuels shipped betwe and the receipt of fuels from other locations at the INEL, Hanford Site, or

River Site primarily on fuel type.

- Option 4b assumes that DOE would base the spent nuclear fuels shipped betwe and the receipt of fuels on geography. There would be a single western sit Hanford Site, INEL or Nevada Test Site. Option 4b(1) in which the INEL is regional site is essentially the same as Alternative 5b. Option 4b(2) in w SNF to another western regional site is the same as Alternative 5a.

3.1.4.1 Transportation. Under option 4a, the INEL would receive all Zircaloy- and

stainless-steel-clad spent nuclear fuel. This redistribution would optimize DOE sp management.

The spent nuclear fuel inventory involved under option 4a would be greater than Alternative 1, 2, or 3 because this alternative assumes that the INEL would manage inventory plus the following additional spent nuclear fuels (see Table 3-3) prior t disposal:

- Naval-type spent nuclear fuel
- All spent nuclear fuel except aluminum-clad fuel and Hanford spent nuclear
- All Training Reactor Isotopics General Atomics spent nuclear fuels from the
- Fort St. Vrain spent nuclear fuel from Public Service of Colorado
- Special case commercial pressurized water reactor and boiling water reactor fuel from the DOE facility in West Valley, New York

Under option 4b(1), DOE would regionalize all western DOE SNF at the INEL. DOE transport all spent nuclear fuel at other western sites to the INEL. Because the f alternative would be within 15 percent of that for Alternative 5b, analyses for thi assume that environmental impacts would be the same as those for as Alternative 5b INEL.

Under option 4b(2), DOE would regionalize all western DOE SNF at either the Nev or Hanford Site. DOE would transport spent nuclear fuel at the INEL to the selecte such, this option would be the same as Alternative 5a - Centralization at Other DOE

3.1.4.2 Stabilization. DOE would stabilize the spent nuclear fuels it would retain at the INEL

as planned for Alternative 3, with the construction of such new facilities as a can characterization facility and the Dry Fuels Storage Facility. Options 4a and 4b(1) facility for the receipt and storage of spent nuclear fuel, while option 4b(2) woul capabilities for shipping spent nuclear fuel. For spent nuclear fuel that the INEL regional sites, the receiving site would perform any stabilization beyond that requ transportation.

3.1.4.3 Storage. Under option 4a, DOE would increase dry storage capacity and undertake

facility upgrades similar to those described for Alternative 3, with replacements a appropriate. Under option 4b(1), DOE would increase dry storage capacity and under upgrades similar to those described for Alternative 5b, with replacements and addit Option 4b(2) would not require increased storage capacity and, therefore, there wou upgrades.

3.1.4.4 Research and Development. As with Alternative 3, this alternative would include

the continuation of activities related to the treatment of spent nuclear fuel, incl development (e.g., Electrometallurgical Process Demonstration Project), and the con Dry Fuels Storage Facility. DOE would initiate pilot programs as needed to support on spent nuclear fuel management and disposition. DOE would use historic data on s to provide the bounding case for a determination of the impacts associated with pot activities.

3.1.4.5 Naval-Type Fuel Examination. Under options 4a and 4b(1), the transportation of

spent nuclear fuel from naval reactors to the Expended Core Facility at the INEL wo with Alternative 1, under option 4b(2) DOE would phase out shipments of naval-type to the INEL and would phase out the Expended Core Facility.

3.1.5 Alternative 5: Centralization

Under this alternative, DOE would send all current and future spent nuclear fue both DOE and the Naval Nuclear Propulsion Program to one DOE site for interim stora disposition.

The two options under Alternative 5 encompass the extreme ranges of spent nucle inventories that DOE could store at the INEL (i.e., all or none of the inventory). DOE would ship the INEL spent nuclear fuel inventory off the site to the Hanford Si River Site, the Nevada Test Site, or the Oak Ridge Reservation. Under option 5b, D existing spent nuclear fuel to the INEL.

This alternative would bound the maximum number of spent nuclear fuel-related a could reasonably undertake at any site. DOE would have to build new facilities at accommodate the increased inventories. Shipments of spent nuclear fuel to the site centralized destination would continue as an interim action pending the constructio storage and examination facilities at the selected site. DOE would then transfer a the selected site, and the other sites would close their spent nuclear fuel facilit ship spent nuclear fuel from the originating site, it would characterize and can al necessary.

The locations from which spent nuclear fuel would originate, in addition to the Savannah River Site, would include Argonne National Laboratory - East, Babcock and Brookhaven National Laboratory, General Atomics, Los Alamos National Laboratory, Oa National Laboratory, Sandia National Laboratories, West Valley, and Fort St. Vrain. would also include fuel that might be returned to the United States following irrad

This alternative would include activities related to the treatment of spent nuc research and development and pilot programs to support future decisions on its disp would use historic data on spent nuclear fuel to provide a foundation case for dete associated with potential pilot program activities.

3.1.5.1 Alternative 5a - Centralization at Other DOE Sites.

3.1.5.1.1 Transportation - This option assumes that the INEL would consolidate and

prepare all existing and projected onsite spent nuclear fuel for shipment to anothe Hanford Site, the Savannah River Site, the Nevada Test Site, or Oak Ridge.

3.1.5.1.2 Stabilization - The DOE would construct a canning and characterization facility

at the Idaho Chemical Processing Plant to accept the different types of INEL spent various shipping casks and storage containers, and to stabilize these fuel types be the selected DOE facility.

3.1.5.1.3 Storage - As in Alternative 1, DOE would complete the CPP-603 Underwater

Fuel Storage Facility pool inventory transfer to existing dry storage facilities by DOE would not
build the Dry Fuels Storage Facility. DOE would then close all spent nuclear fuel- the INEL with the exception of those in direct support of operating reactors, such Reactor canal or the Argonne National Laboratory-West Hot Fuel Examination Facility Facility. This closure would require the establishment of a major surveillance and operation until DOE determined the disposition of these facilities. The timeframe depend on the following factors:

- The time necessary to stabilize the spent nuclear fuel in the CPP-603 Under

Storage Facility

- The time necessary for the selected DOE site to prepare facilities qualifie nuclear fuel

- The time necessary for the procurement and licensing of shipping containers compatible with the selected receiving DOE site

The spent nuclear fuel inventory that DOE would export off the INEL site for Al the same quantity listed for Alternative 1 (see Table 3-3).

3.1.5.1.4 Research and Development - Under this option there would be a phaseout of

all research and development activities, although the Electrometallurgical Process Project would continue at the Argonne National Laboratory - West Fuel Cycle Facilit stabilize only spent nuclear fuel currently on the site).

3.1.5.1.5 Naval-Type Fuel Examination - As with Alternative 1, DOE would phase out

shipments of naval-type spent nuclear fuel to the INEL and would phase out the Expe Facility.

3.1.5.2 Alternative 5b - Centralization at the INEL.

3.1.5.2.1 Transportation - This option assumes that the INEL would receive all DOE and

naval-type spent nuclear fuel (see Table 3-3).

3.1.5.2.2 Stabilization - The Hanford Site, the Savannah River Site, and other DOE

facilities would stabilize as necessary, spent nuclear fuel for safe transportation Processing Plant.
The Hanford Site, the Savannah River Site, and other DOE facilities would procure an undetermined number of additional casks and install cask handling equipment as n would complete an expanded Dry Fuels Storage Facility at the INEL, which would incl Canning and Characterization Facility similar to that described for Alternative 3. if needed, repackage the spent nuclear fuel into compatible canisters for dry stora facility projects would be the same as those described for Alternative 3. In addit stabilizing for safe storage all complex-wide spent nuclear fuel, as necessary, in Idaho Chemical Processing Plant. Upgrades and new facilities would be necessary to term fuel stabilization for ultimate disposition; this would address criticality (u uncontrolled nuclear fission) concerns about the disposal of spent nuclear fuel in repository.

3.1.5.2.3 Storage - Projects and activities for storage of spent nuclear fuel would be similar

to those described for Alternative 3, except that accelerated schedules for the Inc and Additional Increased Rack Capacity projects would be necessary to accommodate t fuel receipts.
In addition, the schedule for the Dry Fuel Storage Facility project would have to b accelerated and its scope expanded. For example, the Increased Rack Capacity proje completed in late 1996, the Additional Increased Rack Capacity project may have to late 1998, and the Expanded Dry Fuels Storage Facility project may have to be compl the Expanded Dry Fuels Storage Facility would become available even earlier, it cou need for the Additional Increased Rack Capacity project.

3.1.5.2.4 Research and Development - DOE would conduct maximum spent nuclear

fuel research and development under this option.

As with Alternative 4, the Electrometallurgical
Process Demonstration Project would continue at the Argonne National Laboratory - W

3.1.5.2.5 Naval-Type Fuel Examination - Similar to Alternative 3, the practice of

transporting spent nuclear fuel from naval reactors to the Expended Core Facility a resume.

3.2 Comparison of Alternatives

Chapter 5 analyzes the environmental consequences of the alternatives. Tables summarize and compare the potential impacts associated with each alternative from t Chapter 5 for construction, normal operations, and accidents, respectively.

A review of the impacts of the alternatives, as presented in Chapter 5, indicat would be minimal or negligible in most areas. Further, most areas with measurable have no appreciable differences among alternatives.

In general, the levels of potential impacts associated with Alternatives 1 thro would be similar because the amounts of spent nuclear fuel that DOE would manage at these alternatives would be on the same order of magnitude (e.g., 300 to 450 MTHM) would extend throughout the full 40-year management period. The lowest level of ov impact at the INEL would occur under Alternative 4b(2) - Regionalization by Geograp and Alternative 5a - Centralization at Other DOE Sites because DOE would ship INEL fuel off the site well before the management period ended in 2035. Alternative 5b 4b(1), under which DOE would ship all or nearly all spent nuclear fuel to the INEL, greatest potential onsite impacts.

4. AFFECTED ENVIRONMENT

4.1 Overview

Chapter 4 describes the existing environment at the Idaho National Engineering (INEL) site and the surrounding region. It emphasizes areas that the proposed spen management alternatives could affect. The information in this chapter provides the environmental conditions against which the Department of Energy (DOE) can measure t environmental effects of the alternatives. It supports the assessment of the poten consequences that Chapter 5 discusses. DOE used the discussion of the Affected Env Volume 2 of this EIS as input for this chapter.

4.2 Land Use

The INEL site encompasses 570,914 acres (2,310.4 square kilometers) in Butte, B Jefferson, Bonneville, and Clark Counties, Idaho. This section describes existing and in the surrounding region, and land use plans and policies applicable to the su

4.2.1 Existing and Planned Land Uses at the INEL

Categories of land use at the INEL include facility operations, grazing, genera infrastructure such as roads. Facility operations include industrial and support o with energy research and waste management activities (DOE also conducts such activi Falls facilities). In addition, DOE uses INEL land for recreation and environmenta with the designation of the INEL as a National Environmental Research Park.

Much of the INEL is open space that DOE has not designated for specific uses. open space serves as a buffer zone between INEL facilities and other land uses. Fa operations use about 2 percent of the total INEL site area (11,400 acres or 46 squa Public access to most facility areas is restricted. Approximately 6 percent of the 32,985 acres (133.5 square kilometers), is devoted to public roads and utility righ the site. Recreational uses include public tours of general facility areas and the Reactor-I (a National Historic Landmark), and controlled hunting, which is generall 0.5 mile (0.8 kilometer) inside the INEL boundary.

Cattle and sheep grazing occupies between 300,000 and 350,000 acres (1,200 and kilometers). The U.S. Sheep Experiment Station uses a 900-acre (3.6-square-kilomet land, at the junction of Idaho State Highways 28 and 33, for a winter feed lot for sheep. Grazing is not allowed within 2 miles (3.2 kilometers) of any nuclear facil possibility of milk contamination by long-lived radionuclides, dairy cattle are not The Department of the Interior's Bureau of Land Management grants and administers r grazing permits. Figure 4.2-1 shows selected land uses at the INEL and in the surr Figure 4.2-1 Selected land uses at the INEL and in the surrounding region. The I 568.3 square kilometers in the eastern and southern portions of the INEL site) and Resource Area (430,499 acres or 1,742 square kilometers in the central and western Bureau of Land Management administers both of these areas. Under Resource Manageme Bureau manages portions of these Resource Areas for grazing and wildlife habitat. exploration or development is allowed on INEL land.

DOE land use plans and policies applicable to the INEL include the INEL Institu Fiscal Year 1994 - 1999 (DOE-ID 1993c) and the INEL Technical Site Information Repo 1993a). The Institutional Plan provides a general overview of INEL facilities, out program directions and major construction projects, and identifies specific technic capital equipment needs. The Technical Site Information Report presents a 20-year development activities at the site. Under the scope of these planning documents, e waste management activities would continue in existing facility areas and, in some into currently undeveloped site areas. These documents also describe environmental management, and spent nuclear fuel activities. Projected land use scenarios for th include the outgrowth of current functional areas and the possible development of w ponds in existing grazing areas.

No onsite land use restrictions due to Native American treaty rights would exis alternatives described in this EIS. The INEL does not lie within any of the land b by the Fort Bridger Treaty, and the entire INEL site is land occupied by the U.S. D Energy. Therefore, the provisions in the Fort Bridger Treaty that allows the Shosh Indians to hunt on unoccupied lands of the United States do not apply to the INEL s

4.2.2 Existing and Planned Land Use in Surrounding Areas

The Federal government, the State of Idaho, and private parties own the lands surro site. Land uses on Federally owned land consist of grazing, wildlife management, r and energy production, and recreational uses. State-owned lands are used for grazi management, and recreational purposes. Privately owned lands are used primarily fo production, and range land.

Small communities and towns near the INEL boundaries include Mud Lake to the ea Butte City, and Howe to the west; and Atomic City to the south. The larger communi Falls, Rexburg, Blackfoot, and Pocatello and Chubbock are to the east and southeast The Fort Hall Indian Reservation is to the southeast of the INEL. Recreation and t the region around the INEL include the Craters of the Moon National Monument, Hell' Wilderness Study Area, Black Canyon Wilderness Study Area, Camas National Wildlife Market Lake State Wildlife Management Area, North Lake State Wildlife Management Ar Yellowstone National Park, Grand Teton National Park, Jackson Hole Recreation Compl and Challis National Forests, and the Snake River.

Lands surrounding the INEL site are subject to Federal and state planning laws Federal rules and regulations that require public involvement in their implementati for and use of Federal lands and their resources. Land use planning in the State o from the Local Planning Act of 1975 (State of Idaho Code 1975). Because the State land use planning agency, the Idaho legislature requires each county to adopt its o and zoning guidelines. County plans that are applicable to lands bordering the INE

Clark County Planning and Zoning Ordinance and Interim Land Use Plan (Clark County Bonneville County Comprehensive Plan (Bonneville County 1976); Bingham County Zonin and Planning Handbook (Bingham County 1986); Jefferson County Comprehensive Plan (J County 1988); and Butte County Comprehensive Plan (Butte County 1992). Land use pl INEL facilities within the Idaho Falls city limits is subject to Idaho Falls planni restrictions (City of Idaho Falls 1989, 1992).

All county plans and policies accept development adjacent to previously develop minimize the need to extend infrastructure improvements and to avoid urban sprawl. INEL is remote from most developed areas, INEL lands and adjacent areas are not lik residential and commercial development; no new development is planned near the INEL However, DOE expects recreational and agricultural uses to increase in the surround response to greater demand for recreational areas and the conversion of range land

4.3 Socioeconomics

This section presents a brief overview of current socioeconomic conditions with influence where approximately 97 percent of the INEL workforce lived in 1991 (DOE-I INEL region of influence is a seven-county area comprised of Bingham, Bonneville, B Jefferson, Bannock, and Madison Counties. The region of influence also includes th Reservation and Trust Lands (home of the Shoshone-Bannock Tribes) in Bannock, Bingh and Power Counties.

4.3.1 Employment

Historically, the regional economy has relied predominantly on natural resource extraction. Today, farming, ranching, and mining remain important components of th economy. Idaho Falls is the retail and service center for the region of influence, evolved into an important processing and distribution center and site of higher edu

4.3.1.1 Region. The labor force in the region of influence increased from 92,159 in 1980 to

104,654 in 1991, an average annual growth rate of approximately 1.2 percent. In 19 influence accounted for approximately 18 percent of the total state labor force of (ISDE 1992). As listed in Table 4.3-1, the projected labor force in the region of 108,667 by 1995.

Unemployment rates varied considerably among the counties of the region of infl ranging from 2.6 percent in Clark County to 6.3 percent in Bannock and Bingham Coun 1980 the average annual unemployment rate for the region has ranged from 5.3 percen 8.3 percent in 1983. In 1991 the average annual unemployment rate for the region o 5.5 percent compared to the statewide average of 6.2 percent (ISDE 1992).

Employment in the region of influence increased from 86,261 in 1980 to 98,898 i average annual growth rate of approximately 1.3 percent. As listed in Table 4.3-1, projected to increase to 101,450 by 1995.

Table 4.3-1. Projected labor force, employment, and population for the INEL region 1995-2004.

	1995	1996	1997	1998	1999	2000	2001
Labor Force	108,667	109,607	110,547	111,487	112,427	113,367	114,308
Employment	101,450	102,328	103,205	104,083	104,960	105,838	106,716
Population	247,990	251,518	255,096	258,726	262,406	266,140	268,667

Source: ISDE (1992); SAIC (1994); ISDE (1991); ISDE (1986).

4.3.1.2 Idaho National Engineering Laboratory. INEL plays a substantial role in the

regional economy. During Fiscal Year 1990, INEL directly employed approximately 11,100 personnel, accounting for almost 12 percent of total regional employment. T population directly supported by INEL employment was approximately 38,000 persons, of the total regional population. The major employers at INEL are DOE-ID, DOE-ID c Argonne National Laboratory-West, and the Naval Reactors Facility (see Figure 4.3-1 total direct INEL employment was approximately 11,600 jobs (DOE-ID 1994). Projecti January 1995 indicate that the total number of jobs at INEL will decrease to approx Fiscal Year 1995 and to approximately 7,250 in Fiscal Year 2004 (Tellez 1995). Pro in INEL employment are primarily related to contractor consolidation, which account of the projected losses between Fiscal Year 1994 and Fiscal Year 2004, and to reduc Naval Reactors Facility, which accounts for 33 percent of the projected job losses. at DOE-ID resulted in the consolidation of several contracts under one contract. T eliminated redundant administrative activities previously performed by each individ offered early retirement or other options to impacted INEL contractor employees.

4.3.2 Population and Housing

4.3.2.1 Population. From 1960 to 1990, population growth in the region of influence

mirrored statewide growth. During this period, the region's population increased a rate of approximately 1.3 percent, while the growth rate for the State was 1.4 perc and 1990, population growth in the region of influence approximately equaled that o average growth rate of 0.6 percent per year. The region of influence had a 1990 po 219,713, which comprised 22 percent of the total State population of 1,006,749. Ba and employment trends, the population in the region of influence will reach approxi 248,000 persons by 1995 (Table 4.3-1).

Figure 4.3-1. Historic and projected employment at the Idaho National Engineerin

In 1990, the most populous counties were Bannock and Bonneville, which together over 60 percent of the seven-county total (Figure 4.3-2). Butte and Clark were the the counties in the region of influence. The largest cities in the region of influ Idaho Falls, with 1990 populations of approximately 46,000 and 44,000, respectively Fort Hall Indian Reservation and Trust Lands contained 5,113 residents, most of who resided in Bingham County.

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 uni influence in 1990 (see Table 4.3-2). Of this number, approximately 70 percent were units, 17 percent were multifamily units, and 13 percent were mobile homes. Most o units (75 percent) were in Bonneville and Bannock Counties. About 29 percent of th housing units in the region were rental units and 71 percent were homeowner units (

The median value of owner-occupied housing units ranged from $37,300 in Clark C $68,700 in Madison County, and median monthly rents ranged from $243 in Butte Count Bonneville County. In 1990, there were 1,510 occupied housing units on the Fort Ha Reservation and Trust Lands (USBC 1992) and a vacancy rate of 14 percent.

4.3.3 Community Services

This assessment considers the following selected community services in the regi public schools, law enforcement, fire protection, hospital services, and solid wast Table 4.3-3 summarizes pertinent characteristics of these services for the region o

Seventeen public school districts and three nonpublic schools provide education **about 58,000 children in the region of influence.** Of these students, about 6,500 w INEL-related employees. During the 1990-1991 academic year, most public school dis average of $3,000 to $4,000 per student annually. Higher education in the region i University of Idaho, Idaho State University, Brigham Young University, Ricks Colleg Eastern Idaho Technical College.

Seven county sheriff's offices, 12 city police departments, and the Idaho State enforcement services in the region. There was a total of 479 sworn officers and 10

Figure 4.3-2. Historic and projected total population for the counties of the re

Table 4.3-2. Number of housing units, vacancy rates, median house value, and media by county and region of influence.

County	Homeowner housing units: Number of units	Vacancy rates	Median value ($)	Rental units: Number of units	Va
Bannock	16,447	2.4	53,300	7,467	10
Bingham	9,010	2.0	50,700	2,955	9.
Bonneville	17,707	1.9	63,700	7,375	6.

Butte	780	4.6	41,400	302	16
Clark	177	1.7	37,300	114	9.
Jefferson	4,000	2.0	54,300	992	4.
Madison	3,522	1.3	68,700	2,392	2.
Region of influence	51,674	2.1	-	21,556	4.

a. Source: USBC (1992).

enforcement personnel in 1991, more than 59 percent of whom served Bannock and Bonn Counties.

Eighteen fire districts in the region of influence operate 30 fire stations sta approximately 300 volunteer firefighters. Bingham, Bonneville, Butte, Clark, and J which surround the INEL, have developed emergency plans to be implemented in the ev radiological or hazardous materials emergency. Each emergency plan identifies faci extremely hazardous substances and defines transportation routes for these substanc plans also include procedures for notification and response, listings of emergency facilities, evacuation routes, and training programs.

Eight hospitals serve the region of influence with more than 900 licensed beds nearly 128,000 patient-days per year. Occupancy rates range from 22.0 to 61.7 perc (IDHW 1990). County governments and the Blackfoot, Dubois, Idaho Falls, and Pocate departments provide regional ambulance services. A private ambulance company serve Butte County. Four quick-response units, two medical helicopters, and two clinics emergency medical services also serve the region of influence (Hardinger 1990; U.S. 1992).

Table 4.3-3. Summary of public services available in the region of influence.

Public Service	County Bannock	Bingham	Bonneville	But
Schools				
Number of public school districts	2	5	3	1
Total enrollment	15,455	11,311	17,896	765
Number of INEL-related students (excluding military)	485	1,532	4,040	301
Health Care Delivery				
Number of hospitals	3	2	1	1
Number of licensed beds	309	238	311	4
Law Enforcement				
Number of sworn law enforcement officers	151	65	143	4
Total personnel per 1000 population	2.5	2.0	2.2	1.3
Fire Protection				
Number of fire stations	9	7	6	2
Number of firefighters	166	96	121	15
Number of firefighting vehicles	37	25	24	3
Municipal Solid Waste Disposal				
Number of landfills meeting EPAb regulations	1c	3d	1e	2
Expected lifespan in years	30	3-6	50	30

a. Source: IDE (1991); IDHW (1990); IDLE (1991); Kouris (1992a); and Kouris (1992
b. EPA = U.S. Environmental Protection Agency.
c. Fort Hall Mine Landfill is being redesigned to meet EPA standards.
d. Aberdeen Landfill may close due to noncompliance with EPA standards.
e. A new landfill is replacing Bonneville County Landfill.
f. Madison and Clark Counties are evaluating a regional landfill for use after 199

Municipal solid waste generated in the region of influence is transported to co 1992, twelve landfills served the region of influence. Four landfills (one each in Jefferson, and Madison Counties) will close without replacement before reaching the capacity due to noncompliance with new Environmental Protection Agency standards (C

4.3.4 Public Finance

In Fiscal Year 1991, total county revenues for the region of influence amounted $90 million (see Table 4.3-4). County governments receive most of their revenues f intergovernmental transfers. In 1991 the total assessed value of taxable property influence was about $4.5 billion. In addition to property tax revenues, local gove counties) also receive revenue from sales tax disbursements and revenue-sharing pro sources provide approximately 60 to 85 percent of the total revenues received by ea

Table 4.3-4. Total revenues and expenditures by county, 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	89,486,364

a. Sources: Ghan (1992); Bingham County (circa 1992); McFadden (circa 1992); Swage (1992a); Swager & Swager (1992b); Draney, Searle, and Associates (1992); Schwend Sutton (1992).

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

Although DOE as a Federal agency is exempt from paying state or local taxes, IN and contractors are not. In 1992, INEL employees paid an estimated $60 million in withholding tax and $24 million in state withholding tax.

In 1991 the major categories of county government expenditures were general gov services, 27 percent; road maintenance, 18 percent; public safety, 16 percent; heal programs, 16 percent; sanitation and public works, 9 percent; debt service, 3 perce 2 percent; and other expenditures, 9 percent.

4.4 Cultural Resources

This section discusses cultural resources at the INEL, including prehistoric an archeological sites and historic sites and structures, and traditional resources th religious importance to local Native Americans. It also discusses paleontological INEL site.

4.4.1 Archeological Sites and Historic Structures

As summarized in the INEL Draft Management Plan for Cultural Resources (Miller INEL contains a rich and varied inventory of cultural resources. This includes fos provide an important paleontological context for the region and the many prehistori sites that are preserved within it. These latter sites, including campsites, lithi hunting blinds, among others, are also an important part of the INEL inventory beca information about the activities of aboriginal hunting and gathering groups who inh approximately 12,000 years. In addition, archeological sites, pictographs, caves, features of the INEL landscape are also important to contemporary Native American g historic, religious, and traditional reasons. Historic sites, including the abando Powell/Pioneer, a northern spur of the Oregon Trail known as Goodale's Cutoff, many homesteads, irrigation canals, sheep and cattle camps, and stage and wagon trails, the area during the late 1800s and early 1900s. Finally, the many scientific and t inside the INEL boundaries have preserved important information on the historic dev nuclear science in America.

To date, more than 100 cultural resource surveys have been conducted over appro 4 percent of the area on the INEL site. These surveys, most of which have occurred facility areas, have identified 1,506 archeological resources, including 688 prehis sites, 753 prehistoric isolates, and 27 historic isolates (Miller 1992; Gilbert and numbers do not include architectural properties associated with the creation and op Until formal significance evaluations (archeological testing and historic records s completed, all cultural sites in this inventory are considered to be potentially el the National Register of Historic Places. However, all the isolates have been cat to meet eligibility requirements (Yohe 1993).

Due to the relatively high density of prehistoric sites on the INEL and the nee resources during Federal undertakings, DOE has sponsored a preliminary study, which development of a predictive model, to identify areas where densities of sites are h potential impacts to significant archeological resources, as well as costs of compl correspondingly (Ringe 1993). This information provides guidance for INEL project selection of appropriate areas for new construction. However, it does not take the that are required by the National Historic Preservation Act before ground-disturbin (NHPA 1966 as amended).

The predictive model, constructed using a multivariate statistical technique on variables associated with areas with and without sites, indicates that prehistoric appear to be concentrated in association with certain definable physical features o context, very high densities of resources are likely to occur along the Big Lost Ri atop buttes, and within craters and caves. The Lemhi Mountains, the Lake Terreton mile- (2,800-meter-) wide zone along the edge of local lava fields probably contain density of sites. Within the extensive flows of basaltic lava and along the low fo Mountains, site density is classified as moderate, and the lowest density of prehis probably occurs in the floodplain of the Big Lost River and the alluvial fans emerg Creek Valley, in the sinks, and in the recent Cerro Grande lava flow. However, a c or medium density does not eliminate the possibility that significant resources exi Although the predictive model has not been tested, it is useful as a planning guide most likely to contain archeological resources based on past surveys.

Although there has been no systematic inventory of historically significant fac with the creation and operation of the INEL, a preliminary study indicated that all require evaluation (Braun et al. 1993). The Experimental Breeder Reactor-I is a Na Landmark listed in the National Register of Historic Places. To date, however, few properties have been formally evaluated for eligibility to the National Register. Agreement between DOE, the Idaho State Historic Preservation Office, and the Nation Council on Historic Preservation establish that certain structures at Test Area Nor Auxiliary Reactor Area (DOE 1993a) are eligible for nomination, and outline specifi preserving the historic value of the areas in conformance with the requirements of American Building Survey and the Historic American Engineering Record. Other facil INEL site are likely to require similar efforts if DOE schedules them for major mod demolition, or abandonment.

4.4.2 Native American Cultural Resources

Because Native American people believe the land is sacred, the entire INEL rese important to them. Cultural resources, to the Shoshone-Bannock peoples, include al traditional lifeways and usage of all natural resources. This includes not only pr sites, which are important in a religious or cultural heritage context, but also fe landscape, air, plant, water, or animal resources that might have special significa may be affected by changes in the visual environment (construction, ground disturba introduction of a foreign element into the setting), dust particles, or by contamin the INEL is included within a large territory once inhabited by and still of import Shoshone-Bannock Tribes. Plant resources used by the Shoshone-Bannock Tribes that or near the INEL site are listed in Table 4.4-1. Areas significant to the tribes w buttes, wetlands, sinks, grasslands, juniper woodlands, Birch Creek, and the Big Lo

Five Federal laws prompt consultation between Federal agencies and Indian Tribe Environmental Policy Act (NEPA 1969), the National Historic Preservation Act (NHPA amended), the American Indian Religious Freedom Act (AIRFA 1978), the Archeological Protection Act (ARPA 1979), and the Native American Graves Protection and Repatriat (NAGPRA 1990). In accordance with these directives and in consideration of its Nat Policy (DOE 1990a and DOE 1992a), DOE is developing procedures at the INEL for cons coordination with the Shoshone-Bannock Tribes of the Fort Hall Reservation. DOE ha additional interaction and exchange of information with the Shoshone-Bannock Tribes outlined this relationship in a formal Working Agreement with these tribes (DOE 199 the Cultural Resources Management Plan for the INEL (Miller 1992) and the curation permanent storage of archaeological materials will be completed by June 1996. The Resources Management Plan will define procedures for involving the tribes during th of project development and the curation agreement will provide for the repatriation accordance with NAGPRA.

4.4.3 Paleontological Resources

There are 31 known fossil localities at the INEL site. Available information s region has relatively abundant and varied paleontological resources. Preliminary a

Table 4.4-1. Plants used by the Shoshone-Bannock tribes that are located on or nea

Plant Family	Type of Use	Location
Desert Parsley	medicine, food	scattered over site
Milkweed	food, tools	roadsides
Sagebrush	medicine, tools	throughout the site
Balsamroot	food, medicine	around buttes
Thistle	food	scattered throughout site
Gumweed	medicine	disturbed areas
Sunflower	medicine, food	roadside
Dandelion	food, medicine	throughout site
Beggar's Ticks	food	disturbed areas throughout site
Tansymustard	food, medicine	disturbed areas
Cactus	food	throughout the site
Honeysuckle	food, tools	Big Southern Butte
Goosefoot	food	throughout site
Russian Thistle	food	disturbed areas throughout site
Dogwood	food, medicine, tools	Webb Springs, Birch Creek
Juniper	medicine, food, tools	throughout site
Gooseberry	food	scattered throughout site
Mentha arvensis	medicine	Big Lost River
Wild onion	food, medicine, dye	throughout site
Caloehortus spp.	food	buttes
Fireweed	food	throughout site
Pine	food, tools, medicine	Big Southern Butte
Douglas Fir	medicine	Big Southern Butte
Plantain	medicine, food	throughout site
Wildrye	food, tools	throughout site
Indian Ricegrass	food	throughout site
Bluegrass	food, medicine	throughout site
Serviceberry	food, tools, medicine	buttes
Chokeberry	food, medicine, tools, fuel	buttes
Wood's Rose	food, smoking, medicine, ritual	Big Lost River, Big Southern Butte
Red Raspberry	food, medicine	Big Southern Butte
Willow	medicine	throughout site in moist areas
Coyote Tobacco	smoking, medicine	Big Lost River, Webb Springs
Cattail	food, tools	sinks, outflow from facilities

Source: Andersen et al. (1995).

these materials are most likely to occur in association with archeological sites; i in deposits of the Big Lost River, Little Lost River, and Birch Creek; in deposits playas; in some wind and sand deposits; and in sedimentary interbeds or lava tubes flows (Miller 1992).

4.5 Aesthetic and Scenic Resources

4.5.1 Visual Character of the INEL Site

The Bitterroot, Lemhi, and Lost River mountain ranges border the INEL site on t west. Persons can see volcanic buttes near the southern boundary of the INEL from the site and from the Fort Hall Reservation. Most of the INEL site consists of ope covered predominantly by large sagebrush and grasslands (see Section 4.9). Pasture farmland border much of the INEL site (see Section 4.2).

Although the INEL has a master plan, it has not established specific visual res The nine facility areas on the INEL site are generally of low density, look like co industrial complexes, and are spread across the site. Structures in the facility a from 10 feet to approximately 100 feet (3 to 30 meters). About 90 miles (145 kilom public highway run through the INEL site (see Section 4.11). Although many INEL fa visible from these highways, most facilities are located more than 0.5 mile (0.8 ki roads.

4.5.2 Scenic Areas

The Craters of the Moon National Monument is about 15 miles (24 kilometers) sou INEL site's western boundary. The Monument is located in a designated Wilderness A must maintain Class I (very high) air quality standards or minimal degradation, as Clean Air Act (CAA 1990; CFR 1990; CFR 1991b). Under Section 169a of the Clean Air quality includes visibility and scenic view considerations.

Lands adjacent to the INEL under Bureau of Land Management jurisdiction are Vis Management Class II areas (BLM 1984; BLM 1986), which urge preservation and retenti existing character of the landscape. Lands inside the INEL boundaries are Class II most lenient classes in terms of modification. The Bureau of Land Management is co Black Canyon Wilderness Study Area, which is adjacent to the INEL, for a Wilderness designation (BLM 1986); if approved, this would result in an upgrade from Visual Re Management Class II to a Class I.

Features of the natural landscape have special significance to the Shoshone-Ban visual environment of the INEL site is within the visual range of Fort Hall Reserva

4.6 Geology

This section describes the geology of the INEL and the surrounding area. Secti characterizes the general geology, while section 4.6.2 describes the natural resour Sections 4.6.3 and 4.6.4 describe seismic and volcanic hazards, respectively.

4.6.1 General Geology

The site is on the Eastern Snake River Plain (Figure 4.6-1). The Plain forms a trending, crescent-shaped trough with low relief composed primarily of surface basa formed 1.2 million to 2,100 years ago. The Plain features thin, discontinuous, and deposits of wind-blown loess and sand; water-borne alluvial fan, lacustrine, and fl sediments; and rhyolitic domes formed 1,200,000 to 300,000 years ago (Kuntz et al. (Figure 4.6-2). Mountains and valleys of the Basin and Range Province, which trend northwest and consist of folded and faulted rocks that are more than 70 million yea Plain on the north and south. The Yellowstone Plateau bounds the Plain on the nort episode of Basin and Range faulting began 20 to 30 million years ago and continues recently associated with the October 28, 1983, Borah Peak earthquake [moment magnit magnitude 7.3 on the Richter scale with a resulting peak ground acceleration of 0.0 INEL (Jackson 1985)], which occurred along the Lost River fault, approximately 100 (62 miles) from site facilities and the 1959 Hebgen Lake Earthquake, moment magnitu approximately 150 kilometers (93 miles) from the INEL (Figure 4.6-1).

The northeast-trending volcanic terrain of the Plain has a markedly different g tectonic pattern than the folded and faulted terrain of the northwest-trending Basi Basin and Range faults have not been observed on or across the Plain. Four northwe volcanic rift zones, attributed to basaltic eruptions that occurred 4 million to 2, across the Plain at the INEL (Bowman 1995; Hackett and Smith 1992; Kuntz et al. 199

The seismic characteristics of the Eastern Snake River Plain and the adjacent B Province are also different. Earthquakes and active faulting are associated with t tectonic activity. The Plain has historically experienced few and small earthquake Pelton et al. 1990; WCC 1992; Jackson et al. 1993).

Figure 4.6-1. Location of INEL in context of regional geologic features. Figure 4.6-2. Lithologic logs of deep drill holes in the INEL area. 4.6.2 Natural Resources

In 1979 the INEL drilled a geothermal exploration well to 3,159 meters (10,365 Researchers measured a temperature of 142yC (288yF) but identified no commercial qu geothermal fluids (IDWR 1980). Mineral resources include several quarries or pits boundary that supply sand, gravel, pumice, silt, clay, and aggregate for road const maintenance, new facility construction and maintenance, waste burial activities, an landscaping cinders. During excavations, DOE might study the gravel pits to charac surficial geology of the site. Outside the site boundary, mineral resources includ pumice, phosphate, and base and precious metals (Strowd et al. 1981; Mitchell et al geologic history of the Plain makes the potential for petroleum production at the I

4.6.3 Seismic Hazards

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

Several investigators have suggested hypotheses for the low rate of seismic act Plain compared to the activity in both the Centennial Tectonic Belt and the Intermo Belt:

- Smith and Sbar (1974) and Brott et al. (1981) suggest that high crustal tem the Plain and adjacent region inside the seismic parabola (Figure 4.6-1) re deformation (aseismic creep), in contrast to the brittle deformation (rock in the Basin and Range.
- Anders et al. (1989) suggest that the Plain and the adjacent region inside parabola (Figure 4.6-1) have increased integrated lithospheric strength. T the presence of mid-crustal basic intrusive rock strengthens the crust so t to fracture (see also Smith and Arabasz 1991).

Figure 4.6-3. Earthquakes with magnitudes greater than 2.5 from 1884 to 1989. -

and associated seismicity by altering the local tectonic stress field. As volcanic rift zones, they push apart the surrounding rocks and decrease dif thereby preventing earthquakes from occurring.

- Anders and Sleep (1992) propose that the introduction of mantle-derived mag midcrust beneath the Plain has decreased faulting and earthquakes by loweri deformation.

The markedly different tectonic and seismic histories of the Plain and Basin an reflect the dissimilar deformational processes acting in each region. Both regions same extensional stress field (Weaver et al. 1979; Zoback and Zoback 1989; Pierce a Jackson et al. 1993); however, crustal deformation occurs through dike injection in through large-scale normal faulting in the Basin and Range (Rodgers et al. 1990; Pa Thompson 1991; Hackett and Smith 1992).

Major seismic hazards include the effects from ground shaking and surface defor tilting). Other potential seismic hazards (e.g., avalanches, landslides, mudslides and soil liquefaction) are not likely to occur at the INEL because the local geolog conducive to them. Based on the seismic history and the geologic conditions, earth moment magnitude 5.5 (and associated strong ground shaking and surface fault ruptur to occur in the Plain. However, moderate to strong ground shaking from earthquakes Range can affect the INEL. Researchers use patterns of seismicity and locations of assess potential sources of future earthquakes and to estimate levels of ground mot The sources and maximum magnitudes of earthquakes that could produce the maximum le motions at all INEL facilities include the following (WCC 1990; WCC 1992):

- A moment magnitude 7.0 earthquake at the southern end of the Lemhi fault al and Fallert Springs segments
- A moment magnitude 7.0 earthquake at the southern end of the Lost River fau Arco segment
- A moment magnitude 5.5 earthquake associated with dike injection in either Lava Ridge-Hell's Half Acre Volcanic Rift Zone and the Axial Volcanic Zone
- A "random" moment magnitude 5.5 earthquake occurring in the Eastern Snake R

Figure 4.6-4 shows a facility-specific example of the relationship of the peak on the INEL to the annual frequency of occurrence of seismic events on various seis region, including the four events described above (WCFS 1993). The curves refer sp site of the Idaho Chemical Processing Plant in the south-central INEL and might not other INEL areas. Ground motion contributions from seismic sources not shown on Fi (i.e., Intermountain seismic belt and Yellowstone Region) are significantly smaller distant locations or lower estimated maximum magnitudes. The INEL Natural Phenomen determines INEL seismic design-basis events based on studies such as those performe Clyde Consultants (1990) and Woodward Clyde Federal Services (1993).

A maximum horizontal ground surface acceleration of 0.24g at the Idaho National Laboratory is estimated to result from an earthquake that could occur once every 2, 1994). The seismic hazard information presented in this EIS is for general seismic comparisons across DOE sites. Potential seismic hazards for existing and new facil evaluated on a facility-specific basis, consistent with DOE orders, standards, and procedures. Section 5.15 describes the potential impacts of postulated seismic eve

4.6.4 Volcanic Hazards

Volcanic hazards at the INEL can come from sources inside or outside Plain boun hazards include the effects of lava flows, ground deformation (fissures, uplift, su earthquakes (associated with magmatic processes as distinct from earthquakes associ tectonics), and ash flows or airborne ash deposits (Bowman 1995). Most of the basa activity occurred from 4 million to 2,100 years ago in the INEL area. The most rec volcanic eruption occurred 2,100 years ago at the Craters of the Moon, 25 kilometer southwest of the INEL (Kuntz et al. 1992). The rhyolite domes along the Axial Volc between 1.2 million and 300,000 years ago and have a recurrence interval of about 2 Therefore, the probability of future dome formation affecting INEL facilities is ve

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

Catastrophic Yellowstone eruptions have occurred three times in the past 2 mill INEL is more than 160 kilometers (70 miles) from the Yellowstone Caldera rim and hi winds would not disperse Yellowstone ash in the direction of INEL. Due to the infr distance, and unfavorable dispersal, pyroclastic flows or ash fallout from future Y should not impact the INEL.

Basaltic lava flows and eruptions from fissures or vents might occur. Based on analysis of the volcanic history in the Big Southern Butte area (Volcanism Working conditional probability that basaltic volcanism would affect a south-central INEL l 2.5 y 10-5 per year (once per 40,000 years or longer), where the risk associated wi Zone volcanism is greatest. The estimated probability of volcanic impact on INEL f north, where both silicic and basaltic volcanism have been older and less frequent, year (once every million years or longer). The statistics of 116 measured INEL-are and areas were used to define the two lava flow hazard zones (Figure 4.6-5). The h particular site within or near a volcanic zone is much lower, typically by an order more, and must be assessed on a site-specific basis (Bowman 1995).

Figure 4.6-5. Map of the INEL showing locations of volcanic rift zones and lava flow hazard zones. 4.7 Air Quality

This section describes the air resources of the INEL site and the surrounding a discussion includes the climatology and meteorology of the region, descriptions of radiological air contaminant emissions, and a characterization of existing and proj pollutants. The analysis includes both existing facilities and those that were exp analysis was performed) to be operational before June 1, 1995. Additional detail a information on the material presented in this section is presented in Appendix F, S Volume 2.

4.7.1 Climatology and Meteorology

The Eastern Snake River Plain climate exhibits low relative humidity, wide dail swings, and large variations in annual precipitation. Average seasonal temperature INEL site range from -7.3yC (18.8yF) in winter to 18.2yC (64.8yF) in summer, with a temperature of about 5.6yC (42yF). Temperature extremes range from a summertime ma 39.4yC (103yF) to a wintertime minimum of -45yC (-49yF). The annual average relati 50 percent, with monthly average maximum values ranging from 59 percent in July to February and December, and with monthly average minimum values ranging from 16 perc and July to 47 percent in January (Clawson et al. 1989).

Annual precipitation is light, averaging 221.2 millimeters (8.71 inches), with of zero to 127 millimeters (5 inches). The maximum 24-hour precipitation rate is 4 (1.8 inches). The greatest short-term precipitation rates are attributable primari which occur approximately two or three days per month during the summer. The avera snowfall is 701 millimeters (27.6 inches), with a maximum of 1,516 millimeters (59. minimum of 173 millimeters (6.8 inches) (Clawson et al. 1989).

The INEL site is in the belt of prevailing westerlies; however, the mountain ra Eastern Snake River Plain normally channel these winds into a southwest wind. Most experience the predominant southwest-northeast wind flow of the Eastern Snake River subtle terrain features near some locations cause considerable variations from this annual average wind speed measured at the 6.1-meter (20-foot) level at the Central

Weather Station is 3.4 meters per second (7.5 miles per hour). Monthly average val 2.3 meters per second (5.1 miles per hour) in December to 4.2 meters per second (9. in April and May (Clawson et al. 1989). The highest hourly average near-ground win measured onsite is 22.8 meters per second (51 miles per hour) from the west-southwe maximum instantaneous gust of 34.9 meters per second (78 miles per hour) (Clawson e Figure 4.7-1 presents the frequency of wind speed and wind direction at three meteo monitoring sites on the INEL site from 1988 to 1992. The wind directions presented the direction from which the wind blows. The three wind-roses demonstrate the effe predominant wind directions and wind speed. The winds at the Test Area North monit predominantly from the north-northwest, whereas the winds from the other stations a from the southwest.

Air pollutant dispersion is a result of the processes of transport and diffusio contaminants in the atmosphere. Transport is the movement of a pollutant in the wi diffusion refers to the process whereby turbulent eddies dilute a pollutant plume. gradient of the atmosphere (i.e., the change in temperature with altitude) can rest vertical diffusion of pollutants. Lapse rate conditions, which tend to enhance ver slightly less than 50 percent of the time. Conversely, thermal stratification or i which inhibit vertical diffusion, occur slightly more than 50 percent of the time. the pollutants can freely diffuse is the mixing depth, while the layer of air from mixing depth is the mixed layer. Estimates of the monthly average depth of the mix from 400 meters (1,312 feet) in December to 3,000 meters (9,843 feet) in July. Wit mostly clear skies, nocturnal inversions begin forming after sunset and dissipate a after sunrise. These inversions are often ground-based, meaning the atmospheric te with height from the ground (Clawson et al. 1989).

Other than thunderstorms, severe weather is uncommon. Five funnel clouds (torn touching the ground) and no tornadoes were reported on the site between 1950 and 19 the region is good because of the low moisture content of the air and minimal sourc reducing pollutants. From Craters of the Moon National Monument, the seasonal visu 130 to 155 kilometers (81 to 97 miles) (Notar 1993).

4.7.2 Air Quality

4.7.2.1 Nonradiological Air Quality. The INEL is in the Eastern Idaho Intrastate Air

Quality Control Region (AQCR 61). Neither the INEL nor any of the surrounding coun

Figure 4.7-1. Depiction of annual average wind direction and speed at INEL meteor

designated as a nonattainment area (CFR 1992b) for the National Ambient Air Quality (CFR 1991b). Ambient air quality data monitored in the vicinity of the INEL indica in compliance with applicable air quality standards (DOE 1991a).

The Clean Air Act (CAA 1990) contains requirements to prevent the deterioration in areas designated to be in attainment with the ambient air quality standards. Th administered through a program that limits the increase in specific air pollutants existed in what has been termed a baseline (or starting) year, which is 1977. The maximum allowable ambient pollutant concentration increases or increments. They sp limits for pollutant level increases for the nation as a whole (Class II areas) and stringent increment limits (as well as ceilings) for designated national resources, forests, parks, and monuments (Class I areas). Three areas in the INEL vicinity ar Significant Deterioration Class I ambient air quality areas: Craters of the Moon W approximately 53 kilometers (33 miles) to the west-southwest; Yellowstone National approximately 143 kilometers (89 miles) to the northeast; and Grand Teton National approximately 145 kilometers (90 miles) to the east-northeast.

DOE evaluates proposed new and modified sources of emissions at INEL to determi emissions increase of all pollutants. The INEL is considered a major source, becau emissions of specific regulated air contaminants exceed 227 metric tons (250 tons) Therefore, a Prevention of Significant Deterioration analysis must be performed for emission increases of specified regulated pollutants. Levels of significance for n range from very small quantities (less than 1 pound) for beryllium up to 91 metric year for carbon monoxide. Their significance is dependent on the toxicity of the s radionuclides, significance means any increase in emissions that would result in an millirem per year or greater.

Ambient air quality standards for Idaho are the same as the National Ambient Ai Standards but include total suspended particulates and fluorides. The Idaho Depart Welfare (IDHW) also has ambient concentration limits for hazardous and toxic air po

Table 4.7-1 lists emission rates of criteria and hazardous and toxic air pollutants

The types and amounts of nonradiological emissions from INEL facilities and act **similar to those from other industrial complexes that are the same sizes as the INE** sources such as boilers and emergency generators emit both criteria and toxic pollu

Table 4.7-1. Baseline annual average and maximum hourly emission rates of nonradio pollutants at the INEL.

Pollutant	Annual average (kg/yr)b,c	Maximum hourly (kg/hr
Criteria pollutants		
Carbon monoxide (CO)	301,000	177
Lead (Pb)	11	0.085
Nitrogen dioxide (NO2)	744,000	545
Particulate matter (PM10)d	302,000	230
Sulfur dioxide (SO2)	202,000	136
Hazardous/toxic air pollutantse		
Acetaldehyde	31	0.39
Ammonia	1,600	3.4
Arsenic	4.2	9.0 y 10-4
Benzene	370	16
1,3-Butadiene	220	0.8
Carbon tetrachloride	28	0.08
Chloroform	1.9	5.5 y 10-3
Chromium - trivalent	3.1	2.5 y 10-3
Chromium - hexavalent	0.4	6.2 y 10-4
Cyclopentane	350	0.58
Dichloromethane	620	0.29
Formaldehyde	960	8.9
Hydrazine	8.3	9.5 y 10-4
Hydrochloric acid	1,500	0.34
Mercury	200	0.023
Napthalene	16	2.2
Nickel	270	0.057
Nitric acid	1,500	1.7
Phosphorous	56	0.024
Potassium hydroxide	990	0.24
Propionaldehyde	62	0.24
Styrene	4.7	0.74
Tetrachlorethylene	980	0.11
Toluene	580	56
Trichloroethylene	4.7	0.013
Trimethylbenzene	87	12

a. Source: Volume 2, Table 4.7-2.
b. To convert kilograms to pounds, multiply by 2.2.
c. Annual average values include actual emissions plus projected increases from fac become opertional after the baseline year.
d. It is conservatively assumed that all particulate matter is PM10 (less than 10 m
e. Hazardous/toxic air pollutants that are listed in State of Idaho regulations and that exceed screening criteria.

sources include chemical processing operations, transportation, waste management ac research laboratories.

Table 4.7-2 compares the INEL contribution to air quality to applicable standar This assessment modelled the INEL air emissions inventory for 1990 using the method by the U.S. Environmental Protection Agency to predict the maximum ground-level con would occur at or beyond the site boundary for each regulated pollutant (EPA 1993b) Source Complex-2 model primarily assessed criteria pollutants, and the SCREEN model air pollutants. The SCREEN model incorporates meteorological data that tend to ove and is useful for identifying cases that require additional, more refined assessmen concentrations listed in Table 4.7-2 are the sums of the following factors: the co from potential impacts from current operations and the concentrations resulting fro or operation of planned upgrades or modifications before the implementation of the described in Section 5.7. Background concentrations have not been included because on background levels in the INEL environs are not available for most pollutants and levels are low and are more than offset by the use of the maximum (as opposed to ac The baseline concentrations represent the maximum calculated concentration occurrin locations (site boundary, public roads, and Craters of the Moon Wilderness Area).

the baseline concentrations to applicable Federal and state criteria pollutant and pollutant guidelines and regulations shows that air quality at INEL is in complianc guidelines and regulations. The 24-hour total suspended particulate background con as 40 micrograms per cubic meter, which is the same as the annual geometric mean va sources include chemical processing operations, transportation, waste management ac research laboratories.

4.7.2.2 Radiological Air Quality. The major source of radiation exposure in the Eastern

Snake River Plain is from natural background radiation sources such as cosmic rays; naturally present in soil, rocks, and the human body; and airborne radionuclides of as radon). Sources of radioactivity related to INEL operations include research an spent nuclear fuel testing and stabilization, irradiated material and fuel examinat treatment and storage, and depleted uranium armor production.

Radioactive emissions from INEL facilities include the noble gases (argon, kryp and iodine; particulate fission products such as rubidium, strontium, and cesium; r

Table 4.7-2. Comparison of baseline ambient air concentrations with most stringent regulations and guidelines at the INEL.

Pollutant	Averaging time	Most stringent regulation or guideline (-g/m3)a,b,c	Maximum baseline concentrat (-g/m3)
Criteria pollutants			
Carbon monoxide (CO)	8-hour	10,000	280
	1-hour	40,000	610
Lead (Pb)	Calendar Quarter	1.5	0.001
Nitrogen dioxide (NO2)	Annual	100	4
Particulate matter (PM10)	Annual	50	5
	24-hour	150	80
Sulfur dioxide (SO2)	Annual	80	6
	24-hour	365	140
	3-hour	1,300	580
Hazardous/toxic air pollutants			
Acetaldehyde	Annual	4.5 y 10-1	1.1 y 10-2
Ammonia	Annual	1.8 y 102	6.0 y 100
Arsenic	Annual	2.3 y 10-4	9.0 y 10-5
Benzene	Annual	1.2 y 10-1	2.9 y 10-2
Butadiene	Annual	3.6 y 10-3	1.0 y 10-3
Carbon Tetrachloride	Annual	6.7 y 10-2	6.0 y 10-3
Chloroform	Annual	4.3 y 10-2	4.0 y 10-4
Chromium - hexavalent	Annual	8.3 y 10-5	6.0 y 10-5
Chromium - trivalent	Annual	5.0 y 100	3.6 y 10-2
Cylclopentane	Annual	1.7 y 104	2.7 y 10-0
Formaldehyde	Annual	7.7 y 10-2	1.2 y 10-2
Hydrazine	Annual	3.4 y 10-4	1.0 y 10-6
Hydrochloric acid	Annual	7.5 y 100	9.8 y 10-1
Mercury	Annual	1.0 y 100	4.2 y 10-2
Methylene Chloride	Annual	2.4 y 10-1	6.0 y 10-3
Napthalene	Annual	5.0 y 102	1.8 y 101
Nickel	Annual	4.2 y 10-3	2.7 y 10-3
Nitric Acid	Annual	5.0 y 101	6.4 y 10-1

Table 4.7-2. (continued).

Pollutant	Averaging time	Most stringent regulation or guideline (-g/m3)a,b,c	Maximum baseline concentrat (-g/m3)
Perchloroethylene	Annual	2.1 y 100	1.1 y 10-1
Phosphorous	Annual	1.0 y 100	3.0 y 10-1
Potassium hydroxide	Annual	2.0 y 101	2.0 y 10-1
Proprionaldehyde	Annual	4.3 y 100	3.0 y 10-1
Styrene	Annual	1.0 y 103	1.3 y 100
Toluene	Annual	3.8 y 103	3.7 y 102

Trichloroethylene	Annual	7.7 y 10-2	9.7 y 10-4
Trimethylbenzene	Annual	1.2 y 103	1.0 y 102

a. CFR (1991b).
b. IDHW (1994); the ambient standards for the criteria pollutants are the same as t
c. Standards cited for hazardous/toxic air pollutants are for all new sources const since May 1, 1994, under State of Idaho Regulations for the Control of Air Pollu Idaho (IDHW 1994).
Source: Volume 2, Section 4.7.

by neutron activation such as tritium (hydrogen-3), carbon-14, and cobalt-60; and v (less than 6 y 10-4 curies per year) of heavy elements such as uranium, thorium, pl decay products. Historically, the radionuclide with the highest emission rate is t krypton-85, which is released primarily by the chemical reprocessing of spent nucle Chemical Processing Plant. Fuel reprocessing also releases small amounts (less tha year) of iodine-129, which is of concern because of its long half-life (16 million properties (iodine isotopes tend to accumulate in the human thyroid). Reactor oper gas isotopes with short half-lives, including argon-41 and isotopes of xenon (prima -135, and -138). Other activities at the INEL, including waste management operatio low levels of airborne radionuclide emissions (less than 1 y 10-4 curie per year). summarizes airborne radionuclide emissions from INEL facility areas, plus estimated projects expected, at the time of the analysis was performed, to become operational 1995.

Radioactivity released to the atmosphere can result in human exposure through a pathways, including inhalation, external exposure, and ingestion. DOE conducts phy

Table 4.7-3. Summary of airborne radionuclide emissions from INEL facility areas (

Facility	Tritium/ carbon-14	Iodines	Noble gases	Mixed fission an activation productsb
Argonne National Laboratory-West	1.0 y 102	-d	1.3 y 104	8.1 y 10-4
Central Facilities Area	2.6 y 100	5.0 y 10-7	-	1.9 y 10-5
Idaho Chemical Processing Plant	4.3 y 101	6.4 y 10-2	1.0 y 104	3.6 y 10-2
Naval Reactors Facility	1.9 y 10-1	6.3 y 10-6	5.7 y 10-1	5.6 y 10-5
Power Burst Facility/Waste Experimental Reduction Facility	4.9 y 101	-	-	1.3 y 100
Radioactive Waste Management Complex	-	-	-	2.6 y 10-5
Test Area North	1.2 y 10-1	-	-	5.6 y 10-6
Test Reactor Area	1.6 y 102	1.6 y 10-2	3.3 y 103	3.0 y 100
INEL total	2.1 y 103	1.1 y 10-1	1.2 y 105	5.6 y 100

a. With the exception of the Idaho Chemical Processing Plant, emissions estimates a operations. Idaho Chemical Processing Plant emissions are based on 1993 emissio upward to reflect operation of the New Waste Calcining Facility at maximum permi Anticipated projects in the baseline include the Waste Experimental Reduction Fa and sizing operations but not incineration), Argonne National Laboratory-West Fu and Portable Water Treatment Unit, as described in Appendix F of Volume 2.
b. Mixed fission and activation products that are primarily particulate in nature (cobalt-60, strontium-90, and cesium-137).
c. U/Th/TRU = Radioisotopes of uranium, thorium, or transuranic elements such as pl americium, and neptunium.
d. A dash (-) indicates that the emissions for this group are negligibly small or z
Source: Volume 2, Table 4.7-1.

measurements (ambient air monitoring) and uses calculation techniques (atmospheric modeling) to assess existing levels of radiation (both cosmic and manmade) in and n assess doses to workers and the surrounding population.

The offsite population can receive a radiation dose as a result of radiological attributable to existing INEL operations. DOE assesses such a dose for a maximally individual and for the population as a whole. The maximally exposed individual is person whose habits and proximity to the site are such that the person would receiv projected to result from sitewide radioactive emissions. The calculated annual dos

as a result of current and anticipated sitewide emissions is 0.05 millirem (Section
This value is a small fraction of both the National Emission Standards for Hazardou
dose limit of 10 millirem per year (CFR 1992a) and the dose received from natural b
sources of 351 millirem per year (Section 4.7 to Volume 2). Figure 4.7-2 compares

The collective annual dose to the surrounding population, determined using 1990 Bureau data for the total population residing within an 80-kilometer (50-mile) radi on the site, is about 0.3 person-rem (Section 4.7 to Volume 2). This value is smal the annual dose received by the same population from background sources, which is m 40,000 person-rem (Section 4.7 to Volume 2).

Workers at each major INEL facility can receive radiation exposures. DOE has b assessment of the dose to these workers on contributions from sources at each facil expected to become operational before June 1, 1995. The results of this assessment maximum dose received by a worker at any onsite area is about 4.3 millirem per year Volume 2), well below the National Emissions Standard for Hazardous Air Pollutants 10 millirem per year. The standard applies to the highest exposed member of the pu applicable to workers. However, it is the most restrictive limit for airborne rele useful comparison. This dose value of 4.3 millirem per year includes the maximum p operation of the Portable Water Treatment Unit at the Power Burst Facility Area. H operation would be temporary (1 to 2 years) and is not representative of a permanen baseline. If this facility were not included, the baseline dose to the worker woul 0.2 millirem per year.

Figure 4.7-2. Comparison of dose to maximally exposed individual (MEI) to the Na

4.8 Water Resources

This section describes existing regional and site hydrologic conditions and dis of surface and subsurface water and water use and rights. The subsurface water sect the vadose zone (or unsaturated zone and perched water bodies) located between the the water table.

4.8.1 Surface Water

Other than surface-water bodies formed from accumulated runoff during snowmelt precipitation and manmade infiltration and evaporation ponds, there is little surfa The following sections discuss regional drainage conditions, local runoff, floodpla surface-water quality. Figure 4,8-1 supports discussions in this section.

4.8.1.1 Regional Drainage. The INEL is in the Pioneer Basin, a closed drainage basin that

includes three main surface-water bodies--the Big and Little Lost Rivers and Birch water bodies drain mountain watersheds directly west and north of the site. However surface-water flow is diverted for irrigation before it reaches site boundaries (Ba resulting in little or no flow for several years inside the site boundaries (Pittma

The Big Lost River drains approximately 3,755 square kilometers (1,450 square m before reaching the site. Approximately 48 kilometers (30 miles) upstream of Arco, Dam controls and regulates the flow of the river, which continues southeast past th and Arco and onto the Eastern Snake River Plain. The river channel then crosses the boundary of the site, where the INEL Diversion Dam controls surface-water flow. Dur runoff events, the dam diverts surface water to a series of natural depressions, de areas. The Big Lost River continues northeasterly across the site to an area of nat basins (playas or sinks) near Test Area North. In dry years, surface water does not western boundary of the site, and because the INEL is located in a closed drainage water never flows off the site.

Birch Creek drains an area of approximately 1,943 square kilometers (750 square summer, upstream of the site, surface water from Birch Creek is diverted to provide

Figure 4.8-1. Selected facilities and predicted inundation map for probable maxim

to produce hydropower. In the winter, water flow crosses the northwest corner of th manmade channel 6.4 kilometers (4 miles) north of Test Area North, where it then in channel gravels.

The Little Lost River drains an area of approximately 1,826 square kilometers (miles). Strearnflow is diverted for irrigation north of Howe, Idaho. Surface water

River has not reached the site in recent years; however, during high stream flow ye reach the site and infiltrate into the subsurface (E(3&G 1984).

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 site either evaporates or infiltrates into the ground, increasing subsurface saturation subsurface migration (Wilhelmson et al. 1993).

Localized flooding can occur at the site when the ground is frozen and melting with heavy spring rains. Test Area North was flooded in 1969 (Koslow and Van Haafte 1969 extensive flooding caused by snowmelt occurred in the lower Birch Creek Valley Studies have shown that both the 25- and 100-year, 24-hour rainfall/snowmelt storm flooding within the Radioactive Waste Management Complex (Dames & Moore 1992). The system, including dikes and erosion prevention features designed to mitigate potent flooding, are being upgraded.

4.8.1.3 Floodplains. Intermittent surface-water flow and the INEL Diversion Dam (built in

1958 and enlarged in 1984) have effectively prevented flooding from the Big Lost Ri However, onsite flooding from the river could occur if high water in the Mackay Dam River were coupled with a darn failure. Koslow and Van Haaften (1986) examined the of structural failure of the Mackay Dam due to a seismic event, coupled with a prob flood (the largest flood assumed possible in an area), This scenario predicts flood the INEL Diversion Dam and spreading at the Idaho Chemical Processing Plant, Naval Facility, and the Test Area North Loss-of-Fluid Test Facility (Figure 4.8-1). In th combined Mackay Dam failure and a 100-year flood (flood that occurs on an average o 100 years), flooding along the Big Lost River would also occur, with low velocities on the INEL (Koslow and Van Haaften 1986). The area inundated under the Mackay Dam scenarios probably would use more than the 100- or 500-year floodplains for the Big INEL. A 100-year floodplain study for the INEL is in progress.

4.8.1.4 Surface-Water Ouality, 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. Measure chemical, and radioactive parameters have not exceeded applicable drinking water qu Chemical composition is determined primarily by the mineral composition of the rock mountain ranges northwest of the site and by the chemical composition of irrigation with the surface water (Robertson et al. 1974; Bennett 1990).

Site activities do not directly affect the quality of surface water outside the s discharges from site facilities are to manmade seepage and evaporation basins or st wells. Effluents are not discharged to natural surface waters. In addition, surface directly off the site (Hoff et al. 1990). However, water from the Big Lost River, a from evaporation basins and stormwater injection wells, does infiltrate the Snake R (Robertson et al. 1974; Wood and Low 1988; Bennett 1990). These areas are inspected and sampled as stipulated in the INEL Stormwater Pollution Prevention Program (DOE-

4.8.2 Subsurface Water

Subsurface water at the site occurs in the Snake River Plain Aquifer and the va section describes regional and local hydrogeologic conditions, vadose zone hydrolog and subsurface-water quality. Generally, the term "groundwater" refers to usable qu that enter freely into wells under confined and unconfined conditions within an aqu

4.8.2. 1 Regional Hydrogeology. The INEL overlies the Snake River Plain Aquifer, the

largest aquifer in Idaho (Figure 4.8-2). This aquifer underlies the Eastern Snake R covers an area of approximately 24,900 square kilometers (9,611 square miles). Grou aquifer generally flows south and southwestward across the Snake River Plain. The e storage in the aquifer is 2.5 x 1012 cubic meters (2 billion acre-feet, which is ab volume of water contained in Lake Erie) (Robertson et al. 1974). A typical irrigati much as 13.9 x 106 cubic meters (3.7 x 10(9) gallons) per year of water if pumped e (Garabedian 1989). The Snake River Plain Aquifer is among the most productive aquif nation.

The drainage basin recharging the Snake River Plain Aquifer covers an area of a 90,643 square kilometers (35,000 square miles). The aquifer is recharged by infiltr

Figure 4.8-2. Location of the INEL, Snake River Plain, and generalized groundwate

water, seepage from stream channels and canals, underflow from tributary stream val into the watershed, and direct infiltration from precipitation (Garabedian 1989). M in surface water-irrigated areas and along the northeastern margins of the plain. G discharges primarily from the aquifer through springs that flow into the Snake Rive pumping for irrigation. Major springs and seepages that flow from the aquifer are l American Falls Reservoir (southwest of Pocatello) and the Thousand Springs area bet Dam and King Hill (near Twin Falls).

4.8.2.2 Local Hydrogeology. The INEL site covers 2,305 square kilometers (890 square

miles) of the north-central portion of the Snake River Plain Aquifer. Depth to grou land surface at the site ranges from approximately 61 meters (200 feet) in the nort (900 feet) in the south (Pittman et al. 1988) (see Figure 4.8-3). Groundwater flow the south-southwest, and the upper surface is primarily unconfined (not overlain by or bedrock). However, the aquifer behaves as if it were partially confined because geologic conditions. The occurrence and movement of groundwater in the aquifer depe geologic setting and the recharge and discharge of water within that setting. Most consists primarily of numerous relatively thin, basaltic lava flows with interbedde extending to depths of 1,067 meters (3,500 feet) below the land surface (Irving 199 groundwater migrates horizontally through fractured, basaltic interflow zones (brok zones) that occur at various depths. Water also migrates vertically along joints an edges of interflow zones (Garabedian 1986). Sedimentary interbeds restrict the vert groundwater. The variability in how the aquifer stores and transmits water increase aquifer investigations and modeling.

The rate at which water moves through the ground depends on the hydraulic gradi elevation and pressure with distance in a given direction) of the aquifer, the effe (percentage of void spaces), and hydraulic conductivity (capacity of a porous media of the soil and bedrock. Because aquifer porosity and hydraulic conductivity decrea most of the water in the aquifer moves through the upper 61 to 152 meters (200 to 5 basalts. Estimated flow rates within the aquifer range from 1.5 to 6.1 meters (5 to (Barraclough et al. 1981).

The aquifer's ability to transmit water (transmissivity), and its ability to st are important physical properties of the aquifer. In general, the hydraulic charact enable the easy transmission of water, particularly in the upper portions.

Figure 4.8-3. Hydrostratigraphy scross the INEL and water table surface. Recharge north. Most of the inflow to the aquifer results from the underflow of groundwater alluvial-filled valleys adjacent to the Eastern Snake River Plain and adjacent surf (i.e., Big and Little Lost Rivers and Birch Creek). In addition, recharge at the si amount of precipitation, particularly snowfall, for a given year (Barraclough et al

4.8.2.3 Vadose Zone Hydrology The vadose (unsaturated) zone extends from the land

surface down to the water table. Within the vadose zone, water and air occupy openi geologic materials. Subsurface water in the vadose zone is referred to as vadose wa this complex zone consists of surface sediments (primarily clay and silt, with some and many relatively thin basaltic lava flows, with some sedimentary interbeds. Thic occur in the northern part of the site, which thin to the south where basalt is exp

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

Travel times for water through the vadose zone are important for an understandi contaminant movement. The flow rates in the vadose zone depend directly on the exte the percentage of sediments versus basalt, and the moisture content of vadose zone increases under wetter conditions and slows under dryer conditions.

4.8.2.4 Perched Water. Locally, saturated conditions that exist above the water table are

called perched water. Perched water occurs when water migrates vertically and later surface until it reaches an impermeable layer (Irving 1993). As perched water sprea sometimes for hundreds of meters, it moves over the edges of the impermeable layer downward. Several perched water bodies can form between the land surface and the wa

In general, perched water bodies slow the downward migration of fluids that inf vadose zone from the surface because the downward flow is not continuous. The occur perched water at the site is related to the presence of disposal ponds or other sur which studies have detected at the Idaho Chemical Processing Plant, Test Reactor Ar North. For example, a 1986 field study at the Idaho Chemical Processing Plant showe water occurs in three areas at possibly three depth zones, ranging from approximate (30 feet) to 98 meters (322 feet) below the ground surface and extending laterally 1 ,097 meters (3,600 feet). In general, the chemical concentrations, shape, and siz have fluctuated over time in response to the volume of water discharged to the infi (Irving 1993).

4.8.2.5 Subsurface Water Quality. Natural water chemistry and contaminants originating at

the site affect subsurface water quality. The INEL Groundwater Protection Managemen conducts monitoring programs. This program collects samples from surface water, per aquifer wells to identify contaminants and contaminant migration to and within the

4.8.2,5.1 Natural Water Chemistry - Several factors determine the natural groundwater

chemistry of the Snake River Plain Aquifer beneath the site. These factors include reactions that occur as water interacts with minerals in the aquifer and the chemic (1) groundwater originating outside the site; (2) precipitation falling directly on (3) streams, rivers, and runoff infiltrating the aquifer (Wood and Low 1986, 1988). the groundwater is different, depending on the source areas. For example, groundwat northwest contains calcium, magnesium, and bicarbonate leached from sedimentary roc groundwater from the east contains sodium, fluorine, and silicate resulting from co rocks (Robertson et al. 1974).

Although the natural chemical composition of groundwater beneath the site does Environmental Protection Agency drinking water standards for any component, the nat affects the mobility of contaminants introduced into the subsurface from INEL activ dissolved contaminants adsorb (or attach) to the surface of rocks and minerals in t thereby retarding the movement of contaminants in the aquifer and inhibiting furthe contamination. However, many naturally occurring chemicals compete with contaminant adsorption sites on the rocks and minerals or react with contaminants to reduce the and mineral surfaces.

4.8.2.5.2 Groundwater Quality - Previous waste discharges to unlined ponds and deep

wells have introduced radionuclides, nonradioactive metals, inorganic salts, and or the subsurface.

Table 4.8-1 summarizes the highest detected concentrations of contaminants observed in the aquifer between 1987 and 1992, concentrations near the site boundary, Enviro **Agency maximum contaminant levels, and DOE Derived Concentration Guides.** The follow

Table 4.8-1. Highest dtected contaminant concentrations in groundwater at the Ida

paragraphs discuss each category of contaminants and comparisons of observed concen maximum contaminant levels.

Radionuclides - In general, radionuclide concentrations in the Snake River Plain the site have decreased since the mid-1980s because of changes in disposal practice decay, adsorption of radionuclides to rocks and minerals, and dilution by natural s groundwater entering the aquifer (Pittman et al. 1988; Orr and Cecil 1991; Bargelt Radionuclides released and observed in the soil and groundwater include tritium, st iodine-129, cobalt-60, cesium-137, plutonium-238, plutonium-239/240, and americium- Associates 1994). Most of these radionuclides have been observed at the Idaho Chemi Plant and Test Reactor Area facility areas. However, radionuclides have also been o

Test Area North disposal well.

Concentrations of radionuclides in the aquifer have decreased over time. This dec to reduced discharges, adsorption, radioactive decay, and improved waste management of 1992, concentrations of iodine-129, cobalt-60, tritium, strontiurn-90, and cesiu the EPA maximum contaminant levels for radionuclides in drinking water in localized INEL boundary. Currently, there are no individual maximum contaminant levels for pl plutonium-239, plutonium-240, and americium-24 1. However, these radionuclides have detected above the established limits for gross radioactivity or the proposed adjus activity maximum contaminant level for drinking water (Golder Associates 1994; Mann Orr and Cecil 1991).

Extremely low concentrations of iodine- 129 and tritium have migrated outside sit 1992, iodine- 129 concentrations were well below the maximum contaminant levels in approximately 6 and 13 kilometers (4 and 8 miles) south of the site boundary (Mann concentrations were much below maximum contaminant levels just south of the site bo By 1988 the tritium plume encompassed by the 500 picocurie per liter contour was ba boundary, and its size has continued to decrease (Pittman et al. 1988; Otr and Ceci 1991). Cobalt-60, strontium-90, cesium-i 3?, plutonium-238, plutonium-240!241, and have not been detected outside the site boundaries.

Nonradioactive Metals - The INEL has released sodium, chromium, lead, and mercu site and into the subsurface through unlined ponds and deep wells. Of these metals, sodium in the greatest quantity from waste treatment processes; however, sodium is not have an established maximum contaminant level. In 1988 chromium concentrations maximum contaminant level were measured near the Test Reactor Area. Lead and mercur occurred at concentrations below the maximum contaminant level near the Idaho Chemi Plant (Orr and Cecil 1991).

Inorganic Salts - Human activities at the site have released chloride, sulfate, the subsurface. Although chloride and sulfate releases have occurred, only nitrate maximum contaminant levels (near the Idaho Chemical Processing Plant in 1981). Disp to the injection well and infiltration ponds at the Idaho Chemical Processing Plant elevated nitrate levels in the central portion of the site. By 1988 the levels of n below the maximum contaminant level. Irrigation in the Mud Lake area might be causi contaminants to enter the northeastern portion of the site in concentrations compar nearby irrigated areas (Orr et al. 1991; Robertson et al. 1974; Edwards et al. 1990

Organic Compounds - Concentrations of volatile organic compounds have been dete the aquifer beneath the site. However, many of these compounds were detected at amo detection limit (0.002 milligram per liter), or two parts per billion, which is the which a specific analytical method can detect a contaminant. However, concentration following compounds exceeding the maximum contaminant levels have occurred in and n Area North disposal well: carbon tetrachloride, chloroform, 1,2-cis-dichloroethylen 1,1 -dichloroethylene, 1 ,2-trans-dichloroethylene, trichloroethylene, tetrachloroe chloride (Leenheer and Bagby 1982; Mann and Knobel 1987; Mann 1990; Liszewski and M

4.8.2.5.3 Perched Water Quality - Wastewater discharges from INEL operations have

infiltrated into the vadose zone and created most of the perched water beneath the Studies have
detected elevated concentrations of the following contaminants in samples: tritium, cobalt-60, chromium, and sulfate concentrations in deep perched water near the Test strontium-90 in perched water near the Idaho Chemical Processing Plant and at Test (Irving 1993; Schafer-Perini 1993). DOE has not yet measured potential concentratio contaminants in all INEL perched water bodies. In general, the chemical concentrati size of these bodies have fluctuated over time in response to the volume of water d infiltration ponds.

4.8.3 Water Use and Rights

The INEL does not withdraw or use surface water for site operations, nor does i effluents to natural surface water. However, the three surface-water bodies at or n Little Lost Rivers and Birch Creek) have the following designated uses: agricultura cold-water biota, salmonid spawning, and primary and secondary contact recreation. waters in the Big Lost River and Birch Creek have been designated for domestic wate special resource waters.

Groundwater use on the Snake River Plain includes irrigation, food processing a and domestic, rural, public, and livestock supply. Water use for the upper Snake Ri and the Snake River Plain Aquifer was 16.4 billion cubic meters (4.3 trillion gallo which was more than 50 percent of the water used in Idaho and approximately 7 perce agricultural withdrawals in the nation. Most of the water withdrawn from the Easter Plain [1.8 billion cubic meters (0.47 trillion gallons) per year] is for agricultur source of all water used at the INEL. Site activities withdraw water at an average cubic meters (1.9 billion gallons) per year (DOE-ID 1993e). However, the baseline a rate dropped to 6.5 million cubic meters (1.7 billion gallons) in 1995. The average is equal to approximately 0.4 percent of the water consumed from the Eastern Snake Aquifer, or 53 percent of the maximum annual yield of a typical irrigation well. Of water pumped from the aquifer, a substantial portion is discharged to the surface o eventually returned to it (DOE-ID 1993d,e).

A sole-source aquifer, as designated by the Safe Drinking Water Act (SDWA 1974) supplies 50 percent of the drinking water consumed in the area overlying the aquife aquifer areas have no alternative source or combination of sources that could physi economically supply all those who obtain their drinking water from the aquifer. Bec supplies 100 percent of the drinking water consumed within the Eastern Snake River Northwest 1988) and an alternative drinking water source or combination of sources the Environmental Protection Agency designated the Snake River Plain Aquifer a sole in 1991 (FR 1991b).

DOE holds a Federal Reserved Water Right for the INEL, which permits a water capacity of 2.3 cubic meters (80 cubic feet) per second and a maximum water consump 43 million cubic meters (11.4 billion gallons) per year for drinking, process water cooling. Because it is a Federal Water Right, the site's priority on water rights d establishment of the INEL.

4.9 Ecological Resources

This section describes the biotic resources - flora, fauna, threatened and enda and wetlands - on the INEL site, which are typical of the Great Basin and Columbia Because the proposed actions are most likely to affect areas near existing major fa emphasizes the biotic resources in those areas. However, because the proposed acti other resources outside such areas (e.g., more mobile species like pronghorn, Antil it also describes biotic resources for the entire INEL site.

4.9.1 Flora

Vegetation on the INEL site is primarily of the shrub-steppe type and is a smal 45,000 square kilometers (111.2 million acres) of this vegetation type in the Inter 15 vegetation associations on the INEL site range from primarily shadscale-steppe v altitudes through sagebrush- and grass-dominated communities to juniper woodlands a of the nearby mountains and buttes (Rope et al. 1993; Kramber et al. 1992; Anderson associations can be grouped into six basic types: juniper woodland, grassland, shr consists of "sagebrush-steppe" and "salt desert shrubs"), lava, bareground-disturbe vegetation. Shrub-steppe vegetation, which is dominated by big sagebrush (Artemisi saltbush (Atriplex spp.), and rabbitbrush (Chrysothamnus spp.) covers more than 90 INEL. Grasses include cheatgrass (Bromus tectorum), Indian ricegrass (Oryzopsis hy wheatgrasses, (Agropyron spp.), and squirreltail (Sitanion hysterix). Herbaceous p (Phlox spp.), wild onion (Allium spp.), milkvetch (Astragalus spp.), Russian thistl various mustards. Work being conducted by Idaho State University will provide addi information on INEL plant communities and the status of sensitive plant species.

Facility and human-disturbed (grazing not included) areas cover only about 2 pe INEL. Introduced annuals, including Russian thistle and cheatgrass, frequently dom areas. These species usually are less desirable to wildlife as food and cover, and desirable perennial native species. These disturbed areas serve as a seed source, potential for the establishment of Russian thistle and cheatgrass in surrounding le Vegetation inside facility boundaries is generally disturbed or landscaped. Specie INEL is comparable to that of like-sized areas with similar terrain in other parts West. Plant diversity is typically lower in disturbed and modified areas.

4.9.2 Fauna

The INEL site supports animal communities characteristic of shrub-steppe vegeta habitats. More than 270 vertebrate species occur, including 46 mammal, 204 bird, 1 amphibian, and 9 fish species (Arthur et al. 1984; Reynolds et al. 1986). Common s genera include mice (Reithrodontomys spp. and Peromyscus spp.), chipmunks (Tamias s jackrabbits (Lepus spp.), and cottontails (Sylvilagus spp.).

Songbirds and passerines commonly observed at the INEL include the American rob migratorius), horned lark (Eremophila alpestris), black-billed magpie (Pica pica), (Oreoscoptes montanus), Brewer's sparrow (Spizella breweri), sage sparrow (S. belli meadowlark (Sturnella neglecta), while resident upland gamebirds include the sage g (Centrocercus urophasianus), chukar (Alectoris chukar), and grey partridge (Perdix migratory bird species, which use the INEL for part of the year, include a variety [e.g., mallard (Anas platyrhynchos), northern pintail (Anas acuta), and Canada goos canadensis)] and raptors [e.g., Swainson's hawk (Buteo swainsoni), rough-legged haw and American kestrel (Falco sparverius)].

The most abundant big-game species that occurs on the INEL is the pronghorn, bu (Odocoileus hermonius), moose (Alces alces), and elk (Cervus elaphus) are present i as transients. Other large mammals observed on the INEL include the coyote (Canis common across the site, and the badger (Taxidea taxus) and bobcat (Felis rufus), bo present across the site but are much less abundant. Fish, including kokanee salmon nerka), rainbow trout (Oncorhynchos mykiss), and mountain whitefish (Prosopium will on the INEL only when the Big Lost River flows onto the site (as a result of heavy in the mountains to the northwest); they are not full-time residents.

A number of researchers have studied effects of radiation exposure from contami INEL on small mammals and birds, and have concluded that subtle sublethal effects (growth rates and life expectancies) can occur in individual animals as a result of However, they can attribute no population or community-level impacts to such exposu Markham 1978; Evenson 1981; Arthur et al. 1986; Millard et. al 1990).

The monitoring of radionuclide levels outside the boundaries of the various INE off the INEL site has detected radionuclide concentrations above background levels and animals (Markham 1974; Craig et al. 1979; Markham et al. 1982; Morris 1993), bu data suggest that populations of exposed animals (e.g., mice and rabbits) as well a on these exposed animals (e.g., eagles and hawks) are not at risk.

4.9.3 Threatened, Endangered, and Sensitive Species

State and Federal regulatory agency lists (Lobdell 1992, 1995), the Idaho Depar Game Conservation Data Center list, and information from site surveys provided the identify Federal- and state-protected, candidate, and sensitive species that potent INEL. This information identified two Federal endangered (bald eagle, and peregrin Federal Category 2 candidate (white-faced ibis, northern goshawk, ferruginous hawk, long-eared myotis, small-footed myotis, pygmy rabbit, Townsend's western big-eared pointheaded grasshopper) species as animals that potentially occur on the INEL site Five animal species listed by the state as Species of Special Concern occur on the observations of the Federal- or state-listed animal species have occurred near any where proposed actions would occur. This analysis did not identify any Federal- or species as potentially occurring on the INEL site. Eight plant species identified agencies and the Idaho Native Plant Society as sensitive, rare, or unique occur on and Henderson 1984).

4.9.4 Wetlands

The U.S. Fish and Wildlife Service National Wetlands Inventory has identified m areas inside the boundaries of the INEL that might possess some wetlands characteri conducted in the fall of 1992 indicate that these possible wetlands cover about 1.4 kilometers or 8,206 acres) of the INEL site (Hampton et al. 1993). Approximately 7 possible wetlands areas occur near the Big Lost River and its spreading areas and p Birch Creek Playa, and in an area north of and in the general vicinity of Argonne N Laboratory-West. Limited riparian (riverbank) communities with mature trees along River (Reynolds 1993) reflect the intermittent flow in the river (1986 and 1993 wer with flow reported on the site). The remainder of the possible wetlands are scatte INEL site. In 1994, INEL began evaluating these potential wetlands to determine if

Corps of Engineers definition of jurisdictional wetlands (COE 1987). Approximately near facilities and are mostly manmade (e.g., industrial waste and sewage treatment pits, and gravel pits).

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

	Name	Statusa
BIRDS	Northern goshawk (Accipiter gentilis)	C2, SSC, FS, B
	Burrowing owl (Athene cunicularia)	C2, BLM
	Ferruginous hawk (Buteo regalis)	C2, SSC, 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 leucocephalus)	E
	Long-billed curlew (Numenius americanus)	SPS, BLM
	American white pelican (Pelecanus erythrorhynchos)	SSC
	White-faced ibis (Plegadis chihi)	C2
MAMMALS	Merriam's shrew (Sorex merriami)	SPS
	Pygmy rabbit (Brachylagus (Sylvilagus) idahoensis)	C2, BLM, SSC
	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, B
	Long-eared myotis (Myotis evotis)	C2
	Small-footed myotis (Myotis subulatus)	CS
PLANTS	Lemhi milkvetch (Astragalus aquilonius)	BLM, FS, INPS
	Painted milkvetch (Astragalus ceramicus var. apus)	3c, INPS-M
	Winged-seed evening primrose (Camissonia pterosperma)	BLM, INPS-S
	Nipple cactus (Coryphantha missouriensis)	INPS-M
	Spreading gilia (Ipomopsis (Gilia) polycladon)	BLM, INPS-2
	King's bladderpod (Lesquerella kingii var. cobrensis)	INPS-M
	Tree-like oxytheca (Oxytheca dendroidea)	INPS-S
	Sepal-tooth dodder (Cuscuta denticulata)	INPS-1
INSECTS	Idaho pointheaded grasshopper (Acrolophitus pulchellus)	C2, BLM

a. Key:
C2 = Federal Category 2 species. BLM = Bureau of Land Man
3c = No longer considered for Federal listing. FS = U.S. Forest Servic
E = Federal and state endangered species. INEL = Idaho National Eng
SSC= State species of special concern. SPS = State protected sp

4.10 Noise

The major noise sources at the INEL occur primarily in developed operational ar sources include facilities; equipment and machines (e.g., cooling towers, transform boilers, steam vents, paging systems, construction equipment, and materials-handlin aircraft; and bus, car, truck, and railroad traffic. At the INEL boundary, which i 3 kilometers (2 miles) from any facility, noise from most sources is barely disting background noise levels. Some disturbance of wildlife activities could occur at th noise from operational and construction activities. The State of Idaho and the cou INEL is located have not established any regulations that specify acceptable commun with the exception of prohibitions on nuisance noise.

Existing INEL-related noises of public significance are from the transportation materials to and from the site and in-town facilities via buses, trucks, private ve freight trains. During the normal workweek, most of the 4,000 to 5,000 employees w site (as opposed to those working in Idaho Falls) travel daily by buses from surrou (see Section 4.3). In addition, 300 to 500 private vehicles travel to the INEL sit communities each day (see Section 4.11). Noise measurements along U.S. Highway 20 15 meters (50 feet) from the roadway indicate that the sound level from traffic ran decibels, A-weighted (dBA) (Abbott et al. 1990), and that the primary source is bus While few people reside within 15 meters (50 feet) of the roadway, the results indi traffic noise might be objectionable to members of the public residing near princip bus routes. The acoustic environment along the INEL site boundary in rural areas a away from traffic noise is typical of a rural location, with the day-night sound le range of 35 to 50 dBA (EPA 1974).

Public exposure to aircraft noise is due in part to INEL-related activities. A travel of INEL personnel via commercial air transport is a significant fraction of out of regional airports. Onsite INEL security patrol and surveillance flights do individuals off the site because of the INEL's remoteness. For INEL helicopter fli or terminate in Idaho Falls, members of the public are exposed to the unique noises aircraft. Because the number of flights per day is limited and most flights occur hours, public exposure to aircraft nuisance noise is not great.

Normally only one train per day serves the INEL, via the Scoville spur. Noise rail transport include those from diesel engines, wheel-track contact, and whistle crossings. Even with only one or two exposures to these sources per day, individua railroad tracks might find the noises mildly objectionable.

4.11 Traffic and Transportation

Roads are the primary access to and from the INEL site. Commercial shipments ar via truck and plane, some bulk materials are transported via rail, and waste is tra rail. This section discusses the existing traffic volumes, transportation routes, t and waste and materials transportation, including baseline radiological exposures f materials transportation. This section summarizes the information in Lehto (1993).

4.11.1 Roadways

4.11.1.1 Infrastructure Regional and Site Systems. Figure 4.11 - 1 shows the existing

regional highway system. Two interstate highways serve the regional area. Interstat north-south route that connects several cities along the Snake River, is approximat (25 miles) east of the INEL site. 1-86 intersects 1-15 approximately 64 kilometers the INEL site, and provides a primary linkage from I-li to points west. 1-15 and US primary access routes to the Shoshone-Bannock reservation. US 20 and US 26 are the routes to the southern portion of the INEL site. Idaho State Routes 22, 28, and 33 northern portion of the INEL; State Route 33 provides access to the northern INEL s **Table 4.11-1 lists the baseline (1991) traffic for several of these access routes.** these segments is currently designated "free flow," which is defined as "operation virtually unaffected by the presence of other vehicles."

The INEL has developed an onsite road system of approximately 140 kilometers (8 paved surface, including about 29 kilometers (18 miles) of service roads that are c Most of the roads are adequate for the current level of normal transportation activ some increased traffic volume. DOE plans to reconstruct several deteriorating INEL 1950s that have been and will continue to be used to transport heavier-than-normal

4.11.1.2 Infrastructure Idaho Falls. Approximately 4,000 DOE and contractor personnel

administer and support INEL work at offices in Idaho Falls. DOE shuttle vans provid transport between in-town facilities. One of the busiest intersections is Science C Fremont Avenue, which serves Willow Creek Building, Engineering Research Office Bui Figure 4.11-1. Transportation routes in the vicinity of the INEL. (not available in
Table 4.11-1. Baseline traffic for selected highway segments. Electronic Techno
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 shu motor pool vehicles, commercial trucks, and personal vehicles. Table 4.11-2 summari miles for INEL-related traffic.
Table 4.11-2. Baseline annual vehicle miles traveled for Idaho National Engineeri

4.11.2 Railroads

Figure 4.11-1 shows the Union Pacific Railroad lines in southeastern Idaho. Ida railroad freight service from Butte, Montana, to the north, and from Pocatello and the south, The Union Pacific Railroad's Blackfoot-to-Arco branch, which crosses the of the INEL, provides rail service to the site for the shipment of spent nuclear fu bulk commodities, and radioactive materials. This branch connects with a DOE-owned Scoville Siding, then links with developed INEL areas. Table 4.11-3 lists rail ship Years 1988 through 1992.

Table 4.11-3. Loaded rail shipments to and from the Idaho National Engineering La

4.11.3 Airports and Air Traffic

Commercial airlines provide Idaho Falls with jet aircraft passenger and cargo s commuter service to both the Idaho Falls and Pocatello airports. In addition, local available in Idaho Falls, and private aircraft use the major airport and many other Total landings at the Idaho Falls airport for 1991 and 1992 were 5,367 and 5,598, r Idaho Falls and Pocatello airports collectively record nearly 7,500 landings annual

Non-DOE air traffic over the INEL site is limited to altitudes greater than 305 (1,000 feet) over buildings and populated areas, and non-DOE aircraft are not permi The primary air traffic at the INEL site is DOE helicopters, which are used for sec purposes. These helicopters have specific operations stations and duties.

4.11.4 Accidents

From 1987 through 1992, the average motor vehicle accident rate was 0.94 accident kilometers (1.5 accidents per million miles) for INEL vehicles, which compares with of 1.5 accidents per million kilometers (2.4 accidents per million miles) for all D and 8 accidents per million kilometers (12.8 accidents per million miles) nationwid vehicles (Lehto 1993). There are no recorded rail or air accidents associated with date, no fatal air traffic accidents have involved flights through either the Idaho airports.

4.11.5 Transportation of Waste, Materials, and Spent Nuclear Fuel

Hazardous, radioactive, industrial commercial, and recyclable wastes are transp site. Federal and State regulations and requirements govern the transportation of h radioactive materials (Lehto 1993). Hazardous materials include commercial chemical hazardous wastes that are nonradioactive; they are regulated and controlled based o toxicity. Onsite spent nuclear fuel comes from Argonne National Laboratory - West, Reactors Facility, and the Advanced Test Reactor; it is transported by truck to var and research and development facilities.

This assessment used six years of data (1987 through 1992) to establish a baseli doses from incident-free, onsite total nonnaval spent nuclear fuel transportation a **Table 4.11-4 lists the results in terms of cumulative doses (1995-2035) and health** do not include onsite naval shipments, which are assessed in Attachment A to Append Volume 1 of this ElS. The baseline includes no offsite shipments, which are address Appendixes D and I.

Table 4.11-4. Cumulative dose and cancer fatalities from incident-free onsite shi

4.12 Occupational and Public Health and Safety

4.12.1 Radiological Health and Safety

DOE Order 5480.11, "Radiation Protection for Occupational Workers" (DOE 1992b), radiation dose that INEL workers can receive to 5 rem per year; administrative cont worker dose to 2 rem per year, except under unusual circumstances. In addition, DO a comprehensive program, known as ALARA (As Low As Reasonably Achievable), to ensur reduction of occupational doses to the extent practicable.

The largest fraction of the occupational dose received by INEL workers is from radiation. Internal radiation doses constitute a small fraction of the occupationa could receive annual external radiation exposures with measured doses greater than thermoluminescent dosimeter that they must wear at all times during work on the sit recorded doses for 1987 to 1991 as a baseline for routine site operations for this period, the INEL monitored about 6,000 workers annually for radiation exposure. Ab those individuals received measurable radiation doses. Monitoring reports indicate 1991, 20 individuals (most of whom were maintenance and construction workers employ M-K Ferguson at the Idaho Chemical Processing Plant) received annual doses larger t (4 individuals in 1987, 1 in 1989, and 15 in 1990).

From 1987 to 1991, the average occupational dose to individuals who had receive doses was 0.156 rem per year, resulting in an average collective dose (the number o workers receiving measurable doses was about 32 percent or 1,920) of about 300 pers resulting number of expected excess latent cancer fatalities would be less than 1 f operation.

This analysis based the doses to the maximally exposed individual and offsite p baseline radioactive concentrations associated with normal operations. The baselin maximally exposed individual is 5.6 y 10-2 millirem, which corresponds to a latent probability of 2.8 y 10-8. The baseline population dose is 7.0 y 10-2 person-rem w a latent fatal cancer incidence of less than 1 (4 y 10-5) annually and less than 1 40 years.

4.12.2 Nonradiological Exposure and Health Effects

DOE used the air quality data in Table 4.7-2 to evaluate health impacts associa exposure to two compound classes: criteria pollutant and toxic. This analysis has on air emissions only, and not water pathways, because none of the alternatives wou discharge of pollutants to surface waters or the subsurface. Table 4.7-2 lists 5 c 26 toxic compounds. The classification of two of the toxic compounds (benzene and carcinogens was consistent with EPA designations published in the Integrated Risk I (IRIS) data base (DOE 1991b). However, this data base does not include sufficient quantitative inhalation cancer risk assessment.

To obtain a hazard index, this analysis evaluated toxic and criteria pollutant effects by adding hazard quotients for each compound. The EPA Risk Assessment Guid Superfund (EPA 1989) describes this approach. The hazard quotient is the ratio of concentration or dose to a Reference Concentration (RfC) or Dose (RfD). For compou listed Reference Concentration or Dose values, the analysis used appropriate State The use of the noncancer hazard index assumes a level of exposure (standard) below health effects would be unlikely. The hazard index is not a statistical probabilit be interpreted as such.

This analysis based toxic and criteria pollutant compound hazard index values f exposed individual on the maximum concentrations for the compounds at the INEL site public access roads inside the INEL site boundary, and the Craters of the Moon Wild Because the hazard index for criteria pollutants is less than 1, no adverse health from routine operations for either workers or the maximally exposed individual. Be index for toxic pollutants exceeds 1, the potential for carcinogenic health risks c varying spacial and temporal distributions of the concentrations of individual air unlikely that any individual would be exposed to all the pollutants all the time. hazard indices for the toxic compounds are less than 1, adverse health effects are

4.12.3 Occupational Health and Safety

Total injury and illness incidence rates at the INEL varied from an annual aver 4.9 per 200,000 work hours from 1987 to 1991. During this time, total lost workday from a low of 1 per 200,000 work hours in 1988 and 1989 to a high of 2.6 per 200,00 1991. The rates appear higher for 1991 because of a 1990 change in reporting requi injuries and illnesses. INEL rates for 1987 to 1989 are below overall DOE rates (2 illness incidence and 1.4 total lost workday cases per 200,000 work hours) and Bure Statistics rates (8.5 total injury and illness incidence and 4.0 total lost workday hours). For 1990 and 1991, INEL rates are slightly above overall DOE rates, but be Labor Statistics rate.

There were 1,337 total recordable injury and illness cases at the INEL from 198 average of 8,385 employees working 79,654,000 hours. Of these cases, 114 (8.5 perc occupational illnesses, of which 48 percent were repeated trauma disorders and 30 p classified as skin diseases or disorders. One fatality occurred at the INEL betwee when an employee was struck and killed by a forklift.

4.13 Idaho National Engineering Laboratory Services

This section discusses water, electricity, fuel capacities and consumption, was and security and emergency protection at INEL facilities.

4.13.1 Water Consumption

A system of about 30 wells, with pumps and storage tanks, provides the water su INEL site. Because of the distance between site facility areas, the water supply s facility is independent. The site uses no natural surface water. The City of Idah system, which includes about 16 wells, provides water to DOE and contractor facilit

A Water Rights Agreement between DOE and the State of Idaho regulates groundwat the INEL site. Under this agreement, INEL has claim to 2,300 liters per second (36 minute) of groundwater, not to exceed 43 billion liters (11 billion gallons) per ye has not measured the total pumping rate from the aquifer, which would depend on the pumps operating. There is a slight possibility that the site could exceed the regu very short periods, such as during recovery from an extended power outage when many run to refill depleted storage tanks.

The average INEL site water consumption from 1987 through 1991 was 7.4 billion (1.9 billion gallons) per year, based on the cumulative volumes of water withdrawn (Teel 1993). The projected baseline usage for 1995 will be about 6.5 billion liter gallons). The estimated average water consumption of Idaho Falls facilities is 300 (80 million gallons) per year.

4.13.2 Electricity Consumption

The Antelope substation supplies commercial electric power to the INEL site thr to the Federally owned Scoville substation. The Scoville substation supplies elect the INEL electric power distribution system (Teel 1993). The contract with Idaho P supply electric power to the INEL site provides "up to 45,000 kilowatts monthly" at (IPC/DOE 1986). Hydroelectric generators along the Snake River in southern Idaho a and Valmy coal-fired thermal electric generation plants in southwestern Wyoming and Nevada, respectively, generate the electric power supplied by Idaho Power. The Exp Reactor-II can also provide approximately 12 to 15 megavolt-amperes of capacity for power loop (Teel 1993).

The rated capacity of the INEL site power transmission loop line is 124 megavol peak demand on the system from 1990 through 1993 was about 40 megavolt-amperes, and usage was slightly less than 217,000 megawatt-hours per year (Teel 1993). This usa decrease by about 4 percent by 1995.

The INEL facilities in Idaho Falls receive electric power from the City of Idah operates four hydroelectric power generation plants on the Snake River along with s distribution facilities. The Bonneville Power Administration, which operates hydro the Columbia River system, supplies supplemental power to the City of Idaho Falls. Falls facilities used 31,500 megawatt-hours of electricity (Teel 1993).

4.13.3 Fuel Consumption

Fuels consumed at the INEL site include several liquid petroleum fuels, coal, a fuels are transported to the site for storage and use. Natural gas is the only rep the INEL Idaho Falls facilities; the Intermountain Gas Company provides this fuel t underground lines (Teel 1993).

The average annual fuel consumption at the INEL site from 1990 through 1993 was fuel oil, 10,578,000 liters (2,795,000 gallons); diesel fuel, 5,690,000 liters (1,5 propane gas, 568,000 liters (150,000 gallons). The INEL also uses about 8,200 metr (9,000 tons) of coal. Fuel storage is provided at each facility and inventories ar necessary. No fossil fuel shortage has ever occurred at the INEL site (Teel 1993).

4.13.4 Wastewater Disposal

Sanitary wastewater systems at the smaller onsite facility areas consist primar and drain fields. The larger areas, such as Central Facilities Area, Idaho Chemica and Test Reactor Area, have wastewater treatment facilities. The City of Idaho Fal treatment system serves the Idaho Falls facilities (Teel 1993).

The average annual wastewater discharge volume at the INEL site from 1989 throu 537 million liters (142 million gallons). The wastewater from DOE and contractor-o in Idaho Falls is not metered but is estimated to be 300 million liters (80 million The primary causes of the difference between water pumped and estimated wastewater evaporation from ponds and cooling towers, irrigation of landscaped areas, and disc wastewater (Teel 1993). Some industrial wastewater, such as steam condensate, is a evaporation ponds and injection wells.

4.13.5 Security and Emergency Protection

This section describes the fire protection and prevention, security, and emerge resources for the INEL site and the surrounding areas. This discussion includes th Department, DOE and INEL Emergency Preparedness, and DOE and INEL Security. DOE es an Emergency Management System that incorporates all applicable requirements for em planning, preparedness, and response at the INEL. Each INEL facility must prepare Plan that contains detailed contingency plans and emergency procedures.

4.13.5.1 DOE Fire Department. The contractor-operated Fire Department staffs and operates

three fire stations on the INEL that support the entire site. Each station has the expertise to respond to explosions, fires, spills, and medical emergencies. These north end at Test Area North, at Argonne National Laboratory-West, and at the Centr Each station has a minimum of one engine company capable of supporting any fire eme assigned area. The Fire Department has a staff of 44 firefighters and 11 support p operates with a minimum critical staff of 7 firefighters at any time. In addition firefighting services, the Fire Department provides the INEL ambulance, emergency m (EMT), and hazardous material response services. The Fire Department has mutual ai with other firefighting organizations, such as the Bureau of Land Management and th Falls, Blackfoot, and Arco. Through these agreements, the Idaho Falls Fire Departm facilities in the City of Idaho Falls.

4.13.5.2 DOE and INEL Emergency Preparedness. Each DOE INEL contractor

administers and staffs its own emergency preparedness program under the direction a DOE. All contractor programs for emergency control and response are compatible. T Communication Center is in the DOE Headquarters building and staffed by the INEL pr with DOE oversight; it is the communication and overall control center for support commanders in charge of an emergency response. The DOE emergency preparedness syst mutual aid agreements with all regional county and major city fire departments, pol facilities. Through the agreements, the Idaho Falls emergency preparedness organiz facilities in the City of Idaho Falls.

4.13.5.3 DOE and INEL Security. DOE has oversight responsibility for safeguards and

security at the INEL. The security program has three categories: security operati security, and safeguards. The security operations division provides asset protecti special nuclear material, facilities, and personnel) and technical security (comput Under this category, DOE administers the INEL protective force, which is supplied b personnel security staff processes personnel security clearances. The safeguards d responsible for the management and accountability of special nuclear materials. Th force, consisting of 200 armed guards and 350 support personnel, provides the onsit administer the programs. Each INEL contractor has a safeguards and security staff, similar manner, to manage the security associated with its facilities. Contractor security staffs range from about 5 to 60 persons, depending on the size and complex associated facilities. Each staff works with the INEL protective forces.

4.14 Materials and Waste Management

This section summarizes the management of materials and wastes (high-level, tra low-level, low-level, hazardous, industrial and commercial solid wastes and hazardo INEL and Idaho Falls facilities, and presents an overview of the current status of types generated, stored, and disposed at the INEL.

The total amount of waste generated and disposed has been reduced through waste and treatment. The INEL attains waste minimization by reducing or eliminating wast recycling, and by reducing the volume, toxicity, or mobility of waste before storag addition, the site has achieved volume reduction of radioactive wastes through more surveying, waste segregation, and use of administrative and engineering controls.

The quantitative data presented in this section are from Volume 2 of this EIS, noted.

4.14.1 High-Level Waste

At present, about 11,900 cubic meters (4,970 cubic yards calcine solid and 2,14 liquid) of high-level waste are in storage at the INEL Idaho Chemical Processing Pl for locations of major waste management facilities). This facility blends liquid w aluminum and zirconium wastes from past spent nuclear fuel reprocessing, and sodium and processes them through calcination to produce a granular calcine solid. Becaus termination of reprocessing, the site no longer generates liquid high-level waste, high-level waste residues. Liquid high-level wastes generated by prior reprocessin solidified at the site. At present, the site generates liquid waste that is not di reprocessing. The site manages this liquid as high-level waste. The site will cal high-level waste that does not contain sodium, and as much sodium-bearing high-leve practicable by January 1, 1998, in accordance with the Amended Order Modifying Orde 1993, United States District Court for the District of Idaho, December 22, 1993. T baseline for high-level waste generation is 750 cubic meters (980 cubic yards) annu

4.14.2 Transuranic Waste

About 65,000 cubic meters (85,000 cubic yards) of transuranic and alpha-contami wastes are retrievably stored and 62,000 cubic meters (81,000 cubic yards) of trans (Morton and Hendrickson 1995) have been buried at the Radioactive Waste Management the INEL. At present, no facilities can dispose of transuranic waste; however, DOE to retrieve, repackage, certify, and ship stored transuranic wastes at the INEL to repository for final disposition. DOE has not determined the disposition of alpha-level waste and buried waste. Since the October 1988 ban by the State of Idaho pro of transuranic waste to the INEL, DOE has shipped only minor amounts of transuranic generated on the site to the INEL Radioactive Waste Management Complex for interim present, there are no treatment facilities for transuranic wastes at the INEL. The baseline for transuranic waste generation is 6 cubic meters (8 cubic yards) annuall

4.14.3 Mixed Low-Level Waste

At present, DOE accepts only mixed low-level waste generated at the INEL for tr disposal at the INEL. DOE stores mixed low-level waste generated at the INEL at in facilities until treatment systems become available or operational. A total of 1,8 (2,400 cubic yards) of mixed low-level waste interim storage capacity is available Current mixed low-level waste interim storage is approximately 1,100 cubic meters (yards). Treatment technologies exist for much of the mixed low-level waste generat and waste minimization eliminates potential sources of mixed low-level waste before projected 1995 baseline for mixed low-level waste is 525 cubic meters (687 cubic ya (EG&G 1993).

4.14.4 Low-Level Waste

Through 1991, DOE disposed of 145,000 cubic meters (190,000 cubic yards) of low at the Radioactive Waste Management Complex. In 1991, the total available low-leve capacity at the complex was 37,000 cubic meters (48,000 cubic yards). DOE has curt waste treatment since 1991 while waiting for updated safety documentation and an en impact assessment for the Waste Experimental Reduction Facility. The INEL stores l awaiting treatment on asphalt or concrete pads at the Waste Experimental Reduction radioactive waste storage containers at the generating facilities. The projected l level waste generation is 4,270 cubic meters (5,585 cubic yards) annually (EG&G 199

4.14.5 Hazardous Waste

DOE collects hazardous waste generated at the INEL and stores it temporarily at Waste Storage Facility before shipping it off the site. The Hazardous Waste Storag adequate storage capacity [approximately 64 cubic meters (84 cubic yards)] to manag hazardous waste generated at the INEL. The site recycles, reuses, or reprocesses s possible, and might replace some hazardous substances with nonhazardous substances.

4.14.6 Industrial/Commercial Solid Waste

DOE disposes of the industrial and commercial solid waste generated at the site Landfill Complex at the Central Facilities Area. The Landfill Complex has approxim 910,000 square meters (225 acres) of land available for solid waste disposal, inclu area at Landfill III, which is currently in use. The estimated capacity of the INE will be sufficient to dispose of INEL waste for 30 to 50 years; however, capacity o excavations will be filled by 1998. DOE has proposed expanding the excavation. Vo EIS describes the landfill expansion project. The industrial and commercial solid currently in use is in a 48,000-square-meter (12-acre) gravel pit area north of Dis does not expect to store solid waste intended for disposal. Waste segregation occu facility so recyclable materials do not enter the solid waste stream. The average waste disposed at the Central Facilities Area landfill from 1988 through 1992 was a 52,000 cubic meters (68,000 cubic yards) (also the projected 1995 baseline) (EG&G 1

4.14.7 Hazardous Materials

The INEL 1993 chemical inventory lists 774 hazardous chemicals. The number and weight of hazardous chemicals used on the site and at individual facilities change use. The annual Superfund Amendments and Reauthorization Act reports for the INEL include year-to-year inventories.

5. ENVIRONMENTAL CONSEQUENCES

5.1 Overview

This chapter discusses the potential environmental consequences for each spent management alternative described in Chapter 3. The U.S. Department of Energy (DOE) environmental consequence analyses of nonnaval spent nuclear fuel management from V input for this chapter; however, DOE made necessary adjustments to accommodate the between Volume 1 and Volume 2 alternatives. In addition, DOE adjusted the 10-year horizon for Volume 2 alternatives to 40 years for Volume 1.

As described in Chapter 1, this chapter analyzes only nonnaval DOE actions; how Section 5.16, "Cumulative Impacts and Impacts from Connected or Similar Actions," i from the Naval Nuclear Propulsion Program and nonnaval DOE impacts that are cumulat Appendix B restriction of analysis to nonnaval actions results in Alternative 2 (op becoming a single alternative.

Chapter 5 addresses potential impacts from construction and normal operations f of the affected environment described in Chapter 4. In addition, it provides poten from accidents and several types of summary information. In cases where the conseq does not result in a distinction among the alternatives, this chapter describes the division by alternative to avoid needless repetition. Tables 3-4 through 3-6 in Se and compare the potential impacts associated with each alternative.

5.2 Land Use

Alternatives 1, 2, 4b(2), and 5a [No Action, Decentralization, Regionalization (Elsewhere), and Centralization at other DOE sites] would have the least impact on 0.8 acre (0.003 square kilometer); Alternatives 4b(1) [Regionalization by Geography 5b (Centralization at the INEL) would result in the greatest changes, impacting nea (0.12 square kilometer).

Overall environmental impacts on land use by any of the alternatives would be s DOE would build new facilities in developed areas that it has already dedicated to that previous activities have disturbed. Under all the alternatives, proposed acti consistent with the existing land use plans discussed in Section 4.2 and would be s existing developed areas on the site. None of the proposed activities would involv INEL boundaries, and no effects on surrounding land uses or local land use plans sh

No onsite land use restrictions due to Native American treaty rights would exis alternatives described in this EIS. Potential impacts on Native American and other are discussed in Section 5.4 (Cultural Resources) and in Appendix L (Environmental

5.3 Socioeconomics

This section describes the potential effects of the spent nuclear fuel alternat socioeconomic resources of the region of influence described in Section 4.3. Table list proposed changes in the INEL-related workforce and population. Figure 5.3-1 s proposed changes.

5.3.1 Methodology

This section addresses socioeconomic impacts in terms of both direct and second and population effects. Direct effects are changes in INEL employment that DOE exp under each alternative and include construction and operations phase impacts. Seco include indirect and induced impacts. Indirect effects are impacts to regional bus employment resulting from changes in DOE regional purchases or nonpayroll expenditu effects are impacts to regional businesses and employment that result from changes by affected INEL employees. The total economic impact to the region is the sum of secondary effects.

The bases for the estimated direct impacts in this section are project summary developed in cooperation with INEL contractors. Employment impacts represent actua INEL staffing; they do not include changes in staffing due to a reassignment of the workforce. The projected decline in baseline INEL activity is not part of any alte a comprehensive analysis of potential impacts was not included. Projected declines employment are presented in Figure 5.3-1 in order to provide the reader with a fram evaluating potential employment and population impacts. This assessment used RIMS total employment impacts with multipliers that the U.S. Bureau of Economic Analysis specifically for the INEL region of influence. A comprehensive discussion of the m provided in Appendix F-1 of Volume 2. Cumulative impacts on socioeconomic resource region are discussed in Section 5.16.

Table 5.3-1. Estimated changes in employment and population for Alternatives 3, 4a 1995 - 2004.

Factor	1995	1996	1997	1998	1999	2000	2001	2002	200
Direct employment	0	0	0	0	250	250	375	375	375
Secondary employment	0	0	0	0	352	352	528	528	528
Total employment change	0	0	0	0	602	602	903	903	903
Change in ROIb labor force (%)	0.0	0.0	0.0	0.0	0.5	0.5	0.8	0.8	0.8

Change in ROI employment (%)	0.0	0.0	0.0	0.0	0.6	0.6	0.8	0.8	0.8
Population change	0	0	0	0	2,027	2,027	3,040	3,040	3,0
Change in ROI population (%)	0.0	0.0	0.0	0.0	0.8	0.8	1.1	1.1	1.1

a. Sources: Johnson (1995); USBEA (1993); USBC (1992).
b. ROI = region of influence.

Table 5.3-2. Estimated changes in employment and population for Alternatives 4b(2) 1995 - 2004.

Factor	1995	1996	1997	1998	1999	2000	2001	2002	200
Direct employment	50	50	0	0	0	0	0	0	0
Secondary employment	70	70	0	0	0	0	0	0	0
Total employment change	120	120	0	0	0	0	0	0	0
Change in ROIa labor force (%)	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Change in ROI employment (%)	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Population change	405	405	0	0	0	0	0	0	0
Change in ROI population (%)	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0

a. Sources: Johnson (1995); USBEA (1993); USBC (1992).
b. ROI = region of influence.

5.3.2 Alternatives 1 and 2 - No Action and Decentralization

Activities associated with Alternatives 1 and 2 would not result in any addition operations jobs at the INEL; therefore, implementation of either of these alternati impact on socioeconomic resources in the region of influence.

5.3.3 Alternatives 3, 4a, 4b(1), and 5b - 1992/1993 Planning Basis, Regionalization by Fuel Type,

Regionalization by Geography (INEL), and Centralization at the INEL

5.3.3.1 Construction. As listed in Table 5.3-1, construction employment under these

alternatives would peak during the period from 2001 to 2004 with approximately 375 jobs per year. When added to the estimated 528 indirect jobs, the total employment region would be an addition of approximately 903 jobs. Employment would decline to

Based on historic data, approximately 97 percent of the new employees who would would live in the seven-county region of influence. As listed in Table 5.3-1, if a were filled by in-migrants to the region, there would be a 0.8-percent increase in force and in regional employment during the peak years. These changes would be min have no adverse impacts on socioeconomic resources in the region. In fact, althoug implementation of any of these alternatives would result in an increase over projec levels, as shown in Figure 5.3-1, there would be an overall decline in employment f 1995 levels.

Assuming each new employee represented one household and 3.47 persons per househ would be a corresponding increase in regional population levels of 1.1 percent (app 3,000 people). Given this minor change in population, DOE expects potential impact for community resources and services such as housing, schools, police, health care, to be negligible.

5.3.3.2 Operations. Activities associated with Alternatives 3, 4a, 4b(1), and 5b would not

require any additional operations jobs at the INEL. Therefore, the implementation alternatives would have no impact on socioeconomic resources in the region of influ

5.3.4 Alternatives 4b(2) and 5a - Regionalization by Geography (Elsewhere) and Centralization at Other

DOE Sites

5.3.4.1 Construction. As listed in Table 5.3-2, construction employment under these

alternatives would peak during the period from 1995 to 1996 with approximately 50 a jobs per year. When added to the estimated 70 indirect jobs, the total employment region would be approximately 120 jobs. Employment after 1996 would drop to zero. Figure 5.3-1. INEL employment by SNF alternative relative to site employment pro
Based on historic data, approximately 97 percent of the new employees who would would live in the seven-county region of influence. As listed in Table 5.3-2, if a were filled by in-migrants to the region, there would be a 0.1-percent increase in force and in regional employment levels during the peak years. These changes would would have no adverse impacts on socioeconomic resources in the region. In fact, a implementation of any of these alternatives would be an increase over projected emp from 1995 to 1996, as shown in Figure 5.3-1, there would be an overall decline in e projected 1995 levels.
Assuming each new employee represented one household and 3.47 persons per househ would be a corresponding increase in regional population levels of 0.2 percent (app 400 people). Given this minor change in population, DOE expects potential impacts for community resources and services such as housing, schools, police, health care, to be negligible.

5.3.4.2 Operations. Activities associated with Alternatives 4b(2) and 5a would not result in

any additional operations jobs at the INEL. Therefore, the implementation of eithe alternatives would have no impact on socioeconomic resources in the region of influ

5.4 Cultural Resources

This section summarizes the potential impacts of spent nuclear fuel management cultural resources at the INEL site.
This assessment evaluated both direct and indirect impacts due to the proposed the INEL, direct impacts to archaeological resources usually would be those associa disturbance from construction activities. Direct impacts to existing historic stru demolition, modification, deterioration, isolation from or alteration of the charac setting; or introduction of visual, audible, or atmospheric elements out of charact property's setting. In addition, indirect impacts to archaeological resources coul overall increase in activity at the INEL, which could bring a larger workforce clos sites. Direct impacts to traditional resources could occur through land disturbanc changes to the environmental settings of traditional use and sacred areas. Impacts pollution, noise, and contamination that could affect the traditional hunting and g visual or audible settings of sacred areas.
The potential for adverse impacts on cultural resources would be the least unde 2, 4b(2), and 5a, which would disturb approximately 0.8 acres (0.003 square kilomet would be minor because surveys of the area to be disturbed found no eligible cultur (Reed et al. 1986; DOE 1993a).
The potential for adverse impacts on cultural resources would be similar under 4b(1), and 5b with the greatest potential under Alternatives 4b(1) and 5b [Regional Geography (INEL) and Centralization at the INEL], which would involve the disturban acres (0.12 square kilometer). Again, impacts would be minimal because surveys of disturbed area found no eligible cultural resources (Reed et al. 1986). Under thes proposed modifications at the Idaho Chemical Processing Plant facilities could adve historically significant structures and could require consultation with the Idaho S Preservation Office (Braun et al. 1993).
The Shoshone-Bannock Tribes are also concerned with the potential impact to imp American resources from changes in the visual setting, noise, air quality, or water

activities associated with spent nuclear fuel management would take place within ex currently engaged in similar activities, DOE does not expect any impacts to importa American resources from alteration of the visual setting or noise associated with i any of the alternatives. There could be temporary, minor impacts on air quality fr associated with construction activities. Emissions of radionuclides to the air und would be minor and would be well below applicable standards and guidelines. Under operating conditions, radioactive discharges to the soil or directly to the aquifer

DOE would minimize the potential for direct and indirect adverse impacts on tra resources from pollution, noise, and contamination through compliance with applicab Federal laws and regulations. Impact avoidance and other mitigation measures for c are described in Section 5.20.2.

5.5 Aesthetic and Scenic Resources

None of the alternatives for spent nuclear fuel management at the INEL would ha consequences on scenic resources or aesthetics because DOE would confine the propos developed areas. Although the construction of the proposed facilities would produc could temporarily affect visibility, the INEL would follow standard construction pr both erosion and dust generation. Facility operations under each alternative would emissions to the atmosphere that would impact visibility.

5.6 Geology

This section discusses the potential effects of the spent nuclear fuel manageme geologic resources at the INEL site.

Proposed INEL spent nuclear fuel management activities would only have minor lo impacts on the geology of the site for all the alternatives. Direct impacts to geo site would be associated with the disturbance or extraction of surface deposits to facilities. These impacts could include excavations into the soil and rock of the and banking, and the extraction of aggregate materials from gravel and borrow pits Table 5.6-1 lists estimated extractions of aggregate from site gravel pits for all **fuel, environmental restoration, and waste management projects.** These values serve spent nuclear fuel project usage.

A secondary impact to geological resources from construction activities would b for increased soil erosion. DOE would minimize any potential soil erosion by the u Management Practices designed to control stormwater runoff and slope stability.

Table 5.6-1. Estimated INEL gravel/borrow use (cubic meters). ,b

Alternative		Estimated Gravel/Borrow Use
1.	No Action	158,000
2.	Decentralization	158,000
3.	1992/1993 Planning Basis	392,000
4a.	Regionalization by Fuel Type	392,000
4b(1)	Regionalization by Geography (INEL)	1,772,000
4b(2)	Regionalization by Geography (Elsewhere)	296,000
5a.	Centralization at other DOE Sites	296,000
5b.	Centralization at the INEL	1,772,000

a. Source: EG&G (1994).
b. To convert cubic meters to cubic yards, multiply by 1.31.

5.7 Air Quality and Related Consequences

This section describes the potential nonradiological and radiological impacts t associated with each alternative. The term "baseline concentrations" is defined as concentrations resulting from potential emissions from current operations and those planned upgrades or modifications that DOE would construct or operate prior to any actions described in this EIS. Additional information is provided in Section 5.7 a Volume 2.

5.7.1 Alternative 1 - No Action

5.7.1.1 Nonradiological Air Quality. Construction activities associated with this alternative

would be limited to upgrading an existing facility. Potential impacts to air quali activities would include fugitive dust and exhaust emissions from support equipment the impacts from construction using the EPA Fugitive Dust Model (FDM) (Winges 1992) modeling results showed that the expected construction-related air quality impacts and highly localized.

Minimal spent nuclear fuel activities would occur under this alternative. Ther that the ambient concentrations levels from normal operations would be similar to t **Table 4.7-1 lists nonradioactive emissions from normal operations.** Tables 5.7-1 an maximum potential concentrations for the proposed alternatives; they are all below standards and guidelines. Ambient concentrations from Alternative 1 activities wil applicable standards and guidelines.

5.7.1.2 Radiological Air Quality. No radiological impacts to the environment would result

from construction activities.

No additional facilities that would be in operation for this alternative would emissions. Therefore, for normal operations, doses to the maximally exposed indivi population, and workers would be equivalent to baseline doses, as listed in Table 5 lists associated emission rates.

Table 5.7-1. Maximum impacts to nonradiological air quality from spent nuclear fue pollutants. ,b

Pollutant	Averaging time	Applicable standard (-g/m3)	Maximum baseline concentration (-g/m3)	Baseline plus maximum alternativec (-g/m3)
Carbon monoxide	1-hr	40,000	610	610
	8-hr	10,000	280	280
Nitrogen dioxide	Annual	100	4	4
Lead	Quarterly	1.5	0.001	0.001
Particulate matter (PM10)	24-hr	150	80	80
	Annual	50	5	5
Sulfur dioxide	3-hr	1,300	580	580
	24-hr	365	140	140
	Annual	80	6	6

a. Source: Section 5.7 of Volume 2 of this EIS and Belanger et al. (1995).
b. Listed concentrations are the maximum of those calculated at the INEL site bound inside the INEL site boundary, and the Craters of the Moon Wilderness Area.
c. The listed concentrations are the maximums for any of the proposed alternatives.

Table 5.7-2. Maximum impacts to nonradiological air quality from spent nuclear fue pollutants. ,b

Pollutant	Averaging time	Applicable standard (-g/m3)	Maximum baseline concentration (-g/m3)	Impact from maximum alternativec (-g/m3)
Ammonia	Annual	1.8y102	6.0y100	1.8y100
Benzene	Annual	1.2y10-1	2.9y10-2	2.3y10-2
Formaldehyde	Annual	7.7y10-2	1.2y10-2	4.4y10-2
Methyl isobutyl ketone	Annual	2.1y103	(e)	2.6y101
Hydrofluoric acid	Annual	2.5y101	(e)	1.8y10-2
Tributylphosphate	Annual	2.5y101	(e)	6.1y10- -2

a. Source: Section 5.7 of Volume 2 of this EIS and Raudsep (1995).
b. Listed concentrations are the maximum of those calculated at the INEL site bound inside the INEL site boundary, and the Craters of the Moon Wilderness Area.
c. The listed concentrations are the maximums for any of the proposed alternatives, sources expected to become operational after May 1, 1994.
d. In accordance with State of Idaho regulations for toxic air pollutants, the perc based on concentrations resulting from the alternatives and from new or modified operational since May 1, 1994.
e. Baseline concentrations for these pollutants were not analyzed because their emi

levels.

Table 5.7-3. Annual dose increments by alternative in comparison to the baseline.

Alternative	INEL worker (millirem)	Maximally exposed individual (millirem)	Populati (person-
Baseline	4.3y100c	5.6y10-2	3.4y10-1
1. No Action	3.3y10-4	3.5y10-3	1.0y10-1
2. Decentralization	3.3y10-4	3.5y10-3	1.0y10-1
3. 1992/1993 Planning Basisc	3.3y10-3	8.0y10-3	1.9y10-1
4a. Regionalization by Fuel Type	3.3y10-3	8.0y10-3	1.9y10-1
4b(1). Regionalization by Geography (INEL)d	4.2y10-3	4.8y10-2	3.9y10-1
4b(2). Regionalization by Geography (Elsewhere)	7.0y10-5	3.9y10-3	8.3y10-2
5a. Centralization at Other DOE Sites	7.0y10-5	3.9y10-3	8.3y10-2
5b. Centralization at the INEL	4.2y10-3	4.8y10-2	3.9y10-1

a. Source: Section 5.7 of Volume 2 of this EIS.
b. Population dose is calculated based on the projected population in 2000 or 2010
c. Baseline worker dose includes the maximum projected operation of the portable wa Power Burst Facility area. However, the operation would be temporary (1 to 2 ye representative of a permanent increase in the baseline. If this facility were n the worker would be about 0.2 millirem per year.
d. Alternative 4b(1) doses are slightly less than Alternative 5b doses.

5.7.2 Alternative 2 - Decentralization

5.7.2.1 Nonradiological Air Quality. Potential impacts to air quality from construction

activities would include fugitive dust and exhaust emissions from support equipment assessment showed that the expected construction-related air quality impacts should highly localized.

Emissions resulting from normal operations under this alternative would include emissions and those resulting from the startup of the proposed facilities. Emissio with startup would be less than 1 percent of those from normal operations. Tables the maximum concentrations predicted for the proposed alternatives. Ambient concen Alternative 2 activities would be below applicable standards and guidelines.

Table 5.7-4. Radionuclide emissions by alternative for spent nuclear fuel projects

Project and Location	Associated Alternative	Radionuclides and Emission H-3/ C-14	Co-60	Kr-85
TAN Pool Fuel Transfer Project	1, 2, 3, 4a			
a. Drying operations	4b(1), 5b	9.6y102	-	-
b. Storage operations (Test Area North)		3.9y10-1	-	-
Additional Increased Rack Capacity (Idaho Chemical Processing Plant)	3, 4a, 4b(1), 5b	2.0y10-1	1.2y10-8	-
Dry Fuels Storage Facility (Idaho Chemical Processing Plant)	3, 4a, 4b(1), 4b(2), 5a, 5b	1.8y10-2	1.9y10-6	-
Fort St. Vrain Spent Fuel Storage (Idaho Chemical Processing Plant)	3, 4a, 4b(1), 5b	-	5.6y10-8	-
Increased Rack Capacity (Idaho Chemical Processing Plant)	3, 4a, 4b(1), 5b	2.0y10-1	1.2y10-8	-
EBR-II Blanket Treatment (Argonne National Laboratory - West)	3, 4a, 4b(1), 5b	1.6y102	-	4.9y1
Electrometallurgical Process Demonstration Project (Argonne National Laboratory - West)	3, 4a, 4b(1), 4b(2), 5a, 5b	8.4y102	-	1.4y1
Spent Fuel Processing Facility	4b(1), 5b	3.1y103	1.9y10-6	5.0y1

a. Source: Appendix F-3 of Volume 2 of this EIS.

5.7.2.2 Radiological Air Quality. No radiological impacts to the environment would result

from construction activities.
Emissions resulting from normal operations under this alternative would include emissions and those resulting from the startup of the proposed facilities. Table 5 rates for the spent nuclear fuel alternatives, including Decentralization. Table 5 doses to the maximally exposed individual, the population, and workers. These valu comparison to the National Emission Standards for Hazardous Air Pollutants dose lim per year, the dose limit received from background sources of 351 millirem per year, population dose from background sources of 40,000 person-rem.

5.7.3 Alternative 3 - 1992/1993 Planning Basis

5.7.3.1 Nonradiological Air Quality. Potential impacts to air quality from construction

activities would include fugitive dust and exhaust emissions from support equipment assessment showed that expected construction-related air quality impacts should be highly localized.
Emissions resulting from normal operations under this alternative would include emissions and those resulting from the proposed facilities. Emission rates associa would be less than 1 percent of those from normal operations. Tables 5.7-1 and 5.7 maximum potential concentrations for the proposed alternatives. Ambient concentrat Alternative 3 activities would be below applicable standards and guidelines.

5.7.3.2 Radiological Air Quality. No radiological impacts to the environment would result

from construction activities.
Emissions resulting from normal operations under this alternative would include emissions and those resulting from the startup of the proposed facilities. Table 5 rates for the spent nuclear fuel alternatives. Table 5.7-3 lists the resulting dos exposed individual, the population, and workers. These values are small in compari Emission Standards for Hazardous Air Pollutants dose limit of 10 millirem per year, received from background sources of 351 millirem per year, and the population dose sources of 40,000 person-rem.

5.7.4 Alternative 4a - Regionalization by Fuel Type

5.7.4.1 Nonradiological Air Quality. Potential impacts to air quality from construction

activities would include fugitive dust and exhaust emissions from support equipment assessment showed that the expected construction-related air quality impacts should highly localized.
Emissions resulting from normal operation under this alternative would include emissions and those resulting from the startup of the proposed facilities. Emissio with startup would be less than 1 percent of those from normal operations. Tables the maximum potential concentrations for the proposed alternatives. Ambient concen Alternative 4 activities would be below applicable standards and guidelines.

5.7.4.2 Radiological Air Quality. No radiological impacts to the environment would result

from construction activities.
Emissions resulting from normal operation under this alternative would include emissions and those resulting from the proposed facilities. Table 5.7-4 lists emis nuclear fuel alternatives including Regionalization. Table 5.7-3 lists the resulti maximally exposed individual, the population, and workers. These values are small the National Emission Standards for Hazardous Air Pollutants dose limit of 10 milli dose limit received from background sources of 351 millirem per year, and the popul background sources of 40,000 person-rem.

5.7.5 Alternative 4b(1) - Regionalization by Geography (INEL)

5.7.5.1 Nonradiological Air Quality. Potential impacts to air quality from construction

activities would include fugitive dust and exhaust emissions from support equipment assessment showed that the expected construction-related air quality impacts should highly localized.

Emissions resulting from normal operation under this alternative would include emissions and those resulting from the startup of the proposed facilities. Emissio with startup would be less than 1 percent of those from normal operations. Tables the maximum potential concentrations from the proposed alternatives. Ambient conce Alternative 4b(1) activities would be below applicable standards and guidelines.

5.7.5.2 Radiological Air Quality. No radiological impacts to the environment would result

from construction activities.

Emissions resulting from normal operation under this alternative would include emissions and those resulting from the proposed facilities. Table 5.7-4 lists asso for spent nuclear fuel alternatives including Regionalization by Geography (INEL). resulting doses to the maximally exposed individual, the population, and workers. small in comparison to the National Emission Standards for Hazardous Air Pollutants millirem per year, the dose limit received from background sources of 351 millirem population dose from background sources of 40,000 person-rem.

5.7.6 Alternative 4b(2) - Regionalization by Geography (Elsewhere)

5.7.6.1 Nonradiological Air Quality. Potential impacts to air quality from construction

activities would include fugitive dust and exhaust emissions from support equipment assessment showed that the expected construction-related air quality impacts should highly localized.

Emissions resulting from normal operation under this alternative would include emissions and those resulting from the startup of the proposed facilities. Emissio with startup would be less than 1 percent of those from normal operations. Tables the maximum potential concentrations from the proposed alternatives. Ambient conce Alternative 4b(2) activities would be below applicable standards and guidelines.

5.7.6.2 Radiological Air Quality. No radiological impacts to the environment would result

from construction activities.

Emissions resulting from normal operation under this alternative would include emissions and those resulting from the proposed facilities. Table 5.7-4 lists asso for spent nuclear fuel alternatives including Regionalization by Geography (Elsewhe lists resulting doses to the maximally exposed individual, the population, and work are small in comparison to the National Emission Standards for Hazardous Air Pollut 10 millirem per year, the dose limit received from background sources of 351 millir the population dose from background sources of 40,000 person-rem.

5.7.7 Alternative 5a - Centralization at Other DOE Sites

5.7.7.1 Nonradiological Air Quality. Potential impacts to air quality from construction

activities would include fugitive dust and exhaust emissions from support equipment assessment showed that the expected construction-related air quality impacts should highly localized.

Emissions resulting from normal operation under this alternative would include emissions and those resulting from the startup of the proposed facilities. Emissio with startup would be less than 1 percent of those from normal operations. Tables

the maximum potential concentrations from the proposed alternatives. Ambient conce
Alternative 5a activities would be below applicable standards and guidelines.

5.7.7.2 Radiological Air Quality. No radiological impacts to the environment would result

from construction activities.
Emissions resulting from normal operation under this alternative would include
emissions and those resulting from the proposed facilities. Table 5.7-4 lists asso
for spent nuclear fuel alternatives including Centralization at other DOE sites. T
resulting doses to the maximally exposed individual, the population, and workers.
small in comparison to the National Emission Standards for Hazardous Air Pollutants
millirem per year, the dose limit received from background sources of 351 millirem
population dose from background sources of 40,000 person-rem.

5.7.8 Alternative 5b - Centralization at the INEL

5.7.8.1 Nonradiological Air Quality. Potential impacts to air quality from construction

activities would include fugitive dust and exhaust emissions from support equipment
assessment showed that the expected construction-related air quality impacts should
highly localized.
Emissions resulting from normal operation under this alternative would include
emissions and those resulting from the proposed facilities. Emission rates associa
of the proposed facilities would be less than 1 percent of those from normal operat
and 5.7-2 list the maximum potential concentrations from the proposed alternatives.
concentrations from Alternative 5b activities would be below applicable standards a

5.7.8.2 Radiological Air Quality. No radiological impacts to the environment would result

from construction activities.
Emissions resulting from normal operation under this alternative would include
emissions and those resulting from startup of the proposed facilities. Table 5.7-4
emission rates for spent nuclear fuel alternatives including Centralization at the
lists resulting doses to the maximally exposed individual, the population, and work
are small in comparison to the National Emission Standards for Hazardous Air Pollut
10 millirem per year, the dose limit received from background sources of 351 millir
the population dose from background sources of 40,000 person-rem.

5.8 Water Resources and Related Consequences

This section discusses potential environmental consequences to water resources
spent nuclear fuel management alternatives. DOE evaluated each alternative with res
impacts on water quality (both surface and subsurface water), water use, and human
Any liquid effluents from facilities proposed for the spent nuclear fuel altern
tanks or lined evaporation basins. Under normal operating conditions, radioactive d
soil or directly to the aquifer would not occur. Creed (1994) presents spent nuclea
data for the analysis of the potential impacts resulting from a hypothetical leak o
per day from secondary containment around the SNF storage pools during operations.
addresses the effects that this leak could have on the quality of subsurface water
Preliminary results indicate that there will be no contaminants above maximum conta
the INEL boundary resulting from the postulated operational leak. Some storage pool
leakage in the past. However, based on the bounding accident scenario for high-leve
failure, leakage during the implementation of the selected spent nuclear fuel manag
would cause negligible impacts to water resources (Bowman 1994). None of the propos
for the management of spent nuclear fuel would result in any renewed discharges to
Section 5.15 discusses potential releases of hazardous or radioactive liquids as a
With respect to water usage, Alternative 4b(1) [Regionalization by Geography (I
Alternative Sb (Centralization at the INEL) would consume the largest volume of wat
cubic meters (400 million gallons) over 40 years. The greatest water consumption ra
alternatives would be 50,000 cubic meters (13 million gallons) per year (Hendrickso

incremental usage would represent approximately a 0.7 percent increase over the tot withdrawal rate at the INEL of 7.4 million cubic meters (1.9 billion gallons) per y consumptive use water right is 43 million cubic meters (11.4 billion gallons) per y Alternatives 4b(I) and Sb would have negligible impact on the quantity of water in River Plain Aquifer.

5.9 Ecology

DOE expects that construction impacts, which would include the loss of some wil due to land clearing and facility development, would be greatest under Alternative [Regionalization by Geography (INEL)] and Alternative 5b (Centralization at the INE construction activity would take place either within the boundaries of heavily deve adjacent to those areas, it would have minimal impact on ecological resources. How activities could provide opportunities for the spread of exotic plant species (e.g. Russian thistle).

There would be no construction impacts to wetlands, which would be excluded fro development, and impacts to threatened and endangered species would be unlikely, gi (previously-developed areas) and the maximum size [approximately 31 acres (0.125 sq kilometers)] of the affected area. Construction activities at the INEL probably wo of the endangered species identified in Section 4.9.3 (the bald eagle and peregrine these birds of prey are associated with riparian areas, wetlands, and larger bodies reservoirs) and inhabit dry upland areas only temporarily when migrating (National Society 1987). Disturbance to other sensitive (but not Federally-listed) species i Section 4.9.3 (e.g., the burrowing owl, northern goshawk, ferruginous hawk, Swainso gyrfalcon, Townsend's western big-eared bat, and pygmy rabbit) would be possible bu the scale of the planned construction. Any impacts would be negligible and short l as long as the construction activities.

Representative impacts from operations would include the disturbance and displa animals (such as the pronghorn) caused by the movement and noise of personnel, equi vehicles. Such impacts would be greatest under Alternative 4b(1) [Regionalization (INEL)] and Alternative 5b (Centralization at INEL), which would involve a generall operational activity; however, these impacts would be minor under all the proposed

5.10 Noise

As discussed in Section 4.10, noises generated on the INEL do not travel off th that affect the general population. Therefore, INEL noise impacts for each alterna limited to those resulting from the transportation of personnel and materials to an would affect nearby communities, and from onsite sources that could affect wildlife

Transportation noises would be a function of the size of the workforce (e.g., a workforce would result in increased employee traffic and corresponding increases in truck and rail; a decreased workforce would result in decreased employee traffic an decreases in deliveries). This analysis of traffic noise considered railroad noise roadways that provide access to the INEL. DOE does not expect the number of freigh in the region and through the site to change as a result of any of the alternatives spent nuclear fuel, regardless of the alternative, would be a small fraction of the Blackfoot-to-Arco Branch of the Union Pacific System line that crosses the INEL. T transport employees and personnel on roads would be the principal source of communi near the INEL.

This analysis used the day-night average sound level to assess community noise, the EPA (EPA 1974, 1982) and the Federal Interagency Committee on Noise (FICON 1992 analysis based its estimate of the change in day-night average sound level from the for each alternative on projected changes in employment and traffic levels. The an considers the combination of construction and operation employment. The baseline n comparable to that for the No-Action alternative. Section 4.10 discusses levels re No-Action alternative. The traffic noise analysis considered U.S. Highway 20, whic to access the INEL from Idaho Falls. Changes in noise level below 3 decibels proba result in a change in community reaction (FICON 1992).

The new employment associated with each alternative is a small percentage of th workforce. The maximum new employment of about 375 INEL onsite jobs would occur wi Alternatives 3, 4a, 4b(1), and 5b during the peak construction period beginning in

Section 5.3, Socioeconomics). No new operations employment is projected for any of except Alternatives 4b(1) and 5b for which there would be 25 new jobs beginning in cumulative onsite workforce under each alternative would be greatest in 1995 and wo thereafter. The peak cumulative onsite workforce for Alternatives 4b(2) and 5a wou 1995 by less than 1 percent compared to the No-Action baseline. There would be a c increase in private vehicle and truck trips to the site. The day-night sound level (50 feet) from the roads that provide access to the INEL probably would increase by 1 decibel. The peak cumulative onsite workforce for Alternative 2 in 1995 would be for the No-Action baseline.

For any of the alternatives, truck activity would consist of a few trips per da site carrying spent nuclear fuel. This increase in truck trips would not result in in traffic noise levels along the routes to the INEL. The day-night average sound Highway 20 and other access routes probably would decrease slightly as a result of overall decrease in employment levels at the INEL. DOE expects no change in the co reaction to noise along this route and other access routes. No mitigation efforts

5.11 Traffic and Transportation

5.11.1 Introduction

Spent nuclear fuel management activities involve the transportation of spent nu the boundaries of the INEL (onsite) and on highways and rail systems outside the bo INEL (offsite). This section summarizes the methods of analysis used to determine t consequences of onsite transportation of nonnaval spent nuclear fuel under normal c (incident-free) and of transportation accidents. The impacts include doses and heal Appendices D and I of Volume 1 address consequences of shipments to or from the INE other DOE sites and spent nuclear fuel-related locations.

5.11.2 Methodology

5.11.2.1 Incident-Free Transpodation. Radiological impacts were determined for two

groups of people during normal incident-free transportation: (1) crewmen (drivers) of the public. Members of the public are persons sharing the transport link (on-lin were determined for Onsite shipments because members of the public have access to t the roads on the INEL. Radiological impacts were calculated using the RADTRAN 4 (Ne Kanipe 1992) and RISKIND (Yuan et al. 1993) computer codes.

The magnitude of the incident-free dose depends mainly on the Transport Index o and the on-link vehicle densities. The Transport Index is defined as the dose rate (3.28 feet) from the surface of a radioactive package; it is measured in millirem p nuclear fuel was assigned a dose rate of 14 millirem per hour at 1 meter from the s This dose rate yielded a dose rate of 10 millirem per hour at 2 meters (6.56 feet) transport vehicle, which is the regulatory limit for an exclusive use vehicle (see

Radiological doses were converted to cancer fatalities using risk conversion fa 5.0 x 1O~ fatal cancer per person-rem for members of the public and 4.0 x 10A fatal person-rem for workers. These risk conversion factors are from Publication 60 of th Commission on Radiological Protection (ICRP 1991).

Because the onsite transportation of spent nuclear fuel at the INEL is consider incident-free nonradiological risk (from exhaust emissions and dust resuspension) w

5.11.2.2 Accidents. The doses of the maximum reasonably foreseeable onsite spent nuclear

fuel transportation accident were calculated using the RISKIND computer code. Doses for generic rural and suburban population densities, assuming 6 persons per square areas and 719 persons per square kilometer for suburban areas. Areas within 80 kilo of INEL have population densities between rural and suburban but are closer to the population density. Doses were also assessed under both neutral and stable atmosphe Radiation doses calculated were used to estimate the potential for fatal cancers in population using risk factors developed by the International Commission on Radiolog (ICRP 1991).

The probability of the maximum reasonably foreseeable onsite spent nuclear fuel accident was estimated taking into account spent nuclear fuel handling procedures w Test Reactor facility as well as factors related to transportation of the spent nuc accident to occur, errors must occur in loading the wrong spent nuclear fuel into t radiation surveys of the loaded cask fail to detect abnormally high radiation level vehicle must breakdown or rollover during the short transit between the Advanced Te the Idaho Chemical Processing Plant, and operators fail to ensure that adequate coo maintained inside the cask. The estimated probability of this accident is no greate million years.

The risk of the onsite spent nuclear fuel transportation accident was estimated accident doses by the accident probability, taking into account the probability of conditions used. The resulting risk value gives a bounding estimate of the annual p cancers occurring in the local population due to onsite spent nuclear fuel transpor

5.11.3 Onsite Spent Nuclear Fuel Shipments

For each spent nuclear fuel management alternative, a small number of onsite DO fuel shipments would be likely each year as a result of continuing reactor operatio Test Reactor and the Experimental Breeder Reactor-li. The alternatives would not af of these two facilities, thus the shipments be'tween these facilities and the Idaho Plant, integrated over 40 years, would be the same for each spent nuclear fuel mana

Spent nuclear fuel shipments to the Idaho Chemical Processing Plant from four l INEL (including the Test Reactor Area, Argonne National Laboratory-West, Test Area Power Burst Facility) were evaluated. The number of shipments would not change with because DOE plans to ship all spent nuclear fuel to the Idaho Chemical Processing P that would ship spent nuclear fuel off the site under Regionalization [Alternatives and Centralization (Alterntives Sa and Sb) would ship it first to the Idaho Chemica for canning or other stabilization prior to shipment. DOE estimated the total proje shipments over 40 years of operation (1995-2035) from each facility from either his current inventories. DOE based the projected number of shipments for Test Reactor A Argonne National Laboratory-West to the Idaho Chemical Processing Plant on historic 1987 through 1992, and the doses reflect shipments for 1995 through 2035. The proje shipments from Test Area North would include Three Mile Island canisters, Loss of F special case commercial fuel, and non-fuel-bearing components stored in the Test Ar The projected number of shipments from the Power Burst Facility includes all spent at that facility.

Onsite shipments would include those that originated and ended on the INEL site that originate or terminate at non-INEL facilities are offsite shipments. Appendixe the consequences of naval and DOE offsite spent fuel shipments, respectively. Movem nuclear fuel inside (INEL) facility fences (e.g., from the CPP-603 Underwater Stora Fuel Storage Area) are operational transfers, not onsite shipments; therefore, this consider such shipments

5.11.4 Incident-Free Impacts

The occupational and general population collective doses from onsite spent nucl shipments and the resulting incidence of latent cancer fatalities were calculated. same regardless of alternative. Occupational radiation exposure would potentially b resulting in 0.0014 latent cancer fatalities. General population exposure would pot person-rem, resulting in 0.000044 latent cancer fatalities.

In addition to collective radiation exposure, the maximally exposed individual onsite SNF shipments were calculated for a driver (occupational exposure), a person shipment, and a person standing beside the road as a single shipment passes by (gen the public). The calculated dose to a driver would be 1.7 rem, assuming that person shipments over 40 years. The calculated maximally exposed individual dose to a pers single shipment covering the longest distance from Test Area North to the Idaho Che Plant would be 0.015 millirem, and to a person exposed to passing shipment at a dis (3.28 feet), the dose would be 0.0014 millirem (Maheras 1995).

Traffic impacts for the spent nuclear fuel shipments were estimated from data i (1994). The maximum number of spent nuclear fuel shipments of 691 per year would oc Alternative Sb, Centralization at the INEL. A maximum 23-percent increase in traffi would occur with this alternative, based on the estimates of the number of trips re transport of construction equipment, material, spent nuclear fuel, other wastes, an from the INEL. Even if this average daily traffic volume were to occur for 1 hour, traffic volume would increase to 145 vehicles per hour for US 20, US 26, Routes 33 would not change the baseline level of service, which is designated as "free flow."

5.11.5 Accident Impacts

An onsite spent nuclear fuel transportation accident involving the inadvertent cooled fuel element from the Advanced Test Reactor to the Idaho Chemical Processing considered to be the maximum reasonably foreseeable accident. The melted spent nucl potential to relocate into a critical configuration. However, the probability of a much less than 1 x 10(-7) per year and would be considered to be not reasonably for 5.11-1 lists the calculated maximally exposed individual dose and collective dose t in the maximally impacted sector and corresponding risk of fatal cancers. The dose exposed individual is considered an occupational exposure.

As listed in Table 5.11-1, the total number of fatal cancers expected in the su affected by the transportation for neutral and stable meteorological conditions wou respectively. For the neutral case, this would represent a 0.01-percent increase fr fatal cancers that would be likely from normal incidence in the affected population case, this would represent a 0.20-percent increase from the number of fatal cancers likely from normal incidence in the affected population.

The total number of fatal cancers expected in the rural population affected by for neutral and stable meteorological conditions would be 0.75 and 6.0, respectivel

Table 5.11-1. Impacts from maximum reasonably foreseeable spent nuclear fuel trans and suburban population densities).

Population density categoryb	Meteorologyc	Accident frequencyd (events/yr)	Dose to MEIe (rem)	Offsite population dose (person-rem)	Risk fatal per y
Rural	Neutral	1.0y10-6	7.6y101	1.5y103	7.5y1 (7.5y
Rural	Stable	1.0y10-7	2.5y102	1.2y104	6.0y1 (6.0y
Suburban	Neutral	1.0y10-6	7.6y101	2.1y104	1.1y1 (1.1y
Suburban	Stable	1.0y10-7	2.5y102	1.7y105	8.5y1 (8.5y

a. Source: Enyeart (1994).
b. Results are for generic rural and suburban population densities. The generic ru persons per square kilometer; the generic suburban population density has an ave comparison, the sector with the highest population density within 80 kilometers Plant and Test Reactor Area at the INEL with an average population density of 53
c. Neutral meteorology is characterized by Stability Class D, 4 meters-per-second w time. Stable meteorology is characterized by Stability Class F, 1 meter-per-sec the time.
d. Accident frequency includes both the event frequency and the frequency of the me approximately one-tenth the frequency of neutral meteorology.
e. Maximally exposed individual located at the point of maximum exposure to the air 1,280 feet) downwind, depending on meteorology. For onsite accidents the maxima worker.
f. Fatal cancer risk = dose times accident frequency times (ICRP 60 risk factor for cancer per rem for public, 4.0 y 10-4 fatal cancer per rem for workers. For dos doubled. Numbers in parentheses indicate the total number of fatal cancers in t exposed individual dose is considered an occupational exposure.

case, this would represent a 0.09-percent increase from the number of fatal cancers likely from normal incidences in the affected population. For the stable case, this 1.7-percent increase from the number of fatal cancers that would he likely from nor the affected population.

The estimated maximum nonradiological occupational and general population traff over 40 years due to any of the spent nuclear fuel management alternatives would be 2.5 x 10(-3), respectively. These estimated fatalities were based on fatality risk shipments (Cashwell et. al 1986).

5.11.6 Onsite Mitigative and Preventative Measures

All onsite shipments would be in compliance with DOE ID Directive 5480.3, "Haza Materials Packaging and Transportation Safety Requirements." These requirements pro that, under normal conditions, the INEL would meet as-low-as-reasonably-achievable reasonably foreseeable accident situations (those with a probability of occurrence per year) would not result in a loss of shielding or containment or a criticality, release of radioactive maSerial would generate a timely response.

DOE would approve the type packages used for onsite shipments or would obtain a Regulatory Commission or DOE certificate of compliance. If the Type B onsite packag Nuclear Regulatory Commission or DOE certification, the user of the package would h how administrative controls and site-mitigating circumstances would ensure that the maintain containment and shielding integrity. The administrative and emergency resp considerations would provide sufficient control so that accidents would not result containment or shielding, in criticality, or in an uncontrolled release of radioact create a hazard to the health and safety of the public or workers.

In the event of an accident, each DOE site has an established emergency managem This program incorporates activities associated with emergency planning, preparedne Participating government agencies with plans that are interrelated with the INEL Em Action include the State of Idaho, Bingham County, Bonneville County, Butte County, Jefferson County, the Bureau of Indian Affairs, and Fort Hall Indian Reservation. W emergency condition exists at a facility, the Emergency Action Director is responsi classification, notification, and protective action recommendations. At INEL emerge resources include fire protection, radiological and hazardous chemical material res control center, the INEL Warning Communication Center, the INEL Site Emergency Oper Center, and medical facilities.

5.12 Occupational and Public Health and Safety

This section presents DOE's estimates of the health effects from spent nuclear activities at the INEL for the following human receptor groups:

- Involved Workers - workers at the facilities involved with spent nuclear fu including existing workers and new hires for selected alternative
- Maximally Exposed Individual (MEI) - person residing at the INEL site bound
- Population - the general offsite population in the INEL region
- Construction Worker - labor force associated with construction activities
- Nonconstruction Worker - DOE labor force associated with nonconstruction ac

Radiological, chemical, and industrial safety hazards were considered in the es

5.12.1 Radiological Exposure and Health Effects

The measure of impact used for evaluation of potential radiation exposures is r cancers. Worker and maximally exposed individual effects are reported as individua (in rem) and the estimated lifetime probability of fatal cancer. Population effect collective radiation dose (in person-rem) and the estimated number of fatal cancers population. Tables 5.12-1, 5.12-2, 5.12-3, and 5.12-4 summarize the radiological h calculations for each alternative.

Activities that workers would perform under each of the alternatives would be s currently performed at the INEL. Therefore, the potential hazards encountered in t be similar to those that currently exist at the INEL. Further, DOE would mitigate occupational and radiological safety programs operating under the same regulatory s that currently apply at the INEL. For these reasons, DOE anticipates that the ave

Table 5.12-1. Annual occupational radiation exposure and employment summary.

	No Action (1)	Decentralization (2)	1992/1993 Planning Basis (3)	Regionalization by Fuel Type (4a)b
Number of Workers (annual average over years 1995-2004)c	1	1	200	200

Worker Collective Dosed (person-rem/year)	0.027	0.027	5.4	5.4

a. Source: Johnson (1995).
b. Alternative 4b(1), Regionalization by Geography (INEL), values are the same as t Regionalization by Geography (Elsewhere), values are the same as those for Alter
c. This 10-year average yields conservatively high employment; the 40-year average
d. Based on thermoluminescence dosimetry records.

Table 5.12-2. Annual nonoccupational radiation exposure summary.

	No Action (1)	Decentralization (2)	1992/1993 Planning Basis (3)	Regionalization by Fuel Type (4a)b
MEI Dose (mrem/year)	3.5y10-3	3.5y10-3	8.0y10-3	8.0y10-3
Population Dosea (person-rem/year)	1.0y10-1	1.0y10-1	1.9y10-1	1.9y10-1

a. Population dose is calculated based on the projected population in 2000.
b. Alternative 4b(1), Regionalization by Geography (INEL), values are the same as t Regionalization by Geography (Elsewhere), values are the same as those for Alter

Table 5.12-3. Annual fatal cancer incidence and probability summary from radiologi

	No Action (1)	Decentralization (2)	1992/1993 Planning Basis (3)	Regionalization by Fuel Type(4a)b
Worker				
probability	1y10-5	1y10-5	1y10-5	1y10-5
incidence	1y10-5	1y10-5	2y10-3	2y10-3
Maximally exposed member of the public				
probability	2y10-9	2y10-9	4y10-9	4y10-9
Population incidence	5y10-5	5y10-5	1y10-4	1y10-4

a. Risk factors for the worker (4y10-4 probability of occurrence per rem) or offsit recommended by the International Commission on Radiological Protection (ICRP 199
b. Alternative 4b(1), Regionalization by Geography (INEL), values are the same as t Regionalization by Geography (Elsewhere), values are the same as those for Alter

Table 5.12-4. 40-year fatal cancer incidence summary from radiological exposure.

	No Action (1)	Decentralization (2)	1992/1993 Planning Basis (3)	Regionalization Fuel Type (4a)
Workers				
incidence	4y10-4	4y10-4	8y10-2	8y10-2
Population				
incidence	2y10-3	2y10-3	4y10-3	4y10-3

a. Alternative 4b(1), Regionalization by Geography (INEL), values are the same as t Regionalization by Geography (Elsewhere), values are the same as those for Alter

and the number of reportable cases of injury and illness would be proportional to t workers at the INEL under each alternative.

Table 5.12-1 lists involved worker doses based on an historic annual average do determined from thermoluminescent dosimeter data of workers involved in various INE work over the period 1987 to 1991 (see Appendix F of Volume 2). As mentioned abov associated with spent nuclear fuel activities are the same as the hazards associate activities. Table 5.12-2 lists the exposure summaries for the maximally exposed in population, based on radioactive emissions from normal operations and those resulti proposed facilities for the various alternatives. Note that population collective worker collective dose only under alternatives 1 and 2. For the alternatives, ther worker averaged over 40 years. The nonoccupational population has more people to b When the worker population increases under Alternatives 3, 4, and 5, the worker dos than the population dose. Section 5.7 presents the exposure information. Dose cal on air emissions only, and not water pathways because none of the alternatives woul discharge of pollutants to surface waters or to the subsurface. Section 5.8 summar

Table 5.12-3 summarizes the fatal cancer incidence and probability for workers, exposed individuals, and the offsite population based on the risk factors consisten recommended by the International Commission on Radiological Protection (ICRP 1991). alternatives, the probability of developing fatal cancer for any individual would b maximum value of 1 y 10-5 for the involved worker. The calculated incidence of fat total number of workers for each alternative and the offsite population would be le

Table 5.12-4 summarizes the 40-year projection of fatal cancer incidence associ worker and offsite populations. The highest involved worker and offsite population 0.01, respectively, would be associated with Alternative 5b.

Radiation doses associated with construction activities would be as low as reas and no greater than 2 rem per year to any worker. Historical offsite doses associa are summarized in the Idaho National Engineering Laboratory Historical Dose Evaluat The Centers for Disease Control and Prevention is conducting a more comprehensive r doses from INEL operations.

5.12.2 Nonradiological Exposure and Health Effects

The air quality data listed in Tables 5.7-1 and 5.7-2 were used to evaluate hea associated with potential exposure to two compound classes, criteria pollutant and lists five pollutant criteria and Table 5.7-2 lists six toxic air pollutant compoun compounds were classified as noncarcinogens or carcinogens, consistent with EPA des published in the Integrated Risk Information System (IRIS) data base. However, the does not include sufficient data to perform a quantitative inhalation cancer risk a

Nonradiological health effects (hazard indices) for the INEL worker or maximall individual were estimated by summing the ratios of the appropriate pollutant concen applicable standards presented in Table 5.7-1 and Table 5.7-2. Table 5.7-1 present concentrations at public access roads, which are the maximum of those calculated at boundary, public access roads inside the INEL site boundary, and the Craters of the Area. The hazard index for the five criteria pollutants is less than 1 (0.2) for t maximally exposed individual, based on concentrations for the longest averaging tim **Table 5.7-1.** Table 5.7-2 presents toxic air pollutant concentrations at the public are the maximum when compared with concentrations at the INEL site boundary and the Moon Wilderness Area. The hazard index for the toxic air pollutants is also less t workers or the maximally exposed individual, based on concentrations with annual av consideration. Accordingly, health effects are unlikely for either the criteria po pollutants from spent nuclear fuel-related activities. The hazard index is not a s therefore, it cannot be interpreted as such.

5.12.3 Industrial Safety

This section describes the following measures of impact for workplace hazards: reportable injuries and illness and (2) fatalities in the work force. This analysi fatality rates for construction workers only since the alternatives do not result i in operations employment. Table 5.12-5 lists the maximum annual number of projecte illnesses and fatalities for construction workers by alternatives based on the maxi levels for any year between 1995-2035.

Table 5.12-5. Annual industrial safety health effects incidence summary. ,b

	No Action (1)	Decentralization (2)	1992/1993 Planning Basis (3)	Regionalizatio by Fuel Type (4a)c
Construction workers				
Injury/illness	0	0	23	23
Fatality	0	0	<1	<1

a. 1988-1992 averages for occupational injury/illness and fatality rates for DOE an
b. Sources: DOE (1993b) and Section 5.3 of this appendix.
c. Alternative 4b(1) values are the same as those for Alternative 5b. Alternative

5.13 Idaho National Engineering Laboratory Services

This section discusses the potential impacts from spent nuclear fuel management energy at the INEL. It considers the consumption of water, electrical energy, foss wastewater discharge at the INEL site.

5.13.1 Construction

Table 5.13-1 summarizes estimates of annual requirements for electricity, water diesel fuel for construction activities associated with each alternative and compar 1995 use levels for these resources. In general, the smallest increase in the dema would result from Alternatives 4b(2) and 5a [Regionalization by Geography (Elsewher Centralization at Other DOE Sites] and the largest increase would be associated wit 4b(1) and 5b [Regionalization by Geography (INEL) and Centralization at INEL].

Table 5.13-1. Estimated increase in annual electricity, water, wastewater treatmen requirements for construction activities associated with each alternative.

Service	Projected 1995 usage w/o Alternative	Estimated additional demand construction		
		Alternatives 1 and 2	Alternatives 3 and 4a	Al 4b
Electricity (MWHa per year)	208,000	71	150	2,
Water (millions of liters per year)b	6,450	No increase	2.1	2.
Sanitary wastewater (millions of liters per year)	540	No increase	1.5	4.
Diesel fuel (liters per year)	5,830,000	6,400	8,500	14

a. MWH = megawatt hours.
b. To convert liters to gallons, multiply by 0.264.
Source: Hendrickson (1995).

Under Alternatives 4b(1) and 5b, the estimated annual increases in utility and from construction activities would be 2,100 megawatt-hours of electricity, 2.2 mill (580,000 gallons) of water, 4.5 million liters (1,200,000 gallons) of wastewater di 14,000 liters (3,700 gallons) of diesel fuel. These changes represent modest incr near zero percent to 1.0 percent above projected 1995 usage levels and are well wit capabilities and usage limits (see Section 4.13). The other alternatives would res increases in energy usage and would have no adverse impact on utility services at t

5.13.2 Operations

Table 5.13-2 summarizes estimates of annual requirements for electricity, water fuel for operations activities associated with each alternative and compares them t usage of these resources. In general, the smallest increase in the demand for site from Alternatives 1 and 2 (No-Action and Decentralization) and the largest would be Alternatives 4b(1) and 5b [Regionalization by Geography (INEL) and Centralization a

Table 5.13-2. Estimated increase in annual electricity, water, wastewater treatmen requirements for operations activities associated with each alternative.

Service	Projected 1995 usage w/o Alternative	Estimated additional demand operation		
		Alternatives 1 and 2	Alternatives 3 and 4a	Al 4b
Electricity (MWHa per year)	208,000	180	2,200	11
Water (millions of liters per year)b	6,450	No increase	No increase	48
Sanitary wastewater (millions of liters per year)c	540	No increase	No increase	0.
Fuel oil (liters per year)	11,100,000	28,000	330,000	1,

a. MWH = megawatt hours.
b. To convert liters to gallons, multiply by 0.264.
c. Some industrial wastewater, such as steam condensate, is also discharged to eva
Sources: Hendrickson (1995).

Under Alternatives 4b(1) and 5b, the estimated annual increases in utility and from operations activities would be 11,000 megawatt-hours of electricity, 48 millio gallons) of water, 0.3 million liters (79,000 gallons) of wastewater, and 1,100,000

(290,000 gallons) of fuel oil. These changes represent modest increases ranging fr percent to 10 percent and are well within current system capabilities and usage lim Section 4.13). The other alternatives would result in smaller increases in energy have no adverse impact on utility services at the INEL.

5.14 Materials and Waste Management

This section discusses the impacts to the management of materials and wastes at and Idaho Falls facilities as a result of the implementation of the spent nuclear f alternatives. Alternatives 4b(1), and 5b, both with the spent fuel processing opti upper bound of potential impacts on projected rates of generation, treatment, stora inventories of materials and wastes. Table 5.14-1 and 5.14-2 summarize waste gener for each alternative. The tables present average generating rates over the life cy and maximum annual increments over peak generation periods.

5.14.1 Alternative 1 - No Action

Under the No Action Alternative, 9 cubic meters of industrial solid waste would during construction of the Alternate Fuel Storage Facility for the TAN Pool Fuel Tr the Idaho Chemical Processing Plant. At the completion of this project in 1998, th 485 cubic meters of non-fuel solid low-level waste consisting of Three Mile Island metals that would be removed and dispositioned in a separate project. These impact description of impacts for the other spent nuclear fuel management alternatives wit Alternatives 4b(2) and 5a. The non-fuel solid low-level waste is already existing; included in Table 5.14-1 as an increase in low-level waste generation.

5.14.2 Alternative 2 - Decentralization

In general, the character of the impacts to materials and waste management woul those under the No Action Alternative.

5.14.3 Alternative 3 - 1992/1993 Planning Basis

Industrial solid waste would be generated from construction and operation of th projects under Alternative 3. This nonradioactive waste would be disposed of in th Area landfill. Landfill space is nonrestrictive for industrial solid waste disposa activities would generate a cumulative total of 620 cubic meters of industrial and

Table 5.14-1. Average annual waste generation projections for selected SNF manage

Alternative	Waste type	Phase
No Action (Alternative 1) and Decentralization (Alternative 2)	Industrial	Construction
1992/1993 Planning Basis (Alternative 3) and Regionalization by Fuel Type (Alternative 4a)	Industrial	Construction Operation
	Low-Levelb,c	Construction Operation
	High-Level	Operation
	Mixed Low-Level	Operation
	Transuranic	Operation
Regionalization by Geography (INEL) [Alternative 4b(1)] and Centralization at INEL (Alternative 5b)	Industrial	Construction Operation
	Low-Levelb,c	Construction Operation
	High-Level	Operation
	Mixed Low-Level	Operation
	Transuranic	Operation
Regionalization by Geography (Elsewhere) [Alternative 4b(2)] and Centralization at Other	Industrial	Construction Operation

DOE Sites (Alternative 5a)	Low-Level	Operation
	High-Level	Operation
	Mixed Low-Level	Operation
	Transuranic	Operation

a. Source: Appendix C of Volume 2 of this EIS.
b. Low-level waste from TAN Pool Fuel Transfer Project to be removed and dispositio
c. Low-level waste generated from dispositioning and decontamination of fuel racks

Table 5.14-2. Peak waste generation highlights for selected SNF management alterna

Alternative	Waste type	Phase
No Action (Alternative 1) and Decentralization (Alternative 2)	Industrial	Construction
1992/1993 Planning Basis (Alternative 3) and Regionalization by Fuel Type (Alternative 4a)	Industrial	Construction
		Operation
	Low-Levelb,c	Construction
		Operation
		Concurrent Acti
	High-Level	Operation
	Mixed Low-Level	Operation
	Transuranic	Operation
Regionalization by Geography (INEL) [Alternative 4b(1)] and Centralization at INEL (Alternative 5b)	Industrial	Construction
		Operation
	Low-Levelb,c	Construction
		Operation
		Concurrent Acti
	High-Level	Operation
	Mixed Low-Level	Operation
	Transuranic	Operation
Regionalization by Geography (Elsewhere) [Alternative 4b(2)] and Centralization at Other DOE Sites (Alternative 5a)	Industrial	Construction
		Operation
	Low-Level	Operation
	High-Level	Operation
	Mixed Low-Level	Operation
	Transuranic	Operation

a. Source: Appendix C of Volume 2 of this EIS.
b. Low-level waste from TAN Pool Fuel Transfer Project to be removed and dispositio
c. Low-level waste generated from dispositioning and decontamination of fuel racks
d. Construction and operations occurring simultaneously.

waste. The Fuel Receiving, Canning, Characterization, and Shipping Facility will g
industrial waste of any of the projects, 490 cubic meters per year from 2005 throug

In addition, the Fuel Receiving, Canning, Characterization, and Shipping Facili
220 cubic meters per year of low-level waste during the same period. The Dry Stora
generate an additional 5 cubic meters of low-level waste annually from 2005 through
liquid low-level waste, the Increased Rack Capacity and Additional Increased Rack C
would increase generation rates by 570 cubic meters annually during construction fr
1997. Low-level waste would decrease to approximately 160 cubic meters per year fr
1999 with the completion of the Increased Rack Capacity project. Liquid low-level
disposed in existing liquid waste processing systems at the Idaho Chemical Processi
radioactive wastes would be packaged and disposed of at the Radioactive Waste Manag
Complex, or incinerated at the Waste Experimental Reduction Facility, whichever is
Low-level waste from reracking fuel racks for the Increased Rack Capacity Project w
decontaminated and dispositioned by a licensed commercial vendor.

Experimental Breeder Reactor-II Blanket Treatment will generate 7 cubic meters
waste for 1 year from 1997 to 1998.

The storage of low-level waste for incineration is not considered to be restric
through 2005. However, beyond 2005, low-level waste storage capacity may become st
commercial facilities to incinerate the backlog of low-level waste is under conside
reduce or prevent the accumulation of low-level waste, but no firm commitment or co
been established (EG&G 1993a).

The Radioactive Waste Management Complex appears to have adequate disposal capa
low-level waste between 1995 and 2005. However, beyond 2005, additional capacity m
Excess capacity would be provided with the development of the proposed Low-Level Wa

Low-Level Waste Disposal Facility (EG&G 1993a).

The Electrometallurgical Process Demonstration Project will generate high-level level, low-level, transuranic, and industrial wastes from the demonstration and tes fuel management processes from 1996 through 2024.

Experimental Breeder Reactor-II Blanket Treatment will also generate high-level level, and transuranic wastes.

High-level waste would be immobilized after 2005, and may eventually be transpo Federal high-level waste and spent nuclear fuel repository for disposal. Transuran waste acceptance criteria to be developed could be shipped to a potential Federal r disposal should one be selected (EG&G 1993a).

5.14.4 Alternative 4a - Regionalization by Fuel Type

In general, the character of the impacts to materials and waste management woul those under Alternative 3.

5.14.5 Alternative 4b(1) - Regionalization by Geography (INEL)

The character and intensity of impacts on waste management activities at the IN those under Alternatives 3 and 4a for some of the SNF management projects including Fuel Transfer Project at the Idaho Chemical Processing Plant; the Increased Rack Ca Additional Increased Rack Capacity projects; the Experimental Breeder Reactor-II Bl facility; and the Electrometallurgical Process Demonstration Project. Under Altern Fuel Storage Facility is expanded and Fuel Receiving, Canning/Characterization, and waste streams decrease relative to Alternatives 3 and 4a; however, the net effect o on industrial/commercial solid waste generation and low-level waste generation for and operation results in waste generation rates similar to those under Alternatives

The increase in average and peak generation rates over Alternatives 3 and 4a (T 5.14-2) is due to the Spent Fuel Processing option included under Alternative 4b(1) for the relative increase in generation rates over Alternatives 3 and 4a. Fuel pro in order to stabilize the spent nuclear fuel and remove risks associated with stora to manage the resultant high-level waste in a cost-effective manner. If this alter aggressively, the generated high-level waste residual resulting from segregating fi the spent nuclear fuel may require additional high-level waste tankage. This incre would be covered by the High-Level Tank Farm New Tanks project described in Volume

Capacity discussions for industrial/commercial solid waste and low-level waste Alternative 3 apply to Alternative 4b(1).

5.14.6 Alternative 4b(2) - Regionalization by Geography (Elsewhere)

Construction phase activities would generate a cumulative total of 50 cubic met and commercial solid waste. Overall, waste generation would be lower than all of t management alternatives, with the exceptions of the No Action and Decentralization

5.14.7 Alternative 5a - Centralization at Other DOE Sites

In general, the character of the impacts to materials and waste management woul those under Alternative 4b(2).

5.14.8 Alternative 5b - Centralization at the INEL

In general, the character of the impacts to materials and waste management woul those under Alternative 4b(1).

5.15 Accidents

5.15.1 Introduction

Activities associated with the transportation, receipt, handling, stabilization nuclear fuel at the INEL involve substantial quantities of radioactive materials an toxic chemicals. Under certain circumstances, the potential exists for accidents i materials to occur, which would result in exposure to INEL workers or members of th contamination of the surrounding environment. Accidents can be categorized as foll

- Abnormal events such as minor spills
- Design-basis events, which a facility is designed to withstand
- Beyond-design-basis events, which a facility is not designed to withstand (consequences it may nevertheless mitigate)

This section summarizes postulated radiological and toxic material accidents in category and describes their estimated consequences to workers, members of the publ environment. The scope of this section is limited to accidents within facilities; accidents between facilities are addressed in Section 5.11. [Further information o summarized in this section, as well as information on other "lower consequence" acc provided in Slaughterbeck et al. (1995)].

An accident is a series of unexpected or undesirable "initiating" events that l radioactive or toxic materials within a facility or to the environment. This analy events that can lead to a spent nuclear fuel-related facility accident in three bro initiators, internal initiators, and natural phenomena initiators. External initia and nearby explosions or toxic material releases) originate outside the facility an of the facility to maintain confinement of radioactive or hazardous material. Inte originate within a facility (e.g., equipment failures or human error) and are usual operation. Sabotage and terrorist activities (i.e., intentional human initiators) or internal initiators. Natural phenomena initiators include weather-related (e.g. and seismic events. This analysis defines initiators in terms of events that cause a release of radioactive or hazardous materials within a facility or to the environ bypass of confinement.

Tables 5.15-1 through 5.15-4 summarize the radiological results of the analyses section. Section 5.15.2 summarizes historic accidents at the INEL associated with fuel-related activities. Section 5.15.3 describes the methodology used to identify radiological accidents associated with spent nuclear fuel receipt, handling, storag transportation activities. Sections 5.15.4 and 5.15.5 evaluate the postulated maxi foreseeable radiological and toxic material accidents, respectively.

5.15.2 Historic Perspective

Many of the actions proposed under the different spent nuclear fuel management considered in this EIS are continuations or variations of past practices at the INE consequences to the public from historic INEL accidents in detail and has determine (DOE 1991).

Consequences of accidents can involve fatalities, injuries, or illness. Fatali (immediate), such as in construction accidents, or latent (delayed), such as cancer exposure. While public comments received in scoping meetings for this EIS included about potential accidents at the INEL, the historic record demonstrates that DOE fa the INEL, have a very good safety record, particularly in comparison to commercial (e.g., agriculture and construction). Figure 5.15-1 shows the rate of worker fatal other DOE sites (DOE 1993b) compared to national-average rates that the National Sa compiled over a 10-year period for various industry groups (NSC 1993) and State of rates (Hendrix 1994). While past accident occurrence rates are not necessarily ind rates, the historic record reflects the DOE emphasis on safe operations.

There have been no prompt fatalities and no known latent fatalities to members from accidental releases of radioactive or hazardous materials associated with spen management activities in the 40-year history of INEL facilities, although some acci

Table 5.15-1. Summary of radiological accidents for worker located 100 meters down

Accident Description	Attribute	Alternative 1 No Action	Alternative Decentraliz
1. Fuel handling accident, fuel pin breach, venting of noble gases and iodine at HFEFb	Consequencesc	(d)	(d)
	Adjusted annual frequency	1.0y10-2	1.2y10-2

	Adjusted point estimate of riske	(d)	(d)
2. Uncontrolled chain reaction (criticality) at ICPPf	Consequencesc	3.9y10-5	3.9y10-5
	Adjusted annual frequency	1.0y10-3	1.0y10-3
	Adjusted point estimate of riske	4.0y10-8	4.0y10-8
3. Fuel melting of small number of assemblies at HFEF resulting from seismic event and cell breach	Consequencesc	2.5y10-4	2.5y10-4
	Adjusted annual frequency	1.0y10-5	1.0y10-5
	Adjusted point estimate of riske	2.5y10-9	2.5y10-9
4. Material release from HFEF resulting from aircraft crash and ensuing fire	Consequencesc	1.8y10-3	1.8y10-3
	Adjusted annual frequency	1.0y10-7g	1.0y10-7g
	Adjusted point estimate of riske	1.8y10-10	1.8y10-10
5. Inadvertent nuclear criticality at ICPPf CPP-666 during processing	Consequencesc	(h)	(h)
	Adjusted annual frequency	(h)	(h)
	Adjusted point estimate of riske	(h)	(h)
6. Hydrogen explosion in ICPPf CPP-666 dissolver	Consequencesc	(h)	(h)
	Adjusted annual frequency	(h)	(h)
	Adjusted point estimate of riske	(h)	(h)
7. Inadvertent dissolution of 30-day cooled fuel at ICPPf CPP-666	Consequencesc	(h)	(h)
	Adjusted annual frequency	(h)	(h)
	Adjusted point estimate of riske	(h)	(h)

a. The radiological accident results for Alternative 4b(1), "Regionalization by Geo Alternative 5b, as discussed in Section 5.15.4.4. The radiological accident res presented for Alternative 5a, as discussed in Section 5.15.4.4.
b. HFEF = Hot Fuel Examination Facility.
c. Consequences are presented in terms of latent fatal cancers based on conservativ estimated exposure (i.e., dose) by an International Commission on Radiological P cancer per rem if the estimated exposure is greater than 20 rem).
d. The safety analysis report utilized for this accident analysis does not provide As demonstrated by the dose to the maximally exposed individual, consequences to 4. However, given the high frequency for Accident 1 compared to Accidents 2 thr
e. This attribute is equal to consequences y frequency (events per year). The info
f. ICPP = Idaho Chemical Processing Plant.
g. This frequency is a qualitative bounding estimate for a potential aircraft crash
h. Resuming processing at the INEL under this alternative is not considered.

Table 5.15-2. Summary of radiological accidents for individual located at the near

Accident Description	Attribute	Alternative 1 No Action	Alternative Decentraliz
1. Fuel handling accident, fuel	Consequencesc	(d)	(d)

pin breach, venting of noble gases and iodine at HFEFb			
	Adjusted annual frequency	1.0y10-2	1.2y10-2
	Adjusted point estimate of riske	(d)	(d)
2. Uncontrolled chain reaction (criticality) at ICPPf	Consequencesc	7.0y10-7	7.0y10-7
	Adjusted annual frequency	1.0y10-3	1.0y10-3
	Adjusted point estimate of riske	7.0y10-10	7.0y10-10
3. Fuel melting of small number of assemblies at HFEF resulting from seismic event and cell breach	Consequencesc	3.3y10-4	3.3y10-4
	Adjusted annual frequency	1.0y10-5	1.0y10-5
	Adjusted point estimate of riske	3.3y10-9	3.3y10-9
4. Material release from HFEF resulting from aircraft crash and ensuing fire	Consequencesc	1.6y10-4	1.6y10-4
	Adjusted annual frequency	1.0y10-7g	1.0y10-7g
	Adjusted point estimate of riske	1.6y10-11	1.6y10-11
5. Inadvertent nuclear criticality ICPPf CPP-666 during processing	Consequencesc	(h)	(h)
	Adjusted annual frequency	(h)	(h)
	Adjusted point estimate of riske	(h)	(h)
6. Hydrogen explosion in ICPPf CPP-666 dissolver	Consequencesc	(h)	(h)
	Adjusted annual frequency	(h)	(h)
	Adjusted point estimate of riske	(h)	(h)
7. Inadvertent dissolution of 30-day cooled fuel at ICPPf CPP-666	Consequencesc	(h)	(h)
	Adjusted annual frequency	(h)	(h)
	Adjusted point estimate of riske	(h)	(h)

a. The radiological accident results for Alternative 4b(1), "Regionalization by Geo same as those presented for Alternative 5b, as discussed in Section 5.15.4.4. The "Regionalization by Geography (Elsewhere)," are identical to those presented for Al
b. HFEF = Hot Fuel Examination Facility.
c. Consequences are presented in terms of latent fatal cancers based on conservativ Consequences are calculated by multiplying the estimated exposure (i.e., dose) by a Protection conversion factor of 5.0 y 10-4 cancer per person-rem for the offsite po the estimated population exposure is greater than 20 rem for any individual member
d. The safety analysis report utilized for this accident analysis does not provide to DOE Order 5480.23 requiring this information. As demonstrated by the dose to the public from this accident could be less than the consequences from Accidents 2 thro this accident compared to Accidents 2 through 4, the risk could actually be greater
e. This attribute is equal to consequences y frequency (events per year). The info meteorological conditions.
f. ICPP = Idaho Chemical Processing Plant.
g. This frequency is a qualitative bounding estimate for a potential aircraft crash

h. Resuming processing at the INEL under this alternative is not considered.

Table 5.15-3. Summary of radiological accidents for maximally exposed hypothetical

Accident Description	Attribute	Alternative 1 No Action	Alternative Decentraliz
1. Fuel handling accident, fuel pin breach, venting of noble gases and iodine at HFEFb	Consequencesc	1.0y10-6	1.0y10-6
	Adjusted annual frequency	1.0y10-2	1.2y10-2
	Adjusted point estimate of riskd	1.0y10-8	1.2y10-8
2. Uncontrolled chain reaction (criticality) at ICPPe	Consequencesc	5.0y10-7	5.0y10-7
	Adjusted annual frequency	1.0y10-3	1.0y10-3
	Adjusted point estimate of riskd	5.0y10-10	5.0y10-10
3. Fuel melting of small number of assemblies at HFEF resulting from seismic event and cell breach	Consequencesc	2.5y10-3	2.5y10-3
	Adjusted annual frequency	1.0y10-5	1.0y10-5
	Adjusted point estimate of riskd	2.5y10-8	2.5y10-8
4. Material release from HFEF resulting from aircraft crash and ensuing fire	Consequencesc	2.5y10-3	2.5y10-3
	Adjusted annual frequency	1.0y10-7f	1.0y10-7f
	Adjusted point estimate of riskd	2.5y10-10	2.5y10-10
5. Inadvertent nuclear criticality ICPPe CPP-666 during processing	Consequencesc	(g)	(g)
	Adjusted annual frequency	(g)	(g)
	Adjusted point estimate of riskd	(g)	(g)
6. Hydrogen explosion in ICPPe CPP-666 dissolver	Consequencesc	(g)	(g)
	Adjusted annual frequency	(g)	(g)
	Adjusted point estimate of riskd	(g)	(g)
7. Inadvertent dissolution of 30-day cooled fuel at ICPPe CPP-666	Consequencesc	(g)	(g)
	Adjusted annual frequency	(g)	(g)
	Adjusted point estimate of riskd	(g)	(g)

a. The radiological accident results for Alternative 4b(1), "Regionalization by Geo Alternative 5b, as discussed in Section 5.15.4.4. The radiological accident res presented for Alternative 5a, as discussed in Section 5.15.4.4.

b. HFEF = Hot Fuel Examination Facility.

c. Consequences are presented in terms of latent fatal cancers based on conservativ estimated exposure (i.e., dose) by an International Commission on Radiological P (or 1.0 y 10-3 cancer per rem if the estimated population exposure is greater th

d. This is equal to consequences y frequency (events per year). The information is

e. ICPP = Idaho Chemical Processing Plant.

f. This frequency is a qualitative bounding estimate for a potential aircraft crash

g. Resuming processing at the INEL under this alternative is not considered.

Table 5.15-4. Summary of radiological accidents for offsite population within 80 k

Accident Description	Attribute	Alternative 1 No Action	Alternative Decentraliz
1. Fuel handling accident, fuel pin breach, venting of noble gases and iodine at HFEFb	Consequencesc	(d)	(d)
	Adjusted annual frequency	1.0y10-2	1.2y10-2
	Adjusted point estimate of riske	(d)	(d)
2. Uncontrolled chain reaction (criticality) at ICPPf	Consequencesc	3.0y10-4	3.0y10-4
	Adjusted annual frequency	1.0y10-3	1.0y10-3
	Adjusted point estimate of riske	3.0y10-7	3.0y10-7
3. Fuel melting of small number of assemblies at HFEF resulting from seismic event and cell breach	Consequencesc	7.0y100	7.0y100
	Adjusted annual frequency	1.0y10-5	1.0y10-5
	Adjusted point estimate of riske	7.0y10-5	7.0y10-5
4. Material release from HFEF resulting from aircraft crash and ensuing fire	Consequencesc	1.0y100	1.0y100
	Adjusted annual frequency	1.0y10-7g	1.0y10-7g
	Adjusted point estimate of riske	1.0y10-7	1.0y10-7
5. Inadvertent nuclear criticality ICPPf CPP-666 during processing	Consequencesc	(h)	(h)
	Adjusted annual frequency	(h)	(h)
	Adjusted point estimate of riske	(h)	(h)
6. Hydrogen explosion in ICPPf CPP-666 dissolver	Consequencesc	(h)	(h)
	Adjusted annual frequency	(h)	(h)
	Adjusted point estimate of riske	(h)	(h)
7. Inadvertent dissolution of 30-day cooled fuel at ICPPf CPP-666	Consequencesc	(h)	(h)
	Adjusted annual frequency	(h)	(h)
	Adjusted point estimate of riske	(h)	(h)

a. The radiological accident results for Alternative 4b(1), "Regionalization by Geo Alternative 5b, as discussed in Section 5.15.4.4. The radiological accident res presented for Alternative 5a, as discussed in Section 5.15.4.4.
b. HFEF = Hot Fuel Examination Facility.
c. Consequences are presented in terms of latent fatal cancers based on conservativ estimated exposure (i.e., dose) by an International Commission on Radiological P (or 1.0 y 10-3 cancer per rem if the estimated population exposure is greater th
d. The safety analysis report utilized for this accident analysis does not provide As demonstrated by the dose to the maximally exposed individual, consequences to 4. However, given the high frequency for this accident compared to Accidents 2

e. This attribute is equal to consequences y frequency (events per year). The info
f. ICPP = Idaho Chemical Processing Plant.
g. This frequency is a qualitative bounding estimate for a potential aircraft crash
h. Resuming processing at the INEL under this alternative is not considered.

Figure 5.15-1. Comparison of fatality rates among workers in various industry gr
Processing Plant CPP-601 Fuel Element Cutting Facility failed during decontaminatio estimated 100 curies of particulate radioactivity were released over an area of app (0.809 square kilometers) in the vicinity of the Idaho Chemical Processing Plant. 39 curies became airborne, resulting in an estimated dose of 0.11 millirem to a hyp individual located at the nearest site boundary (DOE 1991).

Three inadvertent nuclear chain reactions (i.e., nuclear criticalities) occurre Chemical Processing Plant in 1959, 1961, and 1978. The 1959 criticality occurred i and cell floor drain collection tank. Available evidence indicates that the critic from an accidental transfer of concentrated uranyl nitrate solution to the waste co a line normally used to transfer decontaminating solutions to the waste tank. The release from this incident was 3,700 curies, and the estimated dose to the maximall hypothetical individual located at the nearest site boundary was 1.1 millirem (DOE and 1978 nuclear criticalities resulted from spent nuclear fuel dissolution and rep Estimated releases to the environment as a result of these accidents were 120 curie the 1961 and 1978 accidents, respectively, and the calculated radiation doses at th boundary were less than 0.1 millirem for both releases (DOE 1991).

The INEL Fluorinel and Storage (FAST) facility (CPP-666), which historically pe nuclear fuel-related reprocessing activities, is currently shut down. Activities a this facility in a permanent shutdown mode. Restart of this facility and the poten nuclear criticality resulting from operating this facility are considered in Sectio [Alternatives 4b(1) and 5b, respectively]. Because DOE has no current plans to res fuel reprocessing activities at the Idaho Chemical Processing Plant, events similar nuclear criticalities discussed above will be unlikely in future INEL spent nuclear activities. Additional information regarding the historical accidents summarized a Slaughterbeck et al. (1995).

In the site's 40-year history, three prompt fatalities of INEL workers have occ involving radiation exposure. In 1961, a steam explosion resulting from an unplann criticality in an experimental reactor (Stationary Low-Power Reactor No. 1) killed were manually moving reactor control elements. The estimated dose from this accide hypothetical individual located at the nearest site boundary was approximately 3 mi All the accidents discussed above have caused contamination that has led to seconda as the contamination of facility equipment and land inside the site boundary, and h cleanup.

Twenty workers at the Argonne National Laboratory-West facility area were injur 1994 when, in an accident involving toxic material exposure, approximately 9 kilogr of chlorine gas used to treat potable (i.e., drinking) water were accidently releas Although an investigation into this incident by the DOE was still ongoing at the ti performed, the accident is presumed to have occurred while a vendor was removing an nearly empty chlorine cylinder. A maintenance employee assisting in the activity a disconnected the nearly empty in-service chlorine gas cylinder from the potable wat cylinder valve in the open position, resulting in the remaining tank contents being environment. As a result of the accidental release, 20 workers were sent to a loca workers reported for treatment of minor respiratory distress, one worker reported s serious respiratory problems, and one worker reported back injuries as a result of responding to the accident. (ANL 1994 and DOE 1994b).

5.15.3 Methodology for Determining the Maximum Reasonably Foreseeable Radiological Accidents

5.15.3.1 Selection of Spent Nuclear Fuel Facilities and Operations Requiring

Accident Analyses. The accident analyses performed to support this EIS considered nonreactor nuclear facilities that support spent nuclear fuel-related activities wi those at the Naval Reactors Facility (NRF) area. Appendix D of this EIS discusses nuclear fuel management alternatives and postulated accident scenarios associated w Reactors Facility and other naval spent nuclear fuel facilities.

DOE Order 5480.23 (DOE 1992a) defines nonreactor nuclear facilities as those ac operations that involve radioactive or fissionable materials in such form and quant hazard potentially exists to the workers or the general public. This analysis cons fuel facilities designed and constructed as direct support to reactor facilities (e Reactor Storage Canal, which stores spent nuclear fuel and irradiated fuels) as non fuel facilities.

DOE manages spent nuclear fuel at the following INEL facility areas: Idaho Che Processing Plant, Naval Reactors Facility, Test Reactor Area, Auxiliary Reactor Are Facility, Argonne National Laboratory-West, and Test Area North. For further infor the activities conducted in these areas, refer to Chapter 2. After identifying all facilities within these facility areas that stabilize, handle, or store spent nucle ranked the facilities according to potential hazards using preexisting facility "ha DOE Order 5480.23 requires contractors operating nonreactor nuclear facilities to p classification of a facility to assess the consequences of an unmitigated release o hazardous material in one of the following categories(1):

- Category 1. The hazard analysis shows the potential for significant offsite
- Category 2. The hazard analysis shows the potential for significant onsite
- Category 3. The hazard analysis shows the potential for only significant lo consequences.

The classification of nonreactor nuclear facilities in one of these three categ accordance with DOE Standard DOE-STD-1027-92 (DOE 1992b). This standard provides g for the hazard categorization of nuclear facilities based on facility inventories o potential for those radionuclides to affect workers or the public if released to th

This analysis used these categories as a screening threshold to identify those (i.e., those spent nuclear fuel-related facilities with sufficient quantities of ra potential for significant impacts to workers or the public if released to the envir excluded (screened out) Category 3 (low hazard) facilities if they present possible consequences enveloped by postulated accidents at Category 2 facilities. Facilitie classification of 2 or greater (or Category 3 facilities that were not screened out further, as discussed in the next section.

5.15.3.2 Determination of Maximum Reasonably Foreseeable Radiological

Accidents. After determining spent nuclear fuel-related facilities with sufficient radionuclides to present radiological consequences to workers or the public (as dis

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1. These categories were formerly labeled "high", "moderate," and "low" in accordan with DOE Order 5480.23 for nonreactor nuclear facilities.

Section 5.15.3.1), the analysis generated potential accident scenarios for each of by performing the following activities:

- Reviewing historic spent nuclear fuel-related accidents that have occurred history of the INEL.
- Reviewing existing accident analyses and safety analysis reports for spent fuel-related activities and facilities.
- Identifying potential internal, external, and natural phenomena events that spent nuclear fuel-related accidents other than those previously analyzed.
- Performing additional accident analyses for those accidents considered to p consequences to workers or the public, as necessary.

The analysis considered internal and external initiators associated with a wide (e.g., research and development and construction or modification of facilities) not in existing safety analyses. For example, potential radiological accident scenario construction activities associated with constructing new spent nuclear fuel-related modifying existing spent nuclear fuel-related facilities (as proposed under the var were postulated. Typically, events involved in the construction of new spent nucle facilities would act as external initiators to existing facilities, while events in existing spent nuclear fuel facilities would act as internal initiators. Examples industrial-type events that could initiate a radiological accident included fires, puncture events, equipment failure, and human error.

Additional considerations used to determine potential internal and external ini lead to spent nuclear fuel-related radiological accidents included vulnerabilities handling, stabilizing, and storing severely degraded spent nuclear fuel and equipme November 1993, DOE issued a report (DOE 1993c) discussing vulnerabilities associate spent nuclear fuel-related facilities across the DOE complex. The report identifie the CPP-603 Underwater Fuel Storage Facility, as requiring immediate management att unnecessary increases in worker exposures, cleanup costs, and postulated accident f Activities have begun to stabilize spent nuclear fuel inventories in the CPP-603 fa them to another facility (CPP-666); these activities will continue for several year 1995 Record of Decision for this EIS. Therefore, the analysis considered postulate associated with stabilizing and relocating CPP-603 spent nuclear fuel inventories t accident initiators in developing the radiological accidents summarized in this EIS accident scenarios considered as a result of degraded spent nuclear fuel or facilit inadvertent nuclear criticalities, physical damage of spent nuclear fuel and spent and radionuclide releases resulting from handling and stabilizing degraded spent nu postulated accident scenarios at facilities other than the CPP-603 Underwater Fuel analysis also considered the potential for long-term degradation of facility struct spent nuclear fuel inventories that could lead to an increased probability for radi

To compare the various possible spent nuclear fuel-related accident scenarios a those maximum reasonably foreseeable accidents that present the greatest consequenc the public, the analysis divided each postulated spent nuclear fuel-related acciden frequency category (abnormal events, design-basis accidents(2), or beyond-design-ba according to its estimated frequency of occurrence. Table 5.15-5 lists the frequen with the abnormal event, design-basis accident, and beyond-design-basis accident ca in Section 5.15.1.

The estimated frequency of each postulated accident was based on an identificat physical basis for the accident and the events required for the accident to occur. postulated accidents or their constituent events (initiators or precursors) have ra frequency data based on historic experience were not available. Therefore, in many necessary to develop a frequency estimate on the basis of events for which experien engineering judgment. More than 40 sources of frequency data for the accident even reviewed, including analyses and reports prepared for the DOE, U.S. Nuclear Regulat (NRC), Electric Power Research Institute, and private industry. [For further infor development of estimated accident frequencies, refer to Slaughterbeck et al. (1995)

After the division of the postulated spent nuclear fuel-related accidents into defined in Table 5.15-5, the analysis identified the postulated nonprocessing-relat each frequency range determined to present the maximum offsite consequences as a ma

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2. For facilities where design-basis accident analyses were unavailable, evaluation accident scenarios (postulated accident scenarios used where documented design basi analyses do not exist) were considered in accordance with DOE-DP-STD-3005-YR (DOE 1

Table 5.15-5. Accident frequency categories.

Frequency Category	Accident Frequency Range (accidents per year)
Abnormal events	frequency > 1y10-3 per year
Design-basis accidents	1y10-3 per year > frequency > 1y10-6 per year
Beyond-design-basis accidents	1y10-6 per year > frequency > 1y10-7 per year

reasonably foreseeable radiological accident to be further analyzed for this EIS. nonprocessing-related accident scenarios were chosen as maximum reasonably foreseea because of the shutdown status of the INEL facility (CPP-666) that historically pro fuel. However, because existing inventories of spent nuclear fuel at the INEL woul increase under Alternatives 4b(1) and 5b [Regionalization by Geography (INEL) and C the INEL, respectively], there could be a need to resume processing operations to s spent nuclear fuel operations and assure adequate storage space for spent nuclear f other sites(3). Therefore, in addition to the maximum reasonably foreseeable nonpr accident scenarios, this analysis considers the three postulated processing-related the maximum offsite consequences as additional maximum reasonably foreseeable accid Alternatives 4b(1) and 5b.

In addition, a postulated inadvertent nuclear criticality accident at the CPP-6 Storage Facility was considered for further analysis because significant vulnerabil its spent nuclear fuel inventories have been identified (DOE 1993b) and postulated have been addressed in virtually all nonreactor DOE EISs and safety analysis report accidents are reasonably foreseeable because of public concerns regarding their pot the seven radiological accidents summarized in Section 5.15.4 were determined to be reasonably foreseeable radiological accidents (i.e., greatest consequences). Furth analysis information for each of these accidents, as well as other accidents analyz Slaughterbeck et al. (1995). Appendix D identifies maximum reasonably foreseeable

associated with transporting, receiving, handling, and storing naval spent nuclear
The postulated accidents summarized in this section considered with the INEL facili

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3. Processing would be performed in the Flourinel and Storage (FAST) facility (CPP-
a new facility to be constructed, the Fuel Processing Restoration (FPR) facility (C
Processing would consist of dissolving spent nuclear fuel to immobilize radionuclid
final waste disposal.

Appendix D provide a basis for characterizing the potential risks and consequences managing spent nuclear fuel at the INEL over the next 40 years.

Seismic events were the only identified common-cause initiators with the potent radioactive material releases to the environment at more than one spent nuclear fue the INEL. However, a seismic event resulting in significant damage and radioactive facilities in more than one facility area (e.g., Idaho Chemical Processing Plant an considered beyond reasonably foreseeable (frequency less than one in ten million ye the physical distance and isolation between facility areas. In accordance with DOE 1994a), a seismic event initiating multiple-facility releases in more than one faci was screened from further consideration because of its extremely low frequency of o

Analyses were performed that evaluated the potential consequences and risks ass multiple-facility releases within a single INEL facility area resulting from a seve (Slaughterbeck et al. 1995). For example, within a 500-meter radius in the Idaho C Plant facility area, there are several spent nuclear fuel facilities, the primary f 749 dry storage facilities and the CPP-666 and CPP-603 underwater fuel storage faci analysis was performed (Slaughterbeck et al. 1995) to determine whether simultaneou these facilities could result from a severe seismic event. Because the CPP-666 and were designed and qualified to withstand a severe seismic event, they are not expec the consequences and risks resulting from a severe seismic event impacting the Idah Processing Plant. However, because of known structural deficiencies and vulnerabil nuclear fuel at the CPP-603 facility, the CPP-603 facility is expected to be signif following a severe seismic event, resulting in one or more criticalities and the le basin water to the surrounding environment. While the consequences from these simu multiple-release mechanisms (one or more criticalities and water drainage) would be single criticality analyzed for CPP-603 facility (Section 5.15.3.3.2), the conseque releases are expected to be bounded by the other accidents analyzed in the EIS--pri event that causes fuel melting at the Argonne National Laboratory-West Hot Fuel Exa (highest consequence accident), and a fuel handling accident in the same facility (where risk = consequence x frequency). Similar analyses (DOE 1993a) for the Test A Argonne National Laboratory-West also demonstrate that potential multiple-facility multiple-release mechanisms from a single facility resulting from a severe seismic bounded by accidents postulated for the Hot Fuel Examination Facility. Based on th the accident selection methodology described 5.15.3.1, the consequences and risks a multiple-facility releases were screened from further consideration since they do n bounding accident scenarios within the frequency categories defined in Table 5.15-5

In addition, the screening methodology did not specifically include potential a associated with operating new spent nuclear fuel handling and storage facilities pr various alternatives considered in this EIS because postulated accident scenarios f would bound the consequences associated with potential accidents at new facilities. is appropriate for two primary reasons. First, the missions of new spent nuclear f be similar to the missions of existing spent nuclear fuel-related DOE facilities, w DOE would consider the same types of accident scenarios for the new facilities it c existing facilities. Second, DOE would design and build new facilities that would preventive and mitigative features to reduce the frequency and potential consequenc postulated accidents.

To compare the consequences of the same accident scenario at an identical hypot constructed at each DOE site included in this EIS (based on local geological and me conditions), Appendix D summarizes postulated accident scenarios for a new Expended at Oak Ridge, Hanford Site, Savannah River Site, or Nevada Test Site.

To determine the radiological and toxicological consequences presented througho associated with the postulated accidents and with spent nuclear fuel-related activi the following definitions:

- Worker. An individual 100 meters (328 feet) downwind of the facility locat release occurs.4
- Nearest Public Access. The nearest point of public access to the location occurs, sometimes inside the site boundary.

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4. The worker is defined as the individual located at 100 meters because reliable s quantifying the impacts (e.g., dose and health effects) to workers at distances les (i.e., "close-in" workers) meters fram an accidental release of radionuclides are u The effects on and risks to workers closer in than 100 meters are recognized and di Section 5.15.3.3. Each of the maximum reasonably forseeable accidents considered in particularly the design-basis and beyond-design-basis accidents, contains some risk or death at distances closer than 100 meters.

- Maximally Exposed Offsite Individual. A hypothetical resident at the site to the facility where the release occurs.
- Offsite Population. The collective total of individuals within an 80-kilom radius of the INEL.
- Environment. The area outward from 100 meters (328 feet) downwind of the f the release occurs.

5.15.3.3 Impact of Accidents on Close-In Workers. An evaluation has been made on the

radiological impact to close-in workers from the selected accident scenarios. Inju might occur due to an external event, such as a severe seismic disturbance or airpl structure, are not considered in this evaluation since they are not attributable to consequences. Seven accident scenarios for nonprocessing-related and processing-re considered maximum reasonably foreseeable accidents.

5.15.3.3.1 Mechanical Handling Accident at the Argonne National Laboratory

West Hot Fuel Examination Facility - This accident is assumed to result in fuel pin venting of noble gases and iodine.
No fatalities to workers are expected from this event. However, a substantial iodine dose to the thyroid could cause radiation-induced hypothyroidism disorder.

5.15.3.3.2 Criticality Accident at the Idaho Chemical Processing Plant -

CPP-603 - This event is an unplanned nuclear criticality associated with underwater fuel storage at the CPP-603 facility.
Based on shielding provided by the pool water, it is likely that no fatalities would occur. To the extent water is expelled due to the energy of th workers could receive substantial radiation exposure. Worker presence in the area very close to the edge of the pool is not routine. The impact of the event would l nearby equipment operators if the criticality were initiated by a handling error.

5.15.3.3.3 Seismic Event Leading to Fuel Melt at the Argonne National

Laboratory West Hot Fuel Examination Facility - A seismic event is postulated to r breech of the main cell used for examination of the fuel, which is assumed to lead fuel cooling system.
It is likely that the release of radioactive materials from fuel melting would occu slowly enough to allow evacuation of all workers before any appreciable exposure. radiation-induced fatalities would be expected.

5.15.3.3.4 Airplane Crash and Fire at Argonne National Laboratory West Hot

Fuel Examination Facility - An airplane crash and subsequent fire sustained by airp could result in a major breach of the confinement barriers and could lead to a subs release of radionuclides.
Workers unaffected by the airplane crash or fire would not be expected to remain in the area long enough to receive substantial radiation exposure. It is as of the radioactive material due to the fire would mitigate the direct radiological workers, substantially reducing the likelihood of radiation induced worker fataliti

5.15.3.3.5 Criticality Accident During Processing at the Idaho Chemical

Processing Plant - CPP-666 - This is the first of three evaluated accidents that co if processing were resumed at the Fluorinel and Storage Facility (FAST).
Three inadvertent nuclear
criticalities have occurred in INEL processing facilities and none has resulted in each event, radioactive material was released to the atmosphere and close-in worker exposure. If processing were resumed, the techniques and controls implemented to p of processing-related criticalities would be employed again. Due to the cell wall concrete walls that are several feet thick, it is expected that no workers would re radiation exposure.

5.15.3.3.6 Hydrogen Explosion at the Idaho Chemical Processing Plant - A

hydrogen explosion in the dissolver off-gas system of the Flourinel and Storage (FA result in release of radioactive material to the facility.
If workers were near the dissolver off-gas
system, they could receive substantial radiation exposure from the explosion. No f expected, but radiation-induced health detriments could occur.

5.15.3.3.7 Dissolution of Short-Cooled Fuel at the Idaho Chemical Processing

Plant - An explosion in the dissolver tank could occur if fuel that has not cooled was inadvertently shipped to the dissolver at the Flourinel and Storage Facility (F This energetic
event would likely breach the dissolver off gas system and could breach the dissolv in the areas closely associated with the dissolver tank could receive substantial r it is likely that no radiation-induced fatalities would occur.

5.15.3.4 Analysis of Radiological Accident Consequences. The quantities of

radioactive materials and the ways these materials interact with human beings are i determining health effects. The ways in which radioactive materials reach human be absorption and retention in the body, and the resulting health effects have been st The International Commission on Radiological Protection (ICRP) has made specific re for quantifying these health effects (ICRP 1991). This organization is the recogni establishing standards for the protection of workers and the public from the effect exposure. Health effects can be classified into two categories: prompt (also refe latent. Prompt health effects are those experienced immediately after exposure and the body up to and including death. Latent health effects are those experienced so exposure and include cancers and hereditary symptoms. An INEL-developed computer c Radiological Safety Analysis Computer Program-5 (RSAC-5), estimates potential radia maximally exposed individuals or population groups from accidental releases of radi code, which is customized to specific INEL conditions, uses well-established and ge scientific engineering principles as the basis for its various calculational steps. guidance provided in NRC Guide 1.145 (NRC 1983) and has been validated to comply wi standards for such software. [For a detailed description of RSAC-5, refer to Slaug (1995).]

The RSAC-5 code determined estimated consequences to the worker, an individual be stranded at the nearest point of public access, the maximally exposed hypothetic nearest site boundary, and the offsite population within 80 kilometers (50 miles) o accidents postulated under Alternative 1, No Action. Postulated frequencies and co analyzed under Alternative 1 are based on (1) the approximate amount of spent nucle at the INEL [measured in Metric Tons Heavy Metal (MTHM)], (2) the estimated increas inventories resulting from spent nuclear fuel generated by operating INEL reactors removed from a reactor that has not had sufficient time to cool), and (3) the estim handling activities associated with stabilizing or relocating spent fuel inventorie boundary. Although the four nonprocessing-related maximum reasonably foreseeable r accident scenarios identified for Alternative 1 are also considered under Alternati proposed changes in INEL spent nuclear fuel inventories and the number of fuel hand associated with these changes could affect the estimated frequencies and consequenc Alternatives 2 through 5. Therefore, to reasonably estimate the frequencies and co associated with activities proposed under Alternatives 2 through 5, the frequencies for the accidents presented under Alternative 1 require appropriate "adjustment" or

To be conservative, the analysis assumed that the increase in the annual freque handling accidents would be equal to the estimated increase in the annual number of proposed under Alternatives 2 through 5. However, the consequences associated with handling accident would not vary with a change in the number of handling events bec of material involved in each event would not change. To determine potential change mechanical handling accident frequencies between the different spent nuclear fuel m alternatives, the analysis based its estimates of the annual number of fuel handlin alternative on spent fuel shipment rates anticipated for the next 40 years, as disc Estimates of long-term (40-year) and short-term (5-year) shipments at the INEL were determining the annual shipment rates for each alternative. The basis for the numb shipments include spent nuclear fuel the INEL will continue to receive from operati DOE, Naval Nuclear Propulsion Program, university, and research reactors. Short-te consist of shipments that would be required to relocate existing spent fuel invento under the various alternatives. Table 5.15-6 summarizes the estimated annual shipm from the INEL under each alternative, and within INEL site boundaries. The estimat Table 5.15-6 consider both onsite and offsite shipments.

Table 5.15-6. Determination of accident frequency adjustment factors for Alternati based on estimated number of annual spent nuclear fuel shipments under each alterna

Alternative	Estimated Shipment Rate (per year)a	Adjustment Fact (shipment rate/baseline)
1. No Action	41	Baseline
2. Decentralization	50	1.2
3. 1992/1993 Planning Basis	128	3.1
4a. Regionalization by Fuel Type	195	4.8
4b(1) Regionalization by Geography (INEL)	824	20.0
4b(2) Regionalization by Geography (Elsewhere)	351	8.6
5a. Centralization at Other DOE Sites	351	8.6
5b. Centralization at the INEL	824	20.0

a. Data presented for the estimated annual shipment rate is based on information ta Appendix I. The annual shipment rate for the No-Action Alternative (baseline) i Table 3 of Wichmann 1994.

Based on the number of annual shipments estimated for Alternatives 2 through 5, Table 5.15-6, the analysis calculated multiplication factors by dividing the estima **under Alternatives 2 through 5 by the baseline (Alternative 1) shipment rate.** To d estimated frequency for the maximum reasonably foreseeable mechanical handling acci each alternative, the frequency identified for Alternative 1 was multiplied by the adjustment factor. The same approach determined estimated frequencies for Accident breach and noble gases and iodine release from the Hot Fuel Examination Facility) u Alternatives 2 through 5. For Accident 2 (inadvertent criticality in the CPP-603 U Storage Facility resulting from a handling accident associated with degraded spent estimated frequency considered under Alternative 1 (1 y 10-3 event per year) is bas handling activities associated with relocation of the CPP-603 spent nuclear fuel in CPP-666 facility. Because proposed changes in INEL inventories under the different would not affect handling events associated with relocating spent fuel from the CPP CPP-666 facility, the estimated frequency for this mechanical handling event would result of this approach and the fact that 3 of the 4 accident scenarios that presen consequences are not handling accidents, Accident 1 is the only accident requiring each alternative.

Variable source-term-sensitive accidents would have consequences that depended o spent nuclear fuel in storage. One example is the accidental drainage of a spent f results in the release of corrosion products in the canal to the environment. The inventory in the canal, the larger the release of corrosion products to the environ draining the canal. (Drainage of a water canal completely filled with spent nuclea considered in the determination of the maximum reasonably foreseeable accidents and to present lower consequences than other accident scenarios analyzed.) Variable so accidents depend only on spent nuclear fuel inventories and do not require adjustme estimated frequencies of occurrence. Because none of the postulated accidents summ

Alternative 1 is source-term sensitive (e.g., spent nuclear fuel inventories in the Facility are not likely to increase), adjustment of the estimated consequences calc Alternative 1 is not required for Alternatives 2 through 5.

5.15.4 Impacts from Postulated Maximum Reasonably Foreseeable Radiological Accidents

Section 5.15.4.1 summarizes impacts (e.g., exposures and health effects) from th nonprocessing-related maximum reasonably foreseeable radiological accidents postula Alternative 1 (No Action). Sections 5.15.4.4.2.1 through 5.15.4.5.2 describe chang postulated accident impacts resulting from changes in spent nuclear fuel inventorie activities under the other alternatives. Sections 5.15.4.4.2.1 and 5.15.4.5.2 also from three additional maximum reasonably foreseeable accidents associated with resu processing activities at the INEL. Section 5.15.6 provides more information about and analyses performed for each of the radiological accidents discussed under each

5.15.4.1 Alternative 1: No Action. Based on the quantity of spent nuclear fuel at the INEL

(excluding naval fuel at Naval Reactors Facility, which is analyzed in Appendix D), configuration (wet versus dry), the amount of time the spent fuel has been allowed consideration of various internal, external, and natural phenomena initiators (as d Section 5.15.3), the postulated accidents listed in Table 5.15-7 would have the gre consequences within the abnormal event, design-basis accident, and beyond-design-ac under this alternative. For each accident, Table 5.15-7 also lists estimated accid radiation exposures to the offsite population within 80 kilometers (50 miles), a me stranded at the nearest point of public access inside the INEL site boundary, a hyp exposed individual (MEI) at the nearest site boundary, and a worker; point estimate risk of the maximally exposed individual contracting a fatal cancer during his/her of the radiation exposure; and point estimates of risk of the expected number of fa (annualized and total) in the offsite population. The estimates of the consequence offsite population are based on conservative (95 percentile) and average (50 percen conditions(5). The estimates of the consequences and risk to the maximally exposed based on conservative (95 percentile) meteorological conditions. The postulated ac Table 5.15-7, in conjunction with the maximum reasonably foreseeable spent nuclear identified for the INEL Naval Reactors Facility in Appendix D, characterize the pot and risks associated with the proposed spent fuel management activities at the INEL alternative.

Atmospheric transport of radionuclides from the postulated accidents could resu **secondary impacts, such as contamination of the environment or impacts to national**

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5. Conservative (95 percentile) meteorological conditions are defined as the meteorlogical conditions that, for a given release, the concentration at a fixed receptor location will not be exceeded 95 percent of the time. Average (50 percenti meteorological conditions are defined as the meteorological conditions that, for a given release, the concentration at a fixed receptor location will not be exceeded 50 percent of the time.

Table 5.15-7. Impacts from selected maximum reasonably foreseeable radiological ac Alternative 1, No Action (50 and 95 percentile meteorological conditions).

Accident	Frequency (events per year)	Worker Dosea (rem)	Nearest Public Accessb (rem)	Dose to MEIc (rem)	Offsite Population Dose (95%) (person-rem)	Po (p ME 95
1. Fuel handling accident, fuel pin breach, venting of noble gases and iodine at HFEFe	1.0y10-2	(f)	(f)	2.0y10-3	(f)	1.
2. Inadvertent criticality in ICPPg CPP-603 storage facilityh	1.0y10-3	9.7y10-2	1.4y10-3	1.0y10-3	5.9y10-1	5.

3. Fuel melting of small number of assemblies at HFEF resulting from seismic event and cell breach	1.0y10-5	6.2y10-1	6.5y10-1	5.0y100	1.4y104	2.
4. Material release from HFEF resulting from aircraft crash and ensuing fire	1.0y10-7(i)	4.6y100	3.2y10-1	5.0y100	2.0y103	2.

a. A worker is defined as a worker located 100 meters (328 feet) from the point of
b. Public individual assumed to be stranded at the nearest point of public access i
c. MEI = Maximally exposed hypothetical offsite individual, located at the nearest
d. Maximally exposed individual and offsite population fatal cancer risk = dose y a 5.0 y 10-4 fatal cancer per rem (ICRP-60 conversion factor) if dose is less than more the ICRP-60 conversion factor is doubled, or 1.0 y 10-3. Numbers in parent number of fatal cancers in the population if the accident occurred.
e. HFEF - Hot Fuel Examination Facility.
f. The safety analysis report utilized for this accident analysis does not provide developed prior to DOE Order 5480.23 requiring this information. As demonstrate maximally exposed individual, consequences to the public from this accident coul consequences from Accidents 2 through 4.
g. ICPP = Idaho Chemical Processing Plant.
h. Although three nuclear criticalities associated with spent nuclear fuel reproces the INEL during its 40-year operating history, the estimated frequency for an in based on historic reprocessing data because reprocessing is not considered under frequency estimates vary from 1.0 y 10-4 (CPP-666 underwater storage facility) t underwater storage facility) event per year.
i. This frequency is a qualitative bounding estimate for a potential aircraft crash Section 5.15.6.4.

prevent these radionuclides from increasing any potential safety concerns, DOE woul activities if an accident occurred, and no irreversible environmental impacts would Table 5.15-8 summarizes postulated secondary impacts resulting from the postulated accidents listed in Table 5.15-7.

This analysis takes limited credit for emergency response actions in determining **listed in Table 5.15-7.** DOE would initiate INEL emergency response programs, as ap following the occurrence of an accident to prevent or mitigate potential consequenc emergency response programs, implemented in accordance with 5500-DOE series Orders, involve emergency planning, emergency preparedness, and emergency response actions. emergency response plan utilizes resources specifically dedicated to assist a facil management. These resources include but are not limited to the following:

- INEL Warning Communications Center
- INEL Fire Department
- Facility Emergency Command Centers
- DOE Emergency Operations Centers
- County and State Emergency Command Centers
- Medical, health physics, and industrial hygiene specialists
- Protective clothing and equipment (respirators, breathing air supplies, etc.)
- Periodic training exercises and drills within and between the organizations i implementing the response plans

5.15.4.2 Alternative 2: Decentralization. Adjustments in estimated accident frequencies

and point estimates of risk presented for Alternative 1 would be related to (1) the and storage activities associated with the additional spent nuclear fuel inventorie in overall spent nuclear fuel-related storage, relocation, and handling activities Alternative 1. Because no changes in the accident consequences estimated for Alter to occur under this alternative from increased fuel inventories (i.e., the same amo material would accidentally be released to the environment as discussed in Section changes are likely in the postulated secondary impacts listed in Table 5-15-8. Tab summarizes the four postulated accidents with the greatest radiological impacts und

Table 5.15-8. Estimated secondary impacts resulting from the maximum reasonably fo Action, assuming conservative (95 percentile) meteorological conditions.

Environmental or Social Impacts

Radiological Accident Summary	(Assuming 88 millirem per year limit with 24-hour-per-day expo			
	Biotic Resources	Water Resources	Economic Impacts	Na De
1. Fuel handling accident, fuel pin breach, venting of noble gases and iodine at HFEFb (1x10-2 per year)	Limited adverse effects expected vegetation or wildlife.	Limited adverse effects expected to surface water or groundwater.	Limited economic impacts expected. Any cleanup required would be localized and could be accomplished with existing workforce and equipment.	No na ex
2. Uncontrolled chain reaction (criticality) at ICPPc (1x10-3 per year)	Limited adverse effects expected vegetation or wildlife.	Limited adverse effects expected to surface water or groundwater.	No economic impacts expected. Any cleanup required would be localized and could be accomplished with existing workforce and equipment.	No na ex
3. Fuel melting of small number of assemblies at HFEF resulting from seismic event and cell breach (1x10-5 per year)	Limited adverse effects expected vegetation or wildlife.	Limited adverse effects expected to surface water or groundwater.	Potential interdiction of affected agricultural products on nearby lands. Local cleanup in the vicinity of HFEF.	No na ex
4. Material release from HFEF resulting from aircraft crash and ensuing fire (1x10-7 per year)	Limited adverse effects expected vegetation or wildlife.	Limited adverse effects expected to surface water or groundwater.	Potential interdiction of affected agricultural products on nearby lands. Local cleanup in the vicinity of HFEF.	No na ex

a. Postulated secondary impacts based on 10-microrem-per-hour exposure (88 millirem from the plume. This approach in estimated secondary impacts is conservative be background radiation is 100 millirem per year.
b. HFEF = Hot Fuel Examination Facility.
c. ICPP = Idaho Chemical Processing Plant.
d. To convert acres to square kilometers, multiply by 0.004.

Table 5.15-9. Impacts from selected maximum reasonably foreseeable accidents - Alt Decentralization (50 and 95 percentile meteorological conditions).

Accident	Adjusted Frequencya (events per year)	Worker Doseb (rem)	Nearest Public Accessc (rem)	Dose to MEId (rem)	Offsite Population Dose (95%) (person-rem)
1. Fuel handling accident, fuel pin breach, venting of noble gas and iodine at HFEFf	1.2y10-2 (1.2)	(g)	(g)	2.0y10-3	(g)
2. Inadvertent criticality in ICPPh CPP-603 storage facilityi	1.0y10-3 (1.0)j	9.7y10-2	1.4y10-3	1.0y10-3	5.9y10-1

3. Fuel melting of small number of assemblies at HFEF resulting fr seismic event and ce breach	1.0y10-5 (1.0)	6.2y10-1	6.5y10-1	5.0y100	1.4y104
4. Material release from HFEF resulting from aircraft crash and ensuing fire	1.0y10-7(k) (1.0)	4.6y100	3.2y10-1	5.0y100	2.0y103

a. Numbers in parentheses indicate multiplication factor used to scale or adjust es under Alternative 1, as described in Section 5.15.3.3.
b. A worker is defined as a worker located 100 meters (328 feet) from the point of
c. Public individual assumed to be stranded at the nearest point of public access i
d. MEI = Maximally exposed hypothetical offsite individual located at the nearest s
e. Maximally exposed individual and offsite population fatal cancer risk = dose y a 5.0 y 10-4 fatal cancer per rem (ICRP-60 conversion factor) if dose is less than or more, the ICRP-60 conversion factor is doubled, or 1.0 y 10-3. Numbers in pa number of fatal cancers in the population if the accident occurs.
f. HFEF = Hot Fuel Examination Facility.
g. The safety analysis report utilized for this accident analysis does not provide developed prior to DOE Order 5480.23 requiring this information. As demonstrate maximally exposed individual, consequences to the public from this accident coul consequences from Accidents 2 through 4.
h. ICPP = Idaho Chemical Processing Plant.
i. Although three nuclear criticalities associated with spent nuclear fuel reproces the INEL during its 40-year operating history, the estimated frequency for an in based on historic reprocessing data since reprocessing is not considered under t frequency estimates vary from 1.0 y 10-4 (CPP-666 underwater storage facility) t underwater storage facility) events per year.
j. Refer to Sections 5.15.3.3 and 5.15.6.2 for details on why this frequency was no alternative.
k. This frequency is a qualitative bounding estimate for a potential aircraft crash Section 5.15.6.4.

5.15.4.3 Alternative 3: 1992/1993 Planning Basis. Under this alternative, the receive the following spent nuclear fuel:

- Spent nuclear fuel from domestic DOE and university reactors and foreign re reactors
- All Training Reactor Isotopics General Atomics (TRIGA) spent nuclear fuel f and Hanford reactors
- Fort St. Vrain spent nuclear fuel from Public Service Company of Colorado
- Special case commercial pressurized water reactor and boiling water reactor fuel from West Valley, New York
- Naval spent nuclear fuel from sites such as the Norfolk or Puget Sound Nava

Adjustments in estimated accident frequencies and point estimates of risk prese Alternative 1 would be related to (1) the receipt, handling, and storage activities additional spent nuclear fuel inventories; and (2) the increase in overall spent fu relocation, and handling activities not allowed under Alternative 1. Because no ch accident consequences estimated for Alternative 1 are likely to occur under this al increased fuel inventories (i.e., the same amount of radioactive material would acc to the environment as discussed in Section 5.15.3.3), no changes are likely in the impacts listed in Table 5.15-8. Table 5.15-10 summarizes the postulated accidents radiological impacts under this alternative.

5.15.4.4 Alternative 4: Regionalization. Under this alternative, there are t Regionalization alternatives: (1) Alternative 4a (Regionalization by Fuel Type), w spent nuclear fuel inventories will be distributed between the DOE sites based prim similarity of fuel types, although DOE would also consider transportation distances stabilization capabilities, available storage capacities, or a combination of these (2) Alternative 4b (Regionalization by Geography), where existing and new spent nuc inventories in the western region of the country will be centralized at a single we existing and new spent nuclear fuel inventories in the eastern region of the countr at a single eastern site.

Table 5.15-10. Impacts from selected maximum reasonably foreseeable accidents - Al Planning Basis (50 and 95 percentile meteorological conditions).

Accident	Adjusted	Worker	Nearest	Dose to	Offsite	A

	Frequencya (events per year)	Doseb (rem)	Public Accessc (rem)	MEId (rem)	Population Dose (95%) (person-rem)	c M 9
1. Fuel handling accident, fuel pin breach, venting of noble gases and iodine at HFEFf	3.1y10-2 (3.1)	(g)	(g)	2.0y10-3	(g)	3
2. Inadvertent critical in ICPPh CPP-603 storage facilityi	1.0y10-3 (1.0)j	9.7y10-2	1.4y10-3	1.0y10-3	5.9y10-1	5
3. Fuel melting of small number of assemblies at HFEF resulting from seismic event and cell breach	1.0y10-5 (1.0)	6.2y10-1	6.5y10-1	5.0y100	1.4y104	2
4. Material release from HFEF resulting from aircraft crash and ensuing fire	1.0y10-7(k) (1.0)	4.6y100	3.2y10-1	5.0y100	2.0y103	2

a. Numbers in parentheses indicate multiplication factor used to scale or adjust es under Alternative 1, as described in Section 5.15.3.3.
b. A worker is defined as a worker located 100 meters (328 feet) from the point of
c. Public individual assumed to be stranded at the nearest point of public access i
d. MEI = Maximally exposed hypothetical offsite individual located at the nearest s
e. Maximally exposed individual and offsite population fatal cancer risk = dose y a 5.0 y 10-4 fatal cancer per rem (ICRP-60 conversion factor) if dose is less than or more, the ICRP-60 conversion factor is doubled, or 1.0 y 10-3. Numbers in pa number of fatal cancers in the population if the accident occurs.
f. HFEF = Hot Fuel Examination Facility.
g. The safety analysis report utilized for this accident analysis does not provide developed prior to DOE Order 5480.23 requiring this information. As demonstrate maximally exposed individual, consequences to the public from this accident coul consequences from Accidents 2 through 4. However, given the high frequency for Accidents 2 through 4, the risk could actually be greater than for Accidents 2 t
h. ICPP = Idaho Chemical Processing Plant.
i. Although three nuclear criticalities associated with spent nuclear fuel reproces the INEL during its 40-year operating history, the estimated frequency for an in based on historic reprocessing data since reprocessing is not considered under t frequency estimates vary from 1.0 y 10-4 (CPP-666 underwater storage facility) t underwater storage facility) events per year.
j. Refer to Sections 5.15.3.3 and 5.15.6.2 for details on why this frequency was no alternative.
k. This frequency is a qualitative bounding estimate for a potential aircraft crash Section 5.15.6.4.

5.15.4.4.1 Alternative 4a - Regionalization By Fuel Type - Adjustments in the estimated

accident frequencies and point estimates of risk presented for Alternative 1 would receipt, handling, and storage activities associated with the additional spent nucl and (2) the increase in overall spent nuclear fuel-related storage, relocation, and allowed under Alternative 1.

Because no changes in the accident consequences estimated for Alternative 1 are likely to occur under this alternative from increased fuel invent amount of radioactive material would accidentally be released to the environment as Section 5.15.3.3), no changes are likely in the postulated secondary impacts listed Table 5.15-11 summarizes the postulated accidents with the greatest radiological im alternative.

5.15.4.4.2 Alternative 4b - Regionalization by Geography - Under this alternative, spent

nuclear fuel inventories in the western region of the country would be centralized Hanford Site, or Nevada Test Site.
Alternative 4b(1) considers regionalization at the INEL.
Alternative 4b(2) considers regionalization at the Hanford Site or Nevada Test Site

5.15.4.4.2.1 Alternative 4b(1) - Regionalization by Geography (INEL) - Under

this alternative, existing and new spent nuclear fuel inventories in the western re would be centralized at the INEL. Fuel stabilization would be performed in the Flu (FAST) facility (CPP-666) and a new facility to be constructed, the Fuel Processing facility (CPP-691), to dissolve spent nuclear fuel and stabilize (i.e., immobilize) Because the volume of spent nuclear fuel considered under this alternative is only that considered under Alternative 5b, adjustments in the estimated accident frequen estimates of risk for the four accidents presented under Alternative 1 were conserv equivalent to the adjustments required under Alternative 5b (i.e., centralization o Nuclear Propulsion Program, university, and research reactor spent nuclear fuel in INEL). Adjustments in the estimated accident frequencies and point estimates of ri accidents presented under Alternative 1 would be related to (1) the receipt, handli activities associated with the additional spent nuclear fuel inventories; and (2) t spent nuclear fuel-related storage, relocation, and handling activities not allowed Because no changes in the accident consequences estimated for Alternative 1 are lik this alternative from increased fuel inventories (i.e., the same amount of radioact accidentally be released to the environment as discussed in Section 5.15.3.3), no c the postulated secondary impacts listed in Table 5.15-8.

Table 5.15-11. Impacts from selected maximum reasonably foreseeable accidents - Al Regionalization by Fuel Type (50 and 95 percentile meteorological conditions).

Accident	Adjusted Frequencya (events per year)	Worker Doseb (rem)	Nearest Public Accessc (rem)	Dose to MEId (rem)	Offsite Population Dose (95%) (person-rem)	Ad ca ME 95
1. Fuel handling accident, fuel pin breach, venting of noble gases and iodine at HFEFf	4.8y10-2 (4.8)	(g)	(g)	2.0y10-3	(g)	4.
2. Inadvertent criticality in ICPP-603 storage facilityi	1.0y10-3 (1.0)j	9.7y10-2	1.4y10-3	1.0y10-3	5.9y10-1	5.
3. Fuel melting of small number of assemblies at HFEF resulting from seismic event and cell breach	1.0y10-5 (1.0)	6.2y10-1	6.5y10-1	5.0y100	1.4y104	2.
4. Material release from HFEF resultin from aircraft cras and ensuing fire	1.0y10-7(k) (1.0)	4.6y100	3.2y10-1	5.0y100	2.0y103	2.

a. Numbers in parentheses indicate multiplication factor used to scale or adjust es under Alternative 1, as described in Section 5.15.3.3.
b. A worker is defined as a worker located 100 meters (328 feet) from the point of
c. Public individual assumed to be stranded at the nearest point of public access i
d. MEI = Maximally exposed hypothetical offsite individual located at the nearest s
e. Maximally exposed individual and offsite population fatal cancer risk = dose y a 5.0 y 10-4 fatal cancer per rem (ICRP-60 conversion factor) if dose is less than or more, the ICRP-60 conversion factor is doubled, or 1.0 y 10-3. Numbers in pa number of fatal cancers in the population if the accident occurs.
f. HFEF = Hot Fuel Examination Facility.
g. The safety analysis report utilized for this accident analysis does not provide

developed prior to DOE Order 5480.23 requiring this information. As demonstrate maximally exposed individual, consequences to the public from this accident coul consequences from Accidents 2 through 4. However, given the high frequency for Accidents 2 through 4, the risk could actually be greater than for Accidents 2 t

h. ICPP = Idaho Chemical Processing Plant.

i. Although three nuclear criticalities associated with spent nuclear fuel reproces the INEL during its 40-year operating history, the estimated frequency for an in based on historic reprocessing data since reprocessing is not considered under t frequency estimates vary from 1.0 y 10-4 (CPP-666 underwater storage facility) t underwater storage facility) events per year.

j. Refer to Sections 5.15.3.3 and 5.15.6.2 for details on why this frequency was no alternative.

k. This frequency is a qualitative bounding estimate for a potential aircraft crash Section 5.15.6.4.

Because the option exists to restart processing activities, three additional proc maximum reasonably foreseeable accidents are considered under this alternative (as Section 5.15.3.2). Since the amount of radioactive material that would accidentall environment from these accidents is expected to be lower than in Accidents 3 and 4 melt and aircraft crash at the Hot Fuel Examination Facility, respectively), potent associated with these additional processing-related accidents would be less severe for the nonprocessing-related accidents in Table 5.15-8.

Table 5.15-12 summarizes the postulated accidents with the greatest radiological alternative.

5.15.4.4.2.2 Alternative 4b(2) - Regionalization by Geography (Elsewhere) - Under this

alternative, existing and new spent nuclear fuel inventories in the western region be centralized at either the Hanford Site or Nevada Test Site. Similar to Alternat considers centralization of existing INEL spent nuclear fuel inventories at another inventory of spent nuclear fuel at the INEL would be reduced substantially so that nuclear fuel at the INEL would consist of fresh fuel generated from operating INEL not cooled sufficiently for relocation to the regionalized or centralized site. Th considers the same amount of material considered under Alternative 1 until the regi accept existing inventories of INEL spent nuclear fuel and freshly generated spent sufficiently cooled.

Table 5.15-13 summarizes the postulated accidents with the greatest radiological alternative.

5.15.4.5 Alternative 5: Centralization. Under this alternative, DOE would collect all

current and future spent nuclear fuel inventories from both DOE and the Naval Nucle Program at one site. For the INEL, there are two possibilities: (1) Alternative 5 spent fuel inventories and activities would take place at the Hanford Site, Savanna Test Site, or Oak Ridge Reservation; or (2) Alternative 5b, in which all spent fuel activities would be centralized at the INEL.

5.15.4.5.1 Alternative 5a: Centralization at Other DOE Sites - This alternative

would consider approximately the same amount of material considered under Alternati centralized site could accept existing INEL spent nuclear fuel inventories and fres Table 5.

15-12. Impacts from selected maximum reasonably foreseeable accidents - Alternativ Regionalization by Geography (INEL) (50 and 95 percentile meteorological conditions

Accident	Adjusted Frequencya (events per year)	Worker Doseb (rem)	Nearest Public Accessc (rem)	Dose to MEId (rem)	Offsite Population Dose (95%) (person-rem)	A c M 9
1. Fuel handling						

accident, fuel pin breach, venting of noble gases and iodine at HFEFf	2.0y10-1 (20.0)	(g)	(g)	2.0y10-3	(g)	2
2. Inadvertent critical in ICPPh CPP-603 storage facilityi	1.0y10-3 (1.0)j	9.7y10-2	1.4y10-3	1.0y10-3	5.9y10-1	5
3. Fuel melting of small number of assemblie at HFEF resulting from seismic event and cell breach	1.0y10-5 (1.0)	6.2y10-1	6.5y10-1	5.0y100	1.4y104	2
4. Material release from HFEF resulting from aircraft crash and ensuing fire	1.0y10-7(k) (1.0)	4.6y100	3.2y10-1	5.0y100	2.0y103	2
5. Inadvertent nuclear criticality ICPPh CPP-666 during processingl	1.0y10-3	9.1y10+ 0	4.9y10-2	2.8y10-2	5.6y10+0	1
6. Hydrogen in ICPPh CPP-666 dissolver	1.0y10-5	(m)	(m)	6.3y10-4	8.1y10-1	3
7. Inadvertent dissolution of 30-d cooled fuel at ICPPh CPP-666	1.0y10-6	(m)	(m)	3.0y10-2	2.9y10+1	1

a. Numbers in parentheses indicate multiplication factor used to scale or adjust es described in Section 5.15.3.3.
b. A worker is defined as a worker located 100 meters (328 feet) from the point of
c. Public individual assumed to be stranded at the nearest point of public access i
d. MEI = Maximally exposed hypothetical offsite individual located at the nearest s
e. Maximally exposed individual and offsite population fatal cancer risk = dose y a (ICRP-60 conversion factor) if dose is less than 20 rem. For doses of 20 rem or 1.0 y 10-3. Numbers in parentheses indicate total number of fatal cancers in th
f. HFEF = Hot Fuel Examination Facility.
g. The safety analysis report utilized for this accident analysis does not provide Order 5480.23 requiring this information. As demonstrated by the dose to the ma from Accident 1 could be less than the consequences from Accidents 2 through 4. compared to Accidents 2 through 4, the risk could actually be greater than for A
h. ICPP = Idaho Chemical Processing Plant.
i. Although three nuclear criticalities associated with spent nuclear fuel reproces operating history of CPP-666, the estimated frequency for an inadvertent critica nuclear conditions and fuel vulnerabilities. Nominal estimates vary from 1.0 y 10-3 (CPP-603 underwater storage facility) events per year.
j. Refer to Sections 5.15.3.3 and 5.15.6.2 for details on why this frequency was no
k. This frequency is a qualitative bounding estimate for a potential aircraft crash
l. The Idaho Chemical Processing Plant has experienced three inadvertent nuclear cr 14 years ago. This frequency is based on modern facility conditions and safegua
m. The safety analysis report utilized for this accident does not provide this info Order 5480.23 requiring this information. However, a comparison of the data pre a relative measure of the impacts to this receptor.

Table 5.15-13. Impacts from selected maximum reasonably foreseeable accidents - Al Regionalization by Geography (Elsewhere) (50 and 95 percentile meteorological condi

Accident	Adjusted Frequencya (events per year)	Worker Doseb (rem)	Nearest Public Accessc (rem)	Dose to MEId (rem)	Offsite Population Dose (95%) (person-rem)	A c M 9
1. Fuel handling accident, fuel pin breach, venting of noble gases and iodine at HFEFf	8.6y10-2 (8.6)	(g)	(g)	2.0y10-3	(g)	8

2.	Inadvertent critical in ICPPh CPP-603 storage facilityi	1.0y10-3 (1.0)j	9.7y10-2	1.4y10-3	1.0y10-3	5.9y10-1	5
3.	Fuel melting of small number of assemblie at HFEF resulting from seismic event and cell breach	1.0y10-5 (1.0)	6.2y10-1	6.5y10-1	5.0y100	1.4y104	2
4.	Material release from HFEF resulting from aircraft crash and ensuing fire	1.0y10-7(k) (1.0)	4.6y100	3.2y10-1	5.0y100	2.0y103	2

a. Numbers in parentheses indicate multiplication factor used to scale or adjust es under Alternative 1, as described in Section 5.15.3.3.
b. A worker is defined as a worker located 100 meters (328 feet) from the point of
c. Public individual assumed to be stranded at the nearest point of public access i
d. MEI = Maximally exposed hypothetical offsite individual located at the nearest s
e. Maximally exposed individual and offsite population fatal cancer risk = dose y a 5.0 y 10-4 fatal cancer per rem (ICRP-60 conversion factor) if dose is less than or more, the ICRP-60 conversion factor is doubled, or 1.0 y 10-3. Numbers in pa number of fatal cancers in the population if the accident occurs.
f. HFEF = Hot Fuel Examination Facility.
g. The safety analysis report utilized for this accident analysis does not provide developed prior to DOE Order 5480.23 requiring this information. As demonstrate maximally exposed individual, consequences to the public from this accident coul consequences from Accidents 2 through 4. However, given the high frequency for Accidents 2 through 4, the risk could actually be greater than for Accidents 2 t
h. ICPP = Idaho Chemical Processing Plant.
i. Although three nuclear criticalities associated with spent nuclear fuel reproces the INEL during its 40-year operating history, the estimated frequency for an in based on historic reprocessing data since reprocessing is not considered under t frequency estimates vary from 1.0 y 10-4 (CPP-666 underwater storage facility) t underwater storage facility) events per year.
j. Refer to Sections 5.15.3.3 and 5.15.6.2 for details on why this frequency was no alternative.
k. This frequency is a qualitative bounding estimate for a potential aircraft crash Section 5.15.6.4.

fuel that had cooled sufficiently. On demonstration of the centralized site's capa spent nuclear fuel, the inventory of spent fuel at the INEL would be reduced substa only spent nuclear fuel at the INEL would consist of fresh fuel generated from oper reactors that had not cooled sufficiently for relocation to the centralized site.

Adjustments in estimated accident frequencies and point estimates of risk prese Alternative 1 would be related to (1) the receipt, handling, and storage activities additional spent nuclear fuel inventories; and (2) the increase in overall spent fu relocation, and handling activities not allowed under Alternative 1. Because no ch accident consequences estimated for Alternative 1 are likely to occur under this al increased fuel inventories (i.e., the same amount of radioactive material would acc to the environment as discussed in Section 5.15.3.3), no changes are likely in the impacts presented in Table 5.15-8. Table 5.15-14 summarizes the postulated acciden greatest radiological impacts under these alternatives.

5.15.4.5.2 Alternative 5b: Centralization at the INEL - Adjustments in estimated

accident frequencies and point estimates of risk presented for Alternative 1 would receipt, handling, and storage activities associated with the additional spent nucl and (2) the increase in overall spent nuclear fuel-related storage, relocation, and allowed under Alternative 1.

Because no changes in the accident consequences estimated for Alternative 1 are likely to occur under this alternative from increased fuel invent amount of radioactive material would accidentally be released to the environment as Section 5.15.3.3), no changes are likely in the postulated secondary impacts presen Table 5.15-15 summarizes the postulated accidents with the greatest radiological im alternative.

Because the option exists to restart processing activities, three additional pr maximum reasonably foreseeable accidents are considered under this alternative (as **Section 5.15.3.2).** Since the amount of radioactive material that would accidentall environment from these accidents is expected to be lower than Accidents 3 and 4 (i. and aircraft crash at the Hot Fuel Examination Facility, respectively), potential s associated with these additional processing-related accidents would be less severe for the nonprocessing-related accidents in Table 5.15-8.

Table 5.15-14. Impacts from selected maximum reasonably foreseeable accidents - Al Centralization at Other DOE Sites (50 and 95 percentile meteorological conditions).

Accident	Adjusted Frequencya (events per year)	Worker Doseb (rem)	Nearest Public Accessc (rem)	Dose to MEId (rem)	Offsite Population Dose (95%) (person-rem)	A c M 9
1. Fuel handling accident, fuel pin breach, venting of noble gases and iodine at HFEFf	8.6y10-2 (8.6)	(g)	(g)	2.0y10-3	(g)	8
2. Inadvertent critical in ICPPh CPP-603 storage facilityi	1.0y10-3 (1.0)j	9.7y10-2	1.4y10-3	1.0y10-3	5.9y10-1	5
3. Fuel melting of small number of assemblie at HFEF resulting from seismic event and cell breach	1.0y10-5 (1.0)	6.2y10-1	6.5y10-1	5.0y100	1.4y104	2
4. Material release from HFEF resulting from aircraft crash and ensuing fire	1.0y10-7(k) (1.0)	4.6y100	3.2y10-1	5.0y100	2.0y103	2

a. Numbers in parentheses indicate multiplication factor used to scale or adjust es under Alternative 1, as described in Section 5.15.3.3.
b. A worker is defined as a worker located 100 meters (328 feet) from the point of
c. Public individual assumed to be stranded at the nearest point of public access i
d. MEI = Maximally exposed hypothetical offsite individual located at the nearest s
e. Maximally exposed individual and offsite population fatal cancer risk = dose y a 5.0 y 10-4 fatal cancer per rem (ICRP-60 conversion factor) if dose is less than or more, the ICRP-60 conversion factor is doubled, or 1.0 y 10-3. Numbers in pa number of fatal cancers in the population if the accident occurs.
f. HFEF = Hot Fuel Examination Facility.
g. The safety analysis report utilized for this accident analysis does not provide developed prior to DOE Order 5480.23 requiring this information. As demonstrate maximally exposed individual, consequences to the public from this accident coul consequences from Accidents 2 through 4. However, given the high frequency for Accidents 2 through 4, the risk could actually be greater than for Accidents 2 t
h. ICPP = Idaho Chemical Processing Plant.
i. Although three nuclear criticalities associated with spent nuclear fuel reproces the INEL during its 40-year operating history, the estimated frequency for an in based on historic reprocessing data since reprocessing is not considered under t frequency estimates vary from 1.0 y 10-4 (CPP-666 underwater storage facility) t underwater storage facility) events per year.
j. Refer to Sections 5.15.3.3 and 5.15.6.2 for details on why this frequency was no alternative.
k. This frequency is a qualitative bounding estimate for a potential aircraft crash Section 5.15.6.4.

Table 5.15-15. Impacts from selected maximum reasonably foreseeable accidents - Al Centralization at the INEL (50 and 95 percentile meteorological conditions).

Accident	Adjusted Frequencya (events per year)	Worker Doseb (rem)	Nearest Public Accessc (rem)	Dose to MEId (rem)	Offsite Population Dose (95%) (person-rem)	A c

						M 9
1. Fuel handling accident, fuel pin breach, venting of noble gases and iodine at HFEFf	2.0y10-1 (20.0)	(g)	(g)	2.0y10-3	(g)	2
2. Inadvertent criticality in ICP storage facilityi	1.0y10-3 (1.0)j	9.7y10-2	1.4y10-3	1.0y10-3	5.9y10-1	5
3. Fuel melting of small number of assemblies at HFEF resulting from seismic event and cell breach	1.0y10-5 (1.0)	6.2y10-1	6.5y10-1	5.0y100	1.4y104	2
4. Material release from HFEF resultin from aircraft cras and ensuing fire	1.0y10-7(k) (1.0)	4.6y100	3.2y10-1	5.0y100	2.0y103	2
5. Inadvertent nuclear criticality ICPPh CPP-666 during processingl	1.0y10-3	9.1y10+0	4.9y10-2	2.8y10-2	5.6y10+0	1
6. Hydrogen in ICPPh CPP-666 dissolver	1.0y10-5	(m)	(m)	6.3y10-4	8.1y10-1	3
7. Inadvertent dissolution of 30-day cooled fuel at ICPPh CPP-666	1.0y10-6	(m)	(m)	3.0y10-2	2.9y10+1	1

a. Numbers in parentheses indicate multiplication factor used to scale or adjust es described in Section 5.15.3.3.
b. A worker is defined as a worker located 100 meters (328 feet) from the point of
c. Public individual assumed to be stranded at the nearest point of public access i
d. MEI = Maximally exposed hypothetical offsite individual located at the nearest s
e. Maximally exposed individual and offsite population fatal cancer risk = dose y a (ICRP-60 conversion factor) if dose is less than 20 rem. For doses of 20 rem or 1.0 y 10-3. Numbers in parentheses indicate total number of fatal cancers in th
f. HFEF = Hot Fuel Examination Facility.
g. The safety analysis report utilized for this accident analysis does not provide Orders requiring this information. As demonstrated by the dose to the maximally this accident could be less than the consequences from Accidents 2 through 4. H compared to Accidents 2 through 4, the risk could actually be greater than for A
h. ICPP = Idaho Chemical Processing Plant.
i. Although three nuclear criticalities associated with spent nuclear fuel reproces operating history of CPP-666, the estimated frequency for an inadvertent critica nuclear conditions and fuel vulnerabilities. Nominal estimates vary from 1.0 y 10-3 (CPP-603 underwater storage facility) events per year.
j. Refer to Sections 5.15.3.3 and 5.15.6.2 for details on why this frequency was no
k. This frequency is a qualitative bounding estimate for a potential aircraft crash
l. The Idaho Chemical Processing Plant has experienced three inadvertent nuclear cr 14 years ago. This frequency is based on modern facility conditions and safegua
m. The safety analysis report utilized for this accident does not provide this info Order 5480.23 requiring this information. However, a comparison of the data pre provides a relative measure of the impacts to this receptor.

5.15.5 Impacts from Postulated Maximum Reasonably Foreseeable Toxic Material Accidents

Like radioactive materials, toxic materials (e.g., chemicals) are involved in a operations, including spent nuclear fuel-related activities, at the INEL. As a res and activities, the potential exists for releases of toxic materials to the environ types of initiators considered in determining the radiological accident scenarios d Section 5.15.4. This section summarizes analyses of postulated accident scenarios spent nuclear fuel activities that could result in the release of toxic materials f

5.15.5.1 Identification of Toxic Chemicals at the INEL. The facilities at the INEL use

many types and quantities of chemically toxic materials. To determine the spent fu that exist in sufficient quantities to present health effects to workers or the off performed an initial screening of the chemical inventories at the INEL. This scree identifying those hazardous chemicals at the INEL listed in the Superfund Amendment Reauthorization Act of 1986 (SARA) 312 Report for 1992 (Priestly 1992) that (1) exi quantities [assumed to be greater than 227 kilograms (500 pounds)]; or (2) exceed r [usually 0.45 kilogram (1 pound)] on the EPA Title III List of Lists (EPA 1990), wh hazardous chemicals defined in the following:

- SARA Section 302, Extremely Hazardous Substances (40 CFR Part 355, Appendix B, List of Extremely Hazardous Substances and Their Threshold Planning Quan (CFR 1993)
- Comprehensive Environmental Response, Compensation, and Liability Act Hazar Substances (40 CFR Part 302, Table 302.4, Lists of Hazardous Substances and Quantities) (CFR 1992a)
- SARA Section 313, Toxic Chemicals (CFR 1992b)
- Federal Register list of 100 extremely hazardous chemicals (FR 1994)

5.15.5.2 Selection of Spent Nuclear Fuel-Related Toxic Chemicals Requiring

Accident Analysis. As indicated by the screening methodology discussed above, toxi inventories are located throughout INEL facilities in varying quantities and are in operations and activities performed by INEL facilities, including spent nuclear fue The screening identified no toxic chemicals associated with the dry storage of spen Except for processing-related activities that could be performed under the Regional Centralization at INEL alternatives [i.e., Alternatives 4b(1) and 5b, respectively] identified activities associated with the underwater storage of spent nuclear fuel water chemistry) as the only spent nuclear-fuel related activities that might utili sufficient quantities to present a potential for health effects to workers or the o potential contamination of the environment. For Alternatives 4b(2) and 5a, in whic relocate INEL spent nuclear fuel inventories and related activities to other DOE si chemical inventories at the INEL would be expected to slightly decrease. For Alter 5b, in which the INEL could potentially resume processing activities, a substantial chemical inventories, primarily hydrofluoric acid and anhydrous ammonia, would be e substantial changes in existing spent nuclear fuel-related toxic chemical inventori under Alternatives 1, 2, or 3.

To demonstrate how the consequences of the same accident at an identical hypoth constructed at the Hanford Site or the Savannah River Site under this alternative w INEL (based on local geological and meteorological conditions), Appendix D summariz accident scenarios for a new Expended Core Facility that DOE could construct at any considered in this EIS.

To determine potential accident scenarios associated with handling or storing t the various spent nuclear fuel-related facilities, DOE performed an extensive revie analyses and walkdowns of various facilities. This review identified two nonproces chemicals at the Idaho Chemical Processing Plant - nitric acid and chlorine - as re evaluation to determine potential health effects to workers and the offsite populat two toxic chemicals that would be required to support the resumption of processing Idaho Chemical Processing Plant - hydrofluoric acid and anhydrous ammonia - were id requiring further evaluation(6). Although spent fuel-related facilities at the Ida Plant use several other toxic chemicals (e.g., oxalic acid), the quantities of thes sufficient to present an impact to workers or the environment from accidental relea

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6. Although bulk quantities of nitric acid would be required to perform processing could be resumed Alternatives 4b(1) and 5b, the consequences of processing-related involving nitric acid would be bounded by the hydrofluoric acid and anhydrous accid Sections 5.15.3.3. and 5.15.3.4., respectively. Therefore, this analysis focuses on nitric acid accident resulting from the nonprocessing spent nuclear fuel-related ac considered under the other alternatives.

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environment. (For postulated accident scenarios involving Naval spent nuclear fuel the INEL, refer to Appendix D.)

Because DOE determined that it needed to evaluate postulated toxic chemical acc Idaho Chemical Processing Plant as part of this EIS, it did not consider postulated accidents at the Advanced Test Reactor Storage Canal and the Hot Fuel Examination F could be involved in spent fuel-related activities(7) for further evaluation in thi reasons:

- In general, quantities of spent nuclear fuel-related chemicals at the Idaho Processing Plant are substantially greater than those at the Advanced Test Canal and Hot Fuel Examination Facility.
- The Idaho Chemical Processing Plant is located approximately 1,000 meters (closer to the nearest site boundary than the Advanced Test Reactor.

Based on a review of safety documentation for the Test Area North spent nuclear storage facility and discussions with facility personnel, DOE determined that none chemicals identified in the screening (Section 5.15.5.1) is related to spent fuel h activities.

5.15.5.3 Toxic Chemical Accident Analysis. For chemically toxic materials, several

government agencies recommend quantifying health effects that cause short-term effe values of concentrations in air or water. The long-term health consequences of hum toxic materials are not as well understood as the long-term health consequences rel exposure. Thus, the potential health effects for exposures to toxic chemicals are those for radioactive materials. Factors such as receptor locations, terrain, mete release conditions, and characteristics of chemical inventories are required parame determinations of airborne concentrations of toxic chemicals at various distances f point of release.

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7. The scope of this analysis has been restricted to the Advanced Test Reactor fuel canal. Everything inside the reactor gas-tight boundary and associated with reactor has been excluded from consideration because reactor operations are not related to nuclear fual activities considered in this EIS.

EPICodeTM was used to estimate airborne concentrations resulting from spent nuc toxic chemical releases at the INEL. [For a detailed description of EPICodeTM, ref et al. (1995).]

To determine the potential health effects from accidental releases of toxic che compared the concentrations determined by EPICodeTM against Emergency Response Plan Guideline values, where available. These values, which are specific for each subst three general severity levels:

- Exposure to concentrations greater than Emergency Response Planning Guideli for a period of time greater than 1 hour results in an unacceptable likelih would experience mild transient adverse health effects, or perception of a objectionable odor.
- Exposure to concentrations greater than Emergency Response Planning Guideli for a period of time greater than 1 hour results in an unacceptable likelih would experience or develop irreversible or other serious health effects, o could impair one's ability to take protective action.
- Exposure to concentrations greater than Emergency Response Planning Guideli for a period of time greater than 1 hour results in an unacceptable likelih would experience or develop life-threatening health effects.

If there were no Emergency Response Planning Guideline values for a toxic subst analysis substituted other chemical toxicity values, as follows:

- Threshold limit values/time-weighted average values (ACGIH 1988) substitute Emergency Response Planning Guideline-1. This is the time-weighted average for a normal 8-hour workday and a 40-hour workweek to which nearly all work repeatedly exposed, day after day, without adverse effect.
- Level of concern values (equal to 0.1 of the immediately dangerous to life see below) substituted for Emergency Response Planning Guideline-2. The le value is the concentration of a hazardous substance in the air above which serious irreversible health effects or death as a result of a single exposu short period of time.
- Immediately dangerous to life or health values are substituted for Emergenc Planning Guideline-3. The immediately dangerous to life or health value is concentration from which a person could escape within 30 minutes without a

without experiencing any impairment of escape or irreversible side effects

As stated in the above section, four toxic chemicals - chlorine, nitric acid, h and anhydrous ammonia - at the Idaho Chemical Processing Plant were identified as r evaluation to estimate potential health effects to workers and the public. The fol summarize the analyses performed for these chemicals.

5.15.5.3.1 Accidental Chlorine Release - Chlorine, while not directly associated with

spent nuclear fuel-related activities at the INEL, is used to treat drinking water spent fuel facilities.

Therefore, an analysis of a postulated accidental chlorine release at the Idaho Chemical Processing Plant was performed to determine potential impacts on workers o spent fuel-related facilities.

At the Idaho Chemical Processing Plant, chlorine is contained in two pressurize [65 atmospheres at 20yC (68yF)], a 68-kilogram (150-pound) bottle and a 55-kilogram (120-pound) bottle, totaling 123 kilograms (270 pounds). To be conservative, DOE a breach of the drain line causes an instantaneous release of the total inventory of highest chlorine concentrations at the receptor locations would result from the lar shortest time period. Therefore, the release duration was assumed to be approximat

An accidental chlorine release from one of the chlorine tanks could be initiate events, such as a handling event, piping or valve rupture, or human error. Because physically separated, an accidental simultaneous release from both tanks would requ initiator such as a delivery accident, a common maintenance failure, or a natural p (e.g., seismic) that damaged or punctured both tanks. The frequency of an accident pressurized tank is 1.0 y 10-4 event per year (EPA/FEMA/DOT 1987). A common cause resulting in the release of chlorine from two separated tanks is assumed to be no g of the time given for the first tank failure. Therefore, the estimated frequency o from both tanks is 5.0 y 10-6 events per year (with no credit taken for pressure ve training).

Table 5.15-16 summarizes the concentrations of the subject chlorine release at receptor locations: a facility worker, a member of the public stranded at the near access inside the INEL boundary, and a maximally exposed hypothetical member of the at the nearest site boundary. As listed in Table 5.15-10, the peak chlorine concen workers could result in life-threatening health effects (i.e., Emergency Response P values are exceeded) for both conservative (95 percentile) and average (50 percenti conditions.

Table 5.15-16. Summary of chemical concentrations for postulated nonprocessing-rel releases at the Idaho Chemical Processing Plant under Alternatives 1 through 5.

Receptor Location	Chemical Concentrations (milligrams per cubic meter)a		
	95% Meteorologyb		50%
	Chlorine	Nitric Acide	Chl
	ERPG-1d = 3 (1) ERPG-2 = 9 (3) ERPG-3 = 60 (20)	TWA = 5.2 (2) LOC = 25.5 (10) IDLH = 255 (100)	ERP ERP ERP
1. Worker located at 100 meters (325 feet).	84,000 (28,000)	250 (95)	1,6 (54
2. Nearest point of public access where a member of the public is assumed stranded at the time of the release.f	19.5 (6.5)	0.32 (0.12)	1.8 (0.
3. Maximally exposed hypothetical individual located at the nearest site boundary.g	4.2 (1.4)	0.12 (0.047)	0.4 (0.

a. Numbers in parentheses reflect concentrations in parts per million.
b. The 95 percentile meteorology is based on Class F (unfavorable) meteorological c second (1.1 miles per hour) wind speed for receptors located within 2 kilometers and 2 meters per second (4.5 miles per hour) for receptors beyond 2 kilometers o
c. The 50 percentile meteorology is based on Class D (typical) meteorological condi second (10 miles per hour) wind speed for all receptors.
d. ERPG = Emergency Response Planning Guidelines.

e. Because Emergency Response Planning Guideline values are not available for nitri average values are substituted for ERPG-1 values, level of concern values are su and immediately dangerous to life or health values are substituted for Emergency Guideline-3 values. Refer to Section 5.15.5.3 for further information regarding
f. The nearest point of public access from this postulated release is 5,870 meters
g. The nearest site boundary is located at 14,000 meters (15,310 yards).

Peak chlorine concentrations estimated at the nearest point of public access ca Emergency Response Planning Guideline-2 value assuming 95 percentile meteorological listed in Table 5.15-10. Symptoms associated with exposure to these concentrations burning of the eyes, nose, and throat, coughing, choking, and possibly skin burns.

As listed in Table 5.15-16, the estimated peak averaged chlorine concentration boundary would be above the Emergency Response Planning Guideline-1 value for 95 pe meteorological conditions. However, due to the nature of the release, this concent would not last for more than a few minutes. Therefore, it would be likely that ind distance would experience no more than mild transient adverse health effects.

This analysis took limited credit for emergency response actions following a ch calculating the concentrations listed in Table 5.15-16. To mitigate the consequenc release to the environment, the same emergency response programs and actions descri radiological accident scenarios (Section 5.15.4.1) would be initiated following the actual health effects experienced by persons inside the site boundary would realist the values listed in Table 5.15-16.

Because the estimated airborne concentration of chlorine at 100 meters (328 fee exceeds the guidelines listed in Table 5.15-16, workers could be fatally injured or long-term or permanent health effects. Potential secondary impacts associated with accident scenario would involve economic impacts such as workers' compensation, med potential lawsuits. No other secondary impacts, such as impacts on national defens resources, were identified.

5.15.5.3.2 Accidental Nitric Acid Release - Nitric acid is used at various spent

nuclear fuel-related storage facilities for maintaining the chemistry of the water storage facilities(8).

Based on the toxic chemical screening discussed in Section 5.15.5.1, review of existing safety analyses, walkdowns of spent nuclear fuel-related facilities, and i

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8. Although bulk quantities of nitric acid would be required to perform processing could be resumed under Alternatives 4b(1) and 5b, the consequences of processing-re involving nitric acid would be bounded by the hydrfluoric acid and anhydrous accide in Sections 5.15.5.3.3. and 5.15.5.3.4., respectively. Therefore, this analysis foc potential nitric acid accident resulting from the non-processing spent nuclear fuel activities considered under the other alternatives.

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personnel, DOE determined that the potential exists for an accidental release of ni two 1,135 liters (300-gallon) storage tanks used to support spent nuclear fuel-rela activities at the Idaho Chemical Processing Plant. Because one of the tanks is usu tanks have separate valves, and they are physically separated, DOE could not identi likely initiator that could cause an accidental simultaneous release from both tank

The quantity of nitric acid assumed available for release from a single initiat (1,135 liters) 300 gallons. The following assumptions were made for this analysis:

- An initiating event causes severe structural damage (e.g., large puncture)
- The entire inventory of nitric acid is released into the containment wall s storage tank.
- The area of the containment wall is approximately 28 square meters (300 squ
- The total release of nitric acid [i.e., 1.135 liters (300 gallons)] evapora atmosphere before the implementation of emergency response procedures can r nitric acid.

Table 5.15-16 summarizes the concentrations of the nitric acid release at the f locations for both conservative (95 percentile) and average (50 percentile) meteoro a facility worker, a member of the public stranded at the nearest point of public a INEL boundary, and a maximally exposed hypothetical member of the public at the nea boundary. The estimated frequency for this event is 1 y 10-5 events per year.

This analysis took limited credit for emergency response actions following a ni calculating the concentrations listed in Table 5.15-16. To mitigate the consequenc environment, the same emergency response programs and actions described for radiolo scenarios (Section 5.15.4.1) would be initiated following a nitric acid release. T effects experienced by persons inside the site boundary would realistically be less listed in Table 5.15-16.

Other than limited economic secondary impacts, no other secondary impacts would this accident occurred.

5.15.5.3.3 Accidental Hydrofluoric Acid Release - To resume spent nuclear fuel

processing activities at the Fluorinel and Storage (FAST) facility (CPP-666), which shutdown and being placed in a permanent shutdown mode, bulk quantities of hydroflu be required to support the dissolution process.

A hydrofluoric acid storage tank with an operating capacity of approximately 30,283 liters (8,000 gallons) is located in the Idaho Che Plant facility area to support processing activities, although only 11,356 liters (hydrofluoric acid remain in the tank, and efforts are currently underway to remove hydrofluoric acid in the tank from the INEL site.

Table 5.15-17 summarizes the potential impacts upon a maximally exposed hypothe individual located at the nearest site boundary [14,000 meters (15,310 yards)] resu potential hydrofluoric acid release at the Idaho Chemical Processing Plant assuming meteorological conditions. Slaughterbeck et al. (1995) provides further details an regarding this postulated accident scenario. Although Slaughterbeck et al. (1995) only the maximally exposed offsite hypothetical individual resulting from this post 95 percentile meteorological conditions, a comparison of the airborne concentration acid at 14,000 meters (15,310 yards) to the airborne concentrations from other post accident scenarios (as presented in Table 5.15-16) at the same receptor distance pr perspective on the significance of this accident.

Table 5.15-17. Summary of chemical concentrations for postulated processing-relate releases at the Idaho Chemical Processing Plant under Alternatives 4b(1) and 5b.

Receptor Location	Chemical Concentrations (milligrams per cubic meter)a 95% Meteorologyb Hydrofluoric Acid ERPG-1c = 4 (5) ERPG-2 = 17 (20) ERPG-3 = 43 (50)	Anhydrous Ammo ERPG-1 = 17 (2 ERPG-2 = 136 (ERPG-3 = 680 (
Maximally exposed hypothetical individual located at the nearest boundaryd	0.078 (0.09)	82 (120.6)

a. Numbers in parentheses reflect concentrations in parts per million.
b. The 95 percentile meteorology is based on Class F (unfavorable) meteorological c 0.5 meter per second (1.1 miles per hour) wind speed for receptors located withi (1.2 miles) of the release and 2 meters per second (4.5 miles per hour) for rece 2 kilometers of the release.
c. ERPG = Emergency Response Planning Guidelines.
d. The nearest site boundary is located at 14,000 meters (15,310 yards).

The estimated frequency for this event is 1 y 10-5 events per year. It should potential accident applies only to Alternatives 4b(1) and 5b, and is in addition to and nitric acid release accidents described in Sections 5.15.5.3.1 and 5.15.5.3.2,

This analysis took limited credit for emergency response actions following a hy release in calculating the concentrations listed in Table 5.15-17. To mitigate the release to the environment, the same emergency response programs and actions descri radiological accident scenarios (Section 5.15.4.1) would be initiated following a h release. Therefore, actual health effects experienced by persons inside the site b realistically be less than the values listed in Table 5.15-17.

Other than limited economic secondary impacts, no other secondary impacts would this accident occurred.

5.15.5.3.4 Accidental Anhydrous Ammonia Release - To resume spent nuclear

fuel processing activities at the Fluorinel and Storage (FAST) facility (CPP-666), anhydrous ammonia would be required to support operation of the NOx-Abatement Facil (CPP-1670), a facility that would be constructed to treat airborne effluents from t facilities before being released to the environment.

The NOx-Abatement Facility would be expected to utilize two anhydrous ammonia t with a storage capacity of 68,000 liters (18,000 gallons). Table 5.15-17 summarize impacts upon the maximally exposed hypothetical offsite individual located at the n boundary [14,000 meters (15,310 yards)] resulting from a short-term release of the storage tanks [i.e., 136,000 liters (36,000 gallons)] at the Idaho Chemical Process 95 percentile meteorological conditions. Slaughterbeck et al. (1995) provides furt discussion regarding this postulated accident scenario. Although Slaughterbeck et only impacts to the maximally exposed offsite hypothetical individual resulting fro accident for 95 percentile meteorological conditions, a comparison of the airborne anhydrous ammonia at 14,000 meters (15,310 yards) to the airborne concentrations fr postulated chemical accident scenarios (as presented in Table 5.15-16) at the same meaningful perspective on the significance of this accident.

The estimated frequency for this event is 5 y 10-6 events per year. The basis frequency is identical to that described for an accidental chlorine release from tw described in Section 5.15.5.3.1. It should be noted that this potential accident a Alternatives 4b(1) and 5b, and is in addition to the potential chlorine and nitric described in Sections 5.15.5.3.1 and 5.15.5.3.2, respectively.

This analysis took limited credit for emergency response actions following an a ammonia release in calculating the concentrations listed in Table 5.15-17. To miti consequences of a release to the environment, the same emergency response programs described for radiological accident scenarios (Section 5.15.4.1) would be initiated hydrofluoric acid release. Therefore, actual health effects experienced by persons boundary would realistically be less than the values listed in Table 5.15-17.

Other than limited economic secondary impacts, no other secondary impacts would this accident occurred.

5.15.6 Maximum Reasonably Foreseeable Radiological Accident Scenario Descriptions

The purpose of this section is to summarize the different accident scenarios id Section 5.15.4. The Facility Safety Report for the Argonne National Laboratory-Wes Examination Facility (ANL 1975) contains further details and discussions for Accide below. Slaughterbeck et al. (1995) provides further details, discussions, and refe through 7, discussed below. Additional discussions and references regarding the pr accidents summarized in this section are also provided in a study performed to dete impacts spent nuclear fuel processing-related accidents could have on the siting of reactor at the INEL (EG&G 1993b). These documents contain additional information, fractions, source terms, and other assumptions used in the accident analyses. Appe postulated accident scenarios associated with Naval spent nuclear fuel-related faci the INEL.

5.15.6.1 Accident 1: Fuel Pin Breach and Venting of Noble Gases and Iodine to

the Environment from a Mechanical Handling Accident at the Argonne National Laboratory-West Hot Fuel Examination Facility. The accident screening methodology in Section 5.15.3 identified a mechanical handling event at the Argonne National La Fuel Examination Facility as an initiator to the maximum reasonably foreseeable acc abnormal event frequency range. This event would result in a fuel pin breach and v gases and iodine to the environment. The identification of this accident as a maxi foreseeable accident is based on the estimated radiological consequences to the max hypothetical offsite individual at the nearest site boundary presented in the Hot F Facility Safety Report (ANL 1975). Other postulated accidents associated with hand fuel in the Hot Fuel Examination Facility before the identification of the fuel pin the maximum reasonably foreseeable accident included an inadvertent criticality and fuel pin breach accident was chosen as the maximum reasonably foreseeable accident estimated frequencies for an inadvertent criticality and a sodium fire in the facil (ANL 1975).

The analyses defined in the Facility Safety Report (ANL 1975) made the followin

- The fuel subassemblies and experimental capsules being examined in the faci cooled for at least 15 days to ensure that the short-lived fission products
- The noble gases and iodines that could be released from this accident scena immediately released.
- One hundred percent of the noble gases, 25 percent of the iodines, and 1 pe particulates were available for escape to the atmosphere.
- The building containment structure, including the building ventilation syst

Cell, including the argon ventilation system, remained operational followin accident. This assumption is considered appropriate because the mechanical accident scenario under consideration would not initiate a failure in these (Accident 3 considers the simultaneous failure of all these systems in conj melting of fuel assemblies stored in the facility).

The Facility Safety Report (ANL 1975) contains specific information on the sour associated with breaching the fuel section of a pin. Because that report does not frequency of occurrence for the subject mechanical handling accident scenario, the historic information and engineering judgment to determine the conservatively estim this accident of 1.0 y 10-2 event per year.

For determining the impacts from this postulated accident scenario, the nearest access is equivalent to the nearest site boundary, which is 5,240 meters (5,730 yar the release. Although the Facility Safety Report (ANL 1975) does not estimate cons offsite population resulting from this accident scenario, this analysis reasonably exposures (i.e., dose) to the offsite population would be less than the offsite pop for Accidents 2 through 4 because the dose to the maximally exposed hypothetical in nearest site boundary from this accident would be less than that estimated for Acci

5.15.6.2 Accident 2: Inadvertent Nuclear Chain Reaction in Wet Spent Nuclear

Fuel Storage (1 y 1019 fissions, 8-hour release) at the Idaho Chemical Processing P CPP-603 Underwater Fuel Storage Facility. The accident screening methodology discu Section 5.15.3 identified an inadvertent nuclear criticality associated with underw storage at the CPP-603 Underwater Fuel Storage Facility as an accident requiring fu Other postulated accidents that were considered before the identification of an ina accident as a maximum reasonably foreseeable accident included pool leaks, fuel dam loss of cooling events. This analysis selected an inadvertent nuclear criticality EIS over the other accidents for the following reasons:

- Postulated inadvertent nuclear criticality accidents have been addressed in nonreactor EISs and safety analysis reports in which such accidents were re foreseeable because of public concerns regarding the potential for these ac
- The Idaho Chemical Processing Plant has experienced three inadvertent nucle accidents. Although none of these accidents involved a fuel storage facili demonstrate the potential and concern for such events.
- The consequences of water leakage from a pool-draining event would present consequences to workers than a criticality because the INEL could implement response plans to evacuate workers before the risk to these workers could s increase. In addition, a pool drain was considered to be an initiator to a
- Mechanical fuel damage events are less impacting than a nuclear chain react because some degree of fuel damage is part of the criticality accident scen

Of the different Idaho Chemical Processing Plant facility areas that store spen CPP-603 Underwater Fuel Storage Facility was selected for analysis of a criticality following reasons:

- CPP-603 facility storage includes most types of spent nuclear fuel stored e site. Fuel stored at reactor basins is an exception (but was considered in of other reasonably foreseeable accident scenarios) because of its much sho after removal from a reactor.
- CPP-603 facility spent nuclear fuel storage quantities are comparable to or nuclear fuel inventories stored elsewhere on the site.
- The CPP-603 facility is an older facility that does not contain all the pre mitigative design features found in more modern facilities, such as the CPP Storage Area.

The analysis selected the underwater fuel storage portion of the CPP-603 facili Irradiated Fuels Storage Facility portion of the CPP-603 facility because accidents fuels in dry storage probably would have less severe potential consequences because removed from reactors for a much longer period of time and, because of their design most of the remaining fission products from being released if a criticality acciden

Initiating events that the analysis considered possible to lead to an inadverte included operator error, hanger corrosion, equipment failure, an earthquake, pool d crash. The scenario discussed in this EIS assumes a postulated criticality scenari initiated by human error, equipment failure, or earthquake. Heat generated from th would easily dissipate and thereby avoid fuel melting but would still cause the rel products associated with 1 y 1019 fissions over an 8-hour period.

Between 1945 and 1980, 40 known inadvertent criticalities occurred worldwide, n involved the handling or storage of spent nuclear fuel in an underwater fuel storag addition, between 1975 and 1980, there were 160 nuclear power reactor facilities wi storage facilities worldwide. None of these facilities ever had a nuclear critical underwater storage facilities. Therefore, it is generally assumed that the likelih in a modern underwater storage facility is unlikely, with a frequency estimated at year. This estimated frequency is supported by information in the safety analysis CPP-666 underwater storage facility, which is a modern facility (e.g., 1980s vintag to store various types of spent nuclear fuel. In the CPP-603 Underwater Fuel Stora however, where spent nuclear fuel inventories have substantially corroded or degrad and where the design of the facility and its supporting equipment do not meet curre specifications, activities associated with handling and storing spent nuclear fuel the likelihood for an inadvertent nuclear criticality accident by as much as an ord Therefore, this analysis conservatively assumes the estimated frequency for an inad criticality associated with handling spent nuclear fuel in the CPP-603 Underwater F to be 1 y 10-3 event per year for this analysis.

The handling activities associated with stabilizing CPP-603 facility spent nucl would occur under each of the five alternatives considered in this EIS. The estima inadvertent criticality at the CPP-603 facility is an order of magnitude larger tha INEL facility (e.g., 1 y 10-3 event per year), and is considered a "worst-case" fre changes in estimated criticality frequencies at other INEL facilities resulting fro activities associated with changes in spent nuclear fuel inventories. Therefore, u criticality frequency related to the CPP-603 as the estimated frequency under each a conservative bound on the estimated criticality frequencies for other spent nucle handling and storage facilities.

To determine the accident impacts from this postulated accident scenario, the a the worker to be located 100 meters (328 feet) from the event, the nearest point of Route 20/26) is 5,870 meters (6,420 yards), and the nearest site boundary is locate (15,310 yards).

5.15.6.3 Accident 3: Earthquake-Induced Breach and Fuel Melt at the Argonne

National Laboratory-West Hot Fuel Examination Facility. The accident screening methodology discussed in Section 5.15.3 identified an earthquake-induced breach and Argonne National Laboratory-West Hot Fuel Examination Facility as a maximum reasona foreseeable accident that would present higher radiological consequences to facilit offsite population than other postulated accidents analyzed in the same accident fr postulated events leading to atmospheric release of radionuclides are as follows:

- The earthquake results in a peak horizontal ground acceleration of sufficie cause structural damage to the building structure and a large breach in the
- Coincident with the breach, a failure of the fuel subassembly cooling syste resulting in the melting of fresh assemblies.
- Radionuclides from the melting fuel subassemblies are released to the atmos

The estimated probability of an earthquake in the Argonne National Laboratory-W resulting in a peak horizontal acceleration of sufficient magnitude to damage the f breach the cell is 1 y 10-5 event per year. This analysis conservatively assumes t failure of the building structure, Main Cell, and subassembly cooling to be 1.0, gi earthquake has occurred. A preliminary assessment of the seismic integrity of the Examination Facility, as discussed in Slaughterbeck et al. (1995), indicates that, of analysis, significant failures could result at the Hot Fuel Examination Facility

In determining the number of fuel assemblies that would be affected during this analysis assumed that 20 fuel subassemblies would melt due to failure of the forced accident. Although 40 storage positions are available for fuel that would require current plans do not estimate the need to use more than 20 of these positions. The this scenario is 30 days. To prevent doses greater than 5 rem to the public from t analysis assumed intervention by evacuation or prevention of contaminated food cons calculated doses reflecting this assumption.

To determine the impacts from this postulated accident scenario, the analysis a to be located 100 meters (328 feet) from the event, and the nearest point of public Route 20) and the nearest site boundary at 5,240 meters (5,730 yards).

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9. As discussed in Slaughterbeck et al. (1995), accelerations with any of several p seismic events with a combined estimated frequency of 1 * 10(-5) per year are beyon design of the Hot Fuel Examination Facility and were determined to compromise the a of the structure to maintain confinement. Events this rare are beyond the requireme

DOE Order 5480.28 and DOE-ID Architechtural Engineering Standards for Category 1 (h hazard) facilities.

5.15.6.4 Accident 4: Radiological Material Release from the Argonne National

Laboratory-West Hot Fuel Examination Facility Resulting from an Aircraft Crash and Ensuing Fire. The accident screening methodology discussed in Section 5.15.3 ident radioactive material release from the Argonne National Laboratory-West Hot Fuel Exa resulting from an aircraft crash as the maximum reasonably foreseeable accident in basis accident frequency range. Of externally initiated events, an aircraft crash Examination Facility is a maximum reasonably foreseeable accident because it could breach of confinement barriers, (2) involve a large portion of the material at risk energy release mechanism (physical impact followed by a sustained fire). The analy other accident scenarios considered in this frequency range because they would not energy sources to cause a large breach of confinement and release to the atmosphere facility contains little combustible material to sustain a fire, a fire caused by a the crash could increase potential consequences over other beyond-design-basis acci events of an aircraft crash scenario are as follows:

- A large or high-velocity aircraft (e.g., commercial or military) crashes di Fuel Examination Facility.
- The impact has sufficient force to cause catastrophic failure of the buildi of the Main Cell, and loss of forced cooling to subassemblies in the cell.
- The fuel in the aircraft is released to the facility and is ignited.
- The ensuing fire involves the contents of the Main Cell, Decontamination Ce Area, and Hot Repair Area, resulting in atmospheric release of radionuclide

To determine aircraft crash probability, the analysis limited this scenario to jet airplanes. High-velocity military jets from the U.S. Air Force Base at Mountai southwestern Idaho could enter the airspace of the INEL. In addition, large jet ai flown at low altitudes in landing configurations over portions of the INEL for vort likelihood of a large aircraft crash directly in the Hot Fuel Examination Facility possible. Analyses of jet aircraft crashes at specific facilities, such as the Ida Plant, have resulted in predicted frequencies on the order of 1.0 y 10-7 event per specific analyses have not determined the likelihood of an aircraft crash into the Facility (although it is expected that fewer flights occur over the Argonne Nationa facility area than the Idaho Chemical Processing Plant), the analysis conservativel frequency for an aircraft crashing into the Hot Fuel Examination Facility is 1.0 y

For determining impacts from this postulated accident scenario, the analysis as was located 100 meters from the event; and the nearest point of public access (U.S. nearest site boundary were both at 5,240 meters (5,730 yards).

5.15.6.5 Accident 5: Inadvertent Nuclear Chain Reaction During Spent Nuclear

Fuel Processing (1 x 1019 fissions) at the Idaho Chemical Processing Plant CPP-666 Fluorinel and Storage (FAST) Facility. The accident screening methodology discusse Section 5.15.3 identified an inadvertent nuclear criticality resulting from spent n reprocessing in the CPP-666 Fluorinel and Storage Facility as a maximum reasonably processing accident. Although the CPP-666 Fluorinel and Storage Facility, which hi reprocessed spent nuclear fuel to recover fissionable radionuclides (e.g., uranium- shutdown, there may be a need to resume processing operations to dissolve spent nuc stabilize the radionuclides in a waste form. Therefore, while the potential for th currently exist, the potential would exist if processing-related activities are res Alternatives 4b(1) and 5b (Regionalization and Centralization at the INEL, respecti

Initiating events that the analysis considered possible to lead to an inadverte during processing included human error, equipment failure, an earthquake, an aircra fissionable radionuclides in the spent nuclear fuel being processed, and reduced ne concentrations. Consistent with the inadvertent criticality scenario associated wi of spent nuclear fuel described in Section 5.15.6.2, the fission yield associated w assumed to be 1 y 1019 fissions. Further information and references regarding this scenario are provided in Slaughterbeck et al. (1995) and EG&G (1993b).

As discussed in Section 5.15.2, three inadvertent nuclear criticalities have oc processing facilities during the 40-year history of the INEL. The last of these cr 14 years ago. As a result of these accidents, administrative controls and facility implemented to reduce the potential for inadvertent nuclear criticality accidents r processing-related activities. If the decision is made to resume processing operat controls would be utilized. Therefore, the estimated frequency for a potential ina criticality is assumed to be 1 y 10-3 events per year, which is consistent with ass regarding the potential for an inadvertent criticality resulting from underwater st severely degraded spent nuclear fuel (as discussed in Section 5.15.6.2).

Limited credit was taken for mitigative features, such as emergency response pr determining worker and public exposures resulting from this postulated accident sce credit was taken for shielding walls placed in the facility to reduce potential per resulting from an inadvertent nuclear criticality.

To determine the accident impacts from this postulated accident scenario, the a the worker to be located 100 meters (328 feet) from the event, the nearest point of (U.S., Route 20/26) is 5,870 meters (6,420 yards), and the nearest site boundary is 14,000 meters (15,310 yards).

5.15.6.6 Accident 6: Radionuclide Release During Spent Nuclear Fuel Processing

at the Idaho Chemical Processing Plant CPP-666 Fluorinel and Storage (FAST) Facilit Resulting from a Hydrogen Explosion in the Dissolver Off-Gas System. The accident screening methodology discussed in Section 5.15.3 identified a hydrogen explosion i Fluorinel and Storage Facility dissolver off-gas system as a maximum reasonably for processing accident. Despite CPP-666's current shutdown status, there may be a nee processing operation to dissolve spent nuclear fuel and stabilize the radionuclides Therefore, while the potential for this accident does not currently exist, the pote processing-related activities are resumed under Alternatives 4b(1) and 5b (Regional Centralization at the INEL, respectively).

Initiating events that the analysis considered possible to lead to a hydrogen e dissolver off-gas system included human error, equipment failure, and an earthquake information and references regarding this postulated accident scenario are provided et al. (1995) and EG&G (1993b).

Limited credit was taken for mitigative features, such as emergency response pr determining worker and public exposures resulting from this postulated accident sce determine the accident impacts from this postulated accident scenario, the analysis to be located 100 meters (328 feet) from the event, the nearest point of public acc Route 20/26) is 5,870 meters (6,420 yards), and the nearest site boundary is locate (15,310 yards).

5.15.6.7 Accident 7: Radionuclide Release During Spent Nuclear Fuel Processing

at the Idaho Chemical Processing Plant CPP-666 Fluorinel and Storage (FAST) Facilit Resulting from the Inadvertent Dissolution of 30-Day Cooled Spent Nuclear Fuel. Th accident screening methodology discussed in Section 5.15.3 identified a radionuclid from the inadvertent dissolution of 30-day cooled spent nuclear fuel in the CPP-666 Storage Facility as a maximum reasonably foreseeable accident. There may be a need processing operation at CPP-666 to dissolve spent nuclear fuel and stabilize the ra waste form. Therefore, while the potential for this accident does not currently ex would exist if processing-related activities are resumed under Alternatives 4b(1) a (Regionalization and Centralization at the INEL, respectively).

Upon removal from a nuclear reactor, spent nuclear fuel is placed in an underwa (e.g., Advanced Test Reactor Storage Canal in the Test Reactor Area) to allow the f cool and short-lived radionuclides to decay. Inadvertent processing of spent nucle had the opportunity to sufficiently cool presents the potential for accidents durin fuel. Examples of accidents that could potentially occur are explosions in the dis inadvertent criticality. An explosion resulting from inadvertent dissolving spent not sufficiently cooled (i.e., 30-day cooled fuel) is considered for this analysis criticality is already considered (as discussed in Section 5.15.6.6).

The potential initiating event considered for this accident involves several op result in the wrong spent nuclear fuel assemblies being dissolved. First, fuel coo would have to be shipped to and received by the Fluorinel and Storage Facility. Se the CPP-666 Fluorinel and Storage Facility would have to inadvertently dissolve the cooled fuel. Based on the individual probability of these events, and the probabil fuel would accidentally release radionuclides to the environment, the estimated fre is 1 y 10-6 events per year. Further information and references regarding this pos

scenario are provided in Slaughterbeck et al. (1995) and EG&G (1993b).
Limited credit was taken for mitigative features, such as emergency response pr determining worker and public exposures resulting from this postulated accident sce determine the accident impacts from this postulated accident scenario, the analysis to be located 100 meters (328 feet) from the event, the nearest point of public acc Route 20/26) is 5,870 meters (6,420 yards), and the nearest site boundary is locate (15,310 yards).

5.16 Cumulative Impacts and Impacts from

Connected or Similar Actions

The INEL already contains major DOE facilities unrelated to spent nuclear f continue to operate throughout the life of the spent nuclear fuel management progra associated with these existing facilities produce environmental consequences that t in the baseline environmental conditions (Chapter 4) against which it has assessed the spent nuclear fuel alternatives. In addition, the cumulative impacts assessed other past, present, and reasonably foreseeable future actions that DOE expects to such as spent nuclear fuel management, Naval Nuclear Propulsion Program activities, restoration and waste management activities, as well as any known offsite projects government agencies, businesses, or individuals. Onsite projects include decontami decommissioning, repair, and upgrades of existing facilities. Offsite projects inc commercial development, and changes in manufacturing plants.

Consistent with the DOE sliding scale approach and the programmatic aspects of cumulative impacts are discussed commensurate with the degree of impact. Therefore of analysis from Chapter 5 is represented in this section. DOE used information an Volume 2 of this EIS as input for this section. Section 5.15 of Volume 2 provides discussion of cumulative impacts.

Tables 5.16-1 and 5.16-2 list the cumulative impacts identified for each altern necessary adjustments to accommodate the differences between Volume 1 and Volume 2 Cumulative impacts from Alternatives 3 and 4a are nominally the same, as are cumula from Alternatives 1 and 2, 5a and 4b(2), and 5b and 4b(1).

5.16.1 Land Use

Implementation of any of the alternatives would contribute to the cumulative lo open-space land use. However, the cumulative amount of land that would no longer b available for other land uses would be small compared to the size of INEL or region discussed in Section 5.2, Land Use, the maximum land disturbance, 31 acres (0.12 sq would occur under Alternative 4b(1) [Regionalization by Geography (INEL)] and 5b (C INEL). While exact maximum figures are not available, over 200 acres (0.81 square vacant land in nearby communities are scheduled for development. Projects that wou

Table 5.16-1. Nonhealth-related cumulative impacts.

Discipline/Unit of measure	1 (No Action) and 2 (Decentralization)	3 4a
Land use/amount of land not available for other use	Small compared to regional land uses	Small compared land uses
Socioeconomics/change in number of total jobs	Overall decrease of 4,800	Overall decrea
Cultural resources/minimum number of potentially historic structures/archaeological sites disturbeda	6 structures and 0 sites	70 structures
Air resourcesb	Below applicable standards	Below applicab

Waste management/waste volume total pending disposition	High-leveld	12,100 m3	12,500 m3
	Transuranice	67,000 m3	73,000 m3
	Mixed low-level	17,000 m3	17,000 m3
	Low-levele	46,000 m3	72,000 m3
	Hazardousf	12,000 m3	12,000 m3
	Commercial and industriale	540,000 m3	590,000 m3

a. Numbers for archaeological sites potentially impacted would be expected to incre
b. See Table 5.16-2 for cumulative health risks related to air emissions.
c. Derived in Freund (1994), Morton and Hendrickson (1995).
d. High-level waste includes both liquid and calcine forms. Liquid high-level wast of all high-level waste stored onsite.
e. Numbers do not include existing dispositioned waste stored or buried onsite.
f. Numbers represent total volume stored onsite.

Table 5.16-2. Health-related cumulative impacts.

Radiologicala	Pathway	Type of impact	1 (No Action 2 (Decentral
Public	Atmoshperic	Estimated excess fatal cancers	<1
	Groundwater	Estimated excess fatal cancers	<1
	Biotic	Estimated excess fatal cancers	<1
Workersb	Atmospheric	Estimated excess fatal cancers	Negligible
	Occupational exposures	Estimated excess fatal cancers	1
Public	Atmospheric (Carcinogens)	Estimated lifetime cancers	<1
	Atmospheric (Noncarcinogens) c	Estimated adverse health effects	0

Table 5.16-2. (continued).

Radiologicala	Pathway	Type of impact	1 (No Action 2 (Decentral
Workersb	Atmospheric (Carcinogens)	Estimated lifetime cancers	<1
	Atmospheric (Noncarcinogens) c	Estimated adverse health effects	0
	Routine workplace safety hazards	Estimated fatalities	3

a. Approximate numbers. See Volume 2, Section 5.12 and Volume 2, Appendix F for de
b. Estimated excess fatal cancers calculated from dosimeter measurements.

disturb previously disturbed land are scheduled to take place on about 270 acres (1 at the INEL. An additional 1,060 acres (4.3 square kilometers) of open space INEL disturbed by potential projects.

5.16.2 Socioeconomics

Any of the spent fuel management alternatives would cause minimal cumulative im socioeconomic resources of the INEL region when combined with known onsite or offsi The implementation of any of the alternatives would create temporary additional emp construction; the upper bound of potential impact would occur under Alternatives 3, In the long term, the expected future decrease in employment at the INEL would more increase, as well as any increases from known offsite projects. Therefore, the cum employment would be an overall decrease. Potential population declines associated cumulative effect on regional employment are estimated to represent less than 2 per regional population. It is unlikely that a change in population of this size would long-term adverse impacts to housing, community services, or public finance in the

5.16.3 Cultural Resources

The types of cumulative impacts on cultural resources are the same for all alte the alternatives, when combined with associated onsite and offsite activities, coul cultural resources. However, surveying, recording, and stabilizing archeological a structures at the INEL would increase scientific knowledge of the region's cultural stabilizing resources may adversely affect their significance to Native American gr unchecked deterioration of both structures and historic documents on nuclear facili could have a long-term adverse impact on these resources. Long-term effects may al traditional resources that may not be mitigated through scientific studies. Cumula associated with Alternatives 3 and 4a (see 1992/1993 Planning Basis and Regionaliza Type) and Alternatives 5b and 4b(1) [Centralization at INEL and Regionalization by (INEL)] have the greatest potential for impacts. Alternatives 1 and 2 (No Action a would have the least potential for impacts.

5.16.4 Air Quality

For radiological emissions, all cumulative impacts at onsite and offsite locati applicable standards and are a small fraction of the dose received from natural bac The highest dose to a maximally exposed member of the public would be caused by Alt and 5b and would be about 0.05 millirem per year. When added to the projected dose INEL proposed projects of approximately 0.7 millirem per year and the maximum basel 0.05 millirem per year, this dose would be well below the National Emissions Standa Air Pollutants limit of 10 millirem per year (CFR 1992c). The National Council on Protection and Measurements has identified a dose rate below 1 millirem per year as 1987).

Cumulative nonradiological impacts were analyzed in terms of concentrations of toxic air pollutants in ambient air. At site boundary locations, the highest poten criteria pollutants remain well below applicable National Ambient Air Quality Stand Concentrations at public road locations within the INEL boundary could increase sig current levels, but would remain well below applicable standards.

5.16.5 Occupational and Public Health and Safety

Work activities and the exposure to radiological and chemical hazards under eac alternatives would be similar to those at present. Therefore, average radiation do chemicals, and associated health effects would be related to the number of site wor alternative. Because the cumulative impacts of any alternative would be a decrease workers, the cumulative impact of any alternative on occupational health would be health effects to the levels listed in Table 5.16-2. The incidence of expected hea similar for all alternatives because the relative difference in employment effects effects on the health of those employed) is very small. While air emissions presen pathway for public radiation exposure due to spent nuclear fuel management, groundw pathways are included in Table 5.16-2 due to Volume 2 analyses of environmental res waste management activities.

Occupational health data concerning historic accidents are incomplete and not r Though historical records of accidents at the INEL are available, occupational dose known and reported. Worker dose data are currently being collected and analyzed un Institute of Occupational Safety and Health program. Historical offsite doses asso are summarized in the Idaho National Engineering Laboratory Historical Dose Evaluat The Centers for Disease Control and Prevention is conducting a more comprehensive r doses from INEL operations. An assessment of the cumulative impacts of accidents a health of INEL workers is not available at this time.

Cumulative transportation impacts are addressed in Volume 1, Appendix I.

5.16.6 Materials and Waste Management

The total volumes of waste existing and projected to be generated or shipped to spent nuclear fuel management, as well as known onsite and offsite projects over a presented by waste stream for each alternative in Table 5.16-1. The storage of low incineration is not considered to be restrictive between 1995 and 2005; however, be additional capacity may be required. Although spent nuclear fuel management would permitted storage capacity to exceed its limits without available treatment or disp Action and Decentralization Alternatives, it is anticipated that the permitted stor low-level waste will be exceeded during the first year of a 10-year timeframe. All include facility construction for storage of, or shipping of, mixed low-level waste capacity is accounted for.

5.17 Adverse Environmental Effects That Cannot Be Avoided

The construction and operation of any of the alternatives at the INEL could res impacts to the environment. Changes in project design and other measures would avo mitigate most of these impacts to minimal levels. This section identifies only adv mitigation could not reduce to minimal levels or avoid altogether.

Under each alternative, the continued deterioration of structures with histori potential and historic documents on nuclear facilities could have a long-term adver resources at the INEL. However, DOE would avoid potentially adverse impacts by pre historic value of the property through appropriate research, or by conducting limit these structures. This impact is discussed in Section 5.4.

As discussed in Section 5.2, the maximum loss of habitat would involve the con industrial use of about 31 acres (0.12 square kilometers) of previously disturbed h quality and limited use to wildlife; conversion would occur under Alternatives 4b(1

The amount of radiation exposure from normal operation of the spent nuclear fu would be a small fraction of the existing natural background at the INEL and would applicable regulatory standards. In all cases, the number of estimated additional fraction of 1 per year of site operation through 2035. This effect is discussed in

With the exception of the unavoidable temporary increase in noise due to const any impact of noise from activities under any of the alternatives would be minor an

An unavoidable adverse impact of the proposed activities with any of the alter an accident either at the involved facilities or during the transportation of const dismantled components. Accidents are discussed in Section 5.15; transportation is Section 5.11.

Spent nuclear fuel management supports the continuation of beneficial activiti radiopharmaceutical and other research. An unavoidable adverse impact of the No-Ac would be a reduction in the support of such activities.

As discussed in Section 5.14, the increased generation of industrial solid was under all alternatives is an unavoidable adverse impact. However, the amount gener alternative would be a very small percentage increase from the projected 1995 basel

5.18 Relationship Between

Short-Term Use of the Environment and the
Maintenance and Enhancement of Long-Term Productivity

Under all alternatives, short-term use of the environment is generally associat demands for spent nuclear fuel management activities. Resources demands also inclu for upgrade, construction, and operation of facilities. These short-term demands a foundation and direction for the long-term productivity of INEL; they also have an success of future INEL missions. A brief discussion of the influence proposed acti the long-term productivity of the INEL follows. The INEL missions, including spent discussed in Section 2.1.

The No-Action Alternative would provide few long-term benefits and would not al DOE-Idaho Operations Office to fulfill its missions regarding the disposition and m nuclear fuel. The activities proposed in this alternative would not support future technology development. Further, the No-Action Alternative could bring enforcement it would not meet all the requirements of existing DOE regulatory commitments such in the Federal Facility Agreement and Consent Order.

To a varying degree, Alternatives 2, 3, and 4(a) would provide more flexibility alternatives for fulfilling existing or future missions and actions at INEL. Near-under these alternatives ensure compliance with regulatory requirements and protect environment. Furthermore, these alternatives would provide a diverse decisionmakin future actions concerning disposition of DOE spent nuclear fuel. Facilities constr technologies developed under these alternatives could be used for a wide range of a interim treatment and storage or preparation and packaging for transportation offsi

The approach that would be taken for spent nuclear fuel under Alternatives 4b(2 confine and hinder long-term productivity at INEL. Efforts would focus on shipment fuel to other locations. No emphasis would be placed on solving particular spent n problems or increasing the understanding of how certain spent nuclear fuels react o

Alternatives 4b(1) and 5b would direct INEL's future mission and development pr large-scale canning and characterization, storage, and disposal of all INEL and DOE complex-wide spent nuclear fuel. These alternatives could limit INEL's flexibility enhancing future INEL-specific missions.

5.19 Irreversible and Irretrievable Commitment of Resources

The irreversible and irretrievable commitment of natural and manmade resources the construction and operation of facilities related to the spent nuclear fuel alte materials and resources that could not be recovered or recycled or that would be co to unrecoverable forms. Some of these commitments would be irretrievable because o the commitment or the cost of reclamation. For example, the construction and opera nuclear fuel facilities at the INEL would consume irretrievable amounts of electric concrete, steel, aluminum, copper, plastics, lumber, sand, gravel, groundwater, and chemicals.

Alternatives 4b(1) and 5b are each estimated to require approximately 11,000 m year of electricity, 1,100,000 liters (290,000 gallons) per year of fuel oil, and 4 (13 million gallons) per year of water above the projected baseline (1995) usage of (see Section 5.13). These changes would represent a modest increase of 5.3 percent 0.7 percent respectively, and are well within current system capabilities and usage alternatives would place smaller demands on these resources, commensurate with the construction and operation activities proposed.

Alternatives 4b(1) and 5b would also commit 31 acres (0.12 square kilometer) o disturbed land to industrial use; the conversion of this acreage would result in th quality wildlife habitat and natural resource services. Alternatives 4b(1) and 5b greatest irretrievable consumption of other resources, such as construction materia supplies. However, this demand would not constitute a permanent drain on local res any material that is in short supply in the region.

Other commitments would be irreversible because the construction or operation related to the spent nuclear fuel alternatives would consume the resource. Propose also require an expenditure of labor that would be irretrievable.

5.20 Potential Mitigation Measures

This section summarizes measures that DOE would use to avoid or reduce impacts environment caused by spent nuclear fuel management activities at the INEL. The pot measures for each aspect of the affected environment described below are the same u alternative. Section 5.7 of Volume 1 discusses other generalized measures DOE could

5.20.1 Pollution Prevention

DOE is committed to comply with Executive Order 12856, Federal Compliance with Know Laws and Pollution Prevention Requirements; Executive Order 12873. Federal Acq Recycling and Waste Prevention; and applicable DOE Orders and guidance documents in implementing pollution prevention at the INEL. The DOE views source reduction as th in its pollution prevention program, followed by an increased emphasis on recycling and disposal are considered only when prevention or recycling is not possible or pr

5.20.2 Cultural Resources

The lack of detailed specifications associated with the proposed construction a various alternatives precludes identifying specific project impacts and potential m particular structures and facilities. Basic compliance under cultural resource law that would be essentially the same under all alternatives. These steps are (a) iden evaluation of resources in danger of impact, (b) assessment of effects to these res with the State Historic Preservation Office and representatives of the Shoshone-Ban (c) development of plans and documents to minimize any adverse effects. (d) consult Advisory Council on Historic Preservation and tribal representatives as to the appr mitigation measures, and (e) implementation of potential mitigation measures. There resource survey has not been performed in an area planned for ground disturbance un proposed alternatives, consultation would be initiated with the Idaho State Histori and the survey would be conducted prior to any disturbance. If cultural resources w they would be evaluated according to National Register criteria. Wherever possible. resources would be left undisturbed. If the impacts are determined to be adverse an to leave the resource undisturbed, then measures would be initiated to reduce impac plans would be developed in consultation with the State Historic Preservation Offic Council on Historic Preservation and would conform to appropriate standards and gui established for historic preservation activities by the Secretary of the Interior.

Some actions may affect areas of religious, cultural, or historic value to Nati has implemented a Working Agreement (DOE 1992d) to ensure communication with the Sh Bannock Tribe, especially relating to the treatment of archeological sites during e mandated by the Archeological Resources Protection Act (ARPA 1979); the protection remains, as required under the Native American Graves Protection and Repatriation A 1990); and the free exercise of religion as protected by the American Indian Religi (AIRFA 1978). In keeping with DOE Native American policy (DOE 1990), DOE Order 1230 1992c), and procedures to be defined in the final Cultural Resources Management Pla DOE would conduct Native American consultation during the planning and implementati proposed alternatives. Procedures for dealing with the inadvertent discovery of hum be consistent with the Native American Graves Protection and Repatriation Act (NAGP human remains are discovered, DOE will notify all tribes that have expressed an int repatriation of graves as required under NAGPRA, including the Shoshone-Bannock, Sh and the Northwestern band of the Shoshone Nation. These tribes will then have an op claim the remains and associated artifacts in accordance with the requirements of N Procedures for the repatriation of "cultural items" in accordance with NAGPRA will curation agreement that will be finalized by June 1996.

In addition to consultation, other measures would mitigate potential adverse ef American Resources, in particular effects to air, water, plants, animals, and visua measures include avoidance of sensitive areas, placement of facilities within exist construction, revegetation with native plants of areas with ground disturbance, mon and animals within hunting and gathering areas for radiological contamination, redu night lights outside of existing facilities, monitoring tanks, ponds and runoff for minimizing ground disturbance, use of dust suppressers during construction, and use other air pollutant control equipment to reduce air contaminants.

5.20.3 Traffic and Transportation

All onsite shipments of spent nuclear fuel would be in compliance with ID Direc "Hazardous Materials Packaging and Transportation Safety Requirements." These requi provide assurance that, under normal conditions, the INEL would meet as-low-as-reas achievable conditions, reasonably foreseeable accident situations (those with proba greater than 1x10^-7 per year) would not result in a loss of shielding or containme an unintentional release of radioactive material would result in a timely response.

DOE would approve the type packages used for onsite shipments or would obtain a Regulatory Commission or DOE certificate of compliance. If the onsite package did n Regulatory Commission or DOE certification, the user of the package would have to e administrative controls or other potential mitigating measures would ensure that th maintain containment and shielding integrity. The administrative and emergency resp considerations would provide sufficient control so that accidents would not result containment or shielding, in criticality, or in an uncontrolled release of radioact create a hazard to the health and safety of the public or workers. Accident mitigat below.

5.20.4 Accidents

The DOE would initiate INEL emergency response programs, as appropriate, follow occurrence of an accident to prevent or mitigate consequences. These emergency res implemented in accordance with 5300-DOE series Orders, typically involve emergency emergency preparedness, and emergency response actions. Participating government ag plans that are interrelated with the INEL Emergency Plan for Action include the Sta Bingham County, Bonneville County, Butte County, Clark County, Jefferson County, th Indian Affairs, and Fort Hall Indian Reservation. When an emergency condition exist the Emergency Action Director is responsible for recognition, classification, notif action recommendations. Each emergency response plan utilizes resources specificall assist a facility in emergency management. These resources include but are not limi following:

- INEL Warning Communications Center
- INEL Fire Department
- Facility Emergency Command Centers
- DOE Emergency Operations Centers
- County and State Emergency Command Centers
- Medical, health physics, and industrial hygiene specialists
- Protective clothing and equipment (respirators, breathing air supplies, etc
- Periodic training exercises and drills within and between the organizations implementing the response plans

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Exhibit-------

STAINLESS STEEL SHEET AND PLATE

price per cwt for Atlanta

Type	26-Jun	24-Jul	28-Aug	25-Sep	25-Oct	27-Nov
sheet steel						
14 gauge	$ 193.54	$ 193.54	$ 193.54	$ 193.54	$ 193.54	$ 193.54
16 guage	$ 195.70	$ 195.70	$ 195.70	$ 195.70	$ 195.70	$ 195.70
20 gauge	$ 199.20	$ 199.20	$ 197.00	$ 197.00	$ 197.00	$ 197.00
plate						
304 1/4", 72"x240"	$ 189.50	$ 189.50	$ 188.00	$ 188.00	$ 188.00	$ 188.00
316 1/4", 96"x140"	$ 189.50	$ 210.75	$ 208.00	$ 208.00	$ 208.00	$ 208.00

The above prices are FOB warehouse based on Engineering News-Record mothly spot pricing from a single source