COVER SHEET

Responsible Agency: U.S. Department of Energy (DOE)

Title: Advanced Mixed Waste Treatment Project (AMWTP) Final Environmental Impact Statement (EIS) (DOE/EIS-0290)

Location: Idaho National Engineering and Environmental Laboratory (INEEL)

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Abstract: The AMWTP Final EIS assesses the potential environmental impacts associated with alternatives related to the construction and operation of a proposed waste treatment facility at the INEEL. The alternatives analyzed were: the No Action Alternative, the Proposed Action, the Non-Thermal Treatment Alternative, and the Treatment and Storage Alternative. The Proposed Action is the Preferred Alternative. Under the Proposed Action/Preferred Alternative, the AMWTP facility would treat transuranic waste, alpha-contaminated low-level mixed waste, and low-level mixed waste in preparation for disposal. After treatment, transuranic waste would be disposed of at the Waste Isolation Pilot Plant in New Mexico. Low-level mixed waste would be disposed of at an approved disposal facility depending on decisions to be based on DOE's *Final Waste Management Programmatic Environmental Impact Statement*. Evaluation of impacts on land use, socioeconomics, cultural resources, aesthetic and scenic resources, geology, air resources, water resources, ecological resources, noise, traffic and transportation, occupational and public health and safety, INEEL services, and environmental justice were included in the assessment.

Public Comments: The public comment period on the Draft EIS was held from July 24, 1998 toSeptember 26, 1998. During the comment period, public hearings were held in Idaho Falls and Twin Falls, Idaho. The Draft EIS was made available through mailings, through requests to DOE's Idaho Operations Office, and at DOE Public Reading Rooms. In preparing the AMWTP Final EIS, DOE considered comments received by mail and fax, as well as those handed in at hearings. In addition, comments and concerns identified during discussions at hearings were considered.

In response to comments submitted after issuance of the Draft EIS and additional technical details not available at the time of issuance of the Draft, the Final EIS contains revisions and changes. The revisions and changes made since the issuance of the Draft document are indicated by a sidebar in the margin. In addition, the Summary has been produced as a stand-alone document for the Final EIS. Volume II (Comment Response Document) of the Final EIS contains the comments received during public review of the Draft EIS and DOE responses to those comments. DOE has public reading rooms near the INEEL where these documents may be reviewed.

acronyms and abbreviations

alpha LLMW	alpha-contaminated low-level mixed waste
AAC	acceptable ambient concentrations
AACC	acceptable ambient concentration for a carcinogen
AC	alternating current
ACGIH	American Conference of Governmental Industrial Hygienists
ACHP	Advisory Council on Historic Preservation
ACMM	Analytical Chemistry Methods Manual
AEA	*Atomic Energy Act*
AEC	U.S. Atomic Energy Commission
ALARA	as low as reasonably achievable
amwtp	Advanced Mixed Waste Treatment Project
ANL-E	Argonne National Laboratory–East
ANL-W	Argonne National Laboratory–West
APCS	air pollution control system
ARF	airborne release fraction
AWFC	automatic waste feed cutoff
BACT	Best Available Control Technology
BLEVE	boiling liquid, expanding vapor explosion
BLM	Bureau of Land Management
BLR	Big Lost River
CAA	*Clean Air Act*
C&S	Certified and Segregated
CEDE	Committed effective dose equivalent
CEM	continuous emissions monitor
CEQ	Council on Environmental Quality
CERCLA	*Comprehensive Environmental Response, Compensation, and Liability Act*
CFA	Central Facilities Area
CFR	Code of Federal Regulations
CH	Contact handled
CRD	Comment Response Document
D&D	decontamination and decommissioning

dBA	Decibel A-weighted
DMS	data management system
DOE	U.S. Department of Energy
DOE-ID	U.S. Department of Energy - Idaho Operations Office
DOE INEL EIS	*Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs Final Environmental Impact Statement*
DOT	Department of Transportation
DR	damage ratio
EA	Environmental Assessment
EBR-I	Experimental Breeder Reactor - I
EDE	effective dose equivalent
EDF	Engineering Design File
EEGL	emergency exposure guidance level
EIS	environmental impact statement
EM	Environmental Management
EMT	Emergency medical technician
EPA	U.S. Environmental Protection Agency
EPCRA	*Emergency Planning and Community Right-to-Know Act*
ER	Environmental Restoration
ERPG	Emergency response planning guides
ES&H	Environment, Safety and Health
FDM	Fugitive Dust Model
FFCA	*Federal Facility Compliance Act*
FONSI	Finding of No Significant Impact
FR	Federal Register
GFE	government furnished equipment
HCL	hydrochloric acid
HEC	Hydrologic Engineering Center
HEPA	high-efficiency particulate air (filter)
HVAC	heating, ventilation, and air conditioning
HWMA	*Hazardous Waste Management Act*
HWN	hazardous waste number
ICPP	Idaho Chemical Processing Plant (now known as

	INTEC)
ICRP	International Commission on Radiological Protection
IDAPA	*Idaho Administrative Procedures Act*
IDC	item description code
IDHW	Idaho Department of Health and Welfare
IDLH	immediately dangerous to life or health
ILTSF	Intermediate-Level Transuranic Storage Facility
INEL	Idaho National Engineering Laboratory
INEEL	Idaho National Engineering and Environmental Laboratory
INTEC	Idaho Nuclear Technology and Engineering Center (formerly known as ICPP)
ISC-3	Industrial Source Complex Version 3
IWPF	Idaho Waste Processing Facility
LANL	Los Alamos National Laboratory
LDR	Land Disposal Restrictions
LESAT	Lockheed Environmental Systems and Technologies Company
LITCO	Lockheed Idaho Technologies Company
LLMW	low-level mixed waste
LMITCO	Lockheed Martin Idaho Technologies Company
LPF	leak path fraction
M&O	Management and Operating
MACT	maximum allowable control technology
MAR	material at risk
MCL	maximum contaminant level
MEI	maximally exposed individual
MOU	memorandum of understanding
MOX	mixed oxide
MSDS	material safety data sheet
MTS	material transfer system
NAAQS	National Ambient Air Quality Standard
NAGPRA	*Native American Graves Protection and Repatriation Act*
NDIR	non-dispensive infrared
NEPA	*National Environmental Policy Act*

NESHAP	National Emissions Standard for Hazardous Air Pollutants
NHPA	*National Historic Preservation Act*
NOI	Notice of Intent
NON	Notice of Non-Compliance
NPDES	National Pollutant Discharge Elimination System
NPS	National Park Service
NRC	U.S. Nuclear Regulatory Commission
NRF	Naval Reactors Facility
NRHP	National Register of Historic Places
NSPS	New Source Performance Standards
NWCF	New Waste Calcining Facility
OD	organic debris
OHS	organic homogeneous solids
OPC	ordinary Portland cement
OSHA	Occupational Safety and Health Administration
PBF	Power Burst Facility
PCB	polychlorinated biphenyls
PCC	primary combustion chamber
PEIS	programmatic environmental impact statement
PEL	permissable exposure limit
PES	programmable electronic system
PFA	pulverized fuel ash
ppb	parts per billion
ppm	parts per million
PREPP	Process Experimental Pilot Plant
PSAR	Preliminary Safety Analysis Report
PSD	Prevention of Significant Deterioration
RCRA	*Resource Conservation and Recovery Act*
RF	respirable fraction
RFP	Request for Proposal
RGW	research generated waste
RH	remote handled
ROD	Record of Decision
ROI	region of influence

RSAC-5	Radiological Safety Analysis Computer Program Version 5
RTR	real-time radiography
RWMC	Radioactive Waste Management Complex
SAR	Safety Analysis Report
SCC	secondary combustion chamber
SCW	special case waste
SDA	Subsurface Disposal Area
SEIS-I or II	*Waste Isolation Pilot Plant Disposal Phase Final Supplemental Environmental Impact Statement-I or II*
SHPO	State Historic Preservation Officer (Idaho)
SPD EIS	*Surplus Plutonium Disposition Draft Environmental Impact Statement*
SRS	Savannah River Site
ST	source term
STEL	short term exposure limit
STP	Site Treatment Plan
SWEPP	Stored Waste Examination Pilot Plant
TAN	Test Area North
TEDE	total effective dose equivalent
TLV	threshold limit value
TPA	TRUPACT payload assemblage
TRU	transuranic waste
TRUPACT	Transuranic Package Transporter
TRUPACT-II	Transuranic Package Transporter, Model 2
TSA	Transuranic Storage Area
TSA EA	*Environmental Assessment: Retrieval and Re-Storage of Transuranic Storage Area Waste at the Idaho National Engineering Laboratory*
TSA-RE	Transuranic Storage Area Retrieval Enclosure
TSCA	*Toxic Substances Control Act*
TWA	time-weighted average
USGS	U.S. Geologic Survey
VOC	volatile organic compound
VRZ	volcanic rift zone
WAC	waste acceptance criteria

WC	waste category
WCF	Waste Characterization Facility
WERF	Waste Experimental Reduction Facility
WESP	wet electrostatic precipitator
WIPP	Waste Isolation Pilot Plant
WIPP SEIS-I or II	See SEIS-I or II
WM	waste management
WM PEIS	*Waste Management Programmatic Environmental Impact Statement*
WMF	Waste Management Facility
WSF	Waste Storage Facility
WTS	waste tracking system
XRF	X-ray fluorescence

UNITS CONVERSION GUIDE

This units conversion guide is being provided as a tool for readers to use when encountering unfamiliar metric or English units. Within each discipline (e.g., Land Use, Socioeconomics, Water Resources) convention is followed for use of units predominant with that discipline.

Unit x	Conversion Factor =	Unit
Acre	x 4046	Square Meter
Centimeter	x 0.39	Inch
Cubic Meter	x 1.3	Cubic Yard
Cubic Yard	x 0.76	Cubic Meter
Degree C	x 1.8) + 32	Degree F
Degree F	-32) x 0.555	Degree C
Foot	x 0.3	Meter
Gallon	x 3.8	Liter
Gram	x 0.035	Ounce
Inch	x 2.54	Centimeter
Kilogram	x 2.2	Pound
Kilogram	x 0.001	Ton (short)
Kilometer	x 0.62	Mile
Liter	x 0.26	Gallon
Meter	x 3.28	Foot
Meter per Second	x 2.24	Mile per Hour
Mile per Hour	x 0.45	Meter per Second
Mile	x 1.6	Kilometer
Ounce	x 28.3	Gram
Pound	x 0.454	Kilogram
Pound	x 0.0005	Ton

		(short)
Square Foot	x 0.093	Square Meter
Square Meter	x 10.76	Square Foot
Square Meter	x 0.0002	Acre
Ton (short)	x 2000	Pound
Ton (short)	x 907	Kilogram

1. INTRODUCTION AND BACKGROUND

1.1 Introduction

The Idaho National Engineering and Environmental Laboratory (INEEL) is located on 569,135 acres west of the City of Idaho Falls in southeast Idaho. The site sits on the Eastern Snake River Plain and is bordered by the Biterroot, Lemhi, and Lost River mountain ranges. The land comprising the INEEL is used to support the U.S. Department of Energy (DOE) facility and program operations and as safety-and-security zones around facilities. About two percent of the total INEEL area (11,400 acres) is used for facilities and operations (see Figure 1.1-1).

INEEL is one of DOE's primary centers for research and development activities on reactor performance, materials testing, environmental monitoring, natural resources research and planning, and waste processing. In addition to nuclear reactor research, other INEEL facilities support reactor operations; processing and storage of high-level waste, low-level mixed waste (LLMW), and low-level waste; disposal of low-level waste; and also storage of transuranic (TRU) waste generated by national defense program activities.

In line with its responsibility to manage and dispose of radioactive wastes in an environmentally sound manner, DOE proposes to construct and operate a facility called the Advanced Mixed Waste Treatment Project (AMWTP) to treat TRU waste, alpha-contaminated low-level mixed waste (alpha LLMW), and LLMW at the INEEL. The waste would be treated by technologies proposed by BNFL Inc., the owner and operator of the proposed facility. Currently proposed technologies are supercompaction, macroencapsulation, incineration, and microencapsulation. After treatment, TRU waste would be disposed of at the Waste Isolation Pilot Plant (WIPP) near Carlsbad, NM. LLMW would be disposed of at an approved facility, depending on decisions DOE will make based on evaluations in the *Final Waste Management Programmatic Environmental Impact Statement* (WM PEIS).

1.2 Radioactive Waste at the Idaho National Engineering and Environmental Laboratory

1.2.1 Waste Types

DOE currently stores approximately 65,000 cubic meters of radioactive waste at the Transuranic Storage Area (TSA) at the Radioactive Waste Management Complex (RWMC) at the INEEL. Of this amount, about 25,000 cubic meters are alpha LLMW and about 40,000 cubic meters are TRU waste (see Appendix D, Glossary, for definition of terms). Initially, the alpha LLMW was considered and managed as TRU waste. In 1982, DOE defined TRU waste as waste containing more than 100 nanocuries per gram of alpha-emitting transuranic isotopes with half lives greater than 20 years. That change meant that INEEL alpha LLMW and TRU wastes that are physically intermingled are subject to different treatment and disposal waste acceptance criteria (WAC) based on the level of radioactivity. However, because the alpha LLMW is not segregated from the TRU waste in the storage containers, the INEEL has managed all of the approximately 65,000 cubic meters as TRU waste.

Approximately 95 percent of this waste is classified as "mixed waste" because it contains chemical wastes that, under the *Resource Conservation and Recovery Act* (RCRA), are considered

Figure 1.1-1. INEEL, Idaho, and region.

hazardous. When a waste material is both "hazardous" under RCRA and radioactive it is defined as a mixed waste. Some of these wastes also contain polychlorinated biphenyls (PCBs), which are regulated under the *Toxic Substances Control Act* (TSCA). Most of this 65,000 cubic meters of waste resulted from nuclear weapons production operations at the Rocky Flats Plant in Colorado and was transported to the INEEL before the current definition of TRU waste was established (prior to 1982).

1.2.2 Volumes Analyzed

A summary of the INEEL waste volumes by waste categories that are being considered for treatment at the proposed AMWTP and that are currently stored at the RWMC is presented in Table 1.2-1. A more detailed description can be found in Appendices E and F. Waste descriptions are also contained in the *Hazardous Waste Management Act* (HWMA)/TSCA Permit Application for the AMWTP facility (BNFL-5232-RCRA-01, Rev. 1). Additional waste descriptions used for reference are contained in the following publicly available documents:

- *Waste Description Information for Transuranic Contaminated Wastes Stored at the INEL* (December 1995)
- Appendix A, *Detailed Information for Mixed and Non-mixed Alpha Low-Level Waste* (December 1995)

- Appendix B, *Detailed Information for Mixed and Non-mixed Transuranic Waste* (December 1995)
- *Characterization Information on Additional INEL and Offsite Transuranic Contaminated and Mixed Low-Level Waste Potentially Available for Treatment by the Advanced Mixed Waste Treatment Project* (September 1995)
- *INEL Site Treatment Plan* (October 1995).

Table 1.2-1. Summary of mixed waste volume by waste category.[a]

Waste category	Volume (cubic meters)
Ceramic/Brick Debris	290
Graphite	490
Heterogeneous Debris	3,655
Heterogeneous Debris and Mixed Debris	165
Inorganic Debris	4,930
Inorganic Homogeneous Solids	8,570
Metal Debris	15,835
Metal Debris and Heterogeneous Debris	80
Organic Debris	800
Organic Homogeneous Solids	1,695
Paper/Rags/Plastic/Rubber	14,480
Remote Handled	135
Soils	250
Special Case Waste	80
To Be Determined	6,275
Total	57,730

a. The sum of the waste in this table is less than 65,000 cubic meters because this list includes only mixed waste (hazardous and radioactive) and therefore does not include waste to be treated that is radioactive only.

1.2.3 Condition of Waste at the Idaho National Engineering and Environmental Laboratory

The approximately 65,000 cubic meters of INEEL waste described above is TRU waste, alpha LLMW, and LLMW which is stored at the RWMC at the TSA. Of this amount, approximately 52,000 cubic meters (80 percent) is in wooden boxes and metal drums that were stacked on an asphalt pad and covered with tarps, plywood, and then soil to form an earthen-covered berm. The earthen-covered berm is enclosed within a metal building called the Transuranic Storage Area Retrieval Enclosure (TSA-RE), a RCRA interim status facility. Approximately 13,000 cubic meters of the waste (the other 20 percent) is stored in adjacent RCRA-permitted facilities at the RWMC. Of the 13,000 cubic meters in RCRA-permitted storage facilities, it is estimated only between 3,500 and 7,000 cubic meters would meet the WIPP WAC disposal criteria without some form of treatment. None of the waste in the RCRA storage modules is expected to meet Land Disposal Restriction (LDR) standards. Furthermore, storage of hazardous wastes that are restricted from land disposal is prohibited. Under the *Federal Facility Compliance Act* (FFCA) of RCRA, DOE must develop and comply with a treatment plan for all of these mixed wastes.

The drums and boxes were not designed for, or intended to provide, permanent containment of the waste. The wastes have been in the earthen-covered berm since 1970; the expected design life of the containers was 20 years. The drums and boxes within the earthen-covered berm have exceeded their design life and are subject to breaching and failure through corrosion or decomposition, creating a potential for the wastes to be released into the environment.

1.2.4 Additional Quantities of Waste

DOE anticipates that it may treat up to an additional 120,000 cubic meters of similar waste from the INEEL and other DOE sites at the proposed AMWTP facility. The INEEL Site Treatment Plan (STP) currently identifies over 65 waste streams totaling approximately 1,000 cubic meters from 14 other DOE sites that could be treated at the AMWTP. Other potential sources include similar wastes buried in the RWMC pits and trenches at the INEEL (approximately 60,000 cubic meters), wastes from future treatment of INEEL high-level waste (possibly several hundred cubic meters), wastes from the INEEL's decontamination and decommissioning program, LLMW that continues to be generated at INEEL, and similar wastes from other DOE sites. All of this DOE waste must meet the AMWTP WAC described in Appendix F before it can be treated at the AMWTP, and the offsite waste must satisfy the requirements of the STP Consent Order.

1.3 Background and Project History

A number of legally binding agreements and regulatory standards, program decisions, and other events contribute to the need for the AMWTP (see Appendix F, Project History and Chronology). Figure 1.3-1 presents a summary of the *National Environmental Policy Act* (NEPA) activities leading to the AMWTP. Key events are described in more detail in the following sections.

In the *Waste Isolation Pilot Plant Disposal Phase Final Supplemental Environmental Impact Statement* (WIPP SEIS-II), DOE identified its need to dispose of TRU waste generated by past, present, and future activities in a manner that protects public health and the environment (DOE 1997d). The only site that may accept TRU wastes for disposal is WIPP, located near Carlsbad, NM. TRU waste shipped to WIPP for disposal must meet the WIPP WAC, which are regulatory-based. Virtually all of INEEL's TRU waste must be treated to meet the WIPP WAC; for some TRU wastes, treatment consists of only repackaging the waste. The WIPP WAC was first developed in 1989 and revised several times, most recently in 1996. These criteria govern the form, packaging, and transport of TRU waste to be disposed of at WIPP. These criteria also address WIPP operations and safety requirements, transportation requirements, waste package requirements, RCRA requirements, and performance assessment requirements. Overall, they consolidate the minimum requirements of all laws, regulations, and DOE internal requirements that apply to TRU waste transportation and disposal and establish specific minimum waste characteristics which TRU waste must meet before it can be accepted and emplaced at WIPP.

The WIPP WAC establish the conditions that govern the physical, radiological, and chemical composition for TRU waste, setting weight, thermal, and radiological limits. Weight limits are established for Transuranic Package Transporter, Model 2 (TRUPACT-II) containers, contact-handled (CH) TRU waste drums, and shipments so that highway weight limits are not exceeded. Thermal power limits, which define the amount of heat that may be produced by radioactive decay, are established for waste containers to limit the concentration of flammable gas which may be generated within the container. Radiological criteria include the maximum plutonium-239 equivalent activity for containers and for stored TRU waste to avoid the potential for nuclear criticality (DOE 1997d).

The AMWTP WAC define the requirements for accepting waste for treatment at the AMWTP facility. These requirements are based on the presently proposed and evaluated design capability of the treatment process described in the Proposed Action. Wastes that do not meet the criteria may be accepted for treatment, but only following a detailed case-by-case evaluation of the specific waste characteristics and special authorization. It should be noted that the AMWTP WAC are for receipt of wastes for treatment, and not for outgoing, treated wastes. Treated wastes will meet the WAC for the respective disposal site. The AMWTP WAC are presented in Appendix F of this document.

The waste stored at the RWMC consists of intermingled TRU waste and alpha LLMW waste. DOE's proposed approach is not to separate the wastes but to co-process the wastes to meet RCRA LDR standards and the WIPP WAC. There is currently no designated disposal site for alpha LLMW in storage at the INEEL. To be eligible for disposal at any other site, should one be identified in the future, the alpha LLMW would have to be treated to meet RCRA LDR standards or the U.S. Environmental Protection Agency (EPA) would have to grant an exemption. The WM PEIS assumed that LLMW disposal facilities would be designed to meet all applicable RCRA disposal requirements, including RCRA LDRs. When WIPP receives a RCRA Part B mixed waste disposal permit, DOE may no longer need to treat WIPP-bound waste to LDR standards. However, any remaining or generated alpha LLMW will still require treatment to LDR prior to disposal at permitted facilities other than WIPP. The need for LDR treatment capability for TRU waste will be reconsidered as conditions change.

In 1992 and 1993, DOE undertook studies to examine the potential for private sector treatment of alpha LLMW. These studies concluded that cost savings could be achieved and the schedule shortened by seven years from that proposed by the INEEL Management and Operating (M&O) contractor if DOE were to undertake the waste treatment. As a result, DOE issued a Scope of Work for a "Feasibility Study of Treatment Services for Alpha-Contaminated Mixed Low-Level Waste." Three private sector teams provided feasibility studies in 1994. After extensive evaluation, DOE decided to pursue the procurement of treatment, assay, and characterization services for waste from the private sector, and to treat the alpha LLMW and TRU waste together to RCRA LDR standards. Information from the feasibility studies was provided for analysis in the *Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs Environmental Impact Statement* (DOE INEL EIS, DOE/EIS-0203-F, April 1995). In the DOE INEL EIS Record of Decision (ROD), DOE decided to construct treatment facilities at INEEL to treat TRU waste and alpha LLMW necessary to comply with the FFCA. Treatment of TRU waste at a minimum was to be for the purpose of meeting the WAC for disposal at WIPP and to occur on a schedule to be negotiated with the State of Idaho. This EIS tiers from the information and environmental analysis contained in the DOE INEL EIS.

On October 17, 1995, the State of Idaho, the Department of the Navy, and DOE settled the case of *Public Service Co. of Colorado v. Batt*, Civil No. CV 91-0035-S-EJL (D. Idaho) (Lead case). Certain conditions of the Settlement Agreement/Consent Order obligated DOE to:

- Commence procurement of a treatment facility at the INEEL for the treatment of TRU waste, alpha LLMW, and LLMW, and
- Execute a procurement contract for a treatment facility by June 1, 1997, complete construction of the facility by December 31, 2002, and commence operation by March 31, 2003.

Also, the INEEL STP, negotiated with the State of Idaho in accordance with the FFCA, includes a schedule for constructing treatment capacity for the TRU waste and alpha LLMW, which is consistent with the milestones in the Settlement Agreement/Consent Order. In accordance with the Settlement Agreement/Consent Order and STP, DOE conducted a procurement for a facility to treat the wastes described above.

In January 1996, DOE issued a final request for proposal for treatment of TRU waste, alpha LLMW, and LLMW. Proposals were received from four teams, three of which were determined to be in the competitive range. Each proposal contained a suite of treatment technologies evaluated for use on the INEEL stored wastes. The process set forth in DOE's Implementing Regulations (10 CFR 1021.216) was used to allow DOE to compare the potential environmental impacts between approaches suggested by competing offerors during this procurement process. DOE compared these impacts in an Environmental Critique (November 22, 1996). The environmental considerations detailed in the critique were made available to DOE's Source Evaluation Board and became a part of the technical criteria against which the competing offerors were evaluated during the procurement process. The results of the Environmental Critique were summarized in an Environmental Synopsis that was made available to the public (DOE 1998). A summary of the environmental synopsis of the different technologies proposed by the three offerors is presented in Table 3.3-1.

As a result of this competition and the comparison of potential environmental impacts associated with the competing proposals, the Source Evaluation Board chose BNFL Inc. in December 1996 as the winning contractor for Phase I of the project. Phase I of the contract addresses permitting, a NEPA review, and an environment, safety and health (ES&H) authorization process. Before deciding whether to authorize BNFL Inc. to proceed with construction (Phase II) and operations (Phase III), DOE must complete this EIS. If, after completing this EIS, DOE decides not to move forward with construction and operations of the project, the contract will be terminated.

1.4 The Proposed Advanced Mixed Waste Treatment Project

The contract between DOE and BNFL Inc. has three phases. Phase I involves permitting, preparation of environmental data, and an ES&H authorization by BNFL Inc. and the preparation of this EIS by DOE. Phase II involves the construction and Phase III the operation of the AMWTP. Phases II and III would occur only if, after the completion of this EIS, DOE decides to proceed with the project. The contract is provided in Appendix H.

Under the Proposed Action, BNFL Inc. would construct and operate a facility which would be capable of treating TRU waste, alpha LLMW, and LLMW according to the treatments required by the WIPP WAC and RCRA LDR standards. By 2015, the facility would treat the 65,000 cubic meters of waste that is in temporary storage at the INEEL. In addition, up to 20,000 cubic meters of similar waste could also be treated by 2015. Under the Proposed Action, the AMWTP facility may treat up to 120,000 cubic meters of additional DOE waste from the INEEL or other DOE sites, for a total of 185,000 cubic meters. This EIS considers the impacts of treating the 65,000 and the 120,000 cubic meters of waste. Treatment of 185,000 cubic meters would require the operation of the facility for approximately 30 years, or until 2033.

The AMWTP facility would be located at the RWMC in the southwestern corner of the INEEL and would be positioned on the southern portion of the 56-acre RWMC TSA, between the existing TSA-RE to the west and the seven RCRA Type II storage modules to the east (see Figure 1.4-1). The RWMC in its entirety comprises about 163 acres. The proposed location of the AMWTP would be adjacent to the waste to be treated and thus would avoid movement of retrieved waste across public roads. The proposed location of the AMWTP facility in the RWMC is shown in Figure 1.4-1. The waste that would be processed through the AMWTP facility would be (1) retrieved from covered storage; (2) characterized for storage and treatment; (3) stored in preparation for treatment; (4) pretreated if necessary; (5) treated to meet applicable storage/disposal WAC and/or RCRA LDR standards, as applicable; and (6) characterized and certified for shipment to WIPP or other appropriate disposal facilities (BNFL 1997a). The AMWTP would employ thermal treatment (incineration with microencapsulation of ash) on a fraction of the waste volume, while supercompaction and macroencapsulation, as proposed, would constitute the primary non-thermal treatment technologies for the majority of the remaining waste volumes. Figure 1.4-2 shows the waste types and corresponding treatment technologies.

BNFL Inc. is responsible for achieving compliance with all applicable ES&H laws and regulations, and regulatory agencies are responsible for monitoring the contractor efforts in implementing programs to achieve compliance. The State of Idaho and the EPA will regulate BNFL Inc., according to permits under their purview. DOE regulates occupational safety and health and nuclear safety according to a specific ES&H authorization. Section 7.4 provides a description of the ES&H oversight planned for this project.

Figure 1.4-1. Layout of the Radioactive Waste Management Complex.

Figure 1.4-2. Waste types and treatment.

1.5 Relationship of this Environmental Impact Statement to Other Department of Energy ***National Environmental Policy Act*** Documents

Since 1992, DOE has prepared a number of EISs and environmental assessments (EAs) that provide environmental consequence analyses relevant to the Proposed Action. These detailed evaluations include the DOE INEL EIS, the WM PEIS, WIPP SEIS-II, and the *Environmental Assessment: Retrieval and Re-Storage of Transuranic Storage Area Waste at the Idaho National Engineering Laboratory* (TSA EA).

The ROD for the DOE INEL EIS implements the preferred alternative, which is the Modified Ten-Year Plan (Modified Alternative B), for INEEL environmental restoration and waste management programs. Volume 2 of the DOE INEL EIS includes analysis of the potential environmental impacts associated with treating alpha LLMW and TRU waste and packaging the waste for shipment to a DOE-approved repository. The DOE INEL EIS evaluated two conceptual treatment facilities: the Private Sector Alpha Contaminated Low-Level Waste Treatment Facility and the Idaho Waste Processing Facility. Identical except for how they would be funded and administratively operated, both treatment facility concepts would employ thermal (incineration) and non-thermal treatment processes to meet regulatory requirements and WAC of a disposal site. Within the preferred alternative was the possible receipt of LLMW and TRU waste from other sites, depending upon consent orders negotiated under the FFCA and decisions made from the WM PEIS. The LLMW and TRU waste would be treated, with the residue returned to the original site or shipped to an approved offsite disposal facility, depending on arrangements reached under the FFCA with the State of Idaho and other affected states. Commensurate with the current AMWTP Proposed Action, the DOE INEL EIS evaluated the environmental consequences of operating a private sector alpha LLMW and TRU waste treatment facility at the INEEL and also offsite. Analyses conducted for the DOE INEL EIS indicate that normal operations under the preferred alternative (i.e., treatment of waste to render it more environmentally safe and stable in the long-term) would produce only short-term, minor increases in radionuclide and criteria pollutant emissions. Furthermore, analyses indicated that these short-term increases in emissions would be well within current regulatory limits.

The WM PEIS is consistent with the preferred alternative stated in the DOE INEL EIS in which DOE states a preference for the INEEL to serve as a regional treatment facility for TRU waste from other DOE sites (DOE 1997c). The WM PEIS evaluated the INEEL for potential impacts under all of the alternatives that identified a role for the INEEL, including regional treatment of LLMW and TRU waste. According to the WM PEIS TRU ROD (DOE 1998a), DOE will develop and operate mobile and fixed facilities to characterize and prepare TRU waste for disposal at WIPP. Each of DOE’s sites that has, or will generate, TRU waste will, as needed, prepare and store its TRU waste onsite, except that the Sandia National Laboratory-New Mexico will transfer its TRU waste to Los Alamos National Laboratory in New Mexico. In accordance with future decisions discussed in the ROD, DOE may decide to transfer TRU wastes from sites where it may be impractical to prepare them for disposal to sites where DOE has or will have the necessary capability. The sites that could receive such shipments of TRU waste are the INEEL, Hanford Site, Oak Ridge Reservation, and Savannah River Site. However, any future decisions regarding transfers of TRU waste would be subject to appropriate NEPA review, and to agreements, such as those between DOE and states, relating to the treatment and storage of TRU waste. In the WM PEIS hazardous waste ROD, DOE made the decision to continue its practice of treating INEEL hazardous waste offsite. RODs for the three other waste types (i.e., LLMW, low-level waste, and high-level waste) analyzed in the WM PEIS have not been issued as of this date.

WIPP SEIS-II provides information on environmental impacts associated with DOE’s proposed disposal operations at WIPP (DOE 1997d). The WIPP SEIS-II was prepared to assess the potential impacts of continuing the phased development of WIPP as a geologic repository for the safe disposal of TRU waste. WIPP SEIS-II evaluates the impacts resulting from the various treatment options; the transportation of TRU waste to WIPP using trucks, a combination of truck and regular rail service, and a combination of truck and dedicated rail service; and the disposal of this waste in the repository. Under the decision described in the WIPP SEIS-II ROD (DOE 1998b), DOE will dispose of 175,600 cubic meters of post-1970 defense TRU waste (except PCB-contaminated TRU waste), which falls within the capacity limits specified in the *WIPP Land Withdrawal Act* (Public Law 102-579). Furthermore, TRU wastes bound for WIPP would be treated as necessary to meet the planning basis WIPP WAC, Revision 5 (DOE 1996c). Based upon the DOE Complex’s TRU waste inventory volume and the anticipated emplacement rate, TRU waste will be disposed of at WIPP over a 35-year period.

In the TSA EA, DOE examined the environmental impacts associated with retrieval and re-storage of the stored TRU waste at INEEL’s RWMC. The Proposed Action included construction and operation of the TSA-RE (over TSA Pads

1, 2, and R) (see Figure 1.4-1); construction of the Waste Storage Facility; construction of support facilities (including an Operations Control Building); and upgrades to the RWMC fire water, potable water, power, fencing, and sewage utilities. The purposes of the Proposed Action were: (1) to prevent or delay possible deterioration of TSA waste containers to decrease the probability of future environmental contamination; and (2) to bring the TSA waste storage facilities into compliance with RCRA and the State of Idaho's HWMA requirements. DOE NEPA reviews related to the AMWTP are listed in Table 1.5-1.

Table 1.5-1. NEPA reviews related to the AMWTP decision.

Description of action	Status	EIS	EA
Final Waste Management Programmatic Environmental Impact Statement for Managing Treatment, Storage, and Disposal of Radioactive and Hazardous Waste (WM PEIS)	ROD for TRU waste issued January 1998, ROD for hazardous waste issued August 1998, additional RODs to follow	X	
Final Supplemental Environmental Impact Statement for the WIPP	ROD issued June 1990	X	
WIPP Disposal Phase Final Supplemental Environmental Impact Statement (SEIS-II)	ROD issued January 1998	X	
DOE Programmatic Spent Nuclear Fuel Management and INEL Environmental Restoration and Waste Management Programs Environmental Impact Statement (DOE INEL EIS)	Rod issued May 1995	X	
Low-level and Mixed Waste Processing at the Waste Experimental Reduction Facility	Finding of No Significant Impact (FONSI) issued June 1994		X
Retrieval and re-storage of TSA waste at the INEL (TSA EA)	FONSI issued May 1992		X
Waste Characterization Facility Environmental Assessment	FONSI issued March 1995		X

1.6 Public Participation

Public participation for the EIS consisted of two primary activities: the scoping process and the public comment process.

1.6.1 Public Scoping Process

DOE published the Notice of Intent (NOI) to prepare an EIS for the AMWTP in the *Federal Register* on November 20, 1997. The public scoping period began on that day and continued through January 9, 1998. DOE invited the public to submit comments during the scoping period by postal mail, e-mail, or fax. Additionally, to increase awareness and understanding of the Proposed Action, DOE held two facilitated public scoping workshops. The workshops provided the public with an opportunity to hear presentations, ask questions, participate in small-group discussions, and submit written and/or verbal comments on the scope of this EIS.

Forty-six attendees signed in at the Boise, Idaho, workshop held December 4, 1997, and 20 attendees signed in at the Idaho Falls, Idaho, workshop held December 9, 1997. The workshop participants submitted 55 of the 127 comments received by DOE during the public scoping period.

State agency representatives, members of interested groups, and private individuals attended these workshops and submitted comments on the scope of the EIS. The following signed in at a workshop or were present at a briefing on the Proposed Action:

- Current DOE and INEEL employees
- Contractor representatives
- Coalition 21
- Area elementary and secondary school students
- Snake River Alliance
- Greater Idaho Falls Chamber of Commerce
- Media
- State of Idaho INEEL Oversight Program representatives
- INEEL Citizens Advisory Board members
- DOE Headquarters personnel
- Elected officials and their representatives
- Department of Interior representatives
- Members of the Shoshone-Bannock Tribes
- Nonaffiliated individuals.

1.6.2 Results of Public Scoping

For purposes of tracking and analysis, all comments received were categorized and organized into a database. The categories of comments received are summarized below. DOE took every comment provided at the scoping meetings into consideration before preparing each section of the EIS.

Commentors asked that the EIS fully describe the impacts of operating the proposed facility on air, water, soil, and vegetation. Commentors also asked DOE to analyze the impacts of normal and off-normal facility operations and identify environmental releases under the four treatment components of the Proposed Action. The purpose and need for the AMWTP is discussed in detail in Chapter 2 of the EIS. Incineration and other treatment technologies are described in Chapter 3. Resulting potential impacts are described in Chapter 5 of this EIS. Commentors suggested further that the EIS include a characterization of the treated waste form and asked that DOE examine a wider range of storage and disposal options for the treated waste.

Some commentors made specific suggestions or posed general questions concerning various aspects of the Proposed Action. For example, they asked that DOE Idaho Operations Office (DOE- ID) fully characterize all waste planned for treatment in the proposed facility and that DOE include in the EIS inventories and descriptions of all waste within the DOE Complex that might be candidates for treatment at the proposed facility. DOE was asked that this EIS describe in detail the proposed treatment technologies, as well as other candidate technologies that may potentially be effective but are not proposed. Each of the treatment technologies is described in Chapter 3. In addition, Section 3.3 discusses alternatives considered but not analyzed. Commentors also requested information about follow-on uses that might be made of the proposed facility, and several asked DOE to disclose its plans to treat waste from other DOE sites, foreign countries, or utilities.

Some commentors questioned the need for the AMWTP while others opposed portions of the Proposed Action, such as employing incineration as a treatment technology. All of the options considered are discussed in Section 3.3, Alternatives Considered But Not Analyzed. In several cases, commentors requested that the *Advanced Mixed Waste Treatment Project Environmental Impact Statement* (AMWTP EIS) include a description of the State and Federal regulatory framework under which the proposed facility would be constructed and operated. This is discussed in Chapter 7 of the EIS.

A few comments were received that relate to the economic and employee impacts of siting the proposed facility at the RWMC, ensuring the safety of the incineration process and resulting emissions, limiting the scope of the analysis within the AMWTP EIS, and radiological safety and control features to be included in the proposed facility design.

In the NOI, DOE identified two alternatives for analysis in the EIS. These were (1) the Proposed Action, under which DOE would allow BNFL Inc. to proceed with the construction and operation of the treatment facility and (2) the No Action Alternative, required by the Council on Environmental Quality (CEQ) NEPA regulations. During scoping, the public asked that DOE analyze several additional alternatives in this EIS. In response, DOE added two new alternatives: treatment by non-thermal technologies only, followed by shipment of the treated waste offsite (referred to in this EIS as the Non-Thermal Treatment Alternative); and fully treat the waste but retain it at the INEEL as a contingency in the event WIPP is unable to receive and dispose of INEEL waste (known as the Treatment and Storage Alternative). Chapter 3 contains descriptions of each of the alternatives analyzed in this EIS.

Some commentors requested analysis or information that DOE considers to be outside the scope of this EIS. One example of this is a request that the EIS report on industry waste minimization and storage practices. Industry practices in these areas cover a very broad range and would have no direct bearing on the analysis of the environmental impacts of the Proposed Action or alternatives analyzed in this EIS.

Some commentors requested analyses more appropriately conducted or already included in other DOE NEPA documents. Examples of these requests include: (1) analyze the impacts of the transportation of treated waste from the INEEL to WIPP (this is analyzed in WIPP SEIS-II); (2) analyze the impacts of transportation of waste from other DOE sites to the INEEL for treatment, and the return of treated waste to the originator (this was analyzed in the WM PEIS and DOE INEL EIS); and (3) provide detailed inventories and descriptions of existing waste within the DOE Complex which might eventually be brought to the INEEL for treatment (descriptions of DOE waste streams, waste characteristics, quantities, and locations are included in the WM PEIS).

Some commentors requested that analyses be conducted that DOE considers to be unnecessary to accomplish the purpose of the AMWTP EIS. Among these were requests that DOE: (1) compare the proposed incineration technology that was used in Germany; (2) analyze the variety of waste treatment methods being used throughout the Complex at sites preparing waste for disposal at WIPP; (3) consider contingencies in the event privatization funding fails to materialize in future years or that WIPP does not open on schedule; (4) include cost and budget analyses; and (5) include privatization background. The requests were not considered significant to scoping the EIS, but are management considerations more administrative in nature. Answers to these comments are:

- The incineration technologies chosen for AMWTP have been used in the United States and generally compared to those used in Europe.
- The variety of waste treatment methods being used throughout the Complex at sites preparing waste for disposal at WIPP include size reduction and repackaging. Hanford plans incineration of some of its alpha LLMW at the Allied Technology Group facility in Hanford, WA, but has included a specification that the final waste product remain below 100 nCi/g. All of these treatment methods are analyzed in this EIS.
- In the event privatization funding fails to materialize in future years, requests will be made for funding through the Environmental Management budget process. The Treatment and Storage Alternative in this EIS was considered in the event WIPP is unable to receive and dispose of INEEL waste.
- Costs of the alternatives are contained in the EIS Administrative Record and will be considered by the deciding official in the ROD, but are not significant to the analysis of environmental impacts.
- The privatization background of the project is included in Appendix F of the EIS, but privatization, in and of itself, has no measurable environmental consequences.

Copies of related reference materials have been placed in the AMWTP EIS Technical Library, located in Idaho Falls, Idaho.

1.6.3 Public Comment Process on the Draft Environmental Impact Statement

DOE published the Notice of Availability of the AMWTP Draft EIS in the *Federal Register* on July 24, 1998 (63 FR 39836). The 50-day public comment period for the Draft EIS began on July 24, 1998, and ended on September 11,

1998. To accommodate requests from the public, the public comment period on the Draft EIS was extended to September 26, 1998 (63 FR 49101). Public hearings were held in Idaho Falls, Idaho on August 18, 1998, and Twin Falls, Idaho on August 20 and 21, 1998. In addition, the public was encouraged to provide comments via mail and fax. DOE considered and responded to all of the comments received on the Draft EIS.

The public hearings held for the Draft EIS were conducted using an interactive workshop- type format. The format chosen allowed for a two-way interaction between DOE and the public and encouraged informed public input and comments on the document. Court reporters were also present to provide a verbatim transcript of the proceedings and record any formal comments.

All public hearing comments were combined with comments received by mail and fax during the public comment period. Volume II of this EIS, the Comment Response Document (CRD), describes the public comment process in detail, provides copies of all comments received, and provides responses.

- 164 Major Comments Received on the Draft Environmental Impact Statement

Many comments received on the Draft EIS related to: (1) the priority of treating this stored waste before dealing with buried waste at the INEEL; (2) the need to treat waste that is, in the commentor's perception, already safely stored; (3) the public health and environmental impacts of incineration; (4) ES&H oversight of the project; and (5) requests that the Draft EIS be revised and reissued. Summary responses to these comments are presented below. All of the issues identified are included and responded to in detail in Volume II of the Final EIS, the CRD. Revisions to this EIS resulting from public comments have been made throughout the document.

1.*The priority of treating this stored waste before dealing with buried waste at the INEEL.*

Projects dealing with the buried and stored TRU wastes at the INEEL are both priorities within DOE and proceeding on parallel paths. The buried waste has a higher level of complexity associated with determining what has been buried, what risk it poses to human health and the environment, and what remediation options are most appropriate. The buried waste project is proceeding under the *Comprehensive Environmental Response, Compensation, and Liability Act* (CERCLA) process, with a draft ROD currently scheduled for December 2002. For the stored wastes that are the subject of this EIS, DOE is under regulatory and legal requirements to build a mixed waste treatment facility and begin operations in 2003. If a CERCLA ROD on the buried wastes requires retrieval and treatment, the AMWTP would be able to provide some of the treatment capacity for the buried wastes, and the potential impacts of such treatment is analyzed in the EIS.

2. *The need to treat waste that was, in the commentor's perception, already safely stored.*

Waste is stored in the earthen-covered berm in containers which have exceeded their 20-year design life. These containers are subject to breaching and failure through corrosion or decomposition, with potential for wastes to be released into the environment. In addition, under the FFCA of RCRA, DOE must be in compliance with the INEEL STP. The STP contains milestones for the procurement, construction and operation of a treatment facility for the TRU and mixed wastes. Repackaging and re-storage of the waste would not meet requirements of RCRA or TSCA. Further, the Settlement Agreement with the State of Idaho requires the construction and operation of a mixed waste treatment facility, with waste to be shipped out of Idaho no later than 2018.

3. *The public health and environmental impacts attributed to incineration.*

The potential health and environmental impacts from incineration are small. Incineration is the required treatment for PCBs under TSCA regulations, and is the Best Demonstrated Available Technology under RCRA for some wastes addressed in this EIS. The amount planned for incineration is approximately 25 percent. Incineration would enhance containment by reducing waste volumes prior to permanent disposal in a geologic repository, and after the ash is stabilized, increase the stability of the disposed residual. The project must comply with applicable laws and regulations that were developed to protect public health and the environment.

The EIS assesses the risks of the potential failure of the incinerator and air pollution control system during treatment. The assessment shows that radiological consequences at the nearest INEEL boundary would be 0.24 rem, total effective dose equivalent to the maximally exposed individual. The risk to the individual of a latent cancer from this exposure is about 1 in 8,000. For all toxic substances released concentrations at the nearest INEEL boundary are all far below evaluation guidelines.

4. *Environment, Safety and Health oversight of the project.*

The State of Idaho and the EPA would regulate BNFL Inc., according to permits under their purview. DOE regulates occupational safety and health and nuclear safety according to a specific ES&H authorization. Section 7.4 of the Final EIS describes the ES&H oversight provided for this project.

5. Requests that the Draft EIS be revised and reissued.

Some commentors requested that DOE reissue the Draft EIS. One reason for the request was due to the change from vitrification to microencapsulation of incinerator ash. Other reasons given included a belief that wastes must be fully characterized, scoping comments not adopted, and the financial impacts of privatization were not analyzed in the Draft EIS.

The CEQ NEPA regulations and DOE's Implementing Regulations require that an agency prepare a supplemental EIS (or reissue a draft EIS) when an agency makes substantial changes in the proposed action that are relevant to environmental concerns, or when there are significant new circumstances or information relevant to environmental concerns and bearing on the proposed action or its impacts. DOE believes the Draft EIS was adequate. The microencapsulation process is a minor change that was added to the Proposed Action after the Draft EIS was printed, but early in the public comment period and before the first public hearing. DOE disclosed and discussed this variation in the Proposed Action at the public hearings, and provided the public and other government agencies the opportunity to comment on the addition of the process to the suite of AMWTP processes. In the Final EIS, DOE fully analyzes the environmental impacts of microencapsulation, including cumulative impacts, and considered public comment on the change in process.

BNFL Inc. has extensive experience with microencapsulation. For the Proposed Action/Preferred Alternative and the Treatment and Storage Alternative, impacts of vitrification or microencapsulation to radiation health, air resources, water resources, and INEEL services are very low and essentially the same. Both vitrification and microencapsulation produce very stable final waste forms meeting RCRA LDR standards and the WIPP WAC. The Final EIS analyzes the impacts of both microencapsulation and vitrification. Responses to the other reasons for reissuing the Draft EIS raised by the public are addressed in the CRD.

Other comments on the Draft EIS related to:

- The treatment process technologies.
- The types and volumes of waste to be treated.
- The degree of detail of waste characterization data.
- The need for DOE to provide the necessary oversight to ensure privatization meets the agreed on timetable for treating the waste, as well as monitoring the operation of the facility to protect the public and the environment.
- The possibility that WIPP may not open and the need for DOE to treat the waste to WIPP WAC.
- The need for DOE to adequately consider the potential health and environmental impacts and risks (specifically impacts to air quality) due to incineration and supercompaction technologies.
- Support for INEEL treating the waste that is currently onsite but opposition to accepting waste from other sites.
- The impacts of the alternatives on human health (both from radiation and hazardous chemicals) and how these risks were determined and evaluated.

- The relationship of this EIS to other DOE documents and programs, particularly the *Surplus Plutonium Disposition Draft Environmental Impact Statement*, WM PEIS, the DOE INEL EIS, and the WIPP SEIS-II, and the need to make decisions based on all associated program and activities concurrently.

- 165 Changes from the Draft Environmental Impact Statement

In response to public comments submitted after issuance of the Draft EIS and additional technical details not available at the time of issuance of the Draft EIS, the Final EIS contains revisions and additions. The revisions and additions are indicated by a sidebar in the margin. Volume II (CRD) of the EIS contains the comments received during public review of the Draft EIS and the DOE responses to those comments.

Advanced Mixed Waste Treatment Project Process Description. The public was informed of BNFL Inc.'s intention to substitute microencapsulation for vitrification of incineration ash during DOE's presentations at all of the Draft EIS public hearings. Informational display boards were used. DOE answered questions on the change, and invited public comment during the hearing and the public comment period.

Section 3.1.2.5, Section 3.5 and Appendix B have been expanded to describe why microencapsulation was substituted and its potential effects. Section 3.1.2.5 was modified to describe the microencapsulation process. Section 3.2 was changed to reflect the use of microencapsulation as the incineration ash stabilization process in the Proposed Action/Preferred Alternative. A table comparing specific differences in environmental impacts between microencapsulation and vitrification was added to Section 3.5. The impacts are small and were encompassed within the analyses contained in the Draft EIS. The section on treatment (Section 3.1.2.5) in the Final EIS still includes vitrification, and the potential environmental impacts from vitrification and microencapsulation are presented in Chapter 5.

If DOE decides to proceed with an action alternative, further changes or substitutions to the processes described in the EIS may occur in the future. Any proposed substitution or major change of a treatment process would be evaluated as appropriate under NEPA.

Air Resources. Several commentors were concerned about the air emissions from incineration. More specifically, they stated that the EIS did not present enough information on the air emission control system and high efficiency particulate air (HEPA) filters and therefore they were not convinced that the HEPA filter efficiency was as stated and potential health effects were understated. As a result, a discussion of the AMWTP air emission control system and HEPA filters was added to Section 3.1.2.5. In addition, Section 5.7 now includes an analysis of the emissions from microencapsulation.

Normal Operation Radiological/Chemical Impacts. The normal operation radiological impact section (Section 5.12) was revised to include the contributions of the microencapsulation process as part of the Proposed Action.

Environment, Safety, and Health (ES&H) Oversight. The State of Idaho and the EPA would regulate BNFL Inc., according to permits under their purview. DOE regulates occupational safety and health and nuclear safety according to a specific ES&H authorization. Section 7.4 of the Final EIS describes the ES&H oversight provided for this project.

New Appendix. A new appendix has been added to the Final EIS (Appendix H, BNFL Inc. Contract) because of public comments requesting more detailed information on the contract between DOE and BNFL Inc. and is included on a CD-ROM enclosed with the Final EIS.

1.7 Content of this Environmental Impact Statement

By addressing the following issues, this EIS provides a comprehensive assessment of reasonably foreseeable consequences from the Proposed Action and reasonable alternatives:

- Potential effects on the Snake River Plain Aquifer

- Effects of emissions and discharges from the thermal treatment of TRU waste, alpha LLMW, and LLMW
- Potential effects on the public and workers from exposure to radiological and hazardous materials, during normal operations and from reasonably foreseeable accidents
- Potential effects on air, soil, and water quality, from normal operations and reasonably foreseeable accidents
- Potential effects on members of the public, including minority and low-income populations, from normal operations and reasonably foreseeable accidents
- Pollution prevention, waste minimization, and energy and water use reduction technologies to eliminate or reduce use of energy, water, and hazardous substances, and to minimize environmental impacts
- Potential socioeconomic impacts, including potential impacts associated with the number of workers needed for operations
- Potential impacts on cultural and historic resources
- Regulation of commercial operations on a DOE site
- Compliance with applicable Federal, State, and local requirements including the Settlement Agreement/Consent Order
- Potential cumulative environmental impacts of all past, present, and reasonably foreseeable future operations at the INEEL
- Potential irreversible and irretrievable commitment of resources and the ultimate use of INEEL land
- Potential environmental impacts, including long-term risks to humans, associated with constructing, operating, and decommissioning the AMWTP.

2. PURPOSE AND NEED FOR AGENCY ACTION

The U.S. Department of Energy (DOE) currently stores approximately 65,000 cubic meters of transuranic (TRU) waste, alpha-contaminated low-level mixed waste (alpha-LLMW), and LLMW at the Radioactive Waste Management Complex on the Idaho National Engineering and Environmental Laboratory (INEEL). Approximately 95 percent of this radioactive waste is classified as mixed waste which, because it contains chemically hazardous waste, is regulated under the *Resource Conservation and Recovery Act* (RCRA). Some of the wastes also contain polychlorinated biphenyls, which are regulated under the *Toxic Substances Control Act* (TSCA). These wastes (i.e., radioactive, RCRA, and TSCA wastes) are intermingled in common containers. DOE needs to place these wastes in a configuration that will allow for their disposal at the Waste Isolation Pilot Plant or another appropriate facility, in a manner consistent with state and Federal law and consistent with the schedule contained in the October 17, 1995, Settlement Agreement/Consent Order in the case of *Public Service Co. of Colorado v. Batt,* Civil No. 91-0035-S-EJL (D. Idaho October 17, 1995) (Consent Order).

DOE anticipates that it may treat up to an additional 120,000 cubic meters of the TRU waste, alpha LLMW, and LLMW as bounded by this environmental impact statement. These wastes are currently located, or may be generated, at other areas on the INEEL and at other DOE sites. Depending on future DOE decisions, the treatment of these wastes could occur at the INEEL. Transfers of TRU waste from other sites for treatment and interim storage at INEEL would involve revision of the TRU Record of Decision that DOE issued on the *Final Waste Management Programmatic Environmental Impact Statement* (DOE 1998a), and be subject to agreements, such as those between DOE and states, relating to the treatment and storage of TRU waste.

3. ADVANCED MIXED WASTE TREATMENT PROJECT FACILITY DESCRIPTION AND ALTERNATIVES

3.1 Advanced Mixed Waste Treatment Project Facility

The Advanced Mixed Waste Treatment Project (AMWTP) facility would be located at the Radioactive Waste Management Complex (RWMC) in the southwestern corner of the Idaho National Engineering and Environmental Laboratory (INEEL). Figure 3.1-1 is a map of the RWMC that also shows the location of the RWMC at the INEEL. The AMWTP facility would be designed, built, and operated by BNFL Inc., under a privatized contract with the U.S. Department of Energy (DOE).

The AMWTP facility would be located in the Transuranic Storage Area (TSA) of the RWMC. Figure 3.1-2 is a three-dimensional view of the TSA showing the AMWTP facility in its proposed, as-built location. The facility would have the capability to treat specified INEEL waste streams, with the flexibility to treat other applicable INEEL and DOE onsite and offsite waste streams. Under the BNFL Inc. contract, the contractor cannot treat waste from sources other than DOE.

The goal of the AMWTP facility is to treat transuranic (TRU) waste, alpha-contaminated low-level mixed waste (alpha LLMW), and LLMW to produce final waste forms that are certified for disposal. After treatment, TRU waste would be disposed of at the Waste Isolation Pilot Plant (WIPP) in Carlsbad, NM. After treatment, LLMW would be disposed of at an approved disposal facility depending on decisions to be based on DOE's *Final Waste Management Programmatic Environmental Impact Statement* (WM PEIS). The AMWTP facility would be designed specifically to treat approximately 65,000 cubic meters of contact-handled (CH) TRU waste, alpha LLMW and LLMW from the RWMC. The facility may also process up to 120,000 cubic meters of additional waste from the INEEL and other DOE sites, for a total of up to 185,000 cubic meters. The facility would be designed with an operational life of approximately 30 years. Operation of the facility for its entire design life would depend on DOE approval and the availability of additional waste for treatment.

Because the proposed project is subject to *Resource Conservation and Recovery Act* (RCRA) permit conditions, a proposed RCRA Closure Plan was submitted to the State of Idaho in September 1998. That draft Closure Plan provided the State RCRA regulators with the technical information necessary to generally analyze the overall impacts of the proposed project through the RCRA closure process. The draft Closure Plan is included in the Administrative Record for this EIS.

Closure is usually analyzed under RCRA only from the standpoint of the potential risks during the cleanup of hazardous constituents. Because it is quite likely that the contamination on the equipment would be both hazardous and radioactive, the closure process would actually involve both RCRA closure and some decontamination and decommissioning (D&D) activities. Generation of waste from RCRA closure is expected to be minimal and is within the types and quantities of waste analyzed in this Final EIS.

The nature, extent and timing of future D&D activities are not known at this time. Choices currently exist, both technically and under the environmental regulations, for performing final D&D, and DOE expects that there will be additional options available in the future. No meaningful alternatives or analysis of impacts can be formulated at this time since D&D is so remote in time that neither the means to conduct D&D, nor the impacts of the actions, are foreseeable in the sense of being susceptible to meaningful analysis now. Accordingly, D&D activities are not analyzed in detail. Once meaningful proposals concerning D&D activities are developed, DOE will undertake any additional *National Environmental Policy Act* (NEPA) analysis that may be required.

Figure 3.1-1. Location of the AMWTP facility.

3.1.1 Advanced Mixed Waste Treatment Project Facility Description

The AMWTP facility is proposed to be on the southern portion of the 56-acre TSA, between the existing Transuranic Storage Area Retrieval Enclosure (TSA-RE) to the west and the seven RCRA-compliant Type II storage modules to the east (see Figure 3.1-1). The proposed AMWTP facility would be located near the center of the TSA, which would avoid moving retrieved wastes across public roads for treatment. The waste requiring retrieval is stored in the TSA-RE, which is just west of the proposed AMWTP facility. The Type II modules used for interim storage of drums and containers of the retrieved waste are located adjacent to the east side of the proposed AMWTP facility. Other buildings, such as the Type I module and the Transuranic Package Transporter, Model 2 (TRUPACT-II) Loading Facility, are also located near the AMWTP facility (see Figure 3.1-1). Waste retrieved from the TSA-RE would remain within the boundaries of the TSA until transport to final disposal or to subsequent treatment locations.

The AMWTP facility layout would be designed for material handling and process flow requirements. General arrangement, elevation, and section drawings can be found in the AMWTP RCRA Part B Permit Application located in the INEEL Technical Library in Idaho Falls, Idaho.

The proposed AMWTP facility would be a two-story industrial-type structure with a rooftop mechanical penthouse. The general building height is about 44 feet. The facility houses approximately 60,000 square feet per floor. The rooftop mechanical penthouse encloses approximately 20,000 square feet of additional space and is about 67 feet above ground level at the eave. The utility building attached to the south end of the facility is about 7,300 square feet of space. The facility stack extends from the south end of the building and is enclosed by a structure approximately 19 feet square. The stack (actually a windscreen enclosing seven individual flues) is about 15 feet in diameter and approximately 90 feet high. Further detailed information on the stack can be found in Appendix B, Facility Description Information.

The process portion of the building is generally described as having two levels, but many of the spaces are open from the first floor to the roof structure; others have mezzanine levels or intermediate equipment access platforms. Operations and maintenance personnel may access various work areas via a continuous corridor system around the perimeter of the process area and a central operator corridor on the second floor that separates the non-thermal pretreatment/treatment areas from the thermal treatment areas.

The proposed AMWTP facility is divided into three areas, or zones, for the purposes of radioactive contamination control. Zone 1 is uncontaminated and no clothing or equipment is needed to protect personnel. Zone 2 may be slightly contaminated and workers wear protective clothing. Zone 3 areas are contaminated and these areas are where the process equipment is placed. Zone 3 areas are not normally occupied. When personnel enter Zone 3 areas they must wear full protective equipment. Cross-contamination between zones is prevented by maintaining differential air pressure between zones and by rigorous clothing change procedures and radiation screening. Air within the AMWTP facility generally flows from the outside through the clean areas into Zone 1, then into Zone 2, and then flows into Zone 3 areas (see Appendix B). Under normal operations, uncontainerized waste is located only in Zone 3 areas. Zone 1 and 2 areas remain clean and accessible to AMWTP facility workers. Access to Zone 3 areas is by radiological work permit only.

The AMWTP facility design also includes features and systems that compartmentalize the facility into separate fire zones that comply with applicable Uniform Building Code and National Fire Protection Association standards. Compartmentalization is provided to create separate fire zones or areas of fire control within the facility, separate thermal treatment equipment rated at over 400,000 Btu/hr from the rest of the facility, and create a protected means of egress out of the facility in the event of a fire.

The building design provides egress systems per the Life Safety Code (National Fire Protection Association 101), wherein a means of egress is a continuous and unobstructed way of exit travel from any point in the building or structure to an area outside the facility. Means of egress comprising vertical (stairs) and horizontal travel (corridors), including intervening room spaces, are provided through the operator corridors around and through the pretreatment and treatment areas of the facility and stair towers.

The proposed AMWTP facility would be composed of the following areas: Administrative/Personnel Support Areas; Personnel Access/Security Areas; Offices/Meeting Room Areas; Control Room/Computer Room Areas; Men’s/Women’s Clean Change Rooms; Backup Monitoring Room; Subchange Rooms; Waste Receiving and Staging Area; Supplies Receiving/Low-Level Waste Loading Area; Pretreatment Areas; Box Line; Drum Line; Box Size

Reduction Area; Drum Assay Area; Analytical Laboratory; Drum Staging Area; Central Conveyor Area; Grout Preparation Area; Treatment Areas; Supercompaction/Macroencapsulation Area; Drum Cure Area; Special Case Waste Glovebox; Incineration Area; Thermal Treatment Offgas Systems Area (includes Brine Evaporation); Microencapsulation Grout Preparation Area; Microencapsulation Drum Core Area; Loading Staging Area; Maintenance Areas (Hot and Cold); and Mechanical/Electrical Support Areas. If vitrification of incinerator ash were to be included in the AMWTP facility process instead of microencapsulation, the facility would include a Vitrifier Feed Staging Area, a Glass Former Mixing Area, and a Vitrification Area. These areas would be sited where the microencapsulation areas are located. A discussion of the listed areas can be found in Appendix B.

3.1.2 Advanced Mixed Waste Treatment Project Process Description

The TSA-stored waste designated for treatment at the AMWTP facility would be retrieved, characterized for storage and treatment, stored in preparation for treatment, pretreated, treated, repackaged, certified, staged for shipment and finally loaded for shipment to WIPP or another appropriate facility. Non-TRU final waste forms would be stored onsite or shipped to a permitted disposal facility when one becomes available. Containers typically would be transported/transferred to, from, and within the AMWTP facility using forklifts, trucks, trucks with trailers, conveyors, hand trucks, and other transport vehicles.

3.1.2.1 Retrieval. The existing Type I and II storage modules make up the Waste Storage Facility (WSF), which is currently permitted for storage under the Idaho *Hazardous Waste Management Act* (HWMA) permit, *Final HWMA Storage Permit for the Radioactive Waste Management Complex on the Idaho National Engineering and Environmental Laboratory* (RWMC HWMA Storage Permit). Prior to commencement of AMWTP facility operations, BNFL Inc. would take over as operator of a portion of the WSF (and the RWMC HWMA Storage Permit).

Of the approximately 65,000 cubic meters of waste stored at the TSA, approximately 13,000 cubic meters of waste is stored in the Type II modules. A protective structure (the TSA-RE) has been constructed over the remaining approximately 52,000 cubic meters of waste, much of which is enclosed by an earthen-covered berm. Only some of this waste will be able to meet the WIPP waste acceptance criteria (WAC) in its existing condition. None of it is anticipated to meet RCRA land disposal restriction (LDR) standards without some form of treatment. The TSA-RE provides confinement and weather protection for retrieval operations. The location of the Type I and II modules and the TSA-RE is shown in Figure 3.1-1.

3.1.2.2 Preliminary Characterization. Following retrieval of the waste from the TSA-RE, waste would initially be characterized in the Type I module. The Type I module would house two real-time radiography (RTR) units, two drum radioassay systems, and a box assay system. Drums and boxes are received at the Type I module from the TSA-RE. Waste is unloaded into the Type I module, then the drums and boxes would be placed in interim staging areas awaiting RTR examination, radioassay, and transport to the Type II modules for storage, pending treatment. Select drums pass through the Drum Vent Facility in the Type I module for head space gas venting, filter installation, and/or sampling prior to routing to the Type II modules for storage.

Retrieved containers would undergo RTR examination to determine physical waste parameters (e.g., metals, cellulosics, rubber, plastics, soil, sludge) and to detect items that do not meet the applicable WAC. The RTR examination would also provide information about the waste matrix to facilitate the selection of a radioassay technique (passive/active neutron and/or high-resolution gamma scan) and enable radioassay matrix correction factors to be assigned. The visual examination of RTR images also validates existing characterization data, or, in the case of unlabeled containers, helps to correlate the contents of the container with known waste types. Wastes types that might contain flammable atmospheres will be identified through this process. Details of preliminary characterization activities are described in the AMWTP RCRA Permit Application — Section C (BNFL 1997a).

3.1.2.3 Storage. After preliminary characterization in the Type I module, most of the waste containers would be taken to the Type II modules, where the containers would be grouped by waste category, container type, and fissile material content. The purpose of this staging is to build up an inventory of waste to facilitate efficient treatment campaigns. These wastes will include all corrosive and reactive wastes present in the stored waste inventory. All corrosive and reactive wastes are pre-treated in the Special Case Waste Glovebox to neutralize and stabilize them prior to thermal treatment. In the Type II modules, the waste containers would be sorted by general waste type and characteristics into treatment campaigns, then transported to the AWMTP facility for treatment.

3.1.2.4 Pretreatment. The waste containers would be transported from the WSF to the waste receiving and staging area of the AMWTP facility. The waste would be then transferred within the facility to the pretreatment lines or directly to treatment processes. The primary pretreatment processes contained within the AMWTP facility to sort and pretreat the waste would include the following:

- Pretreatment box line areas where the outer box containers are removed and broken down; and the box contents are removed, size-reduced using a waste feed shredder, and sorted into feed categories for downstream treatment processes; and
- A pretreatment drum line area where facilities would be provided to open the drums, identify the waste contents, and sort the waste for feed to the downstream treatment processes.

Each pretreatment line area is equipped with a packet X-ray that may be used to confirm the content of selected items or containers sorted out of the waste to be processed. Following sorting in the box or drum line, waste destined for treatment would be characterized using one or more of the following methods, depending on the treatment to be performed: radioassay, sampling and analysis, proximate analysis, and X-ray fluorescence spectrometry. Certain waste categories are suitable as direct feed for supercompaction and/or macroencapsulation. These drums do not undergo pretreatment, but pass directly to the downstream treatment processes via the central conveyor system. Drums that bypass pre-treatment for the supercompaction line are previously characterized in the preliminary characterization process to assure explosive safety in the drum puncturing operation which is integral to supercompaction. Pretreatment processes are described in greater detail in the AMWTP RCRA Permit Application, Book 2 (BNFL 1997a).

Pretreatment area (Zone 3 and Glovebox) air emissions control is provided by a recirculatory self-cleaning reverse jet air filtration system. Containment features will prevent the spread or release of contaminant materials both within the facility and to the environment. Air extracted from the Zone 3 area would be passed through three stages of high-efficiency particulate air (HEPA) filtration before exiting through the facility stack. Each bank of HEPA filters includes a backup capacity. In some areas, carbon filtration would also be provided downstream from the first-stage HEPA filter to capture organic emissions. More detailed information on the emissions control system is provided in Appendix Section E-3.2.9.1.

3.1.2.5 Treatment. The AMWTP treatment processes would be designed to contract specifications that require: 65 percent volume reduction, treatment to RCRA LDR standards and *Toxic Substances Control Act* (TSCA) requirements, and treatment to meet WIPP WAC. The facility and equipment would be designed to process up to 85,000 cubic meters of waste in the first 13 years of operation. In the event WIPP is unable to receive and dispose of INEEL TRU waste, or if there are changes to the WIPP WAC, no major changes to the facility design are anticipated since the waste would be treated to RCRA LDR standards, which are the most stringent existing requirements for disposal. Some changes or substitutions to the proposed processes may occur, provided the performance requirements specified in the contract are met. Any proposed substitutions or major change in a treatment process would be evaluated as appropriate under NEPA before a final decision is made.

Several technologies proposed under the various action alternatives are analyzed in this EIS. They are:

Supercompaction. The supercompaction process may receive drums of sorted debris waste from the pretreatment lines or direct feed drums from the waste receiving and staging area via the central conveyor system. The drums of waste would be punctured, then compacted by a hydraulic press that controls the shape of the resultant supercompacted "puck" through the use of a mold. Because drums entering the supercompactor will have been previously characterized and vented, puncturing and compaction within the supercompactor is not likely to present a credible explosion hazard. The supercompactor and its associated air pollution control system have been designed to accommodate such overpressures, should they occur. Under the extreme pressure of supercompaction, gas would be vented and processed through the facility air pollution control system. The volume reduction for each drum is dependent on thedrum contents and packing fraction but is expected to be an average of 80 percent. The pucks would be placed into a puck drum, which is located in the postcompaction glovebox. The puck drums would then be transferred to the macroencapsulation process. The puck drum would be the final waste form's outermost container.

The supercompactor would size-reduce 55-gallon drums containing debris mixed waste, and it is sized to process the peak throughput of approximately 96 drums per day. Drums would be delivered to the supercompactor from two primary sources: the direct-feed line or from the box/drum pretreatment lines. Direct-feed drums (assessed through characterization and RTR analysis as not requiring pretreatment) would be transferred directly to the supercompaction area via the central conveyor system. Waste containers requiring pretreatment would be processed through the box or drum lines first, and repackaged into 55-gallon drums. During the supercompaction process, drums would be managed and compacted within stainless steel gloveboxes. Pucks produced by the process would be staged in the puck staging area of the postcompaction glovebox until they would be loaded into puck drums. A more detailed description of the supercompactor can be found in Appendix B.

Macroencapsulation. Waste is fed into the macroencapsulation process in two forms: containers of pucks and noncompactible debris waste from the pretreatment lines sent directly in mesh baskets within reusable transfer containers via the central conveyor system.

The grout used in the macroencapsulation process is prepared in the adjacent grout preparation area. The grout would be piped from the grout preparation area to the postcompaction glovebox, where it is poured into the puck drum, thus stabilizing the noncompactible waste or pucks in the final waste form container. Grouted drums would be lidded and allowed to cure at the drum cure area.

The macroencapsulation system would be used to encapsulate pucks or large pieces of metal debris not suitable for compaction. The throughput for the macroencapsulation system is approximately 24 loaded puck drums per day. The system comprises three areas: the grout preparation area, the puck drum grout filling station in the postcompaction glovebox, and the drum cure area. The grout preparation area contains equipment for mixing the grout formulation. The puck drum grout filling station includes two bagless transfer systems for importing puck drums and then loading them with pucks or metal debris (in metal baskets) and grout. The grout filling process is interlocked and controlled to prevent overfilling. When the puck drums are filled with waste and fully encapsulated, they would be routed to the drum cure area. The drum cure area would hold up to 28 drums and has a throughput of approximately 24 drums per day. After curing for approximately 24 hours, the final waste form containers would be assayed and certified for final disposal at WIPP or another appropriate facility. A more detailed description of the macroencapsulation system can be found in Appendix B and the AMWTP RCRA Permit Application (BNFL 1997a).

Special Case Waste Glovebox. Special case waste is defined in this EIS as those wastes that are not suitable for direct treatment via the primary AMWTP facility supercompaction, macroencapsulation, incineration, and microencapsulation (or optional vitrification) treatment processes. Corrosive and reactive wastes are neutralized in this process area (described in more detail in Appendix Section B-1.3.1) prior to incineration. Special case waste includes wastes that may require additional characterization and/or pretreatment (e.g., neutralization and/or absorption) prior to processing via incineration/microencapsulation (or optional vitrification) or final treatment (e.g., amalgamation to meet RCRA LDR treatment standards) prior to disposal. Some examples of special case waste are listed below:

- Containers of liquids (i.e., containerized liquids) removed from the original waste containers
- Free liquids (i.e., non-containerized liquids) removed from the original waste containers and containerized prior to transfer to the Special Case Waste Glovebox
- Residual liquids accumulated in the sumps and other containment devices in the pretreatment areas and the Supercompaction/Macroencapsulation Area which are removed and containerized prior to transfer to the Special Case Waste Glovebox
- Elemental mercury, in the form of containerized liquid, free liquid, or residual liquid, from the areas identified above or from the mercury holding tank, which is removed and containerized, if required, prior to transfer to the Special Case Waste Glovebox

- Those waste streams that warrant further evaluation prior to treatment.

Containerized, free, and residual liquids and elemental mercury are expected to be the most common types of special case waste transferred to the Special Case Waste Glovebox for processing.

Appendix Section B-1 describes in greater detail the non-thermal treatment processes: supercompaction, macroencapsulation, microencapsulation, and special case waste treatment.

Incineration. Incineration is the currently proposed method of thermal treatment and is the technology that is analyzed as being representative of thermal treatment. Potential variability in the AMWTP feed stock would be minimized through iterations of characterizing and sorting the waste prior to its arrival at the thermal treatment unit, as described in previous paragraphs. Sorted waste would be treated in discrete campaigns in which final feed rates and composition would be tuned for optimum plant performance and maximum safety. Wastes destined for incineration would be crushed and shredded by a series of size-reducing equipment located at the head of the incineration process. Approximately 25 percent of the 65,000 cubic meters of waste at INEEL is assumed for NEPA analysis to be thermally treated. These wastes will include all corrosive and reactive wastes present in the stored waste inventory. All corrosive and reactive wastes would be pre-treated in the Special Case Waste Glovebox to neutralize and stabilize them prior to thermal treatment. The size-reduced waste is conveyed to a waste hopper, where it would be held until it is fed at a controlled rate into the incinerator glovebox feed system. The incinerator, as currently proposed, is a dual-chamber auger hearth system fired by propane gas. The AMWTP incinerator feed stock will be continuously supplemented by propane to maintain combustion temperatures and flame residence times in ranges adequate to assure full thermal destruction of all waste materials and their intermediate combustion products. The primary combustion chamber operates at 1,500 to 1,600^{o}F and the secondary chamber at 2,200 to 2,400^{o}F. The incinerator has a feed capacity of 650 pounds per hour of solid waste. Both steam reforming and a plasma hearth process are possible alternatives to the proposed auger hearth system. The selected incineration system will be included in the final facility design. Resultant ash from the incinerator would be fed into transfer drums, which are then closed and transported via the centralized conveyor system to a staging area. Incineration is described in more detail in Appendix Section B-2.2 of this document. Energy for evaporation of the salt brine would be provided by enclosed steam heating lines. Water and any volatiles which are evaporated in the salt-drying process would be returned to the packed-bed absorber so that no emissions result from the salt drying operation.

The incinerator air pollution control system (APCS) would include a combination of dry filtration and wet scrubbing systems. The incinerator primary combustion chamber and secondary combustion chamber are integral to the control of airborne emissions from the incinerator because they volatilize and combust waste organic matter. In addition, the downstream APCS will further control pollutants present in the offgas prior to release to the atmosphere. The APCS for the AMWTP facility incinerator will consist of the following: saturation quencher, venturi scrubber, two absorbers in series, condensing wet electrostatic precipitator (WESP), offgas reheater, redundant first stage HEPA filtration, carbon absorbers, redundant second and third stage HEPA filtration, associated pumps and blowers, and an exhaust flue. Operating ranges will be finalized during the HWMA/TSCA trial burn and incorporated into the facility operating and maintenance manual, required 60 days after start of operations. More detailed information on the incinerator APCS can be found in Appendix Sections B-2.3 and E-3.2.9.3.

Brine Evaporation. The main component of the brine reduction system is an evaporator used to dry the scrubber brine blowdown generated from the incinerator APCS. The evaporator also processes inorganic liquid wastes from other areas of the plant. Process brines and other liquids are accumulated and stored in three identical brine mix tanks. During operation, one of these tanks is used to collect the brine blowdown, one is being sampled and stabilized, and one tank is feeding the evaporator.

Microencapsulation. Since the release of the Draft EIS, vitrification has been replaced with microencapsulation as the preferred ash stabilization process. The microencapsulation process is similar in concept to the macroencapsulation process described previously. The microencapsulation process would be used to grout and solidify the incinerator ash and salt from the brine evaporator. The resulting drums of grout would then be ready for final shipping and disposal.

There would be two microencapsulation drum lines in the facility. Ash would be transferred from the Incinerator Area into an ash receipt hopper. The receipt hopper has a nominal capacity of one day of ash production. Ash would then be transferred to an ash blender where high- and low-activity waste ash would be blended to ensure that the final product has a specific activity greater than 100 nCi/g.

Cement powder (ordinary Portland™ cement), pulverized ash, and water would be added to the drum in the in-drum mixing station and mixed. The process would be performed within a Zone 3 glovebox kept at negative pressure to confine any ash that may become airborne during loading. Samples of the mixture would be obtained before an inner lid would be placed on the drum. Once the lid is in place, the drum would be manually swabbed for external contamination, fitted with an outer lid, and transferred to the drum cure area. The microencapsulation process is more completely described in Appendix Section B-4 of this document.

This EIS analyzes the potential impacts of both microencapsulation and vitrification.

Vitrification. Vitrification is an option to microencapsulation for treatment of incinerator ash. Feed to the vitrification process would be ash from the incinerator. Ash destined for vitrification would be transferred to and placed into a hopper and held until fed at a controlled rate into the vitrification unit. A Joule melter has been considered for the vitrification unit, but a direct current arc melter may also be used in its place. Glass-forming chemicals would be continuously fed with the ash to enhance the glass quality of the final waste form. The melter and vitrification processes are more completely described in Appendix Section B-3.1 of this document.

The vitrification offgas treatment system would include a film cooler, cyclone separator, two parallel trains of high-temperature filters, heat exchanges, three HEPA filters in series, and three parallel main blowers which maintain the melter at a constant negative pressure. Efficiency of the cyclone for 10-micron-diameter particles is 80 to 85 percent. The high-temperature filter is designed to collect more than 99 percent of all particles greater than 0.5 microns in diameter and HEPA filters are 99.97 percent efficient for 0.3-micron particles. More detailed information on the melter emission controls are provided in Appendix Section E-3.2.9.4.

3.1.3 Advanced Mixed Waste Treatment Project ***Resource Conservation and Recovery Act*** Closure and Decontamination and Decommissioning

3.1.3.1. ***RCRA Closure.*** "RCRA closure" describes all of those activities that would occur at the end of this project to shut the facility down and minimize any risks to the public from contamination that would exist in the facility. The standards and approach for closure would be required in the RCRA permit, and would minimize the need for further maintenance of the AMWTP site, equipment and facilities by requiring actions that would prevent post-closure escape of hazardous waste, hazardous constituents, leachate, contaminated runoff, or hazardous waste decomposition products to the ground or surface waters or the atmosphere.

According to the draft RCRA Closure Plan, which is a part of the Administrative Record for this Final EIS, for the treatment facility and all government furnished equipment (GFE), BNFL Inc. must remove and dispose of, or decontaminate, all contaminated equipment, structures and soils as required by RCRA.

The draft RCRA Closure Plan proposes removal of wastes, decontamination of equipment and structures, disconnection of energy sources to the equipment no longer operated, and complete dismantling of the treatment units.

Some examples of other deactivation activities that would also occur include:

- tanks, vessels, piping, and idle equipment would be de-energized, drained and flushed,
- ventilation hoods and any gloveboxes would be surveyed and isolated,
- continuous air monitors, air sampling system, and health physics vacuum systems would be reduced to the levels required for decommissioning, and
- underground tanks and equipment sumps would be drained, and access to them for liquid waste collection or discharge would be plugged.

Contaminated equipment will be decontaminated for all contaminants present, including PCBs as indicated by the historical inventory of wastes managed in the unit(s).

Equipment to be disposed of as solid waste would be transported to an onsite or offsite permitted facility in accordance with applicable Federal and State regulatory requirements. The AMWTP contract states that "Final disposal of the process-generated wastes shall be the responsibility of the contractor. TRU waste and low-level waste generated from closure and D&D activities of contractors facilities (including GFE) that is characterized and packaged to WIPP WAC, Rev. 5, or *Idaho National Engineering and Environmental Laboratory Reusable Property, Recyclable Materials, and Waste Acceptance Criteria*, Rev. 5 criteria, respectively will be accepted by the Government for disposal."

Generation of waste from RCRA closure is expected to be minimal and is within the types and quantities of waste analyzed in this Final EIS.

3.1.3.2 Decontamination and Decommissioning. Closure is usually analyzed under RCRA only from the standpoint of the potential risks during the cleanup of hazardous constituents. Because it is quite likely that the contamination on the equipment would be both hazardous and radioactive, the closure process would actually involve both RCRA closure and some D&D activities. Generation of waste from RCRA closure is expected to be minimal and is within the types and quantities of waste analyzed in this Final EIS.

The nature, extent and timing of future D&D activities are not known at this time. Choices currently exist, both technically and under the environmental regulations, for performing final D&D, and DOE expects that there will be additional options available in the future. No meaningful alternatives or analysis of impacts can be formulated at this time since D&D is so remote in time that neither the means to conduct D&D, nor the impacts of the actions, are foreseeable in the sense of being susceptible to meaningful analysis now. Accordingly, D&D activities are not analyzed in detail. Once proposals concerning D&D activities are developed, DOE will undertake any additional NEPA analysis that may be necessary or appropriate.

3.2 Alternatives Analyzed

3.2.1 No Action Alternative

The Council on Environmental Quality (CEQ) NEPA Regulations (40 CFR parts 1500—1508) and the DOE NEPA Regulations (10 CFR part 1021) require the analysis of a No Action Alternative. Under the No Action Alternative, existing waste management operations, facilities, and projects would continue for the management of LLMW and TRU waste on the INEEL. The Management and Operating (M&O) contractor would continue preparation to ship 3,100 cubic meters of TRU waste to WIPP using existing facilities as required by the Settlement Agreement/Consent Order. Retrieval of waste from the TSA-RE would be initiated and completed with re-storage of the retrieved waste in RCRA-compliant storage facilities as described in the *Environmental Assessment: Retrieval and Re-Storage of Transuranic Storage Area Waste at the Idaho National Engineering Laboratory* (TSA EA) (DOE 1992). Shipments to WIPP would continue only as could be supported by existing facilities at the INEEL (see Figure 3.2-1). The INEEL currently does not have the characterization and repackaging facilities necessary to meet shipment schedules required by current agreements. Waste that could not meet the WIPP WAC would be returned to the storage modules at the RWMC for indefinite storage.

Under this alternative, in addition to the initial 3,100 cubic meters, between 3,500 to 7,000 cubic meters of waste would be prepared for offsite disposal and 58,000 to 61,500 cubic meters of waste would remain stored at the RWMC.

The Waste Experimental Reduction Facility (WERF) would continue to treat both onsite and offsite LLMW that meet the WERF WAC. However, current program plans show WERF closing by 2003, leaving the INEEL with only a small encapsulation unit and an evaporative process for treating LLMW. No new major upgrades or new projects would be undertaken. New activities would be limited to ES&H activities required to maintain safe operation.

Wastes that could not be sent to WIPP or another waste disposal facility would be stored in the existing INEEL storage facilities indefinitely. The possible environmental impacts of such an approach have been considered in other DOE NEPA documents including the *Waste Isolation Pilot Plant Disposal Phase Final Supplemental Environmental Impact Statement* (WIPP SEIS-II). The potential impacts of long-term storage of TRU waste at INEEL have been summarized in Section 5.21 of this environmental impact statement (EIS).

The use of this long-term storage approach is not permissible as the law currently stands. RCRA does not allow any public or private entity to store untreated hazardous wastes indefinitely; hazardous wastes must be placed into disposal facilities within a very short period of time after they are generated in order to isolate them from the environment. In the case of the waste at the INEEL, isolation from the environment is particularly important because of the "mixed" nature of the waste. Although environmental laws change over time, DOE is of the opinion that any future change in RCRA is not likely to allow storage of these untreated mixed wastes at the INEEL indefinitely.

Were DOE to continue to store waste, analyses of waste storage for the 100-year period from 2033 to 2133, show that "if DOE continues to provide effective monitoring and maintenance of storage facilities, adverse health effects for the general public would be quite small, and the principal adverse impacts, also small, would be related to occupational activity at the facilities. These health effects would continue at such levels for the indefinite future under the hypothesis of DOE institutional control" (DOE 1997d). In addition, the potential adverse impacts resulting from a storage facility accident would also continue indefinitely.

Over time, the potential for chronic leakage from waste containers and accidents increases. The waste under the No Action Alternative of this EIS is untreated waste, so it contains both hazardous chemicals and unstabilized radioactive waste. The corrosion of the containers may interact with these chemicals, leading to pressure buildup within the containers and a greater likelihood of leakage. Once released, the untreated wastes would pose a greater risk to human health and the environment than the treated, stabilized waste produced in the action alternatives.

If it is assumed that after 100 years of storage "DOE were to lose institutional control of storage facilities, it was estimated that intruders could receive substantial radiation doses, a situation that could persist for the indefinite future. In addition, contaminants in TRU waste stored in shallow trenches and surface storage facilities would eventually be released and would persist in the surrounding environments at the treatment sites exposing onsite and offsite populations to chronic health impacts" (DOE 1997d). If implemented, this alternative would not meet negotiated agreements and commitments (i.e., Settlement Agreement/Consent Order) nor would it meet regulatory requirements under RCRA and TSCA.

Figure 3.2-1. No Action Alternative flow.

3.2.2 Proposed Action/Preferred Alternative

The Proposed Action is DOE's Preferred Alternative. Under this alternative, the M&O contractor would continue preparation to ship 3,100 cubic meters of TRU waste to WIPP using existing facilities as required by the Settlement Agreement/Consent Order. The construction and operation of an AMWTP facility would proceed in accordance with DOE's contract with BNFL Inc. The AMWTP facility would include all the components of the process description identified in Section 3.1.2 and shown in Figure 3.2-2. For the Proposed Action, incinerator ash under the current design would be treated using a microencapsulation process. (Because the AMWTP facility could also use vitrification as an incinerator ash treatment process, the EIS includes analyses for both vitrification and microencapsulation of ash under the Proposed Action in Chapter 5.) Construction of the treatment facility would begin at the permitted siting location, as early as the 1999 construction season. Construction of the treatment facility would be completed no later than December 31, 2002. The facility would begin operation no later than March 31, 2003. The AMWTP facility would treat waste to WIPP WAC, TSCA and RCRA LDR requirements and standards as applicable. Retrieval of waste from the TSA-RE is assumed to begin in calendar year 2001. This early retrieval of waste would be necessary to establish a sufficient quantity of waste to enable efficient treatment. The facility would have sufficient operating capacity to treat approximately 6,500 cubic meters of waste per year. This alternative accommodates the treatment of 65,000 cubic meters of waste at the INEEL during the initial time frame (by 2015 in accordance with the Settlement Agreement/Consent Order) and treatment of up to 120,000 cubic meters of additional waste from the INEEL or other DOE sites by 2033 for a total of 185,000 cubic meters. Only DOE waste that meets the AMWTP WAC, and non-INEEL waste that also satisfies the Site Treatment Plan (STP) Consent Order for receipt and treatment, could be accepted. DOE needs to place these wastes in a configuration that allows for their disposal at the WIPP or another appropriate facility. Under this alternative, approximately 30,000 cubic meters of waste for offsite disposal would result from treating 65,000 cubic meters of waste.[1] If implemented, this alternative would satisfy negotiated agreements and commitments (i.e. Settlement Agreement/Consent Order) and meet regulatory requirements under RCRA and TSCA.

Figure 3.2-2. Proposed Action process flow — 65,000 cubic meters of input volume.

3.2.3 Non-Thermal Treatment Alternative

Under the Non-Thermal Treatment Alternative, the M&O contractor would continue preparation to ship 3,100 cubic meters of TRU waste to WIPP using existing facilities as required by the Settlement Agreement/Consent Order. Some treatment of TRU waste, alpha LLMW, and LLMW would still occur at the AMWTP once built. Wastes such as PCBs, which require thermal treatment, and other waste destined for thermal treatment (e.g., waste with high volatile organic compound [VOC] content) to meet disposal criteria would be repackaged for storage until a treatment option is identified and evaluated under separate NEPA documentation (see Figure 3.2-3). The AMWTP facility would be built at the same proposed location and operated using the treatment options of supercompaction and macroencapsulation. Facility construction would begin as identified in the Proposed Action. Completion of the facility would still occur by December 2002. The Non-Thermal facility size and layout would be the same as described in the Proposed Action. The facility would differ from the Proposed Action in that the thermal treatment processes and corresponding supporting equipment would not be installed. Areas of the facility that were described in the AMWTP to be used for thermal treatment would be reserved for the installation of another drum or box line or for additional treatment processes that may be required in the future. This facility would still receive retrieved waste from the TSA-RE, newly generated INEEL waste, and possibly offsite waste from other DOE sites. Treatment of non-INEEL waste in this facility is anticipated to be minimal. The facility would characterize, treat, and repackage for storage and/or disposal TRU waste, alpha LLMW, and LLMW. This facility would characterize waste in the same manner as described for the Proposed Action; some waste drums would then proceed directly to supercompaction for treatment. The remainder of the waste drums and all of the waste boxes would be opened and the waste would be sorted, sized, and repackaged. The repackaged waste that does not meet the WIPP WAC requirement would be either treated using supercompaction and/or macroencapsulation or be placed into the Type II storage modules until the waste could be disposed of at a disposal facility (other than WIPP), or until other appropriate treatments become available. Through characterization and sorting, the maximum amount of waste possible, would be prepared for shipment to a geological repository such as WIPP. Operation of the facility would continue until 2015 at which time it is anticipated that the need for such a facility would no longer exist. Under this alternative, between 23,000 to 29,000 cubic meters of waste would be prepared for offsite disposal and approximately 14,000 cubic meters of waste would remain stored at the RWMC.[1] If implemented this alternative would not meet negotiated agreements and commitments (i.e., Settlement Agreement/Consent Order) nor would it meet regulatory requirements under RCRA and TSCA.

3.2.4 Treatment and Storage Alternative

Under the Treatment and Storage Alternative, the M&O contractor would still continue preparation to ship 3,100 cubic meters of TRU waste to WIPP using existing facilities as required by the Settlement Agreement/Consent Order. The treatment facility described under Section 3.2.2 would be built in the same location, contain the same treatment processes, and result in the same waste forms. The difference between this alternative and the Proposed Action is that in the Treatment and Storage Alternative, the treated waste would not be shipped to an offsite disposal repository but, instead, would be placed into storage on the INEEL at the RWMC (see Figure 3.2-4). This alternative is being evaluated as a contingency in the event WIPP is unable to receive and dispose of INEEL waste. Long-term storage impacts were previously analyzed in the WM PEIS and WIPP SEIS-II. A discussion of the potential environmental impacts resulting from long-term storage is provided in Section 5.21, Long-Term Storage Impacts. The long-term storage impacts at the INEEL have been tiered from the WIPP SEIS-II. The potential environmental impacts associated with the treatment facility are the same as the Proposed Action.

Figure 3.2-3. Non-Thermal Treatment Alternative process flow — 65,000 cubic meters of input volume.

Figure 3.2-4. Treatment and Storage Alternative process flow — 65,000 cubic meters of input volume.

The wastes would be treated to RCRA LDR standards, packaged for disposal, and then returned to the RCRA-compliant Type II storage modules located at the RWMC. Currently, there are seven RCRA-compliant Type II storage modules within the RWMC. To be able to categorize waste for treatment and also store the treated waste, it is assumed for analysis purposes that possibly three additional Type II modules would be built. The modules to be built would be located inside the existing RWMC fence in the vicinity of the existing storage. The new storage facilities would be built and operated to the same standards as the existing storage modules. The 10 storage modules would only allow for the storage (after treatment) of the 65,000 cubic meters of waste that currently exists in the TSA-RE. For the AMWTP facility to treat other INEEL-generated wastes, additional storage facilities would need to be built or made available, and an acceptable facility location would need to be identified for the new storage facilities. Under this alternative, approximately 30,000 cubic meters of treated waste would be stored at the RWMC.[1]

Wastes from other DOE sites could still come to the AMWTP facility for treatment. As in the Proposed Action, such offsite wastes would only come to the AMWTP facility for treatment in accordance with the STP, and the treated waste would be returned to the waste generator. Implementation of this alternative would not meet negotiated agreements and commitments (i.e., Settlement Agreement/Consent Order) nor would it conform to existing program decisions to dispose of TRU wastes (WM TRU Record of Decision [ROD] [DOE 1998a] and WIPP ROD [DOE 1998b]).

3.3 Alternatives Considered But Not Analyzed

The following alternatives were considered in the selection process described in Section 3.3.1 or in the process of identifying the Proposed Action, but were found not to be reasonable because they were technically infeasible, were not capable of processing the existing waste types, or were not available on the schedule necessary to accommodate DOE's agreement with the State of Idaho. Alternatives found to be unreasonable were not analyzed in detail in this document.

Treatment of the INEEL Waste at a Privatized Facility in Richland, Washington. Under this alternative, U.S. Department of Energy — Idaho Operations Office (DOE-ID) would send to a privatized facility the waste that would meet the WAC for that facility. DOE-ID would still need to build a facility or facilities to characterize, sort, segregate and repackage waste to meet U.S. Department of Transportation (DOT) rules for shipment to Richland.

Waste that could not go to Richland (i.e., TRU waste plus arsenic, asbestos, and beryllium contaminated materials which do not meet the WAC for treatment and/or disposal), after separation and segregation, would still need to be treated and repackaged to meet the WIPP WAC for disposal. DOE-ID would also need to build additional TRUPACT-II loading facilities under this scenario.

Considering that a large percent of the INEEL wastes do not meet the Richland, WA treatment facility's WAC and the facility cannot handle the additional INEEL volume (the permitted capacity is planned to be 2,400 cubic meters per year, which would be overwhelmed by this volume increase since INEEL alone needs to treat a minimum of 5,000 cubic meters per year) this alternative is not considered reasonable.

Siting AMWTP at Another INEEL Location. Other locations for the AMWTP at the INEEL were considered but dismissed because the location of the AMWTP at the RWMC would avoid movement of retrieved waste across public roads. Alternative sites were formally reviewed in support of the *Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs Environmental Impact Statement* (DOE INEL EIS) and as part of the siting license requirements for the AMWTP facility (Monson 1997). For analytical purposes, the DOE INEL EIS analyzed the potential impacts of a treatment facility at a "greenfield" undisturbed site approximately 2.5 miles east of the RWMC. However, that site was not selected for this facility.

Ship to Other DOE Facilities for Treatment. The use of other existing DOE thermal treatment facilities, such as the Consolidated Incineration Facility and M-Area Vitrification Facility at Savannah River Site, the Remote Handled TRU Treatment Facility (in design) in Oak Ridge, and the TSCA incinerator at Oak Ridge Reservation, was also considered but eliminated from detailed study. Based on the amount of onsite waste needing processing at these sites prior to accepting offsite (e.g., INEEL) wastes, the restrictive WAC, and the limited throughput of these facilities, the schedule required for the INEEL program would not be met. In addition, DOE considered shipping untreated waste to the WIPP for treatment and disposal. This was not considered further because it would require changing the WIPP WAC for transportation, legally binding orders, and agreements stipulated in the Settlement Agreement and the INEEL STP under the *Federal Facility Compliance Act* (FFCA). The SEIS-II Action Alternative 2C included analysis that assumed contact-handled (CH)-TRU waste would be treated at WIPP; however, this alternative was not selected in the SEIS-II ROD.

Chop and Grout Alternative. This alternative is a form of macroencapsulation. As a primary process, waste containing PCBs, mercury, and semi-volatile and volatile chemicals would not meet disposal requirements, or RCRA LDR standards, using a chop and grout process. Waste to be processed in the Proposed Action would be handled by the chop and grout process as part of supercompaction and macroencapsulation. The potential environmental impacts associated with chop and grout would be similar to, or potentially greater than, those associated with the proposed supercompaction and macroencapsulation. Chop and grout would not result in the desired volume reduction and would in fact result in an increased waste volume.

In addition, a chop and grout treatment by itself is not a reasonable alternative due to the various physical waste types that may exist in the waste to be treated. Experience has shown that with a wide variety of waste types, the use of a chop and grout process can result in increased equipment down time and, as a result, additional maintenance worker exposure. Therefore, this alternative has not been considered as a primary treatment alternative.

Chemical Processing. Chemical processing refers to any process that removes or changes an unwanted characteristic of the waste using a discrete chemical reaction. Chemical processing may refer to several different types of reactions ranging from neutralization of acids and bases, selective oxidation and reduction reactions, to amalgamation of mercury, or many other reactions. Chemical processing tends to be very specific, not be applicable to broad categories of waste, and produces reaction products, which may also be very difficult to control and dispose. Although BNFL Inc. is planning to use chemical processing in the proposed AMWTP for very small volume waste streams, including mercury amalgamation and neutralization, it is not a reasonable primary treatment alternative.

Biological Processing. As the name implies, biological processing is the use of living organisms to induce reactions that remove or stabilize a toxic characteristic of the waste. Biological processes are most applicable to dispersed hydrocarbon contamination and possess a limited ability to stabilize some metals. Because of the types of waste designated for treatment in the AMWTP, biological processing is not feasible or reasonable.

Other Thermal Treatment Processes. DOE has completed numerous assessments of thermal treatment technologies. The DOE publication, *Report of the Technical Peer Review of Thermal Treatment Technologies for TRU, TRU Mixed, and Mixed Low-Level Wastes,* November 1995 (DOE 1995b), assessed the current status and stage of development of non-incineration thermal treatment systems "to identify technically matured technologies." The Peer Review Panel identified several non-incineration thermal treatment technologies as having "reached a development maturity sufficient enough to begin commercial operation," but also identified "a number of cross-cutting technical issues that represent some risk for commercial operation and apply more or less to all thermal treatment technologies under development by DOE." Also, the *Savannah River Site Waste Management Final Environmental Impact Statement* (DOE 1995c) evaluated both existing and emerging waste treatment technologies for alpha and non-alpha LLMW. Appendix D of the Savannah River Site EIS provided a summary of conventional and emerging treatment technologies that were considered or considered and then rejected from further consideration. Approximately 30 emerging treatment technologies for LLMW treatment were considered based on criteria of availability and proven technology. Two of the 30, vitrification and plasma furnace, were described as being "available" and only vitrification was described as a "proven technology" and then only for treatment of high-level waste. The remaining 28 technologies were considered not reasonable as proposed alternatives when evaluated against the available and proven technology criteria used by the Peer Review Panel.

The following is a discussion of several technically feasible thermal treatment technologies that were potentially applicable to the AMWTP facility. These technologies would need further development before being formally considered for use in the AMWTP.

Steam Reforming. Steam reforming has received attention due to its perceived ability to be permitted as a non-incineration process. Steam reforming is a process by which very hot steam (700° C) is reacted with hydrocarbon materials to produce hydrogen and carbon monoxide. The process has low rates of reaction and thus requires quite long residence times in the hot reaction zone. Although steam reforming has technical merit, and the environmental impacts were found to be equivalent to those of incineration, the process is limited to processing only incinerable waste without heavy metals and has not been proven capable of treating PCBs or other potentially harmful volatile and semi-volatile chemicals found in the INEEL TRU waste and alpha LLMW streams. Therefore, it is not analyzed as a separate alternative in this document.

Fixed and Rotating Plasma Hearth Processes. Plasma processes are based upon electrically ionizing a gas into highly charged plasma. The plasma is then directed at the waste. The waste is heated by absorbing energy directly from the plasma and by resistive current flow. Plasma processes are characterized by their very high point source temperatures (several thousands of degrees). Plasma heating has been used in two primary configurations. The first is a fixed hearth in which the waste to be melted is in a fixed tub with the plasma torch being gimbaled over the waste, creating a molten pool. The second is a rotating hearth in which the waste is added to a rotating tub which moves the waste under the plasma torch. When waste has been melted, the rotation is slowed, allowing the waste to exit via a central hub drain. Both configurations have high melt temperatures and are advertised as being able to process a wide range of waste types. Plasma melters have had little testing on actual radioactive waste. Although the environmental impacts associated with plasma melters were found similar to incineration, operational experience is limited, the process has not been tested commercially, and further developmental work would be required before this alternative can be proven to be a viable option for INEEL mixed TRU and alpha waste streams. Therefore, it is not analyzed as a separate alternative in this document.

Direct Current and Alternating Current Arc Melters. Direct current and alternating current arc melters operate by creating an electrical arc and resistive current path through the waste, causing it to melt. In the direct current melter, the current path is between a central electrode and an outer conductive hearth. In the alternating current melter, the current path is between three electrodes that are at different electrical potentials. The electrodes are made of high-purity carbon. Both direct current and alternating current arc melters have been extensively used in the recycled steel industry for many decades. Arc melters produce high-temperature melts, much like plasma melters, and have been advertised as being applicable to a broad variety of waste types. Direct current and alternating current arc melters have been tested on surrogate radioactive waste. Little testing has been conducted on actual radioactive waste; therefore, based on the lack of production-scale radioactive waste processing experience, this is not a reasonable alternative.

Molten Metal. This technology employs the use of a molten bath of iron or nickel. The waste to be processed is ground up into fine particles and injected into the bottom of the metal bath. Liquid or gas waste may also be injected into the metal bath. The highly reducing characteristics of the metal bath decompose hazardous hydrocarbons to hydrogen and carbon monoxide. Elemental metals are incorporated into the metal bath. Metal oxides, which are not soluble in the metal phase, form a slag layer on top of the bath. Testing done thus far has indicated that molten metal technology does not easily process highly heterogeneous materials, requires a secondary combustion system to oxidize hydrogen and carbon monoxide, may cause excessive corrosion of the refractory at the slag-metal interface, and may produce highly reduced metal particles in the off-gas treatment system which may self-heat when exposed to oxygen. Therefore, due to the technical limitations and the additional emission control features required to use this process, this is not a reasonable alternative.

Joule-Heated Melter. Joule melters operate by passing a current between two electrodes. The current passes directly through the waste, heating it resistively very much like an electric stove burner. Joule melters have been used for many years in the glass-making industry. Joule melters rely to a very high degree on the electrical characteristics of the waste and glass-forming additives that are not suitable for treating highly heterogeneous waste materials. It should be noted the 65,000 cubic meters of waste at the INEEL are very heterogeneous; therefore, this process cannot be considered as a primary treatment for all INEEL waste. Joule melters are currently being used to produce high-level radioactive waste glass at the Savannah River Site and West Valley, New York, and are proposed for use at the Hanford Site. This technology is being analyzed as part of thermal treatment but, because it cannot be used to process all waste types, this is not a reasonable primary thermal treatment process.

Molten Salt Oxidation. The molten salt process employs a bath of magnesium carbonate into which selected waste is injected. Hazardous hydrocarbons are oxidized to water and carbon dioxide. Halogens, such as chlorine, are retained within the bath as magnesium chloride. Solids added to the bath either remain as a separate solid phase or are dissolved in the melt at high temperature. Molten salt oxidation is most suitable for the oxidation of liquid hydrocarbons under conditions in which permitting of a traditional incinerator may not be possible. Most solids and some liquids that have ash-forming ability tend to raise the melting point of the magnesium carbonate. This rise in bath melting point may cause it to solidify during operation. Because of this, the feed to the molten salt oxidation process must be carefully controlled. Because of these process technical concerns, this process was dropped from future consideration.

3.3.1 Advanced Mixed Waste Treatment Project Selection Process

DOE has been storing TRU waste at the INEEL since the early 1970s. Most of this waste came from the DOE Rocky Flats Plant and is in drums and boxes placed on an asphalt pad at the RWMC at the INEEL. The waste is covered with tarps, plywood, and soil and is referred to as an earthern-covered berm. Some waste is also stored in modules at the RWMC. The total volume of waste is approximately 65,000 cubic meters.

The drums and boxes, in which the waste is stored, have a 20-year design life and were not intended to provide permanent containment of the waste. The drums and boxes in the earthen-covered berm are subject to breaching and failure through corrosion or decomposition, creating a potential for the wastes to be released to the environment. In addition, the hazardous wastes (approximately 95 percent of the 65,000 cubic meters) are subject to treatment under a RCRA FFCA STP and Consent Order.

In the early 1990s, DOE considered plans to retrieve the stored waste from the earthen-covered berm, segregate the intermingled alpha LLMW from the TRU waste, and build and operate a two-phased treatment facility. Alpha LLMW was to be treated to comply with RCRA LDR standards and the TRU waste was to be treated to meet the WIPP WAC. (WIPP is a disposal facility for TRU waste that DOE has developed near Carlsbad, NM.) Additional RCRA storage modules were also planned for the retrieved and/or treated waste.

In 1992 and 1993, DOE undertook studies to examine the potential for private sector treatment of alpha LLMW. These studies concluded that cost savings could be achieved and the schedule shortened by seven years from that proposed by the INEEL M&O contractor if DOE were to undertake the waste treatment. As a result, DOE issued a Scope of Work for a "Feasibility Study of Treatment Services for Alpha-Contaminated Mixed Low Level Waste." Three private sector teams provided feasibility studies in 1994. After extensive evaluation, DOE decided to pursue the procurement of treatment, assay, and characterization services for waste from the private sector, and to treat the alpha LLMW and TRU waste together to RCRA LDR standards. Information from the feasibility studies was provided for analysis in the DOE INEL EIS (DOE/EIS-0203-F, April 1995). In the 1995 DOE INEL EIS ROD, DOE decided to construct treatment facilities at INEEL to treat TRU waste and alpha LLMW necessary to comply with the FFCA. Treatment of TRU waste at a minimum was to be for the purpose of meeting the WAC for disposal at WIPP and to occur on a schedule to be negotiated with the State of Idaho. This EIS tiers from the information and environmental analysis contained in the DOE INEL EIS.

On October 17, 1995, the State of Idaho, the Department of the Navy, and DOE settled the case of *Public Service Co. of Colorado v. Batt*, Civil No. CV 91-0035-S-EJL (D. Idaho) (Lead case). Certain conditions of the Settlement Agreement/Consent Order obligated DOE to:

- Commence procurement of a treatment facility at the INEEL for the treatment of TRU waste, alpha LLMW, and LLMW, and
- Execute a procurement contract for a treatment facility by June 1, 1997, complete construction of the facility by December 31, 2002, and commence operation by March 31, 2003.

Also, the INEEL STP, negotiated with the State of Idaho in accordance with the FFCA, includes a schedule for constructing treatment capacity for the TRU waste and alpha LLMW, which is consistent with the milestones in the Settlement Agreement/Consent Order. In accordance with the Settlement Agreement/Consent Order and STP, DOE conducted a procurement for a facility to treat the wastes described above.

In January 1996, DOE issued a final request for proposal for treatment of TRU waste, alpha LLMW, and LLMW. Proposals were received from four teams, three of which were determined to be in the competitive range. Each proposal contained a suite of treatment technologies evaluated for use on the INEEL stored wastes. The unique process described in DOE’s Implementing Regulations (10 CFR 1021.216) was used to allow DOE to compare the potential environmental impacts between approaches suggested by competing offerors during this procurement process. DOE compared these impacts in an Environmental Critique (November 22, 1996). The environmental considerations detailed in the critique were made available to DOE’s Source Evaluation Board, and became a part of the technical criteria against which the competing offerors were evaluated during the procurement process. The results of the Environmental Critique were summarized in an Environmental Synopsis that was made available to the public (DOE 1998e). An environmental comparison of the proposed technologies is contained in Table 3.3-1.

As a result of this competition and the comparison of potential environmental impacts associated with the competing proposals, the Source Evaluation Board chose BNFL Inc. in December 1996 as the winning contractor for Phase I of the project. Phase I of the contract addresses permitting, a NEPA review, and an environment, safety and health authorization process. Before deciding whether to authorize BNFL Inc. to proceed with construction (Phase II) and operations (Phase III), DOE must complete this EIS. If, after completing this EIS, DOE decides not to move forward with construction and operations of the project, the contract will be terminated.

Table 3.3-1. Environmental comparison of offeror proposed AMWTP technologies.

Discipline	Baseline from DOE INEL EIS	Technology A[a]	Technology B[b]	Technology C[c]
Land Use	200 acres of previously	Less than 10 acres of	Approximately 5	40 acres of previously

	undisturbed land would be impacted. Facility to be located outside of the RWMC 2.5 miles to the east.	previously disturbed land within the existing RWMC fence.	acres of previously disturbed land would be potentially impacted.	undisturbed land would be used. No conflict with existing land use plans is anticipated.
Historic/Cultural Resources	Unknown number of historic/cultural sites would be impacted. Surveys would be conducted and recorded. Mitigation necessary under applicable requirements would occur.	No impact anticipated. No known resources/site exist within the proposed RWMC location.	Facility to be located within an existing use area. No known resources/sites would be impacted.	Unknown number of sites may be impacted. Surveys would be conducted and recorded. Mitigation necessary under applicable requirements would occur.
Wetland, Wildlife, and Habitat	Loss of biodiversity and habitat productivity would occur. Animal displacement and mortality may occur. The potential for habitat fragmentation would exist.	In that this is a previously disturbed area, no new impacts are expected.	In that this is a previously disturbed area, no new impacts are expected.	Potential exists as described in the baseline; however, impacts would be less than the baseline in that only 40 acres would be disturbed as compared to 200 acres.
Floodplain	Proposed site is not located within the 100/500-year Big Lost River (BLR) floodplain.	Proposed site is not within the probable BLR maximum flood area. The existing flood diversion system at the RWMC would protect from localized (run-on, run-off) flooding.	Flood diversion system in place to protect facilities. Existing information indicates the existing dikes, culverts, and stream channels at the RWMC would withstand potential floods.	Proposed location is above the 10,000-year floodplain.
Geology and Seismicity	Potential seismic and volcanic hazards exist. Seismic hazards include ground shaking and surface deformation. Effects of lava flows include ground deformation, volcanic earthquakes, and ash flows or airborne ash deposits.	Potential for future seismic and volcanic activity exists. New facilities will be constructed to applicable codes and regulations.	Facility located near the NW margin of the Eastern Snake River Plain that experienced abundant volcanism. The INEEL is not within the active seismic zone of the intermountain seismic belt. The INEEL is a seismic zone 2B of Uniform Building Code.	Site chosen consists mainly of basaltic rock overlain by a thin layer of soil. The site is located one mile or more from a capable fault and is not located in an area subject to volcanic fissuring.

Table 3.3-1. Environmental comparison of offeror proposed AMWTP technologies (continued).

Discipline	Baseline from DOE INEL EIS	Technology A[a]	Technology B[b]	Technology C[c]
Water and Water Quality	Water use: construction - no information	Water use: some water to be used	Water use: approximately 180	No processing effluent, all

	provided. Operation - 20 million l/yr. Effluent - no discharges from normal operations. Some effluent would result from construction.	during construction. Water use during operations would consist primarily of process cooling water and sanitary water. Effluents would result from construction. There will be no discharges from normal operations.	gal/min needed for operation. Effluents - no impacts to groundwater identified.	processing water to be recycled. Water use requirements would be within the INEEL permitted capacity.
Air	See Belanger et al, 1995 for details. The following values are maximum potential impacts taken from both the Idaho Waste Processing Facility project summary and the alpha LLMW project summary. Radiological - 0.046% of the NESHAP limit for alpha LLMW and 4.2% of the NESHAP limit for TRU waste. For toxic air pollutants, 86% of the significant level for combined toxic air pollutants; 68% of the significant level for lead; 60% of the significant level for mercury. For prevention of significant deterioration, 34% of the 3 hr limit for sulfur dioxide impact on the Class I area, Craters of the Moon. Control measures may be needed to mitigate visibility impacts.	Waste stream characteristics and anticipated processing throughputs are consistent with the facilities analyzed in the DOE INEL EIS, indicating similar potential impacts. More detailed potential impacts from both construction and operation will be calculated using design and process data that will be available once detailed design can start. Based on conceptual design information, impacts are anticipated to be less than those analyzed in the DOE INEL EIS.	Conservative modeling using previously developed emission sources and emission estimates per pollutant indicated that no Clean Air Act significant emission rate threshold would be exceeded. Direct impacts to air quality from treatment are not expected. Offgases produced as part of routine operations are not anticipated to exceed applicable air standards. Engine exhaust and vehicle traffic dust are the only expected sources of air pollution.	Based on the conceptual design, impacts from the proposed treatment facility are less than those analyzed in the DOE INEL EIS. Final determination will be made during the Phase I design and permitting process. The proposed treatment approach is not expected to impact air quality. No visual impairment to a Class I area is expected. Minor impacts on visibility due to construction may occur as a result of fugitive particulate emissions.

Table 3.3-1 Environmental comparison of offeror proposed AMWTP technologies (continued).

Discipline	Baseline from DOE INEL EIS	Technology A[a]	Technology B[b]	Technology C[c]
Health and Safety	Health effects would vary over the life of the project based on the treatment schedule. Radiation exposure and cancer risk to the maximally exposed individual, 0.42 mrem/yr with a risk factor of	Conservative basis for the DOE INEL EIS analysis indicated lower impacts for the proposed facility can be expected. Potential impacts will be recalculated based on Phase I design	Operational exposures will be maintained at less than 500 mrem/yr. No foreseeable health and safety impacts are expected from normal operations. Hazard Index during	Safety and dose mitigating factors will be incorporated in the design and construction of the facility. Radiological and nonradiological impacts are expected to be less than the

	$2.1x10^{-7}$ latent cancer fatalities/yr. Potential maximum dose to the affected population was calculated to be 1.6 person-rem or $8.0x10^{-4}$ latent cancer fatalities/yr. Nonradiological exposure — negligible impact on health effects is expected.	information. Plants have been designed and built to minimize worker exposure. The average worker dose will not exceed 500 mrem/yr.	operation for the worker is 0.0001 and for the public is 0.03. Nonradiological cancer risk (per person) would be less than $3.0x10^{-10}$ for workers and $2.0x10^{-9}$ to the public. The radiological cancer risk (per person) is estimated to be less than $1.2x10^{-7}$ for the worker and $6.8x10^{-8}$ to the public.	potential impacts for the proposed facilities in the DOE INEL EIS. Potential impacts will be calculated during the Phase I facility design.

a. Encapsulation, thermal desorption, and vitrification.

b. Plasma hearth melter.

c. Macroencapsulation, steam reforming, vitrification.

3.4 Preferred Alternative

The Preferred Alternative is the alternative that DOE believes would best fulfill its statutory mission, giving consideration to environmental, economic, technical, and other factors. DOE has identified the Proposed Action (i.e., the construction and operation of the AMWTP facility with the treatment process described in Section 3.2.2) as the preferred alternative based on information developed (e.g., environmental impacts from the DOE INEL EIS, feasibility studies, DOE NEPA Section 1021.216 process, procurement process, public comment and this EIS).

The ROD issued after the Final EIS will describe DOE's decision regarding whether to allow BNFL Inc. to proceed with the construction and operation of the AMWTP facility.

3.5 Comparison of Impacts

This section compares the potential environmental impacts of implementing each of the four alternatives described in Sections 3.2. This brief comparison of impacts is presented to aid the decisionmakers and the public in understanding the environmental impacts of proceeding with each of the alternatives at the INEEL.

The following discussion is based on the detailed information presented in Chapter 5, Environmental Impacts. The environmental impact analyses are designed to produce a credible projection of the bounding potential environmental impacts, utilizing conservative assumptions and analytical approaches. A detailed discussion of the level of conservatism and degree of uncertainty in these analyses is presented in Chapter 5. Table 3.5-1 summarizes the potential impacts of each alternative for the various environmental subject areas and lists proposed measures that could mitigate these impacts.

1. Differences in Environmental Impacts in Use of Microencapsulation vs. Vitrification Under Proposed Action and Treatment and Storage Alternative

Since the release of the Draft EIS, vitrification has been replaced with microencapsulation as the preferred ash stabilization process. The processes of incineration, supercompaction, and macroencapsulation described in the Draft EIS remain the same, as does the amount of waste planned for incineration (approximately 25 percent).

Microencapsulation is a slight variation of the macroencapsulation process described in the Draft EIS. In microencapsulation, cement powder and water are mixed with incineration ash in 55-gallon drums; in macroencapsulation, cement powder and water are mixed and then poured into containers to stabilize and immobilize non-compatible waste or pucks.

BNFL Inc. has extensive experience with microencapsulation. The use of microencapsulation also has fewer environmental impacts than vitrification, except for a small increase in water use, and an increase in propane consumption. Both vitrification and microencapsulation produce very stable final waste forms meeting RCRA LDR standards and the WIPP WAC. The Final EIS analyzes the potential impacts of both microencapsulation and vitrification.

Overall environmental impacts in the change from vitrification to microencapsulation of incinerator ash are very low and essentially the same. For more detailed information on these differences, refer to Table 3.5-2.

3.6 Comparison of Waste Outputs by Alternative

Table 3.6-1 reflects a comparison of waste volumes to disposal and/or indefinite storage at the INEEL under each alternative.

Table 3.5-1. Summary comparison of alternative environmental impacts (in addition to baseline).

Discipline	No Action Alternative	Proposed Action[a]	Non-Thermal Treatment Alternative	Treatment and Storage Alternative[a]
Land Use[b]	No new land disturbance would occur at the RWMC or INEEL. Existing and planned land uses within the RWMC and other INEEL facilities would not change. Mitigation: None anticipated.	Disturb approximately 7 acres of previously disturbed land within and adjacent to the RWMC for project construction activities. No effects on surrounding land uses or local land use plans or policies are expected. Mitigation: None anticipated.	Disturb approximately 7 acres of previously disturbed land within and adjacent to the RWMC for project construction activities. No effects on surrounding land uses or local land use plans or policies are expected. Mitigation: None anticipated.	Disturb approximately 7 acres of previously disturbed land within and adjacent to the RWMC for project construction activities. No effects on surrounding land uses or local land use plans or policies are expected. Mitigation: None anticipated.
Socio-economics[b]	No increase in new employment or workers would be expected. The employment and population in the region of influence (ROI) would remain the same. Mitigation: None anticipated.	Construction would generate a total of 254 jobs (125 direct and 129 indirect) in the ROI during the peak year, an increase of less than 1 percent in ROI employment. Operation would require 146 workers and would generate 406 jobs (146 direct and 260 indirect) in the ROI. There would likely be no change to the level of community services provided in the ROI. Mitigation: None anticipated.	Construction would generate a total of 254 jobs (125 direct and 129 indirect) in the ROI during the peak year, an increase of less than 1 percent in ROI employment. Operation would require 133 workers and would generate 369 jobs (133 direct and 236 indirect) in the ROI. There would likely be no change to the level of community services provided in the ROI. Mitigation: None anticipated.	Construction would generate a total of 254 jobs (125 direct and 129 indirect) in the ROI during the peak year, an increase of less than 1 percent in ROI employment. Operation would require 146 workers and would generate 406 jobs (146 direct and 260 indirect) in the ROI. There would likely be no change to the level of community services provided in the ROI. Mitigation: None anticipated.

Table 3.5-1. Summary comparison of alternative environmental impacts (in addition to baseline) (continued).

Discipline	No Action Alternative	Proposed Action[a]	Non-Thermal	Treatment and Storage

			Treatment Alternative	Alternative[a]
Cultural Resources[b]	Impacts to cultural resources at the RWMC are not expected. Mitigation: None anticipated	Implementation of the Proposed Action would result in impacts to cultural resources that appear negligible, although a potential for subsurface discoveries exists. The optional 0.5-acre lagoon expansion would potentially impact a known archaeological site; however, testing has indicated that the site is likely not eligible for nomination to the National Register of Historic Places (NRHP). Construction of the new 138-kV power line to support the proposed AMWTP facility would not impact any known archaeological sites. Mitigation: A strong stop work order is in effect at the INEEL in the event that any cultural resources or human remains are discovered during construction for this project. The INEEL Cultural Resources Management Office, the State Historic Preservation Officer (SHPO), and Native American tribes would be immediately notified for	Implementation of the Non-Thermal Treatment Alternative would result in impacts to cultural resources that appear negligible, although a potential for subsurface discoveries exists. The optional 0.5-acre lagoon expansion would potentially impact a known archaeological site; however, testing has indicated that the site is likely not eligible for nomination to the NRHP. Construction of the new 138-kV power line to support the proposed AMWTP facility would not impact any known archaeological sites. Mitigation: A strong stop work order is in effect at the INEEL in the event that any cultural resources or human remains are discovered during construction for this project. The INEEL Cultural Resources Management Office, the SHPO, and Native American tribes would be immediately notified for consultation if any cultural	Implementation of the Treatment and Storage Alternative would result in impacts to cultural resources that appear negligible, although a potential for subsurface discoveries exists. The optional 0.5-acre lagoon expansion would potentially impact a known archaeological site; however, testing has indicated that the site is likely not eligible for nomination to the NRHP. Construction of the new 138-kV power line to support the proposed AMWTP facility would not impact any known archaeological sites. Mitigation: A strong stop work order is in effect at the INEEL in the event that any cultural resources or human remains are discovered during construction for this project. The INEEL Cultural Resources Management Office, the SHPO, and Native American tribes would be immediately notified for consultation if any cultural

Table 3.5-1. Summary comparison of alternative environmental impacts (in addition to baseline) (continued).

Discipline	No Action Alternative	Proposed Action[a]	Non-Thermal Treatment	Treatment and Storage

			Alternative	Alternative[a]
Cultural Resources[b] (continued)		consultation if any cultural resources or human remains are discovered during excavation.	resources or human remains are discovered during excavation.	resources or human remains are discovered during excavation.
Aesthetic and Scenic Resources[b]	The existing INEEL visual setting would not change, nor would area scenic resources be affected. Mitigation: None anticipated.	The AMWTP would not change the visual setting or affect aesthetic resources of the area. Mitigation: None anticipated.	The AMWTP would not change the visual setting or affect aesthetic resources of the area. Mitigation: None anticipated.	The AMWTP would not change the visual setting or affect aesthetic resources of the area. Mitigation: None anticipated.
Geology[b]	Minor impacts on the geology and geologic resources of the INEEL due to extracting aggregate, clay, sand, and soil from gravel and borrow pits at the INEEL to support existing and ongoing waste management road maintenance, environmental restoration, and other site construction activities.	Minor adverse impacts on the geology and geologic resources of the INEEL due to disturbances associated with construction, parking, and construction laydown areas. Excavation for the proposed AMWTP building foundation and electric substation would amount to approximately 16,000 cubic yards of material. If needed, the 0.5-acre sewage lagoon expansion would require excavation of an additional 1,000 cubic yards of soil. Construction of the AMWTP facility would require the extraction of approximately	Minor adverse impacts on the geology and geologic resources of the INEEL due to disturbances associated with construction, parking, and construction laydown areas. Excavation for the proposed AMWTP building foundation and electric substation would amount to approximately 16,000 cubic yards of material. If needed, the 0.5-acre sewage lagoon expansion would require excavation of an additional 1,000 cubic yards of soil. Construction of the AMWTP facility would require the extraction of approximately	Minor adverse impacts on the geology and geologic resources of the INEEL due to disturbances associated with construction, parking, and construction laydown areas. Excavation for the proposed AMWTP building foundation and electric substation would amount to approximately 16,000 cubic yards of material. If needed, the 0.5-acre sewage lagoon expansion would require excavation of an additional 1,000 cubic yards of soil. Construction of the AMWTP facility would require the extraction of approximately

Table 3.5-1. Summary comparison of alternative environmental impacts (in addition to baseline) (continued).

Discipline	No Action Alternative	Proposed Action[a]	Non-Thermal	Treatment and Storage

			Treatment Alternative	Alternative[a]
Geology[b] (continued)	Mitigation: Runoff controls, dust controls, and reuse of stockpiled soil.	20,000 cubic yards of aggregate, clay, and sand from INEEL borrow areas. Mitigation: Runoff controls, dust controls, and reuse of stockpiled soil.	20,000 cubic yards of aggregate, clay, and sand from INEEL borrow areas. Mitigation: Runoff controls, dust controls, and reuse of stockpiled soil.	20,000 cubic yards of aggregate, clay, and sand from INEEL borrow areas. Mitigation: Runoff controls, dust controls, and reuse of stockpiled soil.
Air Resources	*Radiological Impacts:* Onsite Worker: 0.23 millirem/yr MEI Offsite: 0.11 millirem/yr Population: 0.41 person-rem/yr	*Radiological Impacts with Microencapsulation of Ash:* Onsite Worker: 0.058 millirem/yr MEI Offsite: 0.11 millirem/yr Population: 0.0089 person- rem/yr *Radiological Impacts with Vitrification of Ash:* Onsite Worker: 0.36 millirem/yr MEI Offsite: 0.11 millirem/yr Population: 0.048 person-rem/yr	*Radiological Impacts:* Onsite Worker: 0.003 Millirem/yr MEI Offsite: 0.0031 millirem/yr Population: 0.00085 person-rem/yr NA NA NA	*Radiological Impacts with Microencapsulation of Ash:* Onsite Worker: 0.058 millirem/yr MEI Offsite: 0.11 millirem/yr Population: 0.0089 person-rem/yr *Radiological Impacts with Vitrification of Ash:* Onsite Worker: 0.36 millirem/yr MEI Offsite: 0.11 millirem/yr Population: 0.048 person-rem/yr

Table 3.5-1. Summary comparison of alternative environmental impacts (in addition to baseline) (continued).

Discipline	No Action Alternative	Proposed Action[a]	Non-Thermal Treatment Alternative	Treatment and Storage Alternative[a]
Air Resources (continued)	*Nonradiological Impacts:* Criteria pollutant and toxic pollutant levels well within applicable standards. Mitigation: None anticipated.	*Nonradiological Impacts with either Microencapsulation or Vitrification of Ash:* Projected criteria pollutant emission levels less than 1 percent of applicable standards. Projected incremental emission levels of all carcinogenic substances would be less than 0.3 percent of applicable standards. All noncarcinogenic emission levels would be less than 0.1 percent of applicable standards except for selenium, which would be about 1 percent of the standard. Mitigation: None anticipated.	*Nonradiological Impacts:* Projected criteria pollutant emission levels less than 1 percent of applicable standards. Projected incremental emission levels of all carcinogenic substances would be less than 0.1 percent of applicable standards. All noncarcinogenic emission levels would be less than 0.001 percent of applicable standards. Mitigation: None anticipated	*Nonradiological Impacts with either Microencapsulation or Vitrification of Ash:* Projected criteria pollutant emission levels less than 1 percent of applicable standards. Projected incremental emission levels of all carcinogenic substances would be less than 0.3 percent of applicable standards. All noncarcinogenic emission levels would be less than 0.1 percent of applicable standards except for selenium, which would be about 1 percent of the standard. Mitigation: None anticipated.
Water Resources	No discharges of hazardous or radioactive contaminants to the vadose zone would be expected to occur in the near-term (2133). In the long-term, the potential for chronic leakage and contamination of the vadose zone would increase.	No direct discharges of hazardous or radioactive effluents would occur.	No direct discharges of hazardous or radioactive effluents would occur.	No direct discharges of hazardous or radioactive effluents would occur.

Table 3.5-1. Summary comparison of alternative environmental impacts (in addition to baseline) (continued).

Discipline	No Action Alternative	Proposed Action[a]	Non-Thermal Treatment Alternative	Treatment and Storage Alternative[a]
Water Resources (continued)	No discharges to surface water. Potential minor impacts would result from potential future sources of contamination compared with sources from previous waste management practices at the INEEL. The consumption of 1.3 billion gallons per year of water from the Snake River Plain Aquifer would continue. Mitigation: None anticipated.	No direct discharges to surface water. *With Microencapsulation of Ash:* Increase in water consumption by 4.2 million gallons per year. *With Vitrification of Ash:* Increase in water consumption by 2.7 million gallons per year. Mitigation: None anticipated beyond project design and administrative controls.	No direct discharges to surface water. Increase in water consumption of 3.9 million gallons per year. NA Mitigation: None anticipated beyond project design and administrative controls.	No direct discharges to surface water. *With Microencapsulation of Ash:* Increase in water consumption by 4.2 million gallons per year. *With Vitrification of Ash:* Increase in water consumption by 2.7 million gallons per year. Mitigation: None anticipated beyond project design and administrative controls.
Ecology[b]	The potential to affect Federal-listed plant and animal species, or species identified by other Federal and/or State agencies is not likely. No activities that could potentially affect wetlands and surface waters would be expected.	No impact to Federal- or State-listed protected, sensitive, rare, or unique species expected. If constructed, the 0.5-acre sewage lagoon expansion would have a small beneficial effect on some wildlife species with access to the lagoon.	No impact to Federal- or State-listed protected, sensitive, rare, or unique species expected. If constructed, the 0.5-acre sewage lagoon expansion would have a small beneficial effect on some wildlife species with access to the lagoon.	No impact to Federal- or State-listed protected, sensitive, rare, or unique species expected. If constructed, the 0.5-acre sewage lagoon expansion would have a small beneficial effect on some wildlife species with access to the lagoon

Table 3.5-1. Summary comparison of alternative environmental impacts (in addition to baseline) (continued).

Discipline	No Action Alternative	Proposed Action[a]	Non-Thermal Treatment Alternative	Treatment and Storage Alternative[a]
Ecology (continued)	Mitigation: Ongoing biota monitoring programs, such as the INEEL environmental surveillance program, would continue, with appropriate responses implemented should undesirable impacts be identified.	Potential radiological exposure to plant and animal species within the RWMC and adjacent surrounding area is not expected to significantly affect biotic populations and communities in the area. Mitigation: Ongoing biota monitoring programs, such as the INEEL environmental surveillance program, would continue, with appropriate responses implemented should undesirable impacts be identified.	Potential radiological exposure to plant and animal species within the RWMC and adjacent surrounding area is not expected to significantly affect biotic populations and communities in the area. Mitigation: Ongoing biota monitoring programs, such as the INEEL environmental surveillance program, would continue, with appropriate responses implemented should undesirable impacts be identified.	Potential radiological exposure to plant and animal species within the RWMC and adjacent surrounding area is not expected to significantly affect biotic populations and communities in the area. Mitigation: Ongoing biota monitoring programs, such as the INEEL environmental surveillance program, would continue, with appropriate responses implemented should undesirable impacts be identified.
Noise[b]	No significant noise impacts from existing, ongoing INEEL activities. Mitigation: None anticipated.	Short-term minor increase in noise during construction. Negligible noise increase during operation. Mitigation: None anticipated.	Short-term minor increase in noise during construction. Negligible noise increase during operation. Mitigation: None anticipated.	Short-term minor increase in noise during construction. Negligible noise increase during operation. Mitigation: None anticipated.
Traffic and Transportation[b]	No adverse traffic or transportation impacts. Mitigation: None anticipated	The level of service on local access highways would not change. Mitigation: None anticipated.	The level of service on local access highways would not change. Mitigation: None anticipated.	The level of service on local access highways would not change. Mitigation: None anticipated.

Table 3.5-1. Summary comparison of alternative environmental impacts (in addition to baseline) (continued).

Discipline	No Action Alternative	Proposed Action[a]	Non-Thermal Treatment Alternative	Treatment and Storage Alternative[a]

Occupational and Public Health and Safety	*Health Impacts from Radiological Exposure:* The estimated fatal cancer incidence would be 9.2E-08, 1 chance in 10 million (0.23 mrem/yr) for the MEI onsite and 7.0E-08, 1 chance in 14 million (0.14 mrem/yr) for the MEI offsite individual. The estimated fatal cancer incidence for MEI and average involved workers would be 6.0E-04, 1 chance in 1,600 (1500 mrem/yr) and 3.2E-05, 1 chance in 30,000 (81 mrem/yr), respectively.	*Health Impacts from Radiological Exposure:* *With Microencapsulation of Ash:* The estimated increase in fatal cancer incidence for Microencapsulation Option would be 2.3E-08, 1 chance in 43 million (0.058 mrem/yr) for the MEI onsite individual and 1.1E-08, 1 chance in 90 million (0.022 mrem/yr) for the MEI offsite individual. The estimated fatal cancer incidence for the MEI and average involved workers would be 6.0E-04, 1 chance in 1,600 (1500 mrem/yr) and 3.2E-05 , 1 chance in 30,000 (81 mrem/yr), respectively.	*Health Impacts from Radiological Exposure:* The estimated fatal cancer incidence would be 1.2E-09, 1 chance in 810 million (0.003 mrem/yr) for the MEI onsite and 1.6E-09, 1 chance in 620 million (0.0031 mrem/yr) for the MEI offsite individual. The estimated fatal cancer incidence for Non-Thermal Treatment Alternative for the MEI and average involved worker would be 6.0E-04, 1 chance in 1,600 (1500 mrem/yr) and 3.2E-05, 1 chance in 30,000 (81 mrem/yr), respectively.	*Health Impacts from Radiological Exposure:* *With Microencapsulation of Ash:* The estimated fatal cancer incidence would be the same as the Proposed Action with microencapsulation of ash. The estimated fatal cancer incidence for MEI and averaged involved worker would be 6.0E-04, 1 chance in 1,600 (1500 mrem/yr) and 3.2E-05, 1 chance in 30,000 (81 mrem/yr), respectively.
		With Vitrification of Ash: The estimated fatal cancer incidence for the Vitrification Option would be 1.4E-07, 1 chance in 7 million (0.36 mrem/yr) for the MEI onsite individual and 4.5 E-08, 1 chance in 22 million (0.09 mrem/yr) for the MEI offsite individual. The estimated fatal cancer incidence for MEI and average involved workers would be 6.0E-04, 1 chance in 1,600 (1500 mrem/yr) and 3.2E-05, 1 chance in 30,000 (81 mrem/yr), respectively.	NA	*With Vitrification of Ash:* The estimated fatal cancer incidence would be the same as the Proposed Action with vitrification of ash. The estimated fatal cancer incidence for MEI and average involved worker is 6.0E-04, 1 chance in 1,600 (1500 mrem/yr) and 3.2E-05, 1 chance in 30,000 (81 mrem/yr), respectively.
	No Impact.	*With Microencapsulation of Ash:* Over the 30-year projected operating lifetime, the estimated fatal cancer incidence for the Microencapsulation Option would be 3.5E-06, 1 chance in 285,000 (8.7 mrem) for the MEI onsite and 2.5E-06, 1 chance in 400,000 (4.9 mrem) for the MEI offsite individual.	Over the projected 13-year operating lifetime, the estimated fatal cancer incidence would be 1.2E-06, 1 chance in 833,000 (3.1 mrem/yr) for the MEI onsite and	*With Microencapsulation of Ash:* Over the 30-year operating lifetime, the estimated fatal cancer

Occupational and Public Health and Safety (continued)		*With Vitrification of Ash:* Over the 30-year projected operating lifetime, the estimated fatal cancer incidence with vitrification of ash would be 7.1E-06, 1 chance in 140,000 (18 mrem) for the MEI onsite and 3.5E-06, 1 chance in 285,000 (6.9 mrem) for the MEI offsite individual.	9.4E-07, 1 chance in 1 million (1.9 mrem) for the MEI offsite individual. NA	incidence for MEI onsite and offsite would be the same as the Proposed Action with microencapsulation of ash. *With Vitrification of Ash:* Over the 30-year operating lifetime the estimated fatal cancer incidence for MEI onsite and offsite would be the same as the Proposed Action with vitrification of ash.
		With Microencapsulation of Ash: The population estimated fatal cancer incidence from annual emission for Microencapsulation Option would be 4.5E-06 (0.0089 person-rem)		
		With Vitrification of Ash: The population estimated fatal cancer incidence from annual emission for Vitrification Option would be 2.4E-05 (0.048 person-rem).	The population estimated fatal cancer incidence would be 4.3E-07 (0.00085 person-rem).	*With Microencapsulation of Ash:* The population estimated fatal cancer incidence from annual emission would be the same as the Proposed Action with microencapsulation of ash.
	The population estimated fatal cancer incidence for base case would be 2.5E-04 (0.5 person-rem).	*With Microencapsulation of Ash:* For the 30-year operation lifetime, the population estimated fatal cancer incidence for Microencapsulation Option would be 1.1E-02 (23 person-rem)	NA	*With Vitrification of Ash:* The population estimated fatal cancer incidence from annual emission would be the same as the Proposed Action with vitrification of ash.
		With Vitrification of Ash: For the 30-year operation lifetime, the population estimated fatal cancer incidence for Vitrification Option would be 1.2E-02 (24 person-rem)	For the 13-year operating lifetime, the population estimated fatal cancer incidence would be 4.2E-03 (8.4 person-rem).	*With Microencapsulation of Ash:* For the projected 30-year operating lifetime, the population estimated fatal cancer
	No Impact.	*Nonradiological*	NA	

Occupational and Public Health and Safety (continued)	*Nonradiological Exposure and Health Impacts:* A hazard quotient of less than one, no adverse health effects would occur as a result of criteria and noncarcinogenic emissions. No impact for No Action Alternative. There would not be any emissions in addition to	*Exposure Health Impacts:* *With Microencapsulation of Ash:* A hazard quotient of less than one, no adverse health effects would occur as a result of criteria and noncarcinogenic emissions. *With Vitrification of Ash:* A hazard quotient of less than one, no adverse health effects would occur as a result of criteria and noncarcinogenic emissions. *With Microencapsulation of Ash:* The highest risk for the Proposed Action with microencapsulation of ash is from carbon tetrachloride at the site boundary, at one cancer incidence in 260 million. The fatal cancer incidence from all chemical carcinogenic pollutants for the Proposed Action with microencapsulation of ash would be 1.2E-08 (1 in 85 million) at the site boundary and 3.3E-10 (1 in 3 billion) at the Craters of the Moon. *With Vitrification of Ash:* The highest risk for the	*Nonradiological Exposure Health Impacts:* A hazard quotient of less than one, no adverse health effects would occur as a result of criteria and noncarcinogenic emissions. NA The highest risk for the Non-Thermal Treatment Alternative is from formaldehyde at the site boundary, at one fatal cancer incidence in 600 million. The fatal cancer incidence from all chemical carcinogenic pollutants for this alternative would be 2.8E-09 (1 in 360 million) at the site boundary and 7.0E-11 (1 in 14 billion) at the Craters of the Moon,	incidence would be the same as the Proposed Action with microencapsulation of ash. *With Vitrification of Ash:* For the projected 30-year operating lifetime, the population estimated fatal cancer incidence would be the same as the Proposed Action with vitrification of ash. *Nonradiological Exposure Health Impacts:* *With Microencapsulation of Ash:* A hazard quotient of less than one, no adverse health effects would occur as a result of criteria and noncarcinogenic emissions. *With Vitrification of Ash:* A hazard quotient of less than one, no adverse health effects would occur as a result of criteria and noncarcinogenic emissions. *With Microencapsulation of Ash:* The highest risk would be the same as the

Occupational and Public Health and Safety (continued)	the baseline under this alternative. *Industrial Safety:*	Proposed Action with vitrification of ash is from carbon tetrachloride at the site boundary, at one cancer incidence in 260 million. The fatal cancer incidence from all chemical carcinogenic pollutants for the Proposed Action with vitrification of ash would be 1.2E-08 (1 in 85 million) at the site boundary and 3.3E-10 (1 in 3 billion) at the Craters of the Moon. *Industrial Safety:* During 4-year construction: Estimated total injury/illness would be 28. Estimated total fatalities would be 0.069. During 30-year operation: Estimated total injury/illness would be 135. Estimated total fatalities would be 0.65. Mitigation: None anticipated.	respectively. NA *Industrial Safety:* During 4-year construction: Estimated total injury/illness would be 28. Estimated total fatalities would be 0.069. During 13-year operation: Estimated total injury/illness would be 53. Estimated total fatalities would be 0.26.	Proposed Action with microencapsulation of ash, and is from carbon tetrachloride at the site boundary, at one fatal cancer incidence in 260 million. The fatal cancer incidence from all chemical carcinogenic pollutants for this alternative would be the same as the Proposed Action with microencapsulation of ash, at 1.2E-08 (1 in 85 million) at the site boundary and 3.3E-10 (1 in 3 billion) at the Craters of the Moon. *With Vitrification of Ash:* The highest risk would be the same as the Proposed Action with vitrification of ash, and is from carbon tetrachloride at the site boundary, at one cancer incidence in 260 million. The fatal cancer incidence from all chemical carcinogenic pollutants for Treatment and Storage Alternative would be the same as the Proposed Action with vitrification of ash, at 1.2E-08 (1 in 85 million) at the site bound-ary and 3.3E-10 (1 in 3 billion) at the Craters of the Moon. *Industrial Safety:* During 4-year construction: Estimated total injury/illness would be 28. Estimated total fatalities would be 0.069. During 30-year operation:

Occupational and Public Health and Safety (continued)	Annual injury/illness rates for INEEL operation and construction are 3.3 and 6.4 per 200,000 hours, respectively. Annual fatality rates for INEEL operation and construction are 0.016 fatalities per 200,000 hours. In 1996, the INEEL had 192 injury/illnesses and 1 fatality out of an employment level of 6,645. Mitigation: None anticipated.		Mitigation: None anticipated..	Estimated total injury/illness would be 135. Estimated total fatalities would be 0.65. Mitigation: None anticipated.
INEEL Services	No change to INEEL services. Mitigation: None anticipated.	*With Microencapsulation of Ash:* Electrical usage would increase by 33,000 MWh/yr. Propane use would increase by 1,100,000 gal/yr. *With Vitrification of Ash:* Electrical usage would increase by 35,000 MWh/yr. Propane use would increase by 925,000 gal/yr. Mitigation: None anticipated.	Electrical usage would increase by 24,850 MWh/yr. Propane use would increase by 360,000 gal/yr. NA NA Mitigation: None anticipated.	*With Microencapsulation of Ash:* Electrical usage would increase by 33,000 MWh/yr. Propane use would increase by 1,100,000 gal/yr. *With Vitrification of Ash:* Electrical usage would increase by 35,000 MWh/yr. Propane use would increase by 925,000 gal/yr. Mitigation: None anticipated.

Table 3.5-1. Summary comparison of alternative environmental impacts (in addition to baseline) (continued).

Discipline	No Action Alternative	Proposed Action[a]	Non-Thermal Treatment Alternative	Treatment and Storage Alternative[a]
Accidents[b]	In the anticipated	In the anticipated	In the anticipated	In the anticipated

	frequency range, the waste box spill is the scenario with the highest consequences. The dose[c] to the MEI offsite would be 6.5 $\times10^{-3}$ rem. The likelihood of fatal cancer would be 3.3 $\times10^{-6}$ (1 chance in 300,000). Mitigation: INEEL emergency response planning currently in effect. Interdiction by INEEL accident recovery personnel following an accident to limit doses to offsite individuals at risk.	frequency range, the waste box spill is the scenario with the highest consequences. The dose[c] to the MEI offsite would be 6.5 $\times10^{-3}$ rem. The likelihood of fatal cancer would be 3.3 $\times10^{-6}$ (1 chance in 300,000). Mitigation: INEEL emergency response planning currently in effect. Interdiction by INEEL accident recovery personnel following an accident to limit doses to offsite individuals at risk.	frequency range, the waste box spill is the scenario with the highest consequences. The dose[c] to the MEI offsite would be 6.5 $\times10^{-3}$ rem. The likelihood of fatal cancer would be 3.3 $\times10^{-6}$ (1 chance in 300,000). The absence of incineration and microencapsulation processes results in some reduction of risk. Mitigation: INEEL emergency response planning currently in effect. Interdiction by INEEL accident recovery personnel following an accident to limit doses to offsite individuals at risk.	frequency range, the waste box spill is the scenario with the highest consequences. The dose[c] to the MEI offsite would be 6.5 $\times10^{-3}$ rem. The likelihood of fatal cancer would be 3.3 $\times10^{-6}$ (1 chance in 300,000). Mitigation: INEEL emergency response planning currently in effect. Interdiction by INEEL accident recovery personnel following an accident to limit doses to offsite individuals at risk.

a. Proposed Action includes microencapsulation of ash unless noted otherwise.

b. There would be no change in potential impacts using a vitrification process for incinerator ash.

c. Dose and likelihood of cancer are identical for listed alternatives since waste box spill is common to all alternatives and dominates dose.

Note: NA = Not applicable

Table 3.5-2. Differences in environmental impacts in use of microencapsulation vs. vitrification under the Proposed Action and the Treatment and Storage Alternative.

Discipline	Microencapsulation	Vitrification	Difference
Air Resources Onsite worker Collective population dose	 0.058 millirem (mrem)/yr 0.0089 person-rem/yr	0.36 mrem/yr 0.048 person-rem/yr	Vitrification is 0.302 mre/yr higher than microencapsulation Vitrification is 0.0391 person-rem/yr higher
Water Resources	Increase of 4.2 million gallons per year over baseline	Increase of 2.7 million gallons per year over baseline	Microencapsulation will use 1.5 million gallons per year more than vitrification process
Occupational & Public Health & Safety Estimated fatal cancer incidence MEI onsite	 0.058 mrem/yr		 Vitrification is 0.302 mrem/yr higher

MEI offsite 30-year projection MEI onsite MEI offsite Annual for population 30-year operation — population	0.022 mrem/yr 8.7 mrem/yr 4.9 mrem/yr 0.0089 person-rem/yr 23 person-rem	0.36 mrem/yr 0.09 mrem/yr 18.0 mrem/yr 6.9 mrem/yr 0.048 person-rem/yr 24 person-rem	Vitrificaton is 0.063 mrem/yr higher Vitrification is 9.3 mrem/yr higher Vitrification is 2.0 mrem/yr higher Vitrification is 0.0391 person-rem/yr higher Vitrification is 1 person-rem higher
INEEL Services Electricity Propane	33,000 MW/yr 1,100,000 gal/yr	35,000 MW/yr 925,000 gal/yr	Vitrification uses 2,000 MW/yr more than microencapsulation Microencapsulation uses 175,000 gallons per year more than vitrification

Table 3.6-1. Comparison summary of volumes to WIPP or other approved disposal site after January 1, 2003, and volumes placed in indefinite storage at the RWMC.[1]

Category	No Action Alternative	Proposed Action	Non-Thermal Treatment Alternative	Treatment and Storage Alternative
Volume to disposal site after January 1, 2003	3,500-7,000 cubic meters	30,000 cubic meters	23,000-29,000 cubic meters	0 cubic meters
Volume placed in indefinite storage at the INEEL	58,000-61,500 cubic meters	0 cubic meters	8,000-14,000 cubic meters	30,000 cubic meters
1. These numbers are DOE's current estimates for these alternatives.				

4. Affected Environment

4.1 Introduction

Chapter 4 describes the existing environment at the Idaho National Engineering and Environmental Laboratory (INEEL) and provides site-specific information for the Radioactive Waste Management Complex (RWMC), the proposed site for construction of the Advanced Mixed Waste Treatment Project (AMWTP) under the Proposed Action. Central to the tiered environmental impact statement (EIS) concept, INEEL-wide information was obtained and referenced primarily from the *Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs Final Environmental Impact Statement* (DOE INEL EIS) (DOE 1995). Where necessary, updated environmental baseline information is presented and documented accordingly. Individual sections within Chapter 4 focus predominantly upon RWMC site-specific resources (e.g., water resources) and project-specific resources (e.g., socioeconomics) most likely to be impacted by implementing the Proposed Action.

Chapter 4 summarizes the existing data and technical literature in each discipline where pertinent to the Proposed Action. Citations in Chapter 4 provide the supporting technical references that contain substantiating data and analysis (see Chapter 9, References).

4.2 Land Use

This section describes the existing and planned land use at the INEEL and surrounding area, and the proposed site of the AMWTP at the RWMC.

The INEEL encompasses 569,135 acres within Butte, Bingham, Bonneville, Jefferson, and Clark Counties. The eastern border is 22 miles west of downtown Idaho Falls in southeastern Idaho (see Figure 4.2-1). The land comprising the INEEL is used to support the U.S. Department of Energy (DOE) facility and program operations and as safety-and-security zones around facilities. About 2 percent of the total INEEL area (11,400 acres) is used for facilities and operations. INEEL operations are performed within the site's primary facility areas (i.e., Central Facilities Area [CFA], Test Reactor Area, Idaho Nuclear Technology and Engineering Center, etc.) which occupy 2,032 acres (Figure 4.2-2). The remaining land (567,103 acres) is largely undeveloped and acts as a safety and accident buffer zone. Additionally this undeveloped land is used for environmental research, ecological preservation, socio-cultural preservation, and livestock grazing. A detailed description of the INEEL's land use and land use plans and policies applicable to the area is contained in Volume 2, Section 4.2 of the DOE INEL EIS and the *Idaho National Engineering Laboratory Comprehensive Facility and Land Use Plan* (DOE-ID 1997g).

4.2.1 Existing and Planned Land Use at the Advanced Mixed Waste Treatment Project Site

Facilities at the RWMC, where the AMWTP is proposed to be located, provide waste management support for various processing, storage, and disposal of radioactive waste. One of the missions at the RWMC is preparing waste for shipment to the Waste Isolation Pilot Plant (WIPP).

The 187-acre RWMC is divided into four zones: the Administration Area, located in the northeast section of the facility; the Operation Zone, located west of the Administration Area; the Subsurface Disposal Area (SDA), located in the western section of the facility; and the Transuranic Storage Area (TSA), located in the southern section of the facility. The proposed AMWTP would be located within the TSA (see Figure 1.4-1).

4.2.2 Existing and Planned Land Use at the Idaho National Engineering and Environmental Laboratory and in Surrounding Areas

INEEL facility operations include industrial and support operations associated with energy research and waste management activities. Land is also used for environmental research associated with the DOE designation of the INEEL as a National Environmental Research Park. A summary of the land use within the primary facility areas of the INEEL is shown in Table 4.2-1.

Only 2 percent of the land within the INEEL has been developed for the operating areas and facilities. INEEL facilities are sited within a central core area of approximately 230,000 acres (see Figure 4.2-2). The missions of the INEEL are moving toward management of radiological and hazardous waste, restoration of the environment, development of environmental cleanup technologies, national security, U.S. economic competitiveness, and development of nuclear energy and non-nuclear technologies and applications.

The INEEL was formed through a series of land withdrawals from the public domain called public land orders (i.e., public land orders 318, 545, 637, and 1770) and the acquisition of State-owned and private land parcels. The DOE and Bureau of Land Management (BLM) share administrative responsibilities, through Memoranda of Understanding (MOU) for grazing permits on the INEEL; granting of utility rights-of-way across the INEEL; extracting materials; and controlling wildfires, noxious weeds, insects, and predators. The DOE owns, in fee simple, the land acquired from the State and private parties.

Figure 4.2-1. Idaho National Engineering and Environmental Laboratory vicinity (DOE 1995).

Figure 4.2-2. Land uses at the Idaho National Engineering and Environmental Laboratory.

Table 4.2-1. Summary of land use within the primary facility areas of the INEEL.

Facility area	Land area (acres)	Total gross square feet of facilities	Land use
Argonne National Laboratory—West	84	600,000	Industrial uses associated with nuclear power research. Other land uses include support facilities, tank areas, spent fuel storage, and wastewater treatment and disposal.
Central Facilities Area	968	683,379	Centralized support facilities for site-wide operations (e.g., security, warehousing, transportation, and food service facilities). Other uses include laboratories and other administrative offices (e.g., the National Oceanic and Atmospheric Administration and the U.S. Geological Survey).

Idaho Nuclear Technology and Engineering Center	265	1,152,073	Spent fuels storage, high-level waste treatment and storage, and analytical laboratory facilities. Other uses include a coal-fired steam-generating plant, a wastewater treatment facility, office facilities, and warehouse facilities.
Naval Reactors Facility	187	673,000	Industrial uses associated with receipt and examination of Navy spent nuclear fuel and examination of expended core components and irradiated material test specimens. Other land uses include support facilities such as offices, storage areas, and wastewater treatment and disposal.
Power Burst Facility	19	112,481	Industrial uses associated with research and development of radioactive and mixed waste management technologies and waste-reduction activities.
Radioactive Waste Management Complex	187	738,859	Industrial uses associated with disposal and transfer of hazardous and radioactive waste. Other land uses include support-related facilities such as offices and maintenance shops.
Site-Wide Area	567,103	92,502	Composed of the land outside the boundaries of the primary facility areas. Most of the buildings and structures in the site-wide area are old, abandoned, and scheduled for, or in the process of, demolition. Land uses include communication, utility, and transportation systems and open land that serves as a safety-and-security buffer and a livestock grazing zone. The site-wide area constitutes most of the Idaho National Environmental Research Park, which serves as an outdoor laboratory for ecological research by university, contractor, and Government scientists.
Test Area North	220	693,559	Industrial facilities primarily involved in researching, engineering, and remote handling of radioactive materials. This area is also home to facilities used for activities that are considered hazardous and to facilities used for research, development, and manufacturing for the Department of the Army.
Test Reactor Area	102	610,000	Industrial land use supporting nuclear reactor research. Other uses include support facilities (storage tanks, maintenance buildings, warehouses); laboratories; and sanitary and radioactive waste treatment facilities.

The BLM has entered into a MOU with DOE to permit livestock operators to graze livestock in designated areas outside the central core area. A summary of selected land use at the INEEL and in the surrounding region is shown in

Figure 4.2-2.

The Federal government manages approximately 75 percent of the land bordering INEEL; this land is administered by the BLM and U.S. Forest Service. Twenty-four percent of adjacent land is privately owned, with one percent held by the State of Idaho. Land uses on Federal—owned land consist of grazing, wildlife management, range land, mineral and energy production, and recreation. State-owned lands are used for grazing, wildlife management, and recreation. Privately owned lands are used primarily for grazing and crop production. Small communities and towns located near the INEEL boundaries are shown in Figure 4.2-1.

No onsite land use restrictions due to Native American treaty rights would exist for any of the alternatives described in the EIS. The INEEL does not lie within any of the land boundaries established by the Fort Bridger Treaty. Furthermore, the entire INEEL is land occupied by the DOE, and therefore the provision in the Fort Bridger Treaty that allows the Shoshone and Bannock Indians the right to hunt on the unoccupied lands of the United States does not presently apply to any land upon which the INEEL is located. Potential impacts of the alternatives upon Native American and other cultural resources, and potential mitigation measures, are discussed in Section 5.4, Cultural Resources and Section 5.20, Environmental Justice.

Because the INEEL is remotely located from most developed areas, the INEEL and adjacent areas are not likely to experience large-scale residential and commercial development (DOE-ID 1995c). However, recreational and agricultural uses are expected to increase in the surrounding area in response to greater demand for these types of land uses (DOE-ID 1995c). One proposed new development that could affect the use of the INEEL in the vicinity of the RWMC is a quartzite mining and processing operation in the Arco Canyon area 3 miles east of Arco, Idaho (BLM 1997).

4.3 Socioeconomics

This section presents an overview of current socioeconomic conditions within a region of influence (ROI) where more than 95 percent of the INEEL workforce reside. The INEEL ROI is a seven-county area comprised of Bannock, Bingham, Bonneville, Butte, Clark, Jefferson, and Madison Counties. Cities located in the ROI are shown in Figure 4.2-1. During 1996, INEEL employees and their families accounted for 20 percent of Bonneville County's population and composed almost 30 percent of Idaho Falls' population. INEEL employees and their families represent only 2 percent of the population of Bannock and Madison Counties (CBRS — ISU 1996).

4.3.1 Employment and Income

The INEEL ROI is rural in character, and the economy has historically been based on natural resources. Consistent with most regions of the country, economic growth over the past several decades has been in nonagricultural sectors. Although farming and agricultural services remain important to the ROI economy, these sectors provide less than 8 percent of the total number of jobs in the ROI. The service, wholesale and retail trade, and public sectors are now the major sources of ROI employment. Together, these sectors generate approximately 70 percent of the jobs in the ROI. Manufacturing and construction jobs are also important sectors and accounted for about 13 percent of the ROI's employment in 1995 (BEA 1997a). Table 4.3-1 presents employment levels for the major sectors for the ROI.

The ROI experienced stable growth during the 1990s. The labor force grew from 105,837 in 1990 to 122,725 in 1996, an annual growth rate of almost 2.7 percent. Total ROI employment grew from 100,074 in 1990 to 117,009 in 1996, an annual growth rate of approximately 2.8 percent (BLS 1997). This growth rate was considerably higher than during the 1980s when ROI employment grew at approximately 1.2 percent annually.

The ROI unemployment rate was 4.7 percent in 1996, the lowest level in over a decade. Unemployment rates within the ROI ranged from a low of 3.0 percent in Madison County to a high of 5.4 percent in Bingham County. The unemployment rate for Idaho during 1996 was 5.2 percent (BLS 1997).

Table 4.3-1. Employment by sector in 1995.

Sector	Percentage
Services	29.6
Wholesale and retail	24.8
Government (including Federal, State, local, and military)	16.0
Manufacturing	7.1
Farm	5.9
Construction	5.9
Finance, insurance, and real estate	5.0
Transportation and public utilities	3.9
Agricultural service, forestry, and other	1.7
Source: BEA 1997a.	

Per capita income for the ROI was $16,550 in 1995, a 17-percent increase over the 1990 level of $14,136. Per capita income levels within the ROI ranged from a low of $11,758 for Madison County to a high of $22,444 in Clark County. The per capita income for Idaho was $18,895 in 1995 (BEA 1997a).

The INEEL exerts a major influence on the ROI economy. During 1996, INEEL provided an average of 8,134 jobs, almost 7 percent of the total jobs in the ROI (CBRS-ISO 1996). The INEEL is the largest employer in Southeast Idaho and the second largest employer in Idaho (second to State government). The current workforce, however, is significantly lower than the peak of approximately 11,600 employees that worked at INEEL during 1992. Much of the employment loss was due to consolidation of contracts and reduction in defense-related activities. Employment projections indicate a stabilization of the job force at about 7,250 in Fiscal Year 2004.

4.3.2 Population and Housing

4.3.2.1 Population. From 1960 to 1990, population growth in the ROI paralleled Statewide growth. During this period, the ROI's population increased an average rate of approximately 1.3 percent, while the annual growth rate for the State was 1.4 percent. From 1990 to 1995, State population growth accelerated to over 3 percent per year, while ROI growth remained under 2 percent. Population growth rates for both the ROI and the State are projected to slow after the year 2000. Table 4.3-2 presents population estimates for the ROI through 1995 and projections for 2000 through 2025. Based on population trends, the ROI population will reach more than 339,000 persons by 2025.

Bannock and Bonneville are the two largest counties in the ROI; together, they accounted for almost 64 percent of the total ROI population in 1995. Butte and Clark are the most sparsely populated counties; together, they contain only 1.6 percent of the total ROI population. The largest cities in the ROI are Pocatello (in Bannock County) and Idaho Falls (in Bonneville County), with 1995 populations of approximately 51,132 and 48,411, respectively (DOC 1996).

Table 4.3-2. Population estimates for the INEEL ROI.

County	1990	1995	2000	2005	2010	2015	2020	2025
Bannock	66,026	72,043	78,252	81,303	84,474	90,894	96,802	102,710
Bingham	37,583	40,950	44,479	46,214	48,016	51,666	55,024	58,382
Bonneville	72,207	79,230	86,059	89,415	92,902	99,963	106,460	112,958
Butte	2,918	3,097	3,364	3,495	3,631	3,907	4,161	4,415
Clark	762	841	913	948	985	1,060	1,129	1,198
Jefferson	16,543	18,429	20,017	20,798	21,609	23,251	24,763	26,274
Madison	23,674	23,651	25,690	26,692	27,733	29,841	31,780	33,720
ROI	219,713	238,241	258,774	268,865	279,350	300,582	320,119	339,657

Sources: DOC 1996; BEA 1997a.

4.3.2.2 Housing. There were a total of 77,660 housing units in the ROI during 1990; approximately 70 percent of these units were single-family units, 17 percent were multi-family units, and 13 percent were mobile homes. Approximately 7.7 percent of the housing units were vacant, although some vacant units were used for seasonal, recreational, or other occasional purposes. Rental vacancy rates ranged from 2.8 percent in Madison County to 16.2 percent in Butte County. About 29 percent of the occupied housing units in the ROI were rental units, and 71 percent were homeowner units. The majority of housing units in the ROI were located in Bonneville and Bannock Counties, which include the cities of Idaho Falls and Pocatello.

In 1990, the median value of the owner-occupied housing units ranged from $37,300 in Clark County to $63,700 in Madison County, while the median monthly contract rents ranged from $158 in Butte County to $293 in Bonneville County. Table 4.3-3 shows housing characteristics for the ROI.

Table 4.3-3. ROI housing characteristics (1990).

County	Total number of housing units	Number of owner-occupied units[a]	Owner-occupied vacancy rates	Median value	Number of rental units[a]	Rental vacancy rates	Median monthly contract rent
Bannock	25,694	16,082	2.4%	$53,300	7,330	10.3	$237
Bingham	12,664	8,830	2.0%	$50,700	2,683	9.2	$207
Bonneville	26,049	17,371	1.9%	$63,700	6,918	6.2	$293
Butte	1,265	744	4.6%	$41,400	253	16.2	$158
Clark	502	174	1.7%	$37,300	103	9.6	$189
Jefferson	5,353	3,920	2.0%	$54,300	951	4.1	$221
Madison	6,133	3,476	1.3%	$68,700	2,325	2.8	$239
ROI	77,660	50,597	2.1%	b	20,563	4.6	b

Source: DOC 1992.

a. Does not include housing used for seasonal, recreational, or other uses.

b. Not applicable.

4.3.3 Community Services

This assessment evaluates the following community services in the ROI: public schools, law enforcement, fire protection, and medical services.

Seventeen public school districts and three private schools provide educational services for the approximately 57,000 school-aged children in the ROI. Higher education in the ROI is provided by the University of Idaho, Idaho State University, Ricks College, and the Eastern Idaho Technical College.

Law enforcement is provided by 15 county and municipal police departments that employed 373 sworn officers and 149 civilians in 1995. Idaho Falls and Pocatello supported the largest departments, each employing 82 police officers. Clark County and the Firth police department were each staffed with only two officers (DOJ 1996).

The ROI is served by a total of 18 municipal fire districts staffed with about 500 firefighters, of which approximately 300 are volunteer. In addition, the INEEL fire department provides round-the-clock coverage for the site. The staff includes 50 firefighters with no less than 16 firefighters on each shift. Bingham, Bonneville, Butte, Clark, and Jefferson Counties, which surround the INEEL, have developed emergency plans to be implemented in the event of a radiological or hazardous materials emergency. Each emergency plan identifies facilities, including the INEEL, with extremely hazardous substances and defines transportation routes for these substances. The emergency plans also include procedures for notification and response, listings of emergency equipment and facilities, evacuation routes, and training programs.

The ROI contains seven hospitals with a capacity of 1,012 beds (AHA 1995). Over 65 percent of the hospital beds were in Bannock and Bonneville Counties. No hospitals are located in either Clark or Jefferson Counties.

4.4 Cultural Resources

This section discusses cultural resources located within, and surrounding, the RWMC. These resources include prehistoric and historic archaeological sites, historic sites and structures, traditional resources of cultural or religious importance to local Native Americans, and paleontological localities. A more detailed description of cultural resources at the INEEL is contained in Section 4.4, Volume 2 of the DOE INEL EIS.

4.4.1 Archaeological Sites and Historic Structures

The INEEL contains a rich and varied inventory of cultural resources, including fossil localities, archaeological and historical remains, and military and Cold War era structures and features. Sites important to contemporary Native American groups are located throughout the INEEL. Historic sites document Anglo-European use of the area during the late 1800s and 1900s. These include the abandoned town of Powell/Pioneer, a northern spur of the Oregon Trail known as Goodale's Cutoff that crosses the southeastern edge of the INEEL approximately 4 miles southwest of the proposed AMWTP facility, many small homesteads, irrigation canals, sheep/cattle camps, and stage/wagon trails. Finally, important information on the historical development of nuclear science in America is also preserved in the many scientific and technical facilities within the INEEL's boundaries. Fifty-two nuclear reactors, many of which were "first-of-a-kind" facilities, were eventually built at the site (DOE 1998d). The Experimental Breeder Reactor I was the first reactor built onsite, was the first reactor in the world to generate electricity, and is the only property at INEEL to be formally nominated to the National Register of Historic Places (NRHP). The reactor is a designated National Historic Landmark located approximately 4 miles northeast of the proposed location of the AMWTP facility, as described in the DOE INEL EIS and the *Current INEEL Land Use* (DOE 1998c).

Archaeological sites are numerous on the INEEL, but have been relatively undisturbed by mission activities. As of January 1, 1998, approximately 7 percent (37,681 acres) of the INEEL have undergone systematic archaeological survey. These surveys have recorded 1,839 potentially significant archaeological sites. Over half of these sites are considered to be potentially eligible for nomination to the NRHP and will require formal significance evaluations (Ringe-Pace 1998).

The Idaho State Historic Preservation Office (SHPO) has determined that the portions of the RWMC within the perimeter fence have undergone extensive ground disturbance in the past that have likely destroyed any archaeological remains within that area. Based on this finding, the Idaho SHPO has found that no additional review of proposed projects within this area is necessary. However, if archaeological remains are discovered within the area, "stop work" stipulations must be followed, and the SHPO and DOE cultural resource personnel must be contacted as soon as possible (Yohe 1993).

A predictive model was developed to identify areas where densities of prehistoric sites are apparently highest (Ringe 1995). This information provides guidance for INEEL project managers in selecting appropriate areas for new construction. This model indicates prehistoric archaeological sites appear to be concentrated in association with certain definable physical features of the land, with dense concentrations projected along drainages, atop buttes, within craters and caves, and throughout a 1.75-mile-wide zone along the edge of local lava fields (Ringe 1995). The RWMC is located in a depression surrounded by basaltic and lava ridges (as discussed in Section 4.5.1), which according to the predictive model, have a high potential for archaeological sites.

Nine archaeological surveys have been conducted in the RWMC area. These surveys located 13 potentially significant prehistoric sites within a 656-foot-wide zone surrounding the outside of the perimeter fence. Test excavations have been conducted at three of the prehistoric sites that are in close proximity to the perimeter fence. One of these prehistoric sites has been determined to be ineligible for nomination to the NRHP. The site has since been destroyed by building construction; however, portions may still be present within the northern expansion of the RWMC (Ringe-Pace 1998, Yohe 1995).

The DOE Idaho Operations Office (DOE-ID) has recently completed an historic buildings survey to assess the historic significance of all DOE-ID-managed buildings on the INEEL to determine their eligibility to the NRHP. Of the 516 buildings and structures inventoried, 217 are potentially eligible for nomination to the NRHP individually or as contributing elements of an historic district. Of these, 55 were located within the RWMC. Three of these Waste Management Facility (WMF) buildings (WMF-601, WMF-610, and WMF-612) may be considered individually eligible for nomination to the NRHP or as contributing to a potential historic district (Ringe-Pace 1998). Memorandums of Agreement between DOE-ID, the Idaho SHPO, and the Advisory Council on Historic Preservation (ACHP) outline specific techniques for preserving the historic value of the properties in conformance with the requirements of the National Park Service Historic American Buildings Survey and the Historic American Engineering Record (DOE-ID 1993). Facilities in the RWMC may require similar efforts in the future as they are scheduled for major modification or demolition.

Locations with a high likelihood of archaeological or Native American resources are carefully considered when siting new facilities or planning land use actions. Historically significant architectural structures are also carefully considered prior to activities that may affect their historic integrity. Prior to ground-disturbing activities or facility modifications at INEEL, project managers are required to follow an environmental checklist that includes direct consultation with the INEEL Cultural Resources Management Office to avoid damage to any sensitive archaeological or historic resources. If avoidance is not possible, mitigation plans are developed in consultation with the Idaho SHPO, the ACHP, and the Shoshone-Bannock Tribes (DOE 1998c).

A draft management plan for cultural resources on the INEEL (DOE-ID 1995a) contains procedures for management of all cultural resources, based on Federal laws in combination with DOE policy. Cultural resource sites are further protected by the INEEL security force. Excavation, collection, and curation of artifacts is strictly controlled, and locational information on the sites is protected by law from public disclosure. The management plan also outlines responsibilities and consultation procedures with the Shoshone-Bannock Tribes, State and Federal agencies, and other INEEL stakeholders (DOE-ID 1995a, DOE 1998c).

4.4.2 Native American Cultural Resources

Native American people hold the land sacred. In their terms, the entire INEEL is culturally important and, in fact, is located within the aboriginal territory of the Shoshone and Bannock peoples (USGS 1978). The Shoshone and Bannock Tribes, linguistically distinct groups, were in the INEEL area at the time of European exploration. These tribes used the area as a natural corridor for hunting, gathering, and collecting important natural resources.

Cultural resources, to the Shoshone-Bannock Tribes as well as other Native Americans, include all forms of traditional lifeways and usages of all natural resources. This includes not only prehistoric archaeological sites, which are important in a religious or cultural heritage context, but also features of the natural landscape and air, plant, water, mineral, or animal resources that have special historic and/or contemporary significance. A complete ethnobotanical survey has been conducted for the INEEL, including the RWMC area, which describes traditional Native American cultural uses of plants found on the INEEL (Anderson et al. 1996a).

Areas significant to the Shoshone-Bannock Tribes would include the buttes, wetlands, sinks, grasslands, juniper woodlands, Birch Creek, Big Southern Butte, Middle Butte, and the Big Lost River and the Little Lost River. None of these areas are located within the proposed project area; however, Middle Butte, the Big Lost River, and grasslands are found outside of the RWMC (Figure 4.2-1).

Five Federal laws (discussed in Section 4.4, Cultural Resources, of the DOE INEL EIS) prompt consultation between Federal agencies and Native American tribes. DOE-ID has established an INEEL Cultural Resources Management Team that is comprised of tribal cultural resource management staff, contractor staff, and DOE-ID staff who meet periodically to address cultural resource management issues. This Team has worked with the Shoshone-Bannock Tribes to develop guidelines for conducting consultations with the Tribes (DOE-ID 1995a). INEEL's cultural resources management plan defines procedures for involving the Shoshone-Bannock Tribes during the planning stages of project development. As a comprehensive inventory of Native American resources has not been completed at INEEL, direct consultation with interested tribal governments is critical for successful implementation of INEEL projects. DOE-ID also has a curation agreement with the Idaho Museum of Natural History in Pocatello specifying how non-*Native American Graves Protection and Repatriation Act* (NAGPRA) artifacts from the INEEL (such as unassociated arrowheads or historical artifacts from the Anglo-European settlement era) are submitted to and stored at the museum (DOE-ID 1996a). DOE-ID does not send NAGPRA cultural items or human remains to the museum; rather, DOE-ID consults with the Tribes and the Idaho SHPO on the appropriate management of such items.

4.4.3 Paleontological Resources

Documentation suggests that the region has relatively abundant and varied paleontological resources, including fossils of marine invertebrates, an extinct species of horse, mammoth, and camel representing different geologic eras (DOE-ID 1995a: Table 3-1). Although no formal paleontological surveys have been conducted at the RWMC, several fossil remains from this location have been recovered and are curated at the Idaho Museum of Natural History. These items include a horse metapodial, an unidentified horse megafaunal element, a mammoth tusk and bone, and wood and plant concretions. These fossils were recovered from alluvium strata at 3 to 16 feet below the surface (DOE-ID 1995a: Table 2 Appendix J).

4.5 Aesthetic and Scenic Resources

This section describes the visual character of the INEEL and the RWMC and briefly discusses the scenic areas in the vicinity of the INEEL. A detailed description of the INEEL's aesthetic and scenic resources is contained in Volume 2, Part A, Section 4.5 of the DOE INEL EIS.

The INEEL is part of the Snake River Plain ecosystem and generally consists of sagebrush steppe and native grasses. Seventy-five percent of the land that borders the site is managed by the Federal government (BLM and Forest Service), 24 percent is privately owned, and 1 percent is State-owned. The surrounding volcanic cones, domes, and mountain ranges are visible throughout the INEEL. As discussed in Section 4.2, Land Use, eight primary facility areas are located on the INEEL. The INEEL facilities look like commercial/industrial complexes and are widely dispersed throughout the INEEL. Although many INEEL facilities are visible from highways, most facilities are located over half a mile from public roads.

4.5.1 Visual Character of the Advanced Mixed Waste Treatment Project Site

The RWMC is a restricted-access area located 7 miles southwest of the CFA at the INEEL. The RWMC is located in a depression circumscribed by basaltic lava ridges. The ground surface is relatively flat at an elevation of about 5,000 feet above sea level. The BLM has classified the acreage within INEEL as Visual Resource Management Class III (mixed use: i.e., contrasts to the basic elements caused by management activity are evident, but should remain subordinated to the existing landscape) and IV (industrial use: i.e., any contrast attracts attention and is a dominant feature of the landscape in terms of scale). The RWMC maintains industrial uses consistent with Class IV. The proposed AMWTP site would be located within the TSA Zone of the RWMC between existing structures (see Figure 1.4-1).

4.5.2 Scenic Areas

Lands adjacent to the INEEL under the BLM jurisdiction are designated as Visual Resource Management Class II (i.e., changes in any of the basic elements [form, line, color, texture] caused by a management activity should not be evident in the characteristic landscape) (BLM 1984, 1986). This designation urges preservation and retention of the existing character of the landscape. Lands within the INEEL boundaries are designated as Class III and IV, the most lenient classes in terms of allowed modification.

The Craters of the Moon National Monument is located about 13 miles southwest of the INEEL's western boundary. The Monument contains a designated Wilderness Area, for which Class I (very high) air quality standards, or minimal degradation, must be maintained.

The BLM has listed the Black Canyon Wilderness Study Area, located adjacent to the INEEL (see Figure 4.2-1), for Wilderness Area designation (BLM 1986), which, if approved, would result in an upgrade of its Visual Resource Management class from Class II to Class I (i.e., natural ecological changes and very limited management activity are allowed).

Features of the natural landscape have special significance to the Shoshone-Bannock Tribes, and some INEEL features such as East Butte and Middle Butte are within the visual range of the Fort Hall Indian Reservation.

4.6 Geology

This section describes the geological, mineral resources, seismic, and volcanic characteristics of the INEEL, the RWMC, and surrounding area. A more detailed description of geology at the INEEL can be reviewed in Appendix Section E—2 and in the DOE INEL EIS, Volume 2, Section 4.6.

4.6.1 General Geology

The INEEL occupies a relatively flat area on the northwestern edge of the Eastern Snake River Plain (Figure 4.6-1). The INEEL area consists of a broad plain that has been built up from the eruptions of multiple flows of basaltic lava and deposition sediments. The flows at the surface at the INEEL and surrounding area range in age from 1.2 million to 2,100 years. The Plain is bounded on the north and south by the north-to-northwest-trending mountains and valleys of the Basin and Range Province, comprised of folded and faulted rocks. The Plain is bounded on the northeast by the Yellowstone Plateau. The Plain features thin, discontinuous, interbedded deposits of wind-blown loess and sand; water-borne alluvial fan, lacustrine, and flood-plain alluvial sediments; and rhyolitic domes (Kuntz et al. 1990).

The seismic characteristics of the Plain and the adjacent Basin and Range Province are different. Earthquakes and active faulting are associated with Basin and Range tectonic activity. The Plain, however, has historically experienced few and small earthquakes (King et al. 1987, Pelton et al. 1990, Woodward-Clyde 1992a, Jackson et al. 1993). The major episode of Basin and Range faulting began 20 to 30 million years ago and continues today, most recently associated with the October 28, 1983, Borah Peak earthquake northwest of the RWMC. The earthquake had a surface wave magnitude of 7.3 with peak horizontal acceleration of 0.022 to 0.078g at the INEEL (Jackson 1985).

Four northwest-trending volcanic rift zones (VRZ) (see Figure 4.6-2) are known to lie across the Plain at or near the INEEL; they have been attributed to basaltic eruptions that occurred 4 million to 2,100 years ago (Bowman 1995, Hackett and Smith 1992, Kuntz, et al. 1990).

INEEL soils are derived from volcanic and sedimentary rocks from nearby highlands. In the southern part of the INEEL, the soils are gravelly to rocky and generally shallow. The northern portion is composed mostly of unconsolidated clay, silt, and sand. The thickness of surficial sediments on the INEEL ranges from less than one foot at basalt outcrops east of the Idaho Chemical Processing Plant (ICPP) to 313 feet near and southeast of the Big Lost River sinks (Anderson et al. 1996b).

The RWMC is situated in a small valley surrounded by basaltic ridges rising to 60 feet above the landscape. Surface sediments vary in thickness from about 2 to 23 feet and consist of unconsolidated clay, silt, and gravel (Anderson, et al. 1996b). The elevation of the RWMC is 5,010 feet above mean sea level. Surface sediment at the proposed site of the AMWTP would be excavated to construct the building foundation on bedrock.

Figure 4.6-1. Geologic features in the region of the INEEL.

Figure 4.6-2. Map of INEEL, showing locations of VRZs and lava flow hazard zones.

4.6.2 Mineral Resources

Mineral resources within the INEEL boundary include sand, gravel, pumice, silt, clay, and aggregate. These resources are extracted at several quarries or pits at INEEL and used for road construction and maintenance, new facility construction and maintenance, and waste management activities. The RWMC uses construction materials extracted from the existing INEEL borrow source areas (see Figure 4.2-2). The geologic history of the Plain makes the potential for petroleum production at the INEEL very low. The potential for geothermal energy exists at INEEL; however, a study conducted in 1979 at INEEL identified no commercial quantities of geothermal fluids (Mitchell et al. 1980).

4.6.3 Seismic Hazards

The Snake River Plain has a remarkably low rate of seismicity, whereas the surrounding Basin and Range has a fairly high rate of seismicity (Woodward-Clyde 1992a). Major seismic hazards consist of the effects from ground shaking and surface deformation (e.g., surface faulting, tilting). Other potential seismic hazards such as avalanches, landslides, mudslides, and soil liquefaction are not likely to occur at the INEEL because the local geologic conditions are not conducive to these types of activities. Based on the seismic history and the geologic conditions of the area, a moderately low seismic risk exists at INEEL including the RWMC where the proposed AMWTP would be sited (see Appendix Section E-2). However, moderate to strong ground shaking can affect the INEEL from earthquakes in the Basin and Range.

For purposes of siting new facilities within the INEEL, a series of seismic hazard maps have been generated (Smith 1995). Through the use of contour lines, these maps show the levels of ground motion (acceleration measured in units of gravity [g]) to be expected at various return periods. For a 500-year period, the RWMC falls within the 0.10g contour; and, for a 2,000-year return period, it falls within the 0.18g contour (see Appendix Section E-2). Although the contoured ground motions can be used for site selection purposes and as a general guide to the levels of seismic hazard any place on the INEEL, they are not for design of facilities. INEEL seismic design basis events are determined by the INEEL Natural Phenomena Committee and incorporated into the INEEL Architectural and Engineering Standards based on seismic hazard studies and the requirements of DOE Order 420.1. The potential seismic risk would be considered and incorporated in the design of the AMWTP. Section 5.14, Facility Accidents, presents the potential impacts of postulated seismic events.

4.6.4 Volcanic Hazards

Volcanic hazards include the effects of lava flows, fissures, uplift, subsidence, volcanic earthquakes, and ash flows or airborne ash deposits. Basalt volcanic activity occurred from 4 million to 2,100 years ago in the INEEL site area. The statistics of 116 measured INEEL-area lava flow lengths and areas were used to define the two lava flow hazard zones (see Figure 4.6-2). The most recent and closest volcanic eruption occurred 2,000 years ago at the Craters of the Moon National Monument 15 miles southwest of the INEEL (Kuntz et al. 1992). Based on probability analysis of the volcanic history in and near the south-central INEEL area, the Volcanism Working Group estimated that the conditional probability that basaltic volcanism would affect a south-central INEEL location is less than 2.5×10^{-5} per year (once per 40,000 years or longer), where the hazard associated with Axial Volcanic Zone volcanism is greatest (VWG 1990). The estimated recurrence interval for the Axial Volcanic Zone is 16,000 years, 17,000 years for the Arco VRZ, and 40,000 years for the Lava Ridge-Hells Half Acre VRZ (Hackett and Smith 1994).

Although there is a history of volcanism in the INEEL area, explosive volcanic eruptions are improbable. Lava flows associated with Axial Volcanic Zone volcanism are considered more of a potential hazard at the RWMC. The DOE INEL EIS, Volume 2, Section 5.14, Facility Accidents, presents the effects of a hypothetical lava flow that covers the RWMC. Section 5.14 of this EIS presents tiered analyses of the effects of a hypothetical lava flow that covers the AMWTP after scaling factors have been applied to both frequency and consequences. The scaling was based on AMWTP project-specific-related changes in RWMC waste inventories and handling.

4.7 Air Resources

This section describes the air resources of the INEEL and the surrounding area. The discussion includes the climatology and meteorology of the region, a summary of applicable regulations, descriptions of radiological and nonradiological air contaminant emissions, and a characterization of existing levels of air pollutants. Emphasis is placed on changes in air resource conditions since the characterization performed to support the DOE INEL EIS, Section 4.7, Air Resources, from which this document is tiered. Additional detail and background information on the material presented in this section can be found in Appendix Section E-3, Air Resources.

4.7.1 Climate and Meteorology

The Eastern Snake River Plain climate exhibits low relative humidity, wide daily temperature swings, and large variations in annual precipitation. Average seasonal temperatures measured onsite range from 18.8°F in winter to 64.8°F in summer, with an annual average temperature of about 42°F. Temperature extremes range from a summertime maximum of 103°F to a wintertime minimum of -49°F. Annual precipitation is light, averaging 8.71 inches, with monthly extremes of 0 to 5 inches. The maximum 24-hour precipitation is 1.8 inches. The greatest short-term precipitation rates are primarily attributable to thunderstorms, which occur approximately two or three days per month during the summer. Average annual snowfall at the INEEL is 27.6 inches, with extremes of 59.7 inches and 6.8 inches.

Most onsite locations experience the predominant southwest/northeast wind flow of the Eastern Snake River Plain, although terrain features near some locations cause variations from this flow regime. An illustration of annual wind flow is provided by the wind roses in Figure 4.7-1. These wind roses show the frequency of wind direction (in other words, the direction from which the wind blows) and speed at three of the meteorological monitoring sites on the INEEL for the period 1988 to 1992. Multi-year wind roses exhibit little variability in time and are representative of current conditions. INEEL wind roses reflect the predominance of southwesterly winds that result during storm passage and from daily solar heating. Winds from this direction are frequently unstable or neutral, promoting effective dispersion, and extend to a considerable depth through the atmosphere. At night, cool, stable air frequently drains down the valley in a shallow layer from the northeast toward the southwest. Under these conditions, dispersion is limited until solar heating the following day mixes the plume through the mixing depth. Winds above such stable layers exhibit less variability and provide the transport environment for materials released from INEEL sources.

The highest hourly average near-ground wind speed measured onsite is 51 miles per hour from the west-southwest, with a maximum instantaneous gust of 78 miles per hour (Clawson et al. 1989). Other than thunderstorms, severe weather is uncommon. Five funnel clouds (tornadoes not touching the ground) and no tornadoes have been reported onsite between 1950 to 1997. Visibility in the region is good because of the low moisture content of the air and minimal sources of visibility-reducing pollutants. At Craters of the Moon Wilderness Area (approximately 20 miles southwest of the proposed AMWTP site), the annual average visual range is 144 miles (Notar 1998a).

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

stations on the INEEL.

4.7.2 Standards and Regulations

Air quality regulations have been established to protect the public from potential harmful effects of air pollution. These regulations (1) designate acceptable levels of pollution in ambient air, (2) establish limits on radiation doses to members of the public, (3) establish limits on air pollutant emissions and resulting deterioration of air quality due to vehicular and other sources of human origin, (4) require air permits to regulate (control) emissions from stationary (nonvehicular) sources of air pollution, and (5) designate prohibitory rules, such as rules that prohibit open burning. The Federal *Clean Air Act* (CAA) (and amendments) provides the framework to protect the nation's air resources and public health and welfare. In Idaho, the U.S. Environmental Protection Agency (EPA) and the State of Idaho Department of Health and Welfare (IDHW), Division of Environmental Quality, are jointly responsible for establishing and implementing programs that meet the requirements of the Federal CAA. INEEL activities are subject to air quality regulations and standards established under the CAA and by the State of Idaho (IDHW 1997) and to internal policies and requirements of the DOE. The area around the INEEL is in attainment or unclassified for all National Ambient Air Quality Standards (NAAQS). Air quality standards and programs applicable to INEEL operations are summarized in Appendix Section E-3, Air Resources.

4.7.3 Radiological Air Quality

The population of the Eastern Snake River Plain is exposed to environmental radiation of both natural and human origin. This section summarizes the sources and levels of radiation exposure in this geographical region, including sources of airborne radionuclide emissions from the INEEL.

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

Background radiation includes sources such as cosmic rays; radioactivity naturally present in soil, rocks, and the human body; and airborne radionuclides of natural origin (such as radon). Radioactivity still remaining in the environment as a result of worldwide atmospheric testing of nuclear weapons also contributes to the background radiation level, although in very small amounts. The natural background dose for residents of the Eastern Snake River Plain is estimated at about 360 millirem per year, with more than half (about 200 millirem per year) caused by the inhalation of radioactive particles formed by the decay of radon (DOE-ID 1997c).

INEEL operations can result in releasing radioactivity to air either directly (such as through stacks or vents) or indirectly (such as by resuspension of radioactivity from contaminated soils). Emissions from INEEL facilities include radioisotopes of the noble gases (argon, krypton, and xenon) and iodine; particulate fission products, such as ruthenium, strontium, and cesium; radionuclides formed by neutron activation, such as tritium (hydrogen-3), carbon-14, and cobalt-60; and heavy elements, such as uranium, thorium, and plutonium, and their decay products. Table 4.7-1 provides a summary of the principal types of airborne radioactivity emitted during 1995 and 1996 from INEEL facilities.

Table 4.7-1. Summary of airborne radionuclide emissions (in curies) for 1995 and 1996 from facility areas at the INEEL.

	Tritium/ Carbon-14		Iodines		Noble gases		Mixed fission and activation products[a]		U/Th/TRU[b]	
Area	1995	1996	1995	1996	1995	1996	1995	1996	1995	1996
Monitored sources										
Argonne National Laboratory-West	-	8.9E+00	-[c]	-	1.0E+01	1.0E+03	7.9E-07	3.5E-06	3.1E-05	3.2E-05
Central Facilities Area	-	-	-	-	-	-	-	-	-	-
Idaho Chemical Processing Plant	4.4E+00	1.4E+02	9.6E-03	5.5E-02	6.6E-04	2.9E-02	4.3E-04	3.4E-04	1.1E-06	6.5E-06
Naval Reactors Facility	-	-	-	-	-	-	-	-	-	-
Power Burst Facility	3.8E-02	4.1E-02	2.7E-05	2.7E-05	-	-	-	-	-	-
Rad. Waste Management Complex	-	-	-	-	-	-	-	-	-	-
Test Area North	-	-	-	-	-	-	-	-	-	-
Test Reactor Area	-	-	-	-	-	-	-	-	-	-
INEEL Total	4.5E+00	1.5E+02	9.6E-03	5.5E-02	1.0E+01	1.0E+03	4.3E-04	3.4E-04	3.2E-05	3.8E-05
Other release points										
Argonne National Laboratory-West	5.9E-02	1.9E-02	-	-	-	5.1E-04	1.2E-05	7.8E-06	2.8E-07	1.3E-07
Central Facilities Area	-	-	-	-	-	-	3.1E-06	3.1E-06	1.2E-05	1.3E-05
Idaho Chemical Processing Plant	2.1E-04	2.1E-08	1.8E-09	1.8E-09	-	-	3.6E-04	4.3E-03	6.4E-06	2.0E-06
Naval Reactors Facility	8.6E-01	1.3E+00	5.4E-06	2.4E-05	4.9E-01	4.5E-02	8.9E-06	3.5E-04	-	4.9E-06
Power Burst Facility	-	-	-	-	-	-	1.7E-07	5.8E-07	4.0E-08	1.5E-07
Rad. Waste Management Complex	-	-	-	-	-	-	1.4E-13	1.4E-05	-	2.0E-06
Test Area North	6.8E-03	1.4E-04	-	-	-	-	2.8E-06	4.2E-06	1.4E-05	1.3E-06
Test Reactor Area	1.3E+01	1.3E+01	1.3E-02	2.9E-03	1.4E+03	1.8E+03	3.4E+00	6.0E+00	2.5E-06	9.0E-06
INEEL Total	1.4E+01	1.4E+01	1.3E-02	2.9E-03	1.4E+03	1.8E+03	3.4E+00	6.0E+00	3.5E-05	3.2E-05
Fugitive sources										
Argonne National Laboratory-West	-	-	-	-	-	-	-	-	-	-
Central Facilities Area	6.6E+00	5.6E+00	-	-	-	-	1.9E-05	1.9E-05	6.6E-08	6.4E-08
Idaho Chemical Processing Plant	8.9E-09	8.9E-09	3.8E-08	3.8E-08	-	-	9.2E-06	1.6E-06	5.9E-08	5.7E-08
Naval Reactors Facility	-	1.3E+00	-	2.4E-05	-	-	7.8E-05	2.8E-04	-	5.0E-06
Power Burst Facility	-	1.4E-02	-	-	-	-	5.8E-05	5.8E-05	1.5E-07	1.5E-07
Rad. Waste Management Complex	9.0E+02	7.0E+02	-	-	-	-	1.4E-05	1.4E-05	9.5E-09	9.5E-09
Test Area North	5.9E-02	5.9E-02	-	-	-	-	3.5E-06	1.3E-04	9.4E-08	9.4E-08
Test Reactor Area	8.0E+01	8.0E+01	-	-	-	-	1.1E-02	1.1E-01	3.0E-04	2.9E-04
INEEL Total	9.9E+02	7.9E+02	3.8E-08	2.4E-05	-	-	1.1E-02	1.1E-01	3.0E-04	3.0E-04
Total INEEL releases										
Argonne National Laboratory-West	5.9E-02	8.9E+00	-	-	1.0E+01	1.0E+03	1.3E-05	1.1E-05	3.2E-05	3.2E-05
Central Facilities Area	6.6E+00	5.6E+00	-	-	-	-	2.2E-05	2.2E-05	1.2E-05	1.3E-05
Idaho Chemical Processing Plant	4.4E+00	1.4E+02	9.6E-03	5.5E-02	6.6E-04	2.9E-02	8.0E-04	4.6E-03	7.5E-06	8.6E-06
Naval Reactors Facility	8.6E-01	2.6E+00	5.4E-06	4.8E-05	4.9E-01	4.5E-02	8.7E-05	6.3E-04	-	9.9E-06
Power Burst Facility	3.8E-02	5.5E-02	2.7E-05	2.7E-05	-	-	5.8E-05	5.9E-05	1.9E-07	3.0E-07
Rad. Waste Management Complex	9.0E+02	7.0E+02	-	-	-	-	1.4E-05	2.8E-05	9.5E-09	2.0E-06
Test Area North	6.6E-02	5.9E-02	-	-	-	-	6.2E-06	1.4E-04	1.4E-05	1.4E-06
Test Reactor Area	9.3E+01	9.3E+01	1.3E-02	2.9E-03	1.4E+03	1.8E+03	3.4E+00	6.1E+00	3.0E-04	3.0E-04
INEEL Total	1.0E+03	9.5E+02	2.2E-02	5.8E-02	1.4E+03	2.9E+03	3.4E+00	6.2E+00	3.7E-04	3.7E-04

Sources: DOE-ID 1996b and 1997a.

a. Mixed fission and activation products that are primarily particulate in nature (e.g., cobalt-60, strontium-90, and cesium-137).

b. U/Th/TRU = Radioisotopes of heavy elements such as uranium, thorium, plutonium, americium, neptunium, etc.

c. The emissions from this group are negligibly small or zero.

4.7.3.2 Existing Radiological Conditions. Monitoring and assessment activities are conducted to characterize existing radiological conditions at the INEEL and surrounding environment. Results of these activities show that exposures resulting from airborne radionuclide emissions are well within applicable standards and are a small fraction of the dose from background sources. These results are discussed in the following sections for both onsite and offsite environments.

It is important to note that characterizations of existing conditions also take into account increases in radionuclide emissions and radiation doses that are projected to occur between the present and the time that the proposed AMWTP becomes operational. These increases are assumed to be adequately described by the impacts associated with the Preferred Alternative assessed in the DOE INEL EIS (Section 5.7 and Appendix Section F-3). Thus, all subsequent reference to "baseline conditions and projected increases" refers to existing conditions plus increases associated with the DOE INEL EIS Preferred Alternative. However, some modifications were necessary to correct or update the Preferred Alternative impacts as follows:

- The Preferred Alternative included a conceptual facility (called the Idaho Waste Processing Facility) that has been replaced by the proposed AMWTP.
- The Preferred Alternative included operation of the Waste Experimental Reduction Facility (WERF), which would not operate concurrently with the proposed AMWTP.
- The Preferred Alternative addressed impacts that would occur within or around the entire INEEL, and some of these areas are unaffected by the proposed AMWTP.

The specific modifications made to reflect these conditions are described in Appendix Section E-3.

4.7.3.2.1 Onsite Doses. An indication of radiological conditions is obtained by comparing radiation levels on and near the INEEL boundary communities and distant locations (Figure 4.7-2). Results from onsite and boundary community locations include contributions from background conditions and INEEL emissions, while distant locations represent background conditions beyond the influence of INEEL emissions. These data show that over the most recent 5-year period for which results are available (1992-1996), average radiation exposure levels for the boundary locations were no different than those at distant stations. The average annual dose measured by the Environmental Science and Research Foundation, Inc. during 1996 was 123 millirem for distant locations and 124 millirem for boundary community locations. The corresponding averages measured by Lockheed Martin Idaho Technologies Company (LMITCO) were 127 millirem for the distant group and 125 millirem for the boundary group. These differences are well within the range of normal variation. On the INEEL, dosimeters around some facilities may show slightly elevated levels, since many are intentionally placed to monitor dose rate in areas adjacent to radioactive material storage areas or areas of known soil contamination (DOE-ID 1997c).

The DOE INEL EIS (Sections 4.7 and 5.7) assessed the radiation dose to workers at major INEEL facility areas that results from radionuclide emissions from INEEL facilities. The maximum dose at any onsite area resulting from cumulative emissions was estimated at 0.32 millirem per year (Leonard 1993a)[1]. If corrected to remove contributions of the WERF, this dose would be 0.21 millirem per year. In either case, this dose is a very small fraction of the DOE-established occupational dose limit (5,000 millirem per year) and is below the National Emissions Standard for Hazardous Air Pollutants (NESHAP) dose limit of 10 millirem per year. The NESHAP limit applies to the maximally exposed individual (MEI) (not to workers) but is the most restrictive limit for airborne releases and serves as a useful comparison.

Figure 4.7-2. Offsite environmental dosimeter and foodstuff sampling locations.

4.7.3.2.2 Offsite Doses. The offsite population may receive a radiation dose as a result of radiological conditions directly attributable to INEEL operations. The dose associated with radiological emissions is assessed annually to demonstrate compliance with the NESHAP standard. The effective dose equivalent to the MEI resulting from radionuclide emissions from INEEL facilities during 1995 and 1996 has been estimated at 0.018 millirem and 0.031 millirem, respectively (DOE-ID 1996d, DOE-ID 1997b). These doses are well below both the NESHAP dose limit (10 millirem per year) and the dose received from background sources (about 360 millirem per year).

The DOE INEL EIS (Sections 4.7 and 5.7) provided an estimate of the collective dose to the population surrounding the INEEL as a result of air emissions from all facilities that were expected (at the time the analysis was performed) to become operational before June 1, 1995. The annual collective dose to the surrounding population, based on 1990 U.S. Census Bureau data, was estimated at 0.3 person-rem. This dose applies to the total population residing within a circular area with a 50-mile radius extending from each major facility. The total population within this area is about 120,000 people, resulting in an average individual dose of about 0.003 millirem.

If only the population within 50 miles of the proposed AMWTP location is considered, the annual collective dose from baseline sources is about 0.085 person-rem. Projected increases associated with the DOE INEL EIS Preferred Alternative would increase this dose to about 0.42 person-rem. This population dose of 0.42 person-rem would be distributed over a population of roughly 80,000 and is very small when compared with the annual dose received by the same population from background sources (about 29,000 person-rem).

It should be noted that the collective dose depends not only on the types and levels of emissions, but also on the size and distribution pattern of the surrounding population. Thus, the future baseline population dose could increase even if emission rates do not change. If emission rates remained constant, the collective dose would increase by an amount that corresponds directly to the population growth rate.

4.7.3.3 Summary of Radiological Conditions. Radioactivity and radiation levels resulting from INEEL air emissions are very low, well within applicable standards, and negligible when compared to doses received from natural background sources. This applies both to onsite conditions to which INEEL workers or visitors may be exposed and offsite locations where the general population resides. Health risks associated with maximum potential exposure levels in the onsite and offsite environments are described in Section 4.12, Occupational and Public Health and Safety.

4.7.4 Nonradiological Conditions

Persons in the Eastern Snake River Plain are exposed to sources of air pollutants, such as agricultural and industrial activities, residential wood burning, wind-blown dust, and automobile exhaust. Many of the activities at the INEEL also emit air pollutants. The types of pollutants that are assessed here include (1) the criteria pollutants regulated under the State and NAAQS and (2) other types of pollutants with potentially toxic properties called toxic (or hazardous) air pollutants. Criteria pollutants include nitrogen dioxide, sulfur dioxide, carbon monoxide, lead, ozone, and respirable particulate matter (particles that are small enough to pass easily into the lower respiratory tract PM_{10} and $PM_{2.5}$), for which NAAQS have been established. Volatile organic compounds are assessed as precursors leading to the development of ozone. Toxic air pollutants include cancer-causing agents, such as arsenic, benzene, carbon tetrachloride, and formaldehyde, as well as substances that pose noncancer health hazards, such as fluorides, ammonia, and hydrochloric and sulfuric acids.

4.7.4.1 Sources of Air Emissions. The types of nonradiological emissions from INEEL facilities and activities are similar to those of other major industrial complexes. Combustion sources such as boilers and emergency generators emit both criteria and toxic air pollutants. Sources such as chemical processing operations, waste management activities (other than combustion), and research laboratories emit primarily toxic air pollutants. Waste management, construction, and related activities (such as excavation) also generate fugitive particulate matter.

The DOE INEL EIS (Sections 4.7 and 5.7) characterized baseline emission rates for existing facilities for two separate cases. The *actual emissions case* represented the collective emission rates of nonradiological pollutants experienced by INEEL facilities during 1991 for criteria pollutants and 1989 for toxic air pollutants. The *maximum emissions case* represents a scenario in which all permitted sources at the INEEL are assumed to operate in such a manner that they emit specific pollutants to the maximum extent allowed by operating permits or applicable regulations. These emissions were adjusted to take projected increases (through June 1995) into account.

Actual INEEL-wide emissions for 1995 and 1996 are presented in DOE/ID-10537 and DOE/ID-10594, respectively (DOE-ID 1996b, DOE-ID 1997a). A comparison of actual criteria pollutant emissions during 1995 and 1996 with levels previously assessed in the DOE INEL EIS (Section 4.7) under the maximum emissions case is presented in Table 4.7-2. For each criteria pollutant except lead, the current (1995-1996) emission rates are at least a factor of three less than the levels assessed in the DOE INEL EIS (Section 4.7). In the case of lead, the average hourly emission rates during 1996 were about three times higher than the levels assessed in the DOE INEL EIS (Section 4.7). However, the analysis in the DOE INEL EIS (Section 4.7) determined that the maximum ambient air concentration of lead was about 0.1 percent of the applicable standard. In addition, less than 1 percent of 1996 lead emissions were from sources located within the RWMC.

Table 4.7-2. Comparison of recent criteria air pollutant emissions estimates for the INEEL with the levels assessed under the maximum emissions case in the DOE INEL EIS.

	DOE INEL EIS (Section 4.7)		Actual sitewide emissions					
	Maximum baseline case		1995			1996		
	Maximum	Annual	Actual	Maximum	Annual	Actual	Maximum	Annual
	hourly	average	hourly	hourly	average	hourly	hourly	average
Pollutant	(kg/hr)	(kg/yr)	(kg/hr)	(kg/hr)	(kg/yr)	(kg/hr)	(kg/hr)	(kg/yr)
Carbon monoxide	250	2,200,000	82	123	127,273	73	155	154,545
Nitrogen dioxide	780	3,000,000	245	441	209,091	218	636	218,182
Particulate matter[a]	290	900,000	32	50	200,000	30	45	181,818
Sulfur dioxide	350	1,700,000	109	209	109,091	68	300	118,182
Lead compounds	0.084	4.1	0.0035	0.77	4.6	0.27	1.9	1.5
VOCs[b]	ns[c]	ns	86	105	10,000	43	59	16,364

Sources: 1995 INEEL Air Emissions Inventory Report (DOE-ID 1996b); 1996 INEEL Air Emissions Inventory Report (DOE-ID 1997a).

a. The particle size of particulate matter emissions is assumed to be in the respirable range (less than 10 microns).

b. VOCs = volatile organic compounds, excluding methane.

c. ns = not specified; the DOE INEL EIS (Section 4.7) evaluated emissions of specific types of VOCs from individual facilities, but did not

include a total for the maximum baseline case.

It should also be noted that the New Waste Calcining Facility (NWCF), which is the single largest source of nitrogen dioxide emissions at the INEEL, did not operate during 1995-1996 (DOE-ID 1997c). Operation of that facility can substantially increase annual nitrogen dioxide emissions; however, those emission levels would still be well below the maximum case assessed in the DOE INEL EIS (Section 4.7). The NWCF is currently scheduled to be shut down in 1999 and would not restart unless major emission control modifications are made to bring the facility into compliance with proposed maximum available control technology standards for combustion of hazardous waste, as well as other applicable State of Idaho requirements.

The DOE INEL EIS (Section 4.7) identified 26 toxic air pollutants that were emitted from INEEL facilities in quantities exceeding the screening level established by the State of Idaho. (The health hazard associated with toxic air pollutants emitted in lesser quantities is considered low enough by the State of Idaho not to require detailed assessment.) For a few toxic air pollutants, actual 1996 emissions were greater than the levels assessed in the DOE INEL EIS (Section 4.7). These increases were primarily attributable to decontamination and decommissioning activities. Unlike criteria pollutants, the regulations governing toxic emissions from the proposed AMWTP apply only to incremental increases of these pollutants and not the sum of baseline levels and incremental increases (IDHW 1997).

4.7.4.2 Existing Conditions. The assessment of nonradiological air quality described in the DOE INEL EIS (Sections 4.7 and 5.7) was based on the assumption that the available monitoring data are not sufficient to allow a meaningful characterization of existing air quality and that such a characterization must rely on an extensive program of air dispersion modeling. (See Appendix Section E-3 of this EIS for a discussion of current nonradiological air quality monitoring programs and data applicable to the INEEL region). The modeling program applied for this purpose utilized computer codes, methods, and assumptions that are considered acceptable by the EPA and the State of Idaho for regulatory compliance purposes. The methodology applied in these assessments is described in detail in Appendix Section F-3 of the DOE INEL EIS. The remainder of this section describes the results of the assessments in the DOE INEL EIS (Sections 4.7 and 5.7) for air quality conditions in the affected environment (i.e., concentrations of pollutants in air within and around the INEEL). Potential changes in the affected air environment resulting from changes in INEEL emission levels (compared to those at the time the assessments in the DOE INEL EIS, Sections 4.7 and 5.7, were performed) are also discussed.

4.7.4.2.1 Onsite Conditions. The DOE INEL EIS (Section 4.7) contains an assessment of existing conditions as a result of cumulative toxic air pollutant emissions from sources located within all areas of the INEEL. (Criteria pollutant levels were assessed only for ambient air locations, that is, locations to which the general public has access.) The onsite levels were compared to occupational exposure limits established to protect workers. With one exception, the estimated onsite concentrations were estimated at levels well below the occupational standards. The exception was for maximum short-term benzene concentration, which slightly exceeded the standard at the maximum predicted location within the CFA. Those levels resulted primarily from gasoline and diesel fuel storage tank emissions at the CFA-754 Tank Farm; however, those tanks were taken out of service in 1995, and current benzene levels are estimated to be below the occupational standard for that substance.

4.7.4.2.2 Offsite Conditions. Estimated maximum offsite pollutant concentrations were assessed in the DOE INEL EIS (Section 4.7) for locations along the INEEL boundary, public roads within the site boundary, and at Craters of the Moon Wilderness Area. The results for criteria pollutants are presented in Table 4.7-4 of the DOE INEL EIS (Section 4.7) and indicate that all concentrations are well within the ambient air quality standards for both the actual and maximum emissions cases. For the maximum emissions baseline, the highest sulfur dioxide concentration (over a 3-hour period) at the site boundary is about 13 percent of the standard, while the highest 24-hour particulate matter level is about 33 percent of the standard. Levels of all other pollutants are less than 12 percent of applicable standards. The highest offsite levels are estimated to occur at the boundary south and south-southwest of CFA. Somewhat higher results were obtained for public roads traversing the site, with 24-hour particulate matter at 53 percent of the standard and 3- and 24-hour sulfur dioxide at 45 and 37 percent of the standard, respectively. Values at Craters of the Moon Wilderness Area were below 10 percent of applicable standards in all cases. It should be noted that actual emissions of these pollutants from INEEL facilities are much lower than those assumed for the maximum scenario, so there is a wide margin of protection inherent in these results.

In the DOE INEL EIS (Section 4.7), concentrations of criteria pollutants from certain sources were also compared to Prevention of Significant Deterioration (PSD) regulations, which have been established to ensure that air quality remains good in those areas where ambient air quality standards are not exceeded. (See Appendix Section E-3, Figure E-3-1, for a description of these regulations.) These PSD increments are allowable increases over baseline conditions from sources that have become operational after certain baseline dates. Increments have been established for sulfur dioxide, respirable particulates, and nitrogen dioxide. Separate increments are established for pristine areas, such as national parks or wilderness areas (termed Class I areas) and for the nation as a whole (Class II areas). Craters of the Moon Wilderness Area is the Class I area nearest the INEEL, while the site boundary and public roads are the applicable Class II areas.

In support of this EIS, an update of the PSD increment consumption has been performed to characterize the baseline conditions that apply to sources in the south-central portion of the INEEL. The updated assessment includes all INEEL sources subject to PSD regulation that were operational as of June 1996. Sources which are considered "projected increases to the baseline" (see Section 4.7.3.2) were also included. The results (see Tables 4.7-3 and 4.7-4) show that for all pollutants and averaging times, the amount of increment consumption remains well within allowable Class I and Class II levels.

The DOE INEL EIS (Sections 4.7 and 5.7) assessed concentrations of toxic air pollutants and compared the results to the ambient air standards promulgated for new sources by the State of Idaho Rules for Control of Air Pollution in Idaho (IDHW 1997). These standards are increments that apply only to new or modified sources and not to existing emissions. Nevertheless, these increments were used as "reference levels" for comparing current conditions with recommendations for ensuring public health protection in association with new sources of emissions. Annual average concentrations of carcinogenic toxics were assessed for offsite locations (site boundary and Craters of the Moon Wilderness Area), while levels of noncarcinogenic toxics were assessed for locations along public roads as well as at these offsite locations.

Maximum offsite concentrations of carcinogenic toxics (summarized in Table 4.7-7 of the DOE INEL EIS) occur at the site boundary due south of CFA. All carcinogenic air pollutant levels are below the reference levels. Noncarcinogenic air pollutant levels (Table 4.7-8 of the DOE INEL EIS) are all well below the reference levels (1 percent or less) at all site boundary locations. Levels at some public road locations, which are closer to emissions sources, are higher than site boundary locations, but still well below the reference levels.

4.7.4.3 Summary of Nonradiological Air Quality. The air quality on and around the INEEL is good and within applicable guidelines. The area around the INEEL is in attainment or unclassified for all NAAQS. Levels of criteria pollutants were assessed in the DOE INEL EIS (Section 4.7) and found to be well within applicable standards for the maximum emissions scenario. Changes in criteria pollutant emission rates since the assessments in the DOE INEL EIS (Section 4.7) were performed are not of a magnitude to alter those findings. For toxic emissions, all INEEL boundary and public road levels have been found to be well below reference levels appropriate for comparison. Current emission rates for some toxic pollutants are higher than the baseline levels assessed in the DOE INEL EIS (Section 4.7), but resultant ambient concentrations are expected to remain below reference levels. Similarly, all toxic pollutant levels at onsite locations are expected to remain below occupational limits established for protection of workers.

Table 4.7-3. PSD increment consumption at Craters of the Moon Wilderness (Class I) Area by

existing (1996) and projected sources subject to PSD regulation.

Pollutant	Averaging time	Allowable PSD increment [a] (ug/m^3)	Amount of PSD increment consumed [b] (ug/m^3)	Percent of PSD increment consumed
Sulfur dioxide	3-hour	25	5.9	24
	24-hour	5	1.8	36
	Annual	2	0.09	4.5
Respirable particulates[c]	24-hour	8	0.6	7.5
	Annual	4	0.008	0.2
Nitrogen dioxide [d]	Annual	3	0.004	1.8

a. All increments specified are State of Idaho standards (IDHW 1997).
b. Data on particulate size are not available for most sources. For purposes of comparison to the respirable particulate increments, it is conservatively assumed that all particulates emitted are of respirable size (that is, 10 microns or less in diameter).
c. Assumes that New Waste Calcining Facility (the largest source of nitrogen dioxide emissions at the INEEL) operates for the entire year.

Table 4.7-4. PSD increment consumption at Class II areas at the INEEL by existing (1996) and projected sources subject to PSD regulation.

Pollutant	Averaging time	Allowable PSD increment a (ug/m^3)	Maximum predicted concentration (ug/m^3): INEEL boundary	Maximum predicted concentration (ug/m^3): Public Roads	Amount of PSD increment consumed b (ug/m^3)	Percent of PSD increment consumed

Sulfur dioxide	3-hour 24-hour Annual	512 91 20	74 12 1.8	132 29 2.4	132 29 2.4	26 32 12
Respirable particulates[c]	24-hour Annual	30 17	3.8 0.1	15 0.92	15 0.92	51 5.4
Nitrogen dioxide [d]	Annual	25	1.3	1.4	1.4	5.7

a. All increments specified are State of Idaho standards (IDHW 1997).
b. The amount of increment consumed is equal to the highest value of either the site boundary or public road locations.
c. Data on particulate size are not available for most sources. For purposes of comparison to the respirable particulate increments, it is conservatively assumed that all particulates emitted are of respirable size (that is, 10 microns or less in diameter).
d. Assumes that New Waste Calcining Facility operates for the entire year.

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4.8 Water Resources

This section describes existing water resources, site hydrologic conditions, existing water quality for surface and subsurface water, water use, and water rights. The subsurface water section also describes the vadose zone (or unsaturated zone and perched water bodies) located between the land surface and the Snake River Plain Aquifer. Since the existing major facility area (RWMC) would be affected most by the proposed action, the water resources for the RWMC and surrounding areas are emphasized.

A previous EIS (DOE INEL EIS) conducted an extensive review of the INEEL's affected environment. In lieu of duplication of that discussion in this EIS, the applicable sections of Volume 2 of the DOE INEL EIS are referenced (Section 4.8 and Appendix Section F-2.2) for surface and subsurface water and water rights. New water resources information obtained after issue of the DOE INEL EIS for the RWMC and surrounding area follows.

4.8.1 Surface Water

Other than three intermittent streams, Big Lost River, Little Lost River, and Birch Creek, the remaining surface water bodies consist of natural wetland-like and manmade percolation and evaporation ponds. No wetland areas exist within the RWMC boundary. The following sections discuss the regional drainage, local runoff, floodplains, and surface water quality with emphasis on the RWMC area.

4.8.1.1 Regional Drainage. The INEEL is located in the Pioneer Basin, a closed drainage basin that includes three main tributaries, Big Lost River, Little Lost River, and Birch Creek. These streams receive water from mountain watersheds located to the north and northwest of the INEEL (see Figure 4.8-1). Stream flows are depleted by irrigation diversions and infiltration losses along the stream channels prior to reaching the site boundaries. Stream flows on the INEEL do occur when melting of above-average mountain snowpack causes water to flow in the Big Lost River. A diversion dam was constructed to prevent floodwater impacts to the RWMC. Flow of the Big Lost River on the INEEL averaged 292.55 cubic feet per second and ranged from 0.0 cubic feet per second to 440 cubic feet per second from June 1, 1995, to August 14, 1995. During the timespan from September 1995 to mid-July 1996, the average flow was 53.5 cubic feet per second with the highest one-day flow of 366 cubic feet per second on June 15, 1996 (USGS 1998).

4.8.1.2 Local Runoff. Three historical flood events (1962, 1969, and 1982) have occurred at the RWMC as a consequence of rapid snowmelt combined with heavy rains and warm winds, resulting in runoff water from the surrounding areas entering the facility. Upgrades to the perimeter drainage system have greatly reduced the likelihood of local basin flooding affecting the RWMC. The current peripheral drainage ditch and the main discharge channel are designed for a maximum 10,000-year combined rain-on-snow storm event (Dames and Moore 1993). Since 1982, soil has been added to the surface of the SDA to create sufficient slopes to direct water away from pits and trenches and into surrounding drainage systems. Although several instances of standing water have occurred due to rapid spring thaws in combination with frozen ground since 1982, there has not been flooding from off the RWMC due to improvements in the dikes and drainage diversion systems (Becker et al. 1996).

Figure 4.8-1. Locations of selected INEEL facilities shown with the predicted inundation area for the probable maximum flood-inducing overtopping failure of the Mackay Dam (Bennett 1990).

4.8.1.3 Floodplains. The elevation of the Big Lost River just upstream from the diversion dam is approximately 46 feet higher than the elevation of the RWMC at the proposed AMWTP facility site (USGS 1998). The Big Lost River poses no flood threat to the RWMC (Becker et al. 1996) (see Figure 4.8-1). The Big Lost River flows northeast, away from the RWMC, to its termination in the playas. A detailed flood-routing analysis of a hypothetical failure of the Mackay Dam resulting from hydrologic and seismic failures showed the RWMC would not be inundated from flow from the Big Lost River (DOE 1995, Figure 4.8-1). The RWMC is separated from the Big Lost River by a lava ridge that serves as a hydraulic barrier; therefore, the Big Lost River is not a surface water flowpath for contaminant transport at the RWMC. Big Lost River flows have not entered the RWMC during its operating period, which began in 1952.

4.8.1.4 Surface Water Quality. RWMC sewage lagoon wastewater samples were collected from the time the lagoons were constructed (April 1995) through 1996. The lagoons received sanitary sewage effluent from support facilities at the RWMC. All nonradiological analyses detected in water samples from the RWMC lagoons are typical of those that occur in sanitary sewage. No unusual compounds or elements nor volatile organics were detected. The concentrations of all radiological analyses detected in water samples collected from the RWMC sewage lagoons were below drinking water standards and derived concentration guides (LMITCO 1997b). For National Pollutant Discharge

Elimination System (NPDES) monitoring purposes, three sampling collection points exist within the RWMC. These sampling collection points are located along the northern boundary of the RWMC. RWMC-MP-01 is located upgradient from the SDA and RWMC- MP-02 is located at the interface of the SDA and the TSA. RWMC- MP-03 is located downgradient of the TSA. Sample results obtained in 1996 from one of the three sampling collection sites revealed one storm water sample that exceeded the EPA maximum contaminant level (MCL) for cadmium (0.005 mg/L), chromium (0.1 mg/L), and lead (0.015 mg/L) and the EPA secondary MCL level for total dissolved solids of 500 mg/L. The gross alpha concentration of 33.3 picocuries per liter in this sample exceeded the EPA MCL of 15 picocuries per liter. This sample also contained detectable total suspended solids, which indicates background concentrations in suspended sediments may have contributed to detectable levels of metals and gross alpha. Samples collected from the other two collection sites had no results above EPA MCLs and DOE derived concentration guides, except for two pH samples and one total dissolved solids sample (LMITCO 1997b).

4.8.2 Subsurface Water

Subsurface water at the INEEL occurs in the Snake River Plain Aquifer and the vadose zone. The Snake River Plain Aquifer is the source of all water used at the INEEL. The EPA designated the Snake River Plain Aquifer a sole-source aquifer in 1991 (FR 1991). The Snake River Plain Aquifer, the largest aquifer in Idaho, consists of a series of saturated fractured brecciated basaltic flows, rubbled zones, sedimentary rocks, and sediment materials that underlie the Eastern Snake River Plain. Water enters the regional aquifer from the west, north, and east. Most of the inflow occurs as underflow from alluvial-filled valleys along tributaries of the Snake River on the east side of the plain from mountain ranges on the north, and from the alluvial valleys of Birch Creek, Little Lost River, and Big Lost River on the west. Little recharge occurs through the surface of the plain except for flow in the channel of the Big Lost River, its diversion areas, precipitation, and some surface irrigation (Jorgensen et al. 1994). Groundwater is primarily discharged from the aquifer through springs that flow into the Snake River and from pumping for irrigation.

4.8.2.1 Local Hydrogeology. The INEEL covers about 890 square miles of the north-central portion of the Snake River Plain Aquifer. Depth to groundwater from the land surface at the INEEL ranges from approximately 200 feet in the north to over 900 feet in the south (Pittman et al. 1988). Depth to groundwater near the RWMC is approximately 590 feet. The U.S. Geological Survey (USGS) performs water level monitoring and chemical analyses in approximately 24 aquifer wells (Figure 4.8-2) within and surrounding the RWMC. Water level measurements and sampling schedules vary between quarterly and annually for these wells (LMITCO 1997b). Water levels in the vicinity of the RWMC may have exhibited a response to Big Lost River water infiltrating into the spreading areas (Becker et al. 1996). Competing hypotheses exist on whether this additional Big Lost River water influences gradients beneath the RWMC. Future groundwater modeling will determine whether gradient reversals beneath the RWMC occur (Becker et al. 1996). Figure 4.8-3 shows the water level on a local scale around the SDA portion of the RWMC during the fall of 1992 (Burgess et al. 1994).

In addition, perched aquifer zones are present in the vicinity of the RWMC. Vertically, the perched zones consist of two regions referred to as shallow and deep. The shallow perched water refers to ephemeral saturated zones that form at the contact between the shallow surficial sediments and underlying basalt. Deep perched water occurs at greater depths that are above, but in association with, the 110-foot and 240-foot interbeds. A geologic cross-section along the southern boundary of the RWMC oriented northwest to southeast shows the interbeds related to the perched aquifer and the Snake Plain River Aquifer (Figure 4.8-4). Three of the perched water monitoring wells were constructed such that water could enter the annular space at depths above the monitoring zone. No evidence of contamination to the Snake River Plain, as a result, has been found. Two of these wells were reconstructed in 1995 to eliminate this possibility (Becker et al. 1996).

The *Comprehensive Environmental Response, Compensation, and Liability Act* (CERCLA) Record of Decision signed by the DOE, EPA, and the State of Idaho, which documented the agreement to use the vapor vacuum extraction with treatment as the remediation technology for the vadose zone at RWMC, became final on December 2, 1994. This system was required as a result of small quantities of site-related contaminants reaching the Snake River Plain Aquifer. The full-scale extraction treatment system became operational January 11, 1996 (DOE-ID 1997c).

4.8.2.2 Subsurface Water Quality. Currently, monitoring is conducted in the vicinity of the RWMC for gross alpha, gross beta, tritium, a complete suite of volatile and semivolatile organics, chromium, mercury, nitrate/nitrite-N, carbon-14 (C-14), iodine-129 (I-129), technetium-99 (Tc-99), and strontium-90 (Sr-90). In addition, the USGS monitors for americium-241, plutonium-239/240 (Pu-239/240), plutonium-238 (Pu-238), cadmium, and cesium-137 (Cs-137) (Becker et al. 1996).

Table 4.8-1 gives the highest detected concentration since the DOE INEL EIS for the RWMC. The values were obtained from Becker et al. (1996) and LMITCO (1997b).

Figure 4.8-2. USGS aquifer water level monitoring wells in the RWMC vicinity.

Note: Contour interval is one foot.

Figure 4.8-3. Water level map of the Snake River Plain Aquifer at the SDA of the RWMC.

Figure 4.8-4. NW-SE cross-section along the RWMC southern boundary (Becker et al. 1996)

Table 4.8-1. Summary of highest detected contaminant concentrations in groundwater within the RWMC (1995 to 1996).

Parameter	Highest detected concentration since DOE INEL EIS (year of detection)[a]	Current EPA Maximum Contaminant Level (EPA MCL)[b]	DOE Derived Concentration Guide (DCGs)[c]
Radionuclides in picocuries per liter			
Americium-241	Less than method detection limit (MDL)	15[d]	30
Cesium-137	Less than MDL	200	3,000
Carbon-14	28 (1995)	2,000	70,000
Iodine-129	Less than MDL	1	500
Technetium-99	1.1 (1995)	900	100,000
Strontium-90	Less than MDL	8	1,000
Plutonium-238	Less than MDL	15[d]	40
Plutonium-239/240	Less than MDL	15[d]	30
Tritium	1500 (1996)	20,000	200,000
Nonradioactive metals in milligrams per liter			
Cadmium	Less than MDL	0.005	Not applicable
Chromium	0.996 (1995)	0.1	Not applicable
Mercury	Less than MDL	0.002	Not applicable
Inorganic salts in milligrams per liter			
Chloride	87[e] (1996)	250	Not applicable
Nitrate as N	2.1 (1995)	10	Not applicable
Organic compounds in milligrams per liter			
Carbon tetrachloride	0.007 (1995)	0.005	Not applicable
Chloroform	0.002 (1995)	0.1[f]	Not applicable
1,1,1-Trichloroethane	0.0009 (1995)	0.2	Not applicable
Tetrachloroethylene	0.0004 (1995)	0.005	Not applicable
Trichloroethylene	0.003 (1995)	0.005	Not applicable

a. Values taken from Becker et al. 1996, except where footnoted.

b. EPA MCL values taken from EPA 1996.

c. DOE DCGs for radionuclides taken from DOE Order 5400.5 (DOE 1993).

d. Maximum contaminant levels have not been established for plutonium-238, plutonium-239, plutonium-240 and americium-241. However, these radionuclides have not been detected above the established limits for gross alpha particle activity or the proposed adjusted gross alpha activity maximum contaminant limits for drinking water.

e. Values taken from LMITCO 1997b.

f. Values are for total trihalomethanes, which chloroform is one.

The Environmental Science and Research Foundation collects semiannual drinking water samples from boundary and distant communities and surface water samples from the Snake River at Idaho Falls and Bliss. In addition, quarterly drinking water and surface water samples are collected from the Magic Valley area. Each water sample collected is submitted for gross analyses for alpha- and beta-emitting radionuclides, as well as tritium analysis using liquid scintillation. Tritium was found above the minimum detectable concentration in four offsite drinking water samples. It was not detected in offsite surface water samples. The highest concentration, 160 picocuries per liter from Blackfoot in May 1996, was 0.8 percent of the EPA maximum contaminant level for tritium of 20,000 picocuries per liter (DOE-ID 1997c).

4.8.3 Water Use and Rights

Surface water is not withdrawn at the INEEL. All three tributaries, Big Lost River, Little Lost River, and Birch Creek, have the following designated uses: irrigation for agriculture, cold-water biota, salmonid spawning, and primary and secondary contact recreation. Prior to reaching the INEEL boundary, the Little Lost River and Birch Creek are diverted for irrigation, and irrigation and hydroelectric power, respectively, during the summer months. During the winter months, water in all three tributaries is used to recharge the aquifer (Becker et al. 1996).

Groundwater use on the Snake River Plain includes irrigation; food processing; aquaculture; and domestic, rural, public, and livestock supply. The Snake River Plain Aquifer is the source of all water used at the INEEL. The EPA designated the Snake River Plain Aquifer a sole-source aquifer in 1991 (56 FR 50634, October 7, 1991). The amount of water utilized on the INEEL from the Snake River Plain Aquifer is approximately 1.9 billion gallons each year.

The INEEL received a well construction permit from the Idaho Department of Water Resources in 1996 for eight new wells. The Idaho Department of Water Resources has granted underground injection control permits allowing the continued operation of eight deep injection wells, defined as Class V under 40 CFR 144.6 at the INEEL (DOE-ID 1997c). Seven of these are located at the INEEL and are used for draining excess surface water runoff to avoid facility flooding. The eighth well is located at the INEEL Research Center and is a closed-loop heat exchange system. For surface water, one NPDES point source permit is pending, with two granted. The Idaho Department of Environmental Quality granted four wastewater land application permits with five additional permits pending. The U.S. Army Corps of Engineers issued one 404 Permit (DOE-ID 1997c).

Domestic and fire water is pumped from a production well in the RWMC and is then stored in two 250,000-gallon water storage tanks or pressurized by the fire water and domestic water pumps and distributed to the different buildings. For the Pit 9 comprehensive demonstration project, an additional production well was installed (DOE-ID 1997g).

DOE holds a Federal Reserve Water Right for the INEEL, which permits a water pumping capacity of 80 cubic feet per second and a maximum water consumption of 11.4 billion gallons per year for drinking, process water, and noncontact cooling. Because it is a Federal Reserved Water Right, the INEEL's priority on water rights dates back to its establishment in 1950 (DOE INEL EIS).

4.9 Ecological Resources

This section describes the biotic resources on the INEEL, which are typical of the Snake River Plain ecosystem. Threatened and endangered species, wetlands, and radioecology are also discussed. A detailed description of the INEEL ecology can be reviewed in the DOE INEL EIS, Volume 2, Section 4.9 (DOE 1995).

4.9.1 Flora

The INEEL lies in a cool desert ecosystem dominated by shrub-steppe communities. Most land within the INEEL is relatively undisturbed and provides important habitat for species native to the region. The vegetation associations on INEEL can be grouped into six types: juniper woodland, native grassland, shrub-steppe, lava, modified large ephemeral playas, and wetland-like vegetation types (see Figure 4.9-1). Over 90 percent of the INEEL is covered by shrub-steppe vegetation, which is dominated by big sagebrush (*Artemisia tridentata*), saltbush (*Atriplex corfertifolia and A. nuttali*), and green rabbitbrush (*Chrysothamnus viscidiflorus*). Grasses include cheatgrass (*Bromus tectorum*), Indian ricegrass (*Oryzopsis hymenoides*), wheatgrasses (*Agropyron cristatum and A. desertorum*), and bottlebrush squirreltail (*Sitanion hysterix)*. The RWMC lies within the big sagebrush/bluebunch wheatgrass/green rabbitbrush vegetation type.

Disturbed areas (e.g., industrial areas, parking lots, roads) cover only 2 percent of the INEEL. Disturbed areas, such as the RWMC, frequently are dominated by introduced annuals, including Russian thistle (*Salsola kali*), halogetan (*Halogeton glomeratus*), and cheatgrass. These species are noxious and usually provide less food and cover for wildlife compared to native species and are competitive with perennial native species. The proposed AMWTP site is a previously disturbed area that is essentially devoid of any vegetation. The proposed area for the possible expansion of the sewage lagoon system is within a disturbed construction laydown area. The power line corridor that would have to be constructed to serve the AMWTP would cross an area adjacent to the RWMC occupied by big sagebrush/bluebunch wheatgrass/green rabbitbrush vegetation.

4.9.2 Fauna

Over 270 vertebrate species have been recorded on the INEEL, including 46 mammal, 204 bird, 10 reptile, 2 amphibian, and 9 fish species (Arthur et al. 1984, Reynolds et al. 1986). The INEEL provides an important winter range for deer (*Odocoileus* spp.), elk (*Cervus elaphus*), and pronghorn (*Antelocapra americana*). During some winters on the INEEL, historical highs have reached about 30 percent of Idaho's total pronghorn population. Pronghorn wintering areas are located in the northeastern portion of the INEEL, in the area of the Big Lost River sinks, in the west-central portion of the INEEL along the Big Lost River, and in the south-central portion of the INEEL. Other species include mice, ground squirrels, rabbits and hares, songbirds (sage sparrow [*Amphispiza belli*], western meadowlark [*Sturnella neglecta*]), sage grouse (*Centrocerus urophasianus*), lizards, and snakes. Migratory species, including mourning dove (*Zenaida macroura*), waterfowl, and raptors, use the INEEL for part of the year. Predators observed on the INEEL include raptors, bobcats (*Lynx rufus*), mountain lions *(Felis concolor*), and coyotes (*Canis latrans*). Additional information on fauna is provided in Anderson et al. (1995).

Species found within the RWMC area include deer mice (*Peromyscus maniculatus*), Montane vole (*Microtus montanus*), Ord's kangaroo rat (*Dipodomys ordii*), Townsend's ground squirrel (*Citellus townsendi*), badger (*Taxidea taxus*), marmot (*Marmota* spp.), horned lark (*Eremophila alpestris*), mountain cottontail rabbit (*Sylvilagus nuttalli*), sage grouse, owls, western meadowlark, and coyote.

Figure 4.9-1. Approximate distribution of vegetation map at the INEEL.

Federal-listed animal species potentially occurring on the INEEL include the peregrine falcon *(Falco peregrinus)* and bald eagle *(Haliaeetus leucocephalus)*. Peregrine falcons (endangered) have been observed within the boundary of the INEEL infrequently, only in the winter and for only brief periods. Bald eagles (threatened) are observed each winter near or on the INEEL, but only in areas of the site north of the Test Area North and near Howe.

Two State-protected species (Merriam shrew [*Sorex merriami*] and the long-billed curlew [*Numenius americanus*]) potentially occur on the INEEL. Ten animal species listed by the State as species of special concern occur on the INEEL. None of the Federal- or State-listed animal species have been observed on the RWMC where the AMWTP would be constructed or along the proposed power line corridor (Rope et al. 1993). No Federal- or State-listed plant species were identified as potentially occurring on the INEEL. Volume 2, Part A, Section 4.9.3 of the DOE INEL EIS listed eight plant species as sensitive, rare, or unique known to occur on the INEEL; however, four of these species have been dropped from consideration because they were found to be common (Idaho CDC 1998a). Four plant species (Table 4.9-1) identified by other Federal agencies (U.S. Forest Service or BLM) and the Idaho Native Plant Society as sensitive, rare, or unique are known to occur on the INEEL (Idaho CDC 1998b), but not on the RWMC, along the proposed power line corridor, or near the RWMC sewage ponds.

Table 4.9-1. Sensitive, rare, or unique plant species that may be found on the INEEL.[a]

Species	Status[b]
Lemhi milkvetch (Astragalus aquilonius)	BLM, FS, INPS-S
Winged-seed evening primrose (Camissonia pterosperma)	BLM, INPS-S
Sepal-tooth dodder (Cuscuta denticulata)	INPS-1
Spreading gilia (Ipomopsis [Gilia] polycladon)	BLM, INPS-2

a. The species identified as sensitive, rare, or unique are uncommon on the INEEL because they require unique microhabitat conditions (Idaho CDC 1998a). The plant species are distant from disturbed facilities.

b. BLM = Bureau of Land Management monitored; FS = U.S. Forest Service monitored; INPS-S = Idaho Native Plant Society sensitive; INPS-1 = Idaho Native Plant Society, State Priority 1; INPS-2 = Idaho Native Plant Society, State Priority 2.

4.9.4 Wetlands

National Wetland Inventory maps prepared by the U.S. Fish and Wildlife Service have been completed for most of the INEEL. The National Wetland Inventory maps indicate that the potential wetland-like areas are associated with the Big Lost River, the Big Lost River Spreading Areas, and the Big Lost River sinks, although smaller (less than 1 acre) isolated wetland-like areas also occur (see Figure 4.9-2). Other spreading areas (e.g., Birch Creek Playa) that occur during high-water years and intermittently in other years are also shown on Figure 4.9-2. Approximately 20 potential wetlands listed by the U.S. Fish and Wildlife Service are manmade (e.g., industrial waste and sewage treatment ponds, borrow pits, and gravel pits) and are not considered regulated jurisdictional wetlands. The scattered artificial ponds, potential wetlands, and intermittent waters serve as water sources to many wildlife species including songbirds and mammals. There are no natural wetland areas within the RWMC boundary; however, there are two sewage lagoons adjacent to the boundary.

4.9.5 Radioecology

Potential radiological effects on plants and animals are measured at the population, community, or ecosystem level. Measurable effects of radionuclides on plants and animals, however, have only been observed in individuals on areas adjacent to INEEL facilities, and not at the population, community, or ecosystem level.

Radionuclides have been found above background levels in individuals of some plant and animal species on and around the INEEL (Morris 1993). Studies conducted by Halford and Markham (1984) and Arthur et al. (1986) concluded that small mammals, such as deer mice, Ord’s kangaroo rat, and Montane vole at the Test Reactor Area waste percolation pond and the SDA at the RWMC, received higher concentrations of activation and fission products than small mammals from control areas on the INEEL. Statistically significant differences in several physiological parameters were found between deer mice inhabiting the same two areas and control areas (Evenson 1981). However, radiation exposures were too small to cause cellular changes in the mice. All studies reported that doses to individual organisms were too low to cause any effects at the population level.

Radioecology studies of vegetation at the RWMC have been conducted by Arthur (1982) to document radionuclide concentrations primarily in Russian thistle and crested wheatgrass. About 90 percent of the radioactivity in RWMC vegetation was attributed to Sr-90 and Cs-137; however, no significant difference in concentrations of Sr-90 or Cs-137 was detected between RWMC and control samples for either species. The study concluded that vegetation was not a major transport mechanism for radionuclides from the RWMC.

Gamma contamination of predators that consume rodents at the Test Reactor Area and RWMC has been shown to be insignificant (less than 100 pCi/g whole body for raptors and less than 30 pCi/g feces for coyotes) (Craig et al. 1979, Arthur and Markham 1982). The dose from internal consumption of radionuclides was less than is thought to be required for observable effects (0.1 rad per day [36.5 rads per year]) to occur to individual animals (IAEA 1992). Also, on the basis of limited data, and the infrequent use by the few bald eagles and peregrine falcons observed near contaminated areas, there is no evidence based on measurements that these species are consuming harmful concentrations of radioactive contaminants in their prey (Morris 1993).

Figure 4.9-2. Surface water features at the INEEL.

4.10 Noise

This section discusses the noise levels at the INEEL. The noise level at the INEEL ranges from 10 decibels A-weighted (dBA) (i.e., referenced to the A scale, approximating human hearing response) for the rustling of grass outdoors to as much as 115 dBA indoors, the upper limit for unprotected hearing exposure established by the Occupational Safety and Health Administration (OSHA). The natural environment of the INEEL has relatively low ambient noise levels of about 35 to 40 dBA due to natural sources (EPA 1971). Waste shredding and painting operations at the CFA produced the highest indoor noise levels measured at the INEEL at 104 dBA and 99 dBA, respectively. Noise measurements taken along U.S. Highway 20 about 50 feet from the roadway during a peak commuting period indicate that the sound level from traffic ranges from 64 to 86 dBA (Abbott et al. 1990). Buses are the primary highway noise source (71 to 81 dBA at 50 feet).

Existing INEEL-related noises of public significance are dominated by transportation sources. During the normal work week, most of the 4,000 to 5,000 employees who work at the INEEL are transported daily to the site from surrounding communities and back again over approximately 300 bus routes. About 300 to 500 private vehicles also travel to and from the INEEL site each day.

Public exposure to aircraft nuisance noise is negligible. Onsite INEEL activities have little influence on public exposure to aircraft noise, since security helicopters are no longer based at INEEL. Noise originating from occasional commercial aircraft crossing the INEEL at high altitude is indistinguishable from natural background noise.

Normally, no more than one train per day and usually fewer than one train per week services the INEEL via the Scoville spur. Rail transport noises originate from diesel engines, wheel/track contact, and whistle warnings at rail crossings.

The noise generated at the INEEL is not propagated at detectable levels offsite, since all public areas are at least 4 miles away from site facility areas. Previous studies of the effects of noise on wildlife indicate that even very high intermittent noise levels at the INEEL (over 100 dBA) would have no deleterious effect on wildlifeproductivity (Leonard 1993b).

4.11 Traffic and Transportation

Roads are the primary access to and from the INEEL. Commercial shipments are transported by truck and plane, some bulk materials are transported by train, and waste is transported by truck and train. This section discusses existing traffic volumes, transportation routes, transportation accidents, and waste and materials transportation. This information has been summarized from Section 4.11, Traffic and Transportation, of Volume 2 of DOE INEL EIS and has been updated when relevant to the impacts being assessed.

4.11.1 Roadways

4.11.1.1 Infrastructure–Regional and Site Systems. Two interstate highways serve the regional area as shown in Figure 4.11-1. Interstate 15, a north-south route along the Snake River, is approximately 25 miles east of the INEEL. Interstate 86 intersects Interstate 15 approximately 40 miles south of the INEEL and provides a primary linkage from Interstate 15 to points west. Interstate 15 and U.S. Highway 91 are the primary access routes through the Fort Hall Indian Reservation. U.S. Highways 20 and 26 are the main access routes through the southern portion of the INEEL. Idaho State Routes 22, 28, and 33 pass through the northern portion of the INEEL. Table 4.11-1 shows the baseline (1991) traffic for several of these access routes. The Level-of-Service of these highway segments is designated "free flow," which is defined as "operation of vehicles is virtually unaffected by the presence of other vehicles" (TRB 1994).

A road system of approximately 87 miles of paved surface has been developed on the INEEL, including about 18 miles of service roads that are closed to the public. The onsite road system at the INEEL undergoes continuous maintenance. The proposed AMWTP facility would be located at the RWMC site in the southwestern corner of the INEEL. The principal route to the RWMC is via Van Buren and Adams Boulevards. The turnoff to the RWMC is located between Highway 20 mile posts 266 and 267. Both roads are paved, all-weather roads suitable for heavy truck use. Two alternate, weather-dependent routes to the RWMC are via graded dirt roads. Within the TSA, the three storage pad aprons provide all-weather surfaces for vehicular traffic. All access roads are paved.

Table 4.11-1. Baseline traffic for selected highway segments in the vicinity of the INEEL.

Route	Average daily traffic	Peak hourly traffic
U.S. Highway 20–Idaho Falls to INEEL	2,290	344
U.S. Highway 20/26–INEEL to Arco	1,500	225
U.S. Highway 26–Blackfoot to INEEL	1,190	179
State Route 33–west from Mud Lake	530	80
Interstate 15–Blackfoot to Idaho Falls	9,180	1,380
Source: DOE 1995a.		

4.11.1.2 Transit Modes. Four major modes of INEEL-related transit use the regional highways, community streets, and INEEL roads to transport people and commodities: DOE buses and shuttle vans, DOE motor pool vehicles, commercial vehicles, and personal vehicles. Table 4.11-2 summarizes the baseline miles for INEEL-related traffic.

Figure 4.11-1. Regional roadway infrastructure in Southeastern Idaho.

Table 4.11-2. Baseline annual vehicle miles traveled for traffic related to the INEEL.

Transit mode		Vehicle miles traveled
DOE buses		6,068,200
Other DOE vehicles		9,183,100
Personal vehicles on highways to INEEL		7,500,000
Commercial vehicles		905,900
TOTAL		23,657,200
Source: DOE 1995a.		

4.11.2 Railroads

Union Pacific Railroad lines in southeastern Idaho provide railroad freight service to Idaho Falls from Butte, Montana, to the north, and from Pocatello, Idaho, and Salt Lake City, Utah, to the south. The Union Pacific Railroad's Arco Branch crosses the southern portion of the INEEL and provides rail service to the INEEL. This branch connects at the Scoville Siding with a DOE spur line, which links with developed areas within the INEEL. The Arco Branch also passes approximately 0.5 mile south of RWMC. In 1974, a railroad spur to the TSA was completed to permit direct shipment of waste to the RWMC. Rail shipments to and from the INEEL usually are limited to bulk commodities, spent nuclear fuel, and radioactive waste. During Fiscal Year 1992, there were 23 loaded rail shipments to the INEEL and no loaded outbound rail shipments. The Settlement Agreement/Consent Order (U.S. v. Batt 1995) limits the shipment of naval spent fuel to the INEEL to 20 shipments per year from 1997 through 2035. Because the loaded rail shipments to the INEEL primarily consist of naval spent fuel, this limitation also effectively limits rail shipments to the INEEL.

4.11.3 Airports and Air Traffic

Airlines provide Idaho Falls with jet aircraft passenger and cargo service. Local charter service is available in Idaho Falls, and private aircraft use the major airport and numerous other airfields in the area. The total number of landings at the Idaho Falls airports for 1991 and 1992 were 5,367 and 5,598, respectively. The Idaho Falls and Pocatello Airports collectively record nearly 7,500 landings annually.

Non-DOE air traffic over the INEEL is limited to altitudes greater than 1,000 feet over buildings and populated areas, and non-DOE aircraft are not permitted to use the site. The primary air traffic at the INEEL is occasional high-altitude commercial jet traffic since INEEL no longer operates DOE helicopters.

4.11.4 Accidents

For the years 1987 through 1992, the average motor vehicle accident rate was 1.5 accidents per million miles for INEEL vehicles, which compares with an accident rate of 2.4 accidents per million miles for all DOE complex vehicles and 12.8 accidents per million miles nationwide for all motor vehicles (DOE 1995a).

Collisions between wildlife and trains or motor vehicles are an impact from any human activities involving transportation of materials or humans. Wildlife, such as antelope, often bed down on the train tracks and use the tracks for migration routes when snow accumulation is high. Train collisions with wildlife can involve large numbers of animals and have a significant impact on the local population. Accidents involving motor vehicles and wildlife generally involve individual animals and may occur during any season.

4.11.5 Transportation of Waste and Materials

Hazardous, radioactive, industrial, commercial, and recyclable wastes are transported onsite and off the INEEL. Numerous regulations and requirements which govern transportation of hazardous and radioactive materials are adhered to at the INEEL in order to protect public health and safety. Four main categories of radioactive materials are associated with current INEEL activities: spent nuclear fuel, TRU waste, low-level mixed waste (LLMW), and low-level waste. High-level waste is stored at the INEEL, but currently is not transported. The possible shipment of high-level waste is being addressed in other NEPA documents (see Table 1.5-1).

A baseline of radiological doses from incident-free, onsite waste and materials transportation at the INEEL was established using six years of data (1987 through 1992). Results are presented in Table 4.11-3 in terms of the collective doses and cancer fatalities for 1995 to 2005. The baseline includes no offsite shipments. Additional discussions of radiological conditions at the INEEL are presented in Section 4.12, Occupational and Public Health and Safety.

Table 4.11-3. Collective doses and fatalities from incident-free onsite shipments at the INEEL for 1995 to 2005.

	Estimated collective dose	Estimated cancer fatalities

	(person-rem)	
Occupational	6.6	0.0026
General population	0.14	0.000070
Source: DOE 1995a.		

4.12 Occupational and Public Health and Safety

This section presents the potential health effects to the public and workers as a result of current operations at the INEEL. Since RWMC would be affected most by the proposed actions, occupational health and safety at RWMC are emphasized. This section provides an update of the health impacts from the release of radioactive and nonradioactive constituents and historical health and safety data presented in the DOE INEL EIS. Additional detail and background information on the material presented in this section are included in Appendix Section E-4, Occupational and Public Health and Safety.

The DOE INEL EIS included an extensive discussion of the INEEL affected environment; in lieu of duplication here, Section 4.2 of Volume 1 and Section 4.12 of Volume 2 of that document are referenced.

4.12.1 Radiological Health Risk

The potential health risk to workers and the public from exposure to radionuclides was assessed in Volume 2, Section 4.12.1, of the DOE INEL EIS. The assessment included the evaluation of health effects from routine airborne releases from facilities at the INEEL. The three categories of exposed individuals were (1) a MEI at the site boundary, (2) population within 50 miles, and (3) maximally exposed onsite involved worker. The potential radiological health effects to workers and the public from routine air emissions calculated in the DOE INEL EIS are summarized in the following paragraphs. The potential radiological dose from routine airborne releases at the INEEL are incremental to the dose from natural background radiation. The estimated natural background radiation dose for the Snake River Plain is presented for comparison.

The human health risk associated with radiological emissions is assessed based on risk factors contained in the International Commission on Radiological Protection recommendations (ICRP 1991). For the calculation of health effects from exposure to airborne radionuclides, the annual doses provided in Section 4.7, Air Resources, were multiplied by the appropriate ICRP risk factors.

Table 4.12-1 provides summaries of the annual dose, risk factors, and estimated increased lifetime risk of developing fatal cancer based on the annual exposure. These risks are presented for the maximally exposed onsite worker and MEI near the site boundary (public) for years 1995 and 1996. The offsite individual annual dose of 0.031 millirem in 1996 corresponds to lifetime excess fatal cancer risk of approximately 1 in 60 million. The worker dose of 0.32 millirem corresponds to a lifetime excess fatal cancer risk of approximately 1 in 7 million. Current regulations limit the dose resulting from releases of airborne radioactivity from DOE facilities to no more than 10 millirem per year to any member of the public.

Table 4.12-1. Lifetime excess fatal cancer risk due to annual exposure to routine airborne releases at the INEEL.

Maximally exposed individual	Annual dose (millirem)	Risk factor (risk/person-millirem)	Risk (excess fatal cancer)
Onsite worker	3.2E-01	4.0E-07	1.3E-07
Offsite individual (public) 1995[a]	1.8E-02	5.0E-07	9.0E-09
Offsite individual (public) 1996[a]	3.1E-02	5.0E-07	1.6E-08

a. Differences in offsite individual doses between 1995 and 1996 are based on differences in INEEL facility emissions (see Section 4.7, Table 4.7-1).

Table 4.12-2 provides summaries of the population dose, risk factor, and estimated increased lifetime risk of developing fatal cancer based on annual exposure to the surrounding population for the year 1995. The surrounding population consists of approximately 120,000 people within a 50-mile radius of the CFA at INEEL. The total baseline collective population dose of 0.30 person-rem corresponds to a lifetime excess fatal cancer risk of approximately $1.5x10^{-4}$ within the entire population over the next 70 years.

Table 4.12-2. Increased population risk of developing excess fatal cancers due to routine airborne releases at the INEEL.

Year	Population dose[a] (person-rem)	Risk factor (risk/person-rem)	Risk (number of fatal cancer)
1995	3.0E-01	5.0E-04	1.5E-04

a. The population dose of 0.3 person-rem from the DOE INEL EIS, Section 4.12.1.

Workers at the INEEL and RWMC may be exposed either internally (from inhalation and ingestion) or externally (from direct exposure) to radiation. The largest fraction of occupational dose received by INEEL and, similarly, RWMC workers, is from external radiation from direct exposure or groundshine. The average occupational dose from 1991 to 1995 to individuals with measurable doses was 0.155 rem, which results in an average annual collective dose of about 211 person-rem. This collective dose corresponds to a lifetime increased fatal cancer risk of 0.084 for INEEL, including the RWMC personnel (DOE 1996b). The average occupational dose DOE-wide from 1991 to 1995 to individuals with measurable doses was 0.074 rem, which results in an average annual collective dose of about 2,007 person-rem (DOE 1996b); this corresponds to a lifetime increased fatal cancer risk of 1 occurrence in 35,000 for the average occupational dose throughout the DOE Complex.

To put the offsite doses from the INEEL into perspective, it is useful to compare them to the natural background radiation levels in the vicinity of the INEEL. The estimated annual dose equivalent from natural sources for an individual living on the Snake River Plain is approximately 360 millirem (Appendix Section E-3, Air Resources). The annual dose and estimated incremental lifetime risk of developing fatal cancer reported in Tables 4.12-1 and 4.12-2 are in addition to natural background.

Estimates of potential health effects for onsite workers were made assessing drinking water sampling data as presented in Section 4.8, Water Resources. The highest average radionuclide concentration in any RWMC site drinking water distribution system measured was tritium, at a concentration of 1,500 picocuries per liter. This level is well below regulatory limits of 20,000 picocuries per liter. Consumption of this water for 50 years (an assumed maximum employment duration) would result in an estimated dose equivalent of 3.5 millirem, with a corresponding estimated fatal cancer risk of 1 occurrence in 700,000.

Potential health effects to the offsite population from the groundwater pathway are unchanged from the health effects reported in the DOE INEL EIS, which were calculated as an excess incidence of cancer risk of 1 occurrence in 170 million under INEEL baseline operating conditions.

DOE is currently reassessing the levels of risk to health under the Federal Guidance Report No. 13, Part I, entitled "Health Risks from Low-Level Environmental Exposure to Radionuclides", which EPA issued in January, 1998. This report addresses the risk to health from exposure to specific radionuclides either internally (inhalation or ingestion) or externally through various environmental media (e.g., air, water, soil). The methods and models used in Federal Guidance Report No. 13 account for age and gender-specific aspects of radiation risk. They were developed for application either to low acute doses, defined as acute absorbed doses less than 0.2 Gy, or to low dose rates, defined as dose rates less than 0.1 mGy/minute.

Using Federal Guidance Report No. 13 for assessing the risk from incineration of waste containing low concentrations of radioactivity should result in no significant changes to risk levels presented in this section. The Federal Guidance Report No. 13 methodology would provide additional detail to the risk assessment and promote consistency with future risk assessment results. Because the Federal Guidance Report No. 13 methodology is still being implemented and the calculated risk levels appear to be relatively unaffected, a decision was made by the EIS team to continue the Final EIS impact analysis with the established method.

4.12.2 Nonradiological Health Risk

The potential health risk to workers and the public from exposure to carcinogenic and noncarcinogenic chemicals was assessed in Volume 2, Section 4.12.1, of the DOE INEL EIS. The assessment included the evaluation of health effects from routine airborne releases from facilities at INEEL to a MEI at the site boundary and a maximally exposed onsite worker. The potential nonradiological health effects to workers and the public from routine air emissions calculated in the DOE INEL EIS are summarized in the following paragraphs.

For non-occupational exposures to members of the public, data concerning the toxicity of carcinogenic and noncarcinogenic constituents were obtained from dose-response values approved by the EPA (EPA 1993, 1994). The values included slope factors and unit risks for evaluating cancer risks, reference doses and reference concentrations for evaluating exposures to noncarcinogens, and primary NAAQS for evaluating criteria pollutants. For the individual noncarcinogenic toxic air pollutants, all hazard quotients were less than one. The hazard quotient is a ratio of the calculated concentration in the air to the reference concentration. This indicates that no adverse health effects would be projected as a result of noncarcinogenic emissions. The offsite excess cancer risk from carcinogenic emissions ranged from 1 in 1.4 million for formaldehyde to 1 in 625 million for trichloroethylene (DOE INEL EIS, Table 4.12-6). The hazard quotients for criteria air pollutants associated with maximum baseline emissions were all less than one. This indicates that no adverse health effects were projected from criteria pollutant emissions. The recent actual site-wide emissions for criteria pollutants presented in Section 4.7, Air Resources, Table 4.7-2, are fewer than those assessed in the DOE INEL EIS.

For occupation exposures to workers at the INEEL, modeled chemical concentrations were compared with the applicable occupational standard. The comparison was made by calculating a hazard quotient, which is a ratio between the calculated concentration in air and the applicable standard. The hazard quotients for noncarcinogenic and carcinogenic air pollutants at the INEEL were less than one with the exception of benzene at CFA, for which the hazard quotient was slightly greater than one. The RWMC was predicted to be the location of maximum concentration for only 3 of the 13 carcinogenic air pollutants assessed and none of the noncarcinogenic air pollutants assessed.

The highest chemical constituent concentration measured in the RWMC site production well head was carbon tetrachloride, at a concentration of 7 micrograms per liter. This concentration is higher by a factor of 1.4 than the maximum contaminant level for drinking water of 5 micrograms per liter. Carbon tetrachloride concentrations in the RWMC site drinking water system did not exceed 5 micrograms per liter. A concentration of 7 micrograms per liter of carbon tetrachloride would indicate an excess incidence of cancer risk of 1 occurrence in 40,000 using an ingestion slope factor of 0.13 kilogram-day per milligram (EPA 1993).

4.12.3 Industrial Safety

The radiation doses and nonradiological hazards presented here are based on personnel monitoring data and reported occupational incidences at the INEEL. For occupational exposure to ionizing radiation, health effects assessments are based on actual exposure measurements. For routine workplace hazards, the health risk is presented as reported injuries, illness, and fatalities in the workforce.

At the INEEL, occupational nonradiological health and safety programs are composed of industrial hygiene programs and occupational safety programs. Total recordable case rates for injury and illness incidence at INEEL varied from an annual average of 3.0 to 3.7 per 200,000 work hours from 1992 to 1996. During this time, total lost workday cases ranged from 1.2 to 1.8 per 200,000 work hours. Total recordable case rates for injury and illnesses for INEEL workers are comparable to those for DOE and its contractors across the United States, which varied from 3.5 to 3.8 per 200,000 work hours. During this time, total lost workday case rates varied from 1.6 to 1.8 per 200,000 work hours. One fatality occurred at INEEL between 1992 and 1996 when an employee fell from an elevated area. Detailed information on the INEEL and RWMC occupational health and safety is presented in Appendix Section E-4, Occupational and Public Health and Safety.

4.13 Idaho National Engineering and Environmental Laboratory Services

This section describes the current INEEL services available to the proposed AMWTP. These services include water, electricity, fuel, wastewater disposal, security and emergency protection, communication, and waste minimization/pollution prevention. Certain services for the RWMC that may affect the proposed AMWTP are also described. The contents of this section are tiered from DOE INEL EIS Volume 2, Part A, Section 4.13, which is summarized here and updated as applicable.

4.13.1 Water Consumption

The water supply system for each facility area at INEEL is independent and is provided by wells. No natural surface water is used. DOE's water rights permit allows INEEL to pump 36,000 gallons per minute of groundwater, but not to exceed 11.4 billion gallons per year (Teel 1993). Water consumption for years in which data were available is shown in Table 4.13-1.

The RWMC water supply system consists of two 250,000-gallon storage tanks fed by a deep well. One tank is dedicated to fire fighting water storage, and one tank is dedicated to potable water storage. The potable water tank serves as a backup fire fighting water tank. The RWMC water supply system has unused excess capacity.

Table 4.13-1. Water consumption at the RWMC and the INEEL.

Year(s)	Gallons per year - RWMC (in millions)	Gallons per year - INEEL (in billions)
1987-1991 (Teel 1993)	not available	1.9
1994 (Litus 1997)	9.65	1.5
1995 (Litus 1997)	5.67	1.2
1996 (Litus 1997)	0.482	0.37
1997 (Sehlke 1998)	4.19	1.3

4.13.2 Electricity Consumption

Electric power is supplied to the INEEL by the Idaho Power Company. The contract with Idaho Power (IPC/DOE 1996) is for up to 45,000 kilowatts monthly at 138 kilovolts, the site power transmission line loop is rated 138 kilovolts, and peak demand on the system from 1990 through 1993 was about 40,000 kilowatts (Mantlik 1998a). Average usage prior to 1993 was slightly less than 217,000 megawatt-hours per year (DOE INEL EIS, Volume 2, Part A, Section 4.13). Usage in 1997 for INEEL was 173,862 megawatt-hours, 3,584 megawatt-hours for Pit 9, and 6,206 megawatt-hours for the RWMC (Mantlik 1998b). Within the last two years, a new 138-kilovolt line was constructed from CFA to the RWMC.

4.13.3 Fuel Consumption

Fuels consumed at the INEEL consist of liquid petroleum fuels, coal, and propane. At the INEEL from 1990 through 1992, average fuel consumption for 1990 through 1992 (DOE 1995) and for 1997 (Mantlik 1998c) is given in Table 4.13-2. Fuel storage is provided at each facility.

Table 4.13-2. Average fuel consumption amounts at the INEEL and the RWMC.

Type of fuel	Average per year 1990-1992	INEEL 1997	RWMC 1997
Heating oil	2,795,000 gallons	1,563,536 gallons	NA[a]
Diesel fuel	1,500,000 gallons	617,947 gallons	b
Propane gas	150,000 gallons	130,249 gallons	48,019 gallons
Gasoline	557,000 gallons	343,660 gallons	NA
Jet fuel	73,100 gallons	0	0
Kerosene	33,800 gallons	not available	NA
Coal	9,000 short tons	12,533 short tons	NA

Source: Mantlik 1998b.

a. NA: not applicable.

b. A very small but unknown amount is used.

4.13.4 Wastewater Disposal

The smaller onsite facility areas at INEEL primarily use septic tanks and drain fields. Wastewater treatment facilities are provided for larger areas such as CFA, the INTEC, and the Test Reactor Area.

The RWMC uses sewage lagoons south of the complex. This system may have some available capacity.

Average annual wastewater (sewage) discharge volume on the INEEL for 1993 was 142 million gallons (DOE INEL EIS, Volume 2, Part A, Section 4.13). Wastewater (sewage) disposal at INEEL for 1997 was about 149 million gallons and for the RWMC for 1997 was 1.27 million gallons (Mantlik 1998d).

4.13.5 Security and Emergency Protection

The fire protection and prevention, security, and emergency preparedness resources at the INEEL are described in this section. These resources are described in more detail in DOE INEL EIS Volume 2, Part A, Section 4.13, INEL Services, and are summarized here and updated as appropriate from other references.

An extensive communication system exists at INEEL which connects all of the areas and facilities, such as the RWMC and CFA, with each other and the DOE-ID facilities in Idaho Falls. The communication system includes radio systems, data lines, and phone lines.

Three fire stations on the INEEL provide support to the entire site. Equipment and expertise to respond to explosions, fires, spills, and medical emergencies are available at each station. The station locations are at Test Area North, Argonne National Laboratory-West, and CFA. A new fire station and training facility was recently completed at CFA. The fire department also provides INEEL with ambulance, emergency medical technician, and hazardous material response services. Mutual aid agreements exist with other fire fighting organizations, including the BLM and the cities of Idaho Falls, Blackfoot, and Arco.

An approximately 25,000-square-foot medical facility staffed with doctors and nurses is located at the CFA and can provide support for certain medical emergencies. The facility is staffed 24 hours a day and seven days a week. Basic medical equipment, such as X-ray machines, patient examination equipment, offices, and basic medical testing and laboratory equipment, is provided. Also included are an emergency room, a radiological decontamination room, a cardiac/other treatment room, and an ambulance garage. A communication center provides an emergency phone directly to the fire department.

Emergency preparedness programs are administered and staffed by each INEEL contractor under the direction and supervision of DOE. The communication center is the Warning Communication Center in the DOE-ID Headquarters building in Idaho Falls. This center is staffed by the prime contractor with DOE oversight and supports on-scene commanders in charge of emergency response. Mutual aid agreements exist with all regional county and major city fire departments, police, and medical facilities.

The emergency preparedness program at the RWMC is described in the *Radioactive Waste Management Complex Safety Analysis Report* (LMITCO 1997c). There are three categories of emergency facilities: the Emergency Operations Center, Emergency Control Centers, and facility Command Posts. Emergency actions are directed from the RWMC Command Post. The RWMC Emergency Coordinator, supported by the RWMC Emergency Response Organization has the overall responsibility for the initial and ongoing response to and mitigation of RWMC emergencies. The Emergency Control Centers at the CFA supports the RWMC Command Post. The INEEL Emergency Response Organization responds to the Emergency Operations Center in the DOE-ID Headquarters building in Idaho Falls.

The security program consists of three categories:

- Security operations - Security operations provides asset protection (classified matter, special nuclear material, facilities, and personnel) and technical security (computer and information). Security operations includes the INEEL protective force, which is administered by DOE and supplied by contractors.
- Personnel security - The personnel security staff processes security clearances.
- Safeguards - The safeguards organization is responsible for the management and accountability of special nuclear materials. Each INEEL contractor has a safeguards and security staff with similar responsibilities to manage the security at its facilities.

4.13.6 Waste Minimization/Pollution Prevention

The Waste Minimization/Pollution Prevention programs that apply to the management of materials and wastes at INEEL are summarized in this section. More detailed descriptions are contained in the Annual Report of Waste Generation and Pollution Prevention Progress (DOE 1997a) and the DOE-ID Pollution Prevention Plan (DOE-ID 1997d). The waste streams at INEEL include high-level, TRU, LLMW, and low-level radioactive wastes and hazardous, industrial, and commercial solid wastes.

The INEEL has programs in place to reduce the toxicity and quantity of waste generated. Physical or engineering processes are used to reduce or eliminate waste generation; recycle; and reduce the volume, toxicity, or mobility of waste. The volume of radioactive waste is reduced through more intensive surveying, waste segregation, and administrative and engineering controls. These plans and their accomplishments have been described in various documents including site treatment plans (DOE-ID 1995b) and annual progress reports (DOE 1997a). Overall, in 1996 the INEEL Waste Minimization/Pollution Prevention efforts resulted in the reduction of waste generation by 1,000 cubic meters and the saving of more than $2 million.

Industrial and commercial solid waste is disposed of in the INEEL Landfill Complex at CFA. There is about 225 acres of land available for solid waste disposal at the Landfill Complex. The capacity is sufficient to dispose of INEEL waste for 30 to 50 years. Recyclable materials are segregated from the solid waste stream at each INEEL facility. The average annual volume of waste disposed at the Landfill Complex from 1988 through 1992 was 68,000 cubic yards (EG&G 1993). For 1996 and 1997, the volume of waste was approximately 59,000 and 71,000 cubic yards, respectively.

In November 1996, a paper pelletizer project (DOE-ID 1997e) was brought on-line. This system is referred to as a "cuber" because of the shape of the pellets. This system converts nonradioactive office waste into fuel for the INEEL Coal Fired Steam Generation Facility. Current plans are that all combustible waste at INEEL would be diverted to the cuber, resulting in a reduction of nonradioactive waste going to the landfill.

5. Environmental Impacts

5.1 Introduction

Chapter 5 describes the environmental impacts to the Idaho National Engineering and Environmental Laboratory (INEEL) and surrounding region that may result from implementing each of the Advanced Mixed Waste Treatment Project (AMWTP) alternatives. The Proposed Action using microencapsulation for the stabilization of incinerator ash is the Preferred Alternative.

In accordance with Council on Environmental Quality (CEQ) regulations, the environmental impacts discussions provide the analytical detail for comparisons of environmental impacts associated with the various AMWTP alternatives. Discussions are provided for each environmental resource and relevant issues that could be affected.

To determine the potential environmental impacts resulting from the alternatives analyzed, the period of analysis used was a maximum of 30 years of facility operation starting in 2003. Construction was assumed to begin in 1999 and be completed by 2002. As stated in Section 1.3 of this document, retrieval of waste at the INEEL and transportation of waste to and from the INEEL are related actions that are analyzed in other *National Environmental Policy Act* (NEPA) documents (e.g. *Waste Management Programmatic Environmental Impact Statement* [WM PEIS], *Waste Isolation Pilot Plant Disposal Phase Final Supplemental Environmental Impact Statement II* [WIPP SEIS-II], *Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs Final Environmental Impact Statement* [DOE INEL EIS]) and therefore are not analyzed in this document.

For comparison purposes, environmental concentrations of emissions and other potential environmental effects are presented with appropriate regulatory standards or guidelines. However, compliance with regulatory standards is not necessarily an indication of the significance or severity of the environmental impact for purposes of NEPA.

The purpose of the analysis of environmental impacts is to identify the potential for environmental impacts. The environmental assessment methods used and the factors considered in assessing environmental impacts are discussed in each resource section and in the appropriate appendices. The potential for impacts to a given resource or relevant issue is described in each section that follows.

5.2 Land Use

This section discusses the potential effects of the construction and operation of the proposed AMWTP and alternatives on land use at the INEEL and surrounding area.

5.2.1 Methodology

Potential effects were qualitatively assessed by comparing potential land use changes and/or conflicts of the Proposed Action and alternatives to the existing land use plans and policies.

5.2.2 Land Use Impacts from the No Action Alternative

This alternative would not result in any new major upgrades or new projects to support current INEEL waste management activities for transuranic (TRU) waste, alpha-contaminated low-level mixed waste (alpha LLMW), and LLMW. No land disturbance would occur at the Radioactive Waste Management Complex (RWMC). Existing and planned land uses within the RWMC and other INEEL facility areas would not change as a result of No Action Alternative activities. Ongoing operations at INEEL are consistent with planning documents, including the *INEL Site Treatment Plan* (STP) (DOE-ID 1995b), the *Integration of Environmental Management Activities at the INEL* (LITCO 1995), and the *INEL Comprehensive Facility and Land Use Plan* (DOE-ID 1997g). No Action Alternative activities would be conducted in existing developed industrial-type areas where other historic similar and supporting land uses occur. No Action Alternative ongoing activities conducted outside of the INEEL boundaries would not change, and no effects on surrounding land use plans and policies are expected.

5.2.3 Land Use Impacts from the Proposed Action

The AMWTP facility would occupy 7 acres within and adjacent to the RWMC for project construction activities. All of the project area has been previously disturbed as a result of past and ongoing waste management and environmental restoration activities within the RWMC. The AMWTP facility operations would be consistent with existing ongoing industrial-type activities at the RWMC. Under this alternative, most construction and operation activities would occur within the RWMC (see Figure 1.4-1). The possible expansion of the RWMC sewage lagoon system by constructing a 0.5-acre lagoon would occur within a 1-acre disturbed portion of land used as a subcontractor office and construction laydown area adjacent to the existing sewage lagoons. The routing of a new 3,000-ft 138-kV electrical power line needed to serve the AMWTP facility would parallel the existing north/south RWMC emergency gravel road on the east side. The tie-in would be at the existing 138-kV line supporting the Pit 9 substation on the north side of Adams Blvd. This alternative would be consistent with the current and planned future uses of the RWMC identified in the *INEL Comprehensive Facility and Land Use Plan* (DOE-ID 1997g). No effects on surrounding land uses or local land use plans or policies are expected from constructing and operating the AMWTP at the RWMC.

Sand, gravel, aggregate, and clay to support construction and operation of the AMWTP would be extracted from the existing INEEL borrow areas. The impacts of expanding the INEEL borrow pits to support waste management activities at the INEEL, including the AMWTP, were addressed in DOE INEL EIS (DOE 1995a), Volume 2, Part B, Section C-4.9.2 and the *Environmental Assessment and Plan for New Silt/Clay Source Development and Use at the Idaho National Engineering and Environmental Laboratory* (DOE-ID 1997f). The extraction of these materials to support the Proposed Action activities is consistent with the existing and planned INEEL land uses and management plans for the continued operation and waste management activities at the site.

There would be no change in land use impacts due to the substitution of vitrification of ash from those described for the Proposed Action with microencapsulation of ash.

5.2.4 Land Use Impacts from the Non-Thermal Treatment Alternative

The Non-Thermal Treatment Alternative would be the same as the Proposed Action except that incineration would not be used as a treatment option in the new plant, and it would require the increased use of existing storage facilities to accommodate repackaged waste awaiting appropriate treatment in the future.

The increased use of the existing storage facilities under the Non-Thermal Treatment Alternative would not require any additional land outside of the current boundaries of the RWMC. The storage of alpha low-level and mixed waste is consistent with ongoing and planned uses and activities of the RWMC; no effects on existing INEEL land uses would be expected. Potential land use impacts under this alternative due to possible expansion of the existing RWMC sewage lagoons or construction of a new power line would be the same as described for the Proposed Action.

5.2.5 Land Use Impacts from the Treatment and Storage Alternative

The potential land use impacts of the Treatment and Storage Alternative would be the same as those described for the Proposed Action with regard to treatment of waste; however, the potential storage impacts identified in Section 5.21 would be in addition to impacts for treatment.

5.3 Socioeconomics

Socioeconomic factors, such as employment, income, population, housing, and community services, are interrelated in their response to implementation of an action. This section describes the potential effects of the AMWTP alternatives on the socioeconomic factors of the Region of Influence (ROI). Proposed changes in the U.S. Department of Energy (DOE) related expenditures and workforce levels have the potential to generate economic impacts that may affect local employment, population, and community resources.

5.3.1 Methodology

Socioeconomic impacts are addressed in terms of both direct and indirect impacts. Direct impacts are changes in INEEL employment and expenditures expected to take place under each alternative and include both construction-phase and operations-phase impacts. Indirect impacts include (a) the impacts to ROI businesses and employment resulting from changes in DOE ROI purchase or nonpayroll expenditures and (b) the impacts to ROI businesses and employment that result from changes in payroll spending by affected INEEL employees. The total economic impact to the ROI is the sum of direct and indirect impacts. Both the direct and indirect impacts were estimated for the ROI described in Section 4.3, Socioeconomics.

The direct impacts estimated in the socioeconomic analysis are based on project summary data developed by DOE in cooperation with INEEL contractors and their representatives. Direct employment impacts represent actual increases or decreases in INEEL staffing; they do not include changes in staffing due to reassignment of the existing workforce within the INEEL. Total employment and earnings impacts were estimated using RIMS II multipliers developed specifically for the INEEL ROI by the U.S. Bureau of Economic Analysis. A comprehensive discussion of the methodology can be found in Appendix Section E-1.

The importance of the actions and their impacts is determined relative to the context of the affected environment. Projected baseline conditions in the ROI, as presented in Section 4.3, Socioeconomics, provide the framework for analyzing the importance of potential socioeconomic impacts that could result from implementation of any of the alternatives. Baseline employment and population represent socioeconomic conditions expected to exist in the ROI through 2025. Each alternative other than the No Action Alternative is expected to generate short-term increases in employment and income as a result of construction, as well as longer-term increases as a result of operations.

5.3.2 Socioeconomic Impacts from the No Action Alternative

Under the No Action Alternative, the proposed AMWTP would not be built. No new employment or workers would be expected as a result of this project. The employment and population of the ROI would remain the same as the baseline described in Section 4.3, Socioeconomics.

5.3.3 Socioeconomic Impacts from the Proposed Action

5.3.3.1 Regional Economy Characteristics. Implementation of the Proposed Action would generate a total of 254 jobs (125 direct and 129 indirect) in the ROI during the peak year of construction, an increase of less than 1 percent in ROI employment. This would increase total ROI income by approximately $5,836,500 (less than 1 percent). These changes would be temporary, lasting only the duration of construction.

Operation of the facility would require 146 workers and would generate a total of 406 jobs (146 direct and 260 indirect) in the ROI. Total ROI income would increase by $10,268,900 annually (less than 1 percent).

5.3.3.2 Population and Housing. The existing ROI labor force could fill all of the jobs generated by the increased employment and expenditures at the INEEL. Therefore, there would be no impacts to the ROI's population or housing sector.

5.3.3.3 Community Services. Because there would be no significant change in the population of the area, there would likely be no change to the level of community services provided in the ROI.

There would be no change in impacts on the economy, population, housing, and community services due to the substitution of vitrification of ash from those described for the Proposed Action with microencapsulation of ash.

5.3.4 Socioeconomic Impacts from the Non-Thermal Treatment Alternative

The impacts from the implementation of the Non-Thermal Treatment Alternative on the ROI population, housing, and community services would be the same as from the implementation of the Proposed Action. The impacts on the ROI economy from construction would also be the same. Operation would result in a slightly lower impact, as discussed below.

5.3.4.1 Regional Economy Characteristics. Operation of the facility would require approximately 133 workers. This would generate a total of 369 jobs (133 direct and 236 indirect) in the ROI and increase total ROI income by $9,354,500 annually (less than 1 percent).

5.3.5 Socioeconomic Impacts from the Treatment and Storage Alternative

The impacts from the implementation of the Treatment and Storage Alternative on the ROI economy, population, housing, and community services would be the same as the Proposed Action.

5.4 Cultural Resources

This section discusses the potential impacts of the alternatives on cultural resources; that is, archaeological and historic sites, areas of cultural or religious importance to local Native Americans, and paleontological localities on the INEEL.

5.4.1 Methodology

The methodology for identifying, evaluating, and mitigating impacts to cultural, historical and Native American resources has been established through Federal laws and regulations as discussed in the DOE INEL EIS. In general, direct impacts to existing historic structures may result from demolition, modification, or deterioration of the structures; isolation from or alteration of the property's setting; or the introduction of visual, auditory, or atmospheric elements that are out of character or that alter the property's setting. Direct impacts to traditional Native American resources may occur through land disturbance, vandalism, changes in accessibility to sacred sites or traditional use areas by Native Americans, or by changing the environmental setting of traditional use and sacred areas. Indirect impacts may also result from pollution, noise, and contamination that may affect traditional use areas or the visual or auditory setting of sacred areas. While not all of the archaeological sites, structures, or traditional cultural properties at the RWMC have been formally evaluated, they are considered to be potentially eligible for nomination to the National Register of Historic Places (NRHP).

Both direct and indirect impacts due to the proposed alternatives were evaluated. At the RWMC, direct impacts to archaeological resources are usually those associated with ground disturbance from construction activities. Indirect impacts to cultural resources may also occur due to an overall increase in activity at the RWMC brought about by the proposed AMWTP facility construction workforce.

5.4.2 Cultural Resource Impacts from the No Action Alternative

Impacts to cultural resources at the RWMC are not expected to occur as a result of the No Action Alternative as the proposed AMWTP facility would not be constructed. The Idaho State Historic Preservation Officer (SHPO) has determined that operations within the perimeter fence should not impact cultural resources because of the high degree of prior ground disturbance at this facility (Yohe 1993).

5.4.3 Cultural Resource Impacts from the Proposed Action

The Proposed Action would involve the construction and operation of the AMWTP facility, a project that would affect about 7 acres within the Transuranic Storage Area (TSA) located inside of the RWMC. Impacts to cultural resources appear negligible, although a potential for subsurface discoveries of cultural material always exists. Construction of the proposed AMWTP facility would result in ground disturbance and a change in the visual setting at the RWMC. This facility will contain permanent generators and night lights, creating a visual and audible intrusion. Soil erosion could occur during the construction of the proposed facility, as well as the release of fugitive dust particles that might temporarily affect visibility in localized areas. Such activities would be of limited duration, however, and the INEEL would follow standard construction practices to minimize both erosion and dust. There would be no intentional discharge of radioactive or chemical liquid effluents to the subsurface or natural water resources above allowable levels, as required under applicable Federal and State regulations. Because the proposed construction would occur in a disturbed area of the RWMC, the impacts to cultural resources are expected to be minor.

Expansion of the existing RWMC sewage lagoons located south of the outside of the RWMC boundary may be required to support AMWTP operations. If needed, the existing sewage lagoons would be augmented with a new 0.5-acre lagoon. Construction of the lagoon would occur within an existing 1-acre disturbed portion of land used as a construction laydown area next to the existing sewage lagoons. The 0.5-acre lagoon expansion would potentially impact a known archaeological site; however, archaeological testing has indicated that the site is not likely eligible for nomination to the NRHP (Natoni 1998). A formal determination of eligibility of this site has not yet been made. In the absence of such determination, the site should be monitored by archaeologists during any ground-disturbing activities.

The RWMC has contributed to the overall operation of the INEEL since the 1950s and is considered to be a critical element of the area's historic landscape. The architecture of the proposed treatment facility would be consistent with the industrial style of the existing facilities at the RWMC. Modifications of the three NRHP-eligible Waste Management Facility (WMF) buildings (WMF-601, WMF-610, WMF-612) at the RWMC would be done in consultation with the SHPO prior to activities that might alter those properties (Ringe-Pace 1998).

As discussed in Section 4.4, Cultural Resources, limited paleontological and prehistoric resources have been found inside of the RWMC. Archaeological clearance has been recommended by the SHPO for ongoing and future ground disturbances, such as the construction of the proposed AMWTP facility inside of the RWMC (Yohe 1993). The INEEL has implemented strong "stop work" stipulations in the event that cultural resources or human remains are discovered during any project implementation. These stipulations include provisions for notification of, and consultation with, the SHPO and Native American Tribes in accordance with the *National Historic Preservation Act* (NHPA) and the *Native American Graves Protection and Repatriation Act* (NAGPRA). (Ringe-Pace 1998, Yohe 1995)

Construction of a new 138-kV power line approximately 100 feet east of the RWMC perimeter fence to support the proposed AMWTP facility would not impact any known archaeological sites (Natoni 1998). Other future construction activities associated with AMWTP uses (other power lines, access roads, underground cables, monitoring wells, flood control devices, etc.) outside of the RWMC fence must be carefully monitored to prevent inadvertent impacts to recorded and unrecorded archaeological sites and traditional Native American use areas.

The Shoshone-Bannock Tribes consider air and water quality, plants and wildlife, and visual settings to be important Native American resources. The area surrounding the RWMC contains sensitive habitat, possessing plant and animal diversity that is sensitive to disturbance and subject to exposure to radionuclides, although the level of exposure would be so low that no effect would be expected (see Sections 5.7, Air Resources, and 5.9, Ecological Resources). Impacts to traditionally used plant and animal species that currently occupy or use the area near the RWMC, as discussed in Section 5.9.3, are expected to be minimal.

The visual setting, particularly in the Middle Butte, Big Lost River, Little Lost and Birch Creeks, and Big Southern Butte areas located in the southern portion of the INEEL is perceived by the Shoshone-Bannock Tribes to be an important Native American resource. The Big Southern Butte area is located approximately 5 miles south of the RWMC and off the INEEL, Middle Butte is about 15 miles southeast, the Big Lost River is 5 miles north, and the Little Lost and Birch Creeks are located approximately 12 and 25 miles, respectively, to the north and northeast of the RWMC (see Sections 4.2, 5.2, 4.5, 5.5, 4.8, and 5.8). Construction of the AMWTP facility would not impact these areas or change current Tribal access, as reflected by the Memorandum of Agreement for the Middle Butte area (DOE-ID 1994). DOE will continue its practice to consult with the Shoshone-Bannock Tribes during project development with consideration for potential impacts to resources of importance to the Tribes.

There would be no change in cultural resource impacts due to the substitution of vitrification of ash from those described for the Proposed Action with microencapsulation of ash.

5.4.4 Cultural Resource Impacts from the Non-Thermal Treatment Alternative

Impacts to cultural resources from the Non-Thermal Treatment Alternative would be the same as those of the Proposed Action as both involve the construction of the AMWTP facility at the RWMC.

5. Cultural Resource Impacts from the Treatment and Storage Alternative

Impacts to cultural resources from the Treatment and Storage Alternative would be the same as those of the Proposed Action.

5.5 Aesthetic and Scenic Resources

This section discusses the potential effects of the construction and operation of the AMWTP and alternatives on aesthetic and scenic resources at the INEEL and the surrounding area.

5.5.1 Methodology

Potential impacts to aesthetic and scenic resources include the construction of new structures and/or modifications to existing structures and the additional project contribution of air pollutants that may alter the view or quality of these resources. The impact analyses for the Proposed Action and alternatives considered the effects of construction and operation of the AMWTP at the RWMC on the INEEL. The significance of visual resource degradation due to the construction and operation of the AMWTP is based on the extent of the modification to the RWMC and facility operations. The degree of impact is based on the existing visual setting (i.e., the nature, density, and extent of sensitive visual resources that contribute to the visual character of the INEEL site and surrounding area).

Construction and operation of facilities have the potential to result in visual resource degradation by contributing air emissions that reduce contrast and cause discoloration of the air. The greatest contributor to these types of impacts are emissions of oxides of nitrogen and particulate matter. Atmospheric visibility has been specifically designated as an air-quality-related value under the 1977 Prevention of Significant Deterioration (PSD) Amendments to the *Clean Air Act* (CAA). The VISCREEN computer code (EPA 1992b) was used to estimate the potential worst-case visibility impacts of the "action" alternatives at Craters of the Moon Wilderness Area and the Fort Hall Indian Reservation. The VISCREEN method yields impact results that are greater than those that would be obtained using more realistic input and modeling assumptions. The model calculates contrast and color shift for two assumed plume-viewing backgrounds: the horizon sky and a dark terrain object. Results were then compared to acceptable criteria for these parameters. Additional information on the visibility assessment methodology is presented in Appendix Section E-3.3.3.6.

5.5.2 Aesthetic and Scenic Resource Impacts from the No Action Alternative

Under the No Action Alternative, no new additional construction or major facility upgrades would be implemented at the RWMC. Any new activities would be limited to environment, safety, and health (ES&H) actions to maintain safe worker and facility operations. Neither the existing INEEL visual setting nor area scenic resources would be affected by No Action Alternative activities. The Bureau of Land Management (BLM) Visual Resource Management classification for INEEL acreage of Class III (mixed use) and Class IV (industrial use) would not change.

The air quality analysis (see Section 5.7.4) indicates that No Action Alternative emissions would not adversely impact contrast reduction or color shift values as seen from the Craters of the Moon Wilderness Area. Cumulative criteria pollutant emissions are all well below applicable standards (see Table 5.7-9), therefore no visual degradation would be expected in the INEEL area. There would be no change to the visual setting of the Middle Butte area located in the southern portion of the INEEL. The Middle Butte area is considered by the Shoshone-Bannock Tribes to be an important Native American resource.

5.5.3 Aesthetic and Scenic Resource Impacts from the Proposed Action

Under the Proposed Action, the construction of the AMWTP facility would be confined to the TSA located within the RWMC, the construction laydown area next to the existing sewage lagoon system adjacent to the TSA, and along the existing north/south RWMC emergency gravel road located east and adjacent to the TSA. The proposed new facility would be 60 feet tall and similar in size and shape to the existing waste management structures at the RWMC. The plant’s air emissions control system would have a 90-foot offgas stack (see the facility description in Chapter 3). The poles for the new power line would be wood "H" frame poles set about every 400 feet. Approximately seven or eight poles would be needed to span the 3,000-foot extension. The new power line extension would be visually consistent with the existing infrastructure and site form and context. Because of the developed industrial character of the RWMC, the AMWTP would not change the visual setting of the area (Visual Resource Management Class IV [industrial use]);

therefore, no adverse visual impacts are expected.

Construction of the AMWTP facilities would produce fugitive dust that may affect visibility temporarily in the local construction area (see Section 5.7.6). Dust control measures, such as watering, would be implemented to minimize impacts. Operational emissions under the Proposed Action were modeled (see Appendix Section E-3.3.3.6) and indicated that potential visual impacts resulting from contrast reduction or color shift would be negligible. The absolute value of the sky contrast parameter is about 0.002 compared to the recommended screening criterion of 0.5. The highest color shift value is 0.288 compared to the screening criterion of 2.0. These results indicate that views within the Craters of the Moon Wilderness Area and National Monument would not be impacted. Values at Fort Hall Indian Reservation are about one-third of the Craters of the Moon values for each of these parameters and are not expected to impact the view to Middle Butte, an important cultural resource to the Shoshone-Bannock Tribes.

There would be no change in aesthetic and scenic resource impacts due to the substitution of vitrification of ash from those described for the Proposed Action with microencapsulation of ash.

5.5.4 Aesthetic and Scenic Resource Impacts from the Non-Thermal Treatment Alternative

The impacts of the Non-Thermal Treatment Alternative would be somewhat less than those for the Proposed Action. Operational emissions under the Non-Thermal Treatment Alternative were modeled (see Appendix Section E-3.3.3.6) and indicated that potential visual impacts resulting from contrast reduction or color shift would be negligible. The absolute value of the sky contrast parameter is 0.0 compared to the recommended screening criterion of 0.5. The highest color shift value is 0.060 compared to the recommended screening criterion of 2.0. These results indicate that views within the Craters of the Moon Wilderness Area and National Monument would not be impacted. Values at Fort Hall Indian Reservation are about one-third of the Craters of the Moon values for each of these parameters and are not expected to impact the view to Middle Butte, an important cultural resource to the Shoshone-Bannock Tribes. Similarly, there would be no change to the visual setting of the RWMC area (Class IV) or visual degradation of nearby Craters of the Moon Wilderness Area and National Monument and the Middle Butte area.

5.5.5 Aesthetic and Scenic Resource Impacts from the Treatment and Storage Alternative

The impacts of the Treatment and Storage Alternative would be the same as those for the Proposed Action. There would be no changes to the visual setting of the RWMC area or visual degradation of nearby Craters of the Moon Wilderness Area and National Monument and the Middle Butte area due to treatment and storage of waste after treatment.

5.6 Geology

This section discusses the potential effects of the construction and operation of the AMWTP facility and alternatives on geology at the INEEL and surrounding area. Potential impacts from seismic events and lava flows are discussed in Section 5.14. The potential for these types of events and probability of occurrence are discussed in detail in Appendix Section E—2.1. Based on previous studies described in detail in Appendix Section E—2.1, the probability for a lava flow inundation of the RWMC by the Axial Volcanic Zone, the Arco Volcanic Rift Zone, and the Lava Ridge-Hell's Half Acre Volcanic Rift Zone is 2.9×10^{-6} per year, 9.3×10^{-6} per year, and 2.4×10^{-6} per year, respectively. The impacts from lava flow are analyzed in Section 5.14 and not in this section.

5.6.1 Methodology

Potential impacts to geologic resources would be associated with excavation during construction of the AMWTP and/or modification to existing facilities and infrastructure, and the mining of aggregate, clay, and sand resources to support the construction and operation of new and/or modified facilities.

5.6.2 Geologic Impacts from the No Action Alternative

Activities associated with the No Action Alternative would have minor adverse impacts on the geology and geologic resources of the INEEL. Direct impacts to geologic resources would result from excavating into the soil and rock at the site; soil mounding and banking; and extracting aggregate, clay, and sand from gravel and borrow pits on the INEEL to support existing and ongoing waste management, road maintenance, environmental restoration, and other site construction activities necessary for the continued operation of the site.

The estimated extraction volume of mineral resources from INEEL gravel and borrow pits for the preferred alternative in the DOE INEL EIS is approximately 513,000 cubic yards. The geology and soil impacts were addressed in Volume 2, Part A, Section 5.6.2 of the DOE INEL EIS. The environmental impacts of expanding the existing INEEL gravel/borrow areas were addressed in Volume 2, Part B, Section C-4.9.2 of the DOE INEL EIS, and the *Environmental Assessment and Plan for New Silt/Clay Source Development and Use at the Idaho National Engineering and Environmental Laboratory* (DOE 1997b).

5.6.3 Geologic Impacts from the Proposed Action

Activities associated with the Proposed Action would have minor adverse impacts on the geology and geologic resources of the INEEL. Disturbance would occur at building, parking, and construction laydown areas, destroying the soil profile and causing potential short-term soil erosion. Approximately 16,000 cubic yards of soil would be excavated for the AMWTP facility building foundation and electric substation foundations down to the bedrock to provide a stable construction base. If needed in the future, the new 0.5-acre sewage lagoon expansion would require excavation of an additional 1,033 cubic yards of soil. Soil not used for construction backfill and other project purposes would be dispositioned based on the *INEEL Soil Plan for the RWMC* (Taylor 1997). The major steps in the RWMC soil management plan process involve documentation of historical information, screening and/or conducting detailed sampling and analyses, and completion, including approval from RWMC Operations and WAG-7 Manager, of an Outage Request Form. The strategy is intended to address foreseeable requirements for the excavation and movement of soil associated with RWMC construction and operations. Excavation and movement of clean soil and rock is not constrained by the *Resource Conservation and Recovery Act* (RCRA), *Toxic Substances Control Act* (TSCA), *Comprehensive Environmental Response, Compensation, and Liability Act* (CERCLA), or radiation control regulations. Soil can be excavated and related within the RWMC controlled area, without posting or special management if:

- Management has approved the intended location of the stockpile,

- The screening survey indicates that levels of volatile organic compounds (VOCs) are not above background, and
- The concentration of radionuclides does not exceed maximum background levels.

If sampling and analysis indicates that radioactive and/or chemical contaminants exceed background or regulatory levels, soil excavated or moved may require subsequent management as radioactive or mixed waste, or alternative management. Such alternative management will be determined by DOE and the State of Idaho as part of a RCRA Closure Plan or remedial action under CERCLA.

Soil management associated with environmental restoration activities at RWMC will be addressed in CERCLA decision documents. Unique soil movement circumstances and needs that are not adequately encompassed by the plan will be addressed on a case-by-case basis, and may require negotiation involving DOE Idaho Operations Office (DOE-ID), the State of Idaho, and Region X of the U.S. Environmental Protection Agency (EPA). Standard construction control measures would be used to minimize soil erosion due to storm water runoff and wind.

Construction of the AMWTP would require the extraction of approximately 20,000 cubic yards of aggregate, clay, and sand from INEEL borrow areas. Mineral resource construction materials needed for the AMWTP were included in the estimated extraction volumes analyzed in Volume 2, Part A, Section 5.6.2 of the DOE INEL EIS and the *Environmental Assessment and Plan for New Silt/Clay Source Development and Use at the Idaho National Engineering and Environmental Laboratory* (DOE 1997b). The 20,000 cubic yards of materials extracted from the gravel/borrow pit areas would not have a significant adverse impact on the geologic resources of the INEEL.

There would be no change in geologic impacts due to the substitution of vitrification of ash from those described for the Proposed Action with microencapsulation of ash.

5.6.4 Geologic Impacts from the Non-Thermal Treatment Alternative

Activities associated with the Non-Thermal Treatment Alternative would have similar potential impacts on geology and geologic resources as described for the Proposed Action.

5.6.5 Geologic Impacts from the Treatment and Storage Alternative

Activities associated with the Treatment and Storage Alternative would have similar potential impacts on geology and geologic resources as described for the Proposed Action regarding the treatment of waste. However, the potential storage impact identified in Section 5.21 would be in addition to impacts for treatment.

5.7 AIR RESOURCES

The air resource existing in the region of the INEEL could be affected by air pollutant emissions associated with construction and operation of the proposed AMWTP. Air resource assessments have been performed to determine the maximum consequences at onsite and offsite locations that would result from AMWTP emissions under the four alternatives. The assessments include evaluation of impacts of emissions from stationary sources at the proposed AMWTP (main stack, boiler, and diesel generator stacks); fugitive sources from construction; and mobile sources (motor vehicles) that would operate in support of the facility under each alternative. The types of emissions assessed are the same radiological and nonradiological emissions as those in the baseline assessment (see Section 4.7, Air Resources), namely, radionuclides, criteria pollutants (carbon monoxide, nitrogen dioxide, sulfur dioxide, respirable particulate matter, and lead), and toxic air pollutants.

This section describes the assessment methodology and potential effects of construction and operation of the proposed AMWTP on local and regional air quality. Results of air quality assessments are presented in terms of expected radiation dose and nonradiological pollutant concentration levels, which are evaluated by comparison to applicable standards. The human health impacts from expected radiation doses and nonradiological pollutant concentrations are analyzed in Section 5.12, Occupational and Public Health and Safety. Potential impacts related to emissions of VOCs (which can lead to the formation of ozone), potential for visibility degradation, impacts due to project-induced secondary growth and other air quality related values are also described. Additional details on assessment methods, assumptions, and related information are contained in Appendix Section E-3, Air Resources, and in the DOE INEL EIS, Section 5.7 and Appendix Section F-3.

Impact analyses presented in this section are consistent with methodologies used in the AMWTP's pending air quality permit application, and pertain to normal facility operations. Impact analyses for upset or accident scenarios are presented in Section 5.14 and in Appendix Section E-5.

5.7.1 Methodology

The consequences of air pollutant emissions were assessed using methods and data considered acceptable for regulatory compliance determination by Federal and State agencies and designed to allow for a reasonable prediction of the impacts of proposed facilities. Public comments raised during the scoping process and the AMWTP Draft Environmental Impact Statement (EIS) review were also considered in shaping the methodology. For the most part, the methodology used for AMWTP impact assessment paralleled that used in the DOE INEL EIS, although updated data and methods were used in some cases. The principal components of the air resource assessment methodology are source term estimation and characterization of release parameters, together with local meteorological data and computerized dispersion modeling codes which are used to simulate transport and dispersion of air contaminants. A summary of each of these aspects of the assessment methodology follows.

5.7.1.1 Methodology for Radiological Consequences. Radiological source terms for the proposed AMWTP have been estimated on the basis of knowledge of the proposed equipment and processes, operating schedule, and characteristics of the waste to be treated. These source terms, which represent reasonable estimates of emissions under the proposed AMWTP alternatives, are presented in Section 5.7.2, Sources and Emissions.

The dispersion modeling used features two computer codes: GENII (Napier et al. 1988) and the Industrial Source Complex (ISC-3) code (EPA 1995b). The GENII model has been extensively tested and conforms to applicable software quality assurance criteria. Meteorological and population data specific to the INEEL are used by the model together with project emission rates. The GENII model calculates doses from all important pathways of exposure, including external and inhalation dose from immersion in contaminated air, external dose from deposition of radionuclides on ground surfaces, and ingestion of contaminated food products. The ingestion pathway, however, is not a realistic exposure pathway for onsite workers and was therefore not used for worker exposure assessments. In some cases, dispersion factors were computed using ISC-3, which incorporates features for better prediction of impacts influenced by building (e.g., wake effects, terrain features). In particular, ISC-3-generated dispersion factors were used to determine the location of the highest predicted radionuclide concentrations within the RWMC area and at site boundary locations. The dispersion factors computed for these locations were then manually entered into GENII for calculation of radiation dose from the applicable exposure pathways. Additional information on the radiological assessment methodology, including GENII input, is provided in Appendix Section E-3.

5.7.1.2 Methodology for Nonradiological Consequences. Dispersion modeling to assess nonradiological air contaminants was conducted using the ISC-3 atmospheric dispersion computer code (EPA 1995b). This is a regulatory update of the ISC-2 version (EPA 1992a) used in the DOE INEL EIS. The ISC-3 version incorporates certain improvements in the model, including the incorporation of improved algorithms to better address impacts due to area (fugitive) emission sources. However, for most applications, values estimated by ISC-3 will not differ significantly from those of the earlier version of the model (EPA 1995b). This has been verified by comparative evaluations of sources at the INEEL; the results produced by ISC-3 are virtually identical to the results produced by ISC-2.

The ISC-3 analyses used hourly meteorological data collected during 1991 and 1992 at the Grid III monitoring station. This is one of the same monitoring locations and these are the same years used in the DOE INEL EIS analyses. Wind-flow patterns at the Grid III location, which is located about 13 kilometers northeast of the proposed AMWTP site, are representative of those at the proposed site. Data are collected at both the 10- and 61-meter levels. The meteorological data collected at the 61-meter level are used to model elevated releases (e.g., AMWTP main stack and boiler stack emissions), while the 10-meter data are used for ground-level releases (e.g., diesel generator emissions). Additional details on the ISC-3 model application are provided in Appendix Section E-3.

As in the DOE INEL EIS, the nonradiological assessment did not include methods for quantifying impacts related to ozone formation. Emissions of VOCs (which are precursors of ozone formation) from the proposed AMWTP are well below the significance level designated by the State of Idaho. In addition, no simple, well-defined method exists to assess ozone formation potential (Wilson 1993); and, while the Idaho Division of Environmental Quality has no ozone monitoring data from the vicinity, it is not aware of problematic ozone levels in the area (Andrus 1994). This is further discussed in Section 5.7.4.3.1.

5.7.1.3 Methodology for Mobile Source Impacts. The DOE INEL EIS contained an extensive analysis of the ambient air quality impacts at offsite receptor locations due to mobile sources associated with INEEL operations. Sources included the INEEL bus fleet operations, INEEL fleet light- and heavy-duty vehicles, privately owned vehicles, and heavy-duty commercial vehicles servicing the INEEL facilities. These impacts were quantitatively assessed in the DOE INEL EIS using emission factors and the computerized CALINE-3 methodology (Benson 1979). The model, which implements the recommended EPA methodology, is considered a screening-level model designed to simulate traffic flow conditions and pollutant dispersion from traffic. The model was used to predict maximum 1-hour ambient air concentrations of carbon monoxide and respirable particulate matter. Regulatory-approved averaging time adjustment factors were used to scale results for other applicable averaging times. All receptor locations were selected within 3 meters from the edge of the roadway, in accordance with EPA guidance. Modeling was conducted for 1993 to quantify the impact due to INEEL buses and traffic serving projects and activities on the INEEL at that time, the projected impact of projects planned for construction before 1995, and the projected impacts of environmental restoration and waste management alternatives given in the DOE INEL EIS.

The impacts of mobile sources at the proposed AMWTP are qualitatively assessed in Section 5.7.5. These impacts are assumed to be bounded by the mobile source impacts assessed in the DOE INEL EIS.

5.7.2 Sources and Emissions

5.7.2.1 Emissions During Normal Operations. The principal source of radionuclide emissions at the proposed AMWTP would be the main stack, which is actually an assemblage of several individual smaller stacks (or flues) shrouded by a wind screen. The offgas streams from the incinerator, microencapsulation or vitrification process, gloveboxes, and various waste pre-treatment and handling areas pass through separate air pollution control systems and are then exhausted through separate flues. These flues vary in diameter, but each extends to the top of the 27.5-meter main stack. (An illustration and additional information on main stack parameters are provided in Appendix Section E-3.3.3.3.) In addition to the main stack, nonradiological pollutants would be emitted from propane-fueled steam and hot water boilers, a hot water heater, and diesel-fueled emergency generators. The number of boilers and diesel generators would vary by alternative: For the Proposed Action and Treatment and Storage Alternative, there would be three steam and three hot water boilers (although only two of each type would operate at any one time), a potable water heater and two diesel generators. The Non-Thermal Treatment Alternative would include the three hot water boilers and the potable water heater, but no steam boilers and only one diesel generator. The boiler and heater stacks would extend from the utility building, which is attached to the south end of the proposed AMWTP main building. The generators would be located near the southeast and southwest corners of the main building.

Radionuclide emission rates have been estimated for the incinerator, vitrifier, and non-thermal handling and treatment areas. Emission rates for plutonium and other radionuclides have been estimated on the basis of process design, proposed operations, and radionuclide concentrations in the waste to be treated (BNFL 1998a). Details on the methods and assumptions used in deriving these estimates are described in Appendix Section E-3.3.1. These emission rates are presented by system or area in Table 5.7-1, and by alternative in Table 5.7-2. There would be no radiological emissions from the AMWTP under the No Action Alternative.

Criteria and toxic air pollutant emissions have been estimated for the incinerator, vitrifier, non-thermal treatment and handling areas, boilers, heater, and diesel generators. The methods and assumptions used to estimate emissions are based primarily on information contained in permit applications prepared for the proposed AMWTP (BNFL 1998c, 1998e). These methods are described in Appendix Section E-3.3.1, and are summarized in this section.

Nonradiological emissions may arise through two primary mechanisms: (1) release of contaminants which are present in the waste and which are released during treatment, and (2) formation and release of products of combustion. The first category involves primarily toxic air contaminants and is associated with both thermal and non-thermal treatment. Emissions estimates for this category take into account:

Table 5.7-1. Estimated radionuclide emission rates for the proposed AMWTP by areas or systems (curies per year).[a]

	East (Area 300) Zone 3	East (Area 300) Zone 3	Incinerator	Vitrifier	Evaporator	
Radionuclide	main ventilation extract [b]	glovebox extract [c]	offgas	offgas	offgas	Microencapsulation [d]
Americium-241	1.5E-05 [e]	7.2E-08	1.4E-05	5.4E-04	1.4E-04	5.4E-06
Barium-137m	2.8E-07	1.3E-09	2.5E-07	1.0E-04	2.5E-06	1.0E-07
Bismuth-212	3.3E-09	1.6E-11	3.0E-09	1.2E-07	2.9E-08	1.2E-07
Carbon-14	3.0E-10	1.4E-12	2.6E-10	1.1E-08	2.6E-09	1.1E-08
Cerium-144	3.4E-09	1.6E-11	3.0E-09	1.2E-07	3.0E-08	1.2E-07
Curium-244	6.7E-08	3.2E-10	6.0E-08	2.4E-06	6.0E-07	2.4E-08
Cobalt-60	1.3E-08	5.9E-11	1.1E-08	4.4E-07	1.1E-07	4.4E-09
Cesium-134	1.4E-08	6.6E-11	1.2E-08	4.9E-07	1.2E-07	4.9E-09
Cesium-137	2.8E-07	1.3E-09	2.5E-07	1.0E-04	2.5E-06	1.0E-07
Iron-55	1.4E-10	6.7E-13	1.3E-10	5.0E-09	1.3E-09	5.0E-09
Hydrogen-3	2.7E+01	- [f]	-	-	-	-
Krypton-85	8.6E-10	4.1E-12	7.6E-10	3.0E-08	7.6E-09	3.0E-08
Nickel-63	4.5E-10	2.1E-12	4.0E-10	1.6E-08	3.9E-09	1.6E-08
Lead-212	3.3E-09	1.6E-11	3.0E-09	1.2E-07	2.9E-08	1.2E-07
Promethium-147	3.4E-09	1.6E-11	3.0E-09	1.2E-07	3.0E-08	1.2E-07
Polonium-216	3.3E-09	1.6E-11	3.0E-09	1.2E-07	2.9E-08	1.2E-07
Praseodymium-144	3.4E-09	1.6E-11	3.0E-09	2.1E-12	3.0E-08	1.2E-07
Plutonium-238	1.5E-05	6.9E-08	1.3E-05	5.1E-04	1.3E-04	5.1E-06
Plutonium-239	8.6E-06	4.1E-08	7.6E-06	3.0E-04	7.6E-05	3.0E-06
Plutonium-240	2.0E-06	9.4E-09	1.8E-06	7.0E-05	1.8E-05	7.0E-07
Plutonium-241	2.0E-05	9.6E-08	1.8E-05	7.1E-04	1.8E-04	7.1E-06
Plutonium-242	1.3E-10	6.2E-13	1.2E-10	4.6E-09	1.2E-09	4.6E-11
Radium-224	3.3E-09	1.6E-11	3.0E-09	1.2E-07	2.9E-08	1.2E-07
Antimony-125	2.1E-10	9.8E-13	1.8E-10	2.1E-12	1.8E-09	7.3E-09
Strontium-90	2.5E-07	1.2E-09	2.2E-07	8.9E-06	2.2E-06	8.9E-08

Thorium-228	3.3E-09	1.6E-11	3.0E-09	1.2E-07	2.9E-08	1.2E-07
Thorium-232	9.1E-10	4.3E-11	8.1E-10	3.2E-08	8.1E-09	3.2E-08
Thallium-208	1.2E-09	5.7E-12	1.1E-09	4.2E-08	1.1E-08	4.2E-08
Uranium-232	3.2E-09	1.5E-11	2.9E-09	1.2E-07	2.9E-08	1.2E-07
Uranium-233	1.3E-07	6.1E-10	1.1E-07	4.5E-06	1.1E-06	4.5E-08
Uranium-234	7.2E-10	3.4E-12	6.4E-10	2.6E-08	6.4E-09	2.6E-08
Yttrium-90	2.5E-07	1.2E-09	2.2E-07	8.9E-06	2.2E-06	8.9E-08

a. Source: BNFL (1998a). Emissions estimates are based on the radionuclide inventory and processing rate of waste to be processed. See Table E-3-2 of Appendix E-3 for additional assumptions and details.
b. Sources include box lines, central conveyor system, drum line, drum staging areas, and supercompaction/macroencapsulation glovebox.
c. Sources include analytical laboratory gloveboxes, sample extraction glovebox, and special case waste gloveboxes.
d. Includes ash and salt handling.
e. Scientific notation: 1.5E-05 = 1.5 x 10^{-5}.
f. Dash indicates no releases of radionuclide from indicated area or system. All tritium (H-3) in the waste is assumed to be released during pretreatment.

Table 5.7-2. Estimated radionuclide emission rates by proposed AMWTP alternative (curies per year).

Radionuclide	No Action	Proposed Action with micro-encapsulation	Proposed Action with vitrification	Nonthermal Treatment Alternative [a]	Treatment and Storage Alt. with microencapsulation [b]	Treatment and Storage Alt. with vitrification [c]
Americium-241	- [d]	1.7E-04	7.0E-04	1.5E-05	1.7E-04	7.0E-04
Barium-137m	-	3.1E-06	1.0E-04	2.8E-07	3.1E-06	1.0E-04
Bismuth-212	-	1.5E-07	1.5E-07	3.3E-09	1.5E-07	1.5E-07
Carbon-14	-	1.4E-08	1.4E-08	3.0E-10	1.4E-08	1.4E-08
Cerium-144	-	1.6E-07	1.6E-07	3.4E-09	1.6E-07	1.6E-07
Curium-244	-	7.5E-07	3.1E-06	6.8E-08	7.5E-07	3.1E-06
Cobalt-60	-	1.4E-07	5.8E-07	1.3E-08	1.4E-07	5.8E-07
Cesium-134	-	1.5E-07	6.4E-07	1.4E-08	1.5E-07	6.4E-07
Cesium-137	-	3.1E-06	1.0E-04	2.8E-07	3.1E-06	1.0E-04
Iron-55	-	6.5E-09	6.5E-09	1.4E-10	6.5E-09	6.5E-09
Hydrogen-3	-	2.7E+01	2.7E+01	2.7E+01	2.7E+01	2.7E+01
Krypton-85	-	4.0E-08	4.0E-08	8.6E-10	4.0E-08	4.0E-08
Nickel-63	-	2.1E-08	2.1E-08	4.5E-10	2.1E-08	2.1E-08
Lead-212	-	1.5E-07	1.5E-07	3.3E-09	1.5E-07	1.5E-07
Promethium-147	-	1.6E-07	1.6E-07	3.4E-09	1.6E-07	1.6E-07
Polonium-216	-	1.5E-07	1.5E-07	3.3E-09	1.5E-07	1.5E-07
Praseodymium-144	-	1.6E-07	3.6E-08	3.4E-09	1.6E-07	3.6E-08
Plutonium-238	-	1.6E-04	6.7E-04	1.5E-05	1.6E-04	6.7E-04
Plutonium-239	-	9.5E-05	4.0E-04	8.6E-06	9.5E-05	4.0E-04
Plutonium-240	-	2.2E-05	9.2E-05	2.0E-06	2.2E-05	9.2E-05
Plutonium-241	-	2.2E-04	9.3E-04	2.0E-05	2.2E-04	9.3E-04
Plutonium-242	-	1.4E-09	6.0E-09	1.3E-10	1.4E-09	6.0E-09
Radium-224	-	1.5E-07	1.5E-07	3.3E-09	1.5E-07	1.5E-07
Antimony-125	-	9.5E-09	2.2E-09	2.1E-10	9.5E-09	2.2E-09
Strontium-90	-	2.8E-06	1.2E-05	2.5E-07	2.8E-06	1.2E-05
Thorium-228	-	1.5E-07	1.5E-07	3.3E-09	1.5E-07	1.5E-07
Thorium-232	-	4.2E-08	4.2E-08	9.5E-10	4.2E-08	4.2E-08
Thallium-208	-	5.5E-08	5.5E-08	1.2E-09	5.5E-08	5.5E-08
Uranium-232	-	1.5E-07	1.5E-07	3.3E-09	1.5E-07	1.5E-07
Uranium-233	-	1.4E-06	5.9E-06	1.3E-07	1.4E-06	5.9E-06
Uranium-234	-	3.3E-08	3.3E-08	7.2E-10	3.3E-08	3.3E-08
Yttrium-90	-	2.8E-06	1.2E-05	2.5E-07	2.8E-06	1.2E-05

a. Based on projected emissions from the East (Area 300) Zone 3 pretreatment areas and supercompaction/macroencapsulation gloveboxes.
b. Emissions from treatment same as Proposed Action with Microencapsulation Option; other potential impacts associated with long-term storage

are described in Section 5.21.
c. Emissions from treatment same as Proposed Action with Vitrification Option; other potential impacts associated with long-term storage are described in Section 5.21.
d. Dash indicates no radionuclide emissions from indicated alternative or option.

- The maximum amount of contaminant in the waste;
- The waste processing rate;
- Release of waste contaminants from the treatment or handling area into the offgas system; and
- Removal of contaminants from the offgas by air pollution control systems.

The second category includes both criteria and toxic air pollutants and is associated with thermal treatment and fuel combustion in the boilers, heater, and generators. For thermal treatment, emissions estimates are based on material and energy balance calculations, which have been performed for a variety of waste types and operating conditions (BNFL 1998e). Boiler, heater, and diesel generator emissions are based on projected fuel consumption rates and emission factors recommended by the EPA for fuel-burning equipment (EPA 1997).

A summary of projected nonradiological emission rates for the Proposed Action and Non-Thermal Treatment Alternative is provided in Table 5.7-3. Emissions under the Treatment and Storage Alternative would be the same as the Proposed Action, although additional potential storage impacts could also result as identified in Section 5.21. Additional details regarding these emission estimates are provided in Table E-3-4 of Appendix Section E-3, Air Resources.

5.7.2.2 Emissions During Upset or Off-Normal Operations. The AMWTP stack gas control system has been designed to accommodate off-normal occurrences in the incineration and other treatment lines. Characterization and staging of wastes will minimize the potential for incompatible wastes entering the treatment lines, and will foster efficient treatment campaigns. A shredder, a waste hopper, and a controlled feed system will provide operating flexibility to maintain the incineration process and the stack gas control system at optimum performance.

Exit parameters for each of the AMWTP stacks are presented in Table E-3-4. Except for the diesel generators and the potable hot water heater, all sources are emitted through induced-draft stacks which use a fan to maintain their specified flow rates. The AMWTP will process wastes in each of the several process lines on a campaign basis. Preventive maintenance will be performed on the fan systems between campaigns and fans will be checked prior to initiation of any treatment campaign. These operations will result in very high reliability for the fans serving any stack. In the event of fan failure during operations, the process line or other activities served by the failed fan would be shut down. For non-thermal processes, additional emissions and resulting increased air impacts would be negligible, since stack gas control systems would continue in operation and the source feeding them would be terminated. For thermal systems (e.g., incinerator, steam boilers), stack gas control systems would also continue in operation; however, the source feeding them would continue emissions while cooling after shut down. Stack emissions from thermal stacks in that scenario would not exceed the normal operating emissions, but would be absent the forced draft (67 ft/sec for the incinerator), except for that induced outside the stack orifice by adjacent flumes within the combined stack. The result would be decreased plume rise, and increased concentrations (approximately a factor of 3, which would vary according to weather conditions) in the range beyond a few hundred meters downwind of the stack. If such a fan failure occurred, it would not be projected to cause a violation of any applicable short-term ambient air quality standard.

During operation of any AMWTP process line, any loss of commercial power would be compensated by operation of redundant standby engine-driven electrical generators. These systems are adequate to continue operation of plant ventilation systems which provide negative pressure to fire safety and work zones, as well as to continue operation of the forced draft in the stacks. In the event of a fast shutdown, stack ventilation would continue until the thermal treatment process

Table 5.7-3. Projected nonradiological emission rates for the proposed

AMWTP and support equipment by treatment alternative.[a]

	Proposed Action [b]				Non-Thermal Treatment	
	with microencapsulation		with vitrification		Alternative	
Substance	Maximum hourly (g/hr)	Annual average (kg/yr)	Maximum hourly (g/hr)	Annual average (kg/yr)	Maximum hourly (g/hr)	Annual average (kg/yr)
Criteria Pollutants						
Carbon Monoxide	8.5E+03	2.1E+03	8.5E+03	2.1E+03	4.2E+03	3.8E+02
Oxides of Nitrogen	4.2E+04	2.5E+04	4.2E+04	2.5E+04	2.0E+04	2.2E+03
Sulfur Dioxide	2.8E+03	7.0E+02	2.8E+03	7.0E+02	1.4E+03	2.0E+02
Particulate Matter (PM-10)	2.7E+03	2.9E+02	2.7E+03	2.9E+02	1.4E+03	1.0E+02
Volatile Organic Compounds	3.1E+03	4.8E+02	3.1E+03	4.8E+02	1.5E+03	1.5E+02
Lead	2.2E-06	1.9E-05	2.2E-06	1.9E-05	2.0E-06	1.7E-05
Carcinogens						
Arsenic (as carcinogen)	5.6E-07	4.9E-06	5.6E-07	4.9E-06	1.0E-07	8.9E-07
Asbestos	3.5E-06	3.1E-05	3.5E-06	3.1E-05	3.5E-06	3.1E-05
Benzene	1.2E+02	9.2E+00	1.2E+02	9.2E+00	6.0E+01	3.4E+00
Beryllium	1.0E-07	9.0E-07	6.3E-06	5.5E-05	1.0E-07	8.9E-07
Cadmium	2.8E-07	2.5E-06	2.8E-07	2.5E-06	1.0E-07	8.9E-07
Carbon tetrachloride	1.7E+00	1.5E+01	1.7E+00	1.5E+01	1.5E-01	1.4E+00
Chloroform	3.4E-01	3.0E+00	3.4E-01	3.0E+00	3.0E-02	2.7E-01
Chromium (hexavalent) [c]	3.1E-09	2.7E-08	1.9E-07	1.7E-06	3.1E-09	2.7E-08
1,2-Dichloroethane (Ethylene dichloride)	3.4E-01	3.0E+00	3.4E-01	3.0E+00	3.0E-02	2.7E-01
1,1-Dichloroethylene	3.4E-01	3.0E+00	3.4E-01	3.0E+00	3.0E-02	2.7E-01
Dioxin/furans [d]	2.4E-07	2.1E-06	2.4E-07	2.1E-06	0.0E+00	0.0E+00
Formaldehyde	2.3E+02	1.2E+01	2.3E+02	1.2E+01	1.2E+02	6.0E+00
Methylene chloride	2.4E-02	2.1E-01	2.4E-02	2.1E-01	2.2E-03	1.9E-02
Nickel	9.6E-08	8.4E-07	9.6E-08	8.4E-07	2.3E-08	2.0E-07
Polychorinated Biphenyls	8.9E-02	7.8E-01	8.9E-02	7.8E-01	4.2E-07	3.7E-06
Tetrachloroethylene	3.4E-01	3.0E+00	3.4E-01	3.0E+00	3.0E-02	2.7E-01
1,1,2-Trichloroethane	3.4E-01	3.0E+00	3.4E-01	3.0E+00	3.0E-02	2.7E-01
Trichloroethylene [e]	3.4E-01	3.0E+00	3.4E-01	3.0E+00	3.0E-02	2.7E-01
Noncarcinogens						
Acetone	3.4E-01	3.0E+00	3.4E-01	3.0E+00	3.0E-02	2.7E-01
Barium	5.5E-07	4.8E-06	5.5E-07	4.8E-06	9.8E-08	8.6E-07
Butyl alcohol	3.4E-04	3.0E-03	3.4E-04	3.0E-03	3.0E-05	2.7E-04
Chlorine	9.1E+01	8.0E+02	9.1E+01	8.0E+02	- [f]	- [f]
Chlorobenzene	3.4E-01	3.0E+00	3.4E-01	3.0E+00	3.0E-02	2.7E-01
Chromium (trivalent) [c]	1.0E-07	5.3E-05	6.1E-06	8.8E-07	1.0E-07	8.7E-07

Cyanide	5.9E-01	5.2E+00	5.9E-01	5.2E+00	2.3E-08	2.0E-07
Cyclohexane	3.4E-01	3.0E+00	3.4E-01	3.0E+00	3.0E-02	2.7E-01
2-Ethoxyethanol	3.4E-01	3.0E+00	3.4E-01	3.0E+00	3.0E-02	2.7E-01
Ethyl benzene	3.4E-01	3.0E+00	3.4E-01	3.0E+00	3.0E-02	2.7E-01
Hydrogen chloride	1.9E+02	1.7E+03	1.9E+02	1.7E+03	- [f]	- [f]
Hydrogen fluoride	7.8E-03	6.8E-02	7.8E-03	6.8E-02	- [f]	- [f]
Mercury	2.9E+00	2.6E+01	2.9E+00	2.6E+01	1.4E-07	1.2E-06
Methanol	1.0E-03	9.0E-03	1.0E-03	9.0E-03	9.3E-05	8.1E-04
Methyl ethyl ketone	3.4E-01	3.0E+00	3.4E-01	3.0E+00	3.0E-02	2.7E-01
Nitrobenzene	3.4E-01	3.0E+00	3.4E-01	3.0E+00	3.0E-02	2.7E-01
Selenium	3.3E-07	2.9E-06	3.3E-07	2.9E-06	1.0E-07	8.9E-07
Silver	1.4E-07	1.2E-06	1.4E-07	1.2E-06	1.0E-07	8.9E-07

Table 5.7-3. Projected nonradiological emission rates for the proposed AMWTP and support equipment by treatment alternative (continued).

	Proposed Action [b]				Non-Thermal Treatment	
	with microencapsulation		with vitrification		Alternative	
	Maximum	Annual	Maximum	Annual	Maximum	Annual
Substance	hourly	average	hourly	average	hourly	average
	(g/hr)	(kg/yr)	(g/hr)	(kg/yr)	(g/hr)	(kg/yr)
Noncarcinogens (Cont.)						
Toluene	3.4E-01	3.0E+00	3.4E-01	3.0E+00	3.0E-02	2.7E-01
1,1,1-Trichloroethane	5.1E+00	4.5E+01	5.1E+00	4.5E+01	4.6E-01	4.0E+00
Trichloroethylene [d]	3.4E-01	3.0E+00	3.4E-01	3.0E+00	3.0E-02	2.7E-01
1,1,2-Trichloro-1,2,2-trifluoroethane	1.7E+00	1.5E+01	1.7E+00	1.5E+01	1.5E-01	1.4E+00
Xylene	1.7E-03	1.5E-02	1.7E-03	1.5E-02	1.5E-04	1.4E-03

a. See Appendix E-3, Table E-3-3, for additional details, assumptions, and notes related to emissions estimates.
b. Doses from the Treatment and Storage Alternative would be the same as that from the Proposed Action (with either microencapsulation or vitrification of incinerator ash) regarding the treatment of wastes, however the potential storage impacts identified in Section 5.21 would be in addition to impacts for treatment.
c. Assumes that chromium emissions are 3 percent hexavalent and 97 percent trivalent.
d. The design efficiency of the incinerator air pollution control system is based on meeting the proposed MACT standard for dioxin and furans (as 2,3,7,8 TCDD equivalent). The emission rates listed are maximum values; actual emissions are expected to be less.
e. Trichloroethylene is listed as both a carcinogen and noncarcinogen in the Idaho regulations.

f. Substance would not be emitted by non-thermal treatment.

cooled to near ambient temperatures, which may be as long as 12 hours. For other process lines (e.g., supercompactor, macroencapsulator, microencapsulator) stack emissions would continue for much shorter durations since these processes could be secured in less than one-hour. Short-term concentrations of criteria pollutants, HAPs and radionuclides in the "fast shutdown procedure" scenario would not exceed those of conventional operations, since all stack gas control equipment would remain in operation. Short-term ambient concentrations would not exceed those of conventional operations, since induced draft fans would remain operable.

In the AMWTP design, incinerator exhaust is cooled first by the addition of quench air to cool the exhaust to the range of the high temperature filter and second, through operation of the off-gas quencher which further cools it to saturation well below the limiting temperature of the high-efficiency particulate air (HEPA) filters. Disruption or failure of either component of the cooling system would necessitate emergency recovery procedures to avoid damaging the HEPA filters. Uncontrolled temperature excursions (perhaps by loss of off-gas quencher capability) in the incinerator exhaust air would be met by immediate cut off of incinerator fuel and waste feed, and by admission of full quench air into the off-gas system. This is the primary default, and plant equipment for this recovery is fully-redundant (duplicate motors, blowers, power supply). Quench air capacity is adequate to bring the off-gas air to below the limiting maximum temperature for the HEPA filters. The off-gas quencher however, is a mechanical system served by independent, redundant scrub liquid/feed pumps, therefore such a dual failure is incredible. In either failure mode the high temperature filters are static mechanical systems which would remain operable. Additionally, in either failure mode, the HEPA filters are redundant so that if damage to some filters did occur, particulate control would be maintained. Particulate emission control would be maintained at levels equal to normal operating conditions (see Table 5.7-2) in the event of an off-gas temperature excursion. Control of radiological particulate emissions would be similarly maintained at levels of normal operations (see Table 5.7-1). Acid gas control would be compromised if the packed-bed absorber were damaged or made inoperative. In that scenario, emissions of hydrochloric acid-gas occur in the period between the control system trip and incinerator shutdown. Like the off-gas quencher, however, the packed bed absorber is served by independent, redundant scrub liquid/feed pumps, such that a dual failure is not likely.

In the event of a fast shutdown, stack ventilation would continue until the thermal treatment process cooled to near ambient temperatures, which may be as long as 12 hours. Continued stack ventilation in this scenario would not affect efficiency of the stack gas control system. TSCA compliance requires 99.9999 percent destruction of polychlorinated biphenyls (PCBs), which is primarily a function of incinerator temperatures and flame residence time. Because waste feed would be terminated in a fast shutdown scenario, and residual heat would be available in the incinerator, TSCA compliance would be maintained. In the event of a fast shutdown, the loss of power in a shutdown would be compensated by operation of redundant standby engine-driven electrical generators. These systems are adequate to continue operation of plant ventilation systems, which provide negative pressure to fire safety and work zones, as well as to continue operation of the forced draft in the stacks. Stack ventilation would continue until the thermal treatment process cooled to near ambient temperatures.

5.7.3 Radiological Impacts

Radiation doses associated with radionuclide emissions from the proposed AMWTP have been calculated for (1) a worker at the location of highest predicted radioactivity level, (2) the maximally exposed individual (MEI) at an offsite location, and (3) the entire population (adjusted for future growth) within an 80-kilometer radius of the RWMC (see Table 5.7-4). Doses are assessed for emissions under each alternative and are added to current (baseline) doses and projected increases as a result of other future INEEL facilities to determine cumulative radiological doses. Public and worker health impacts from projected doses are analyzed in Section 5.12, Occupational and Public Health and Safety. Projected increases are assumed to be represented by dose estimates for the Preferred Alternative from the DOE INEL EIS, modified as described in Section 4.7.3.2.

Under the No Action Alternative, the AMWTP would not be constructed, but other new sources of radiological emissions would come into operation between the present and 2005. The doses for the No Action Alternative are based solely on site-wide emissions from existing facilities and projected increases as defined by the Preferred Alternative assessed in the DOE INEL EIS.

Under the Proposed Action, doses would result from radionuclide emissions from thermal treatment (incineration and vitrification) and non-thermal waste processing. The highest dose from AMWTP emissions to an offsite individual is projected for options that include vitrification of incinerator ash. This dose is 0.09 millirem per year and occurs at the site boundary about 6 kilometers south-southwest of the facility. The most important radionuclide and exposure pathway are americium-241 and inhalation. When added to the baseline dose and projected increases, the cumulative dose to the offsite individual would be 0.23 millirem per year. For the Proposed Action with microencapsulation of incinerator ash, these doses would be less: about 0.02 and 0.16 millirem per year, respectively. As in the case of each AMWTP alternative, the cumulative dose from AMWTP emissions and other sources is a very small fraction of that received from natural background sources and is well below the National Emissions Standard for Hazardous Air Pollutants (NESHAP) dose limit of 10 millirem per year.

The highest estimated dose at a potentially occupied onsite location under the Proposed Action with vitrification of incinerator ash is 0.36 millirem per year and would occur within the RWMC area about 300 meters south-southwest of the facility. Under the Proposed Action with microencapsulation of incinerator ash, this dose would be about 0.06 millirem per year. Either of these doses, when added to the baseline dose and projected increases, would remain a very small fraction of the occupational dose limit of 5,000 millirem per year.

The maximum collective dose (i.e., the sum of all individual doses) to the entire population residing within 80 kilometers that would result under the Proposed Action is about 0.009 person-rem per year with the microencapsulation of ash and about 0.05 person-rem per year with the

Table 5.7-4. Summary of radiation doses associated with airborne radionuclide emissions from the proposed AMWTP alternatives.

Case	Baseline	Projected increases [a]	AMWTP operation	Cumulative dose
Highest onsite (worker) location	**(millirem per year)**			
No Action Alternative	0.21 [b]	0.023	0	0.23
Proposed Action with microencapsulation [c]	0.21	0.023	0.058	0.29
Proposed Action with vitrification [c]	0.21	0.023	0.36	0.59
Non-Thermal Treatment Alternative	0.21	0.023	0.003	0.24
Maximally exposed offsite individual	**(millirem per year)**			
No Action Alternative	0.031 [d]	0.11	0	0.14
Proposed Action with microencapsulation [c]	0.031	0.11	0.022	0.16
Proposed Action with vitrification [c]	0.031	0.11	0.09	0.23
Non-Thermal Treatment Alternative	0.031	0.11	0.0031	0.14
Collective population dose	**(person-rem per year)**			
No Action Alternative	0.085 [b,e]	0.41	0	0.5
Proposed Action with microencapsulation [c]	0.085	0.41	0.0089	0.5
Proposed Action with vitrification [c]	0.085	0.41	0.048	0.54
Non-Thermal Treatment Alternative	0.085	0.41	0.00085	0.5

a. Modified as described in Section 4.7.3.2.

b. From Table 5.7-4 of DOE INEL EIS, modified as described in Section 4.7.3.2.

c. Doses from the Treatment and Storage Alternative would be the same as that from the Proposed Action (with either microencapsulation or vitrification of incinerator ash) regarding the treatment of wastes; however the potential storage impacts identified in Section 5.21 would be in addition to impacts for treatment.

d. From 1996 NESHAP Report (DOE-ID 1997b).

e. Baseline population dose applies to total population within 80 kilometers of each major INEEL area.

vitrification of ash. When added to the baseline population dose and projected increases, the collective dose becomes 0.5 or 0.54 person-rem per year, respectively. The differences in cumulative population dose between the alternatives are not significant since the baseline dose and projected increases are dominant. It should be noted that the baseline population dose and projected increases were calculated in the DOE INEL EIS and apply to the entire population residing within 80 kilometers of each major area at INEEL, with growth projected to the year 2010. The population dose resulting from projected AMWTP emissions is determined only for the population residing within 80 kilometers of the RWMC area (within which the AMWTP would be located). This population was 72,837 during 1990. Assuming an annual growth rate of 1.25 percent (see Table 4.3-2), the population within 80 kilometers of RWMC would grow to about 100,000 people by 2015. If it is assumed that the cumulative population dose is distributed among these 100,000 people, the average individual dose would be about 0.005 millirem per year. Since this cumulative dose is dominated by baseline conditions and projected increases, it applies to the other alternatives as well. No applicable standards exist for collective population dose; however, DOE policy requires that doses resulting from radioactivity in effluents be reduced to the levels which are as low as reasonably achievable (ALARA).

Doses incurred under the Non-Thermal Treatment Alternative result from emissions associated with radioactive waste handling and non-thermal treatment such as supercompacting or macroencapsulation, but do not include incineration, vitrification, or microencapsulation. These emissions and the associated doses (see Table 5.7-4) are noticeably lower than those that would result from thermal treatment emissions. Doses projected for the Treatment and Storage Alternative would be identical to the Proposed Action. The relative magnitude of the cumulative doses for the four alternatives is illustrated by the comparisons presented in Figure 5.7-1. The cumulative doses

Note: The applicable radiological limits for an individual member of the public are 10 mrem per year resulting from operations for the air pathways. The radiological limit for an individual worker is 5,000 mrem per year (10 CFR 835).

Note: The Treatment and Storage Alternative impacts are the same as the Proposed Action regarding the treatment of waste; however, the potential storage impacts identified in Section 5.21 would be in addition to impacts for treatment.

Figure 5.7-1. Dose to onsite worker, maximally exposed offsite individual, and collective population due to projected airborne radionuclide emissions under each of the four AMWTP alternatives.

depicted in this figure represent the sum of contributions from baseline emissions, projected increases to the baseline, and projected emissions from the proposed AMWTP.

The radiological doses described above are specified in terms of annual radiation dose, which facilitates comparison to applicable standards. In general, the total radiological doses over the life of the facility would be approximately equal to the annual dose multiplied by the number of years of operation. For population doses, however, changes in projected population must be taken into account. These results are presented in Table 5.7-5.

Table 5.7-5. Radiation doses for a 13-year or 30-year operating lifetime of the AMWTP.[a]

	Effective dose equivalent			
	13-year operating lifetime		30-year operating lifetime	
Case and units	AMWTP only	AMWTP plus baseline [b]	AMWTP only	AMWTP plus baseline [b]
Highest onsite (worker) location (millirem)				
Proposed Action with microencapsulation [c]	0.76	3.8	1.7	8.7
Proposed Action with vitrification [c]	4.6	7.7	11	18
Non-Thermal Treatment Alternative	0.04	3.1	- [d]	- [d]

Maximally exposed offsite individual (millirem)				
Proposed Action with microencapsulation	0.29	2.1	0.67	4.9
Proposed Action with vitrification	1.2	3	2.7	6.9
Non-Thermal Treatment Alternative	0.04	1.9	- [d]	- [d]
Collective population dose (person-rem) [e]				
Proposed Action with microencapsulation	0.11	8.5	0.29	23
Proposed Action with vitrification	0.6	9.0	1.6	24
Non-Thermal Treatment Alternative	0.011	8.4	- [d]	- [d]

a. See Chapter 3 for information on projected AMWTP operating lifetime under the proposed alternatives.

b. Includes contributions from existing sources and foreseeable increases, as described in Section 4.7.3.2.

c. The Treatment and Storage Alternative impacts are the same as the Proposed Action regarding the treatment of waste; however the potential storage impacts identified in Section 5.21 would be in addition to impacts for treatment.

d. AMWTP would not operate beyond 13 years under this alternative.

e. Assumes average population of 95,000 for 13-year operating life and 109,000 for 30-year operating life.

5.7.4 Nonradiological Impacts

This section presents results of the air quality assessments for sources of nonradiological air pollutants. The primary goal of this presentation is to facilitate comparisons of impacts between alternatives. The importance of the results as they apply to regulatory compliance aspects of predicted alternative consequences is also discussed. The impacts described below are expressed in time frames (hourly, annual, etc.) that correspond to the averaging times specified by regulatory criteria. The human health risks associated with these impacts, including total risk over the projected operating life of the facility, are discussed in Section 5.12, Occupational and Public Health and Safety.

5.7.4.1 Concentrations of Pollutants in Ambient Air at Offsite Locations. Maximum concentrations of criteria pollutants in ambient air (i.e., at locations of public access) have been determined for INEEL site boundary locations, along public roads, and at Craters of the Moon Wilderness Area. Results of these assessments are presented and compared to applicable standards in Table 5.7-6. Projected pollutant levels associated with each of the alternatives are low and well within the limits defined by applicable standards (IDHW 1997). As in the case of radiological impacts, these consequences include contributions from existing (baseline) sources and projected increases. Existing source impacts are conservatively assumed to be represented by the maximum baseline emissions (see Table 4.7-2 and associated text for a comparison of maximum and actual baseline emissions).

On a comparative basis, impacts for the Proposed Action and Treatment and Storage Alternatives are greater than the Non-Thermal Treatment Alternative, since the former include incinerator emissions as well as higher boiler and diesel generator emission rates. However, when the cumulative effect of the baseline and projected increases is considered, there is little difference between the alternatives. Figure 5.7-2 illustrates the cumulative impacts with respect to applicable standards for the Proposed Action and Non-Thermal Treatment Alternative at the INEEL boundary and public road locations. It should be noted that the scale of these graphs does not extend to 100 percent to facilitate comparison. The incremental impact from proposed AMWTP operations is greatest at INEEL boundary locations; however, when the effect of baseline levels is added, cumulative pollutant levels are projected to be highest along public roads. The dominance of the baseline and projected increases is clearly evident in these charts.

Impacts presented in Table 5.7-5 and in Figure 5.7-2 are applicable to maximum capacity operation of the AMWTP, and would not perceptibly change when the effects of possible malfunction or upset events are considered. The AMWTP stack gas control systems incorporate dual-path, redundant equipment and power supplies, and have been designed to accommodate off-normal occurrences in the thermal treatment and non-thermal treatment lines without increase in emissions under those circumstances. Characterization and staging of segregated wastes will minimize the potential for incompatible wastes entering the treatment lines and will foster efficient treatment campaigns.

Because the impacts presented in Table 5.7-5 and in Figure 5.7-2 incorporate the effects of controlled emissions from all of the AMWTP treatment lines, they include any impacts arising from emissions of potential radiological decomposition of hydrocarbons which have been exposed to radiation in the stored waste.

Increases in criteria pollutant concentrations at Craters of the Moon Wilderness Area would be very minor under either the Proposed Action, Non-Thermal Treatment, or Treatment and Storage Alternative. Potential impacts related to PSD at Craters of the Moon are discussed in Section 5.7.4.3.2.

The cumulative emissions from the proposed AMWTP include consideration of maximum baseline conditions and the effects of projected increases to the baseline. Background concentrations have not been added because reliable data on background levels in the INEEL environs are not available for most pollutants. Background levels are assumed to be low and are represented in the maximum baseline by incorporation of conservative assumptions. Some pollutants have been monitored onsite, but those results reflect localized effects of INEEL site facility emissions and are not indicative of actual background. (INEEL facility contributions are accounted for in this EIS assessment by application of dispersion modeling.) Appendix Section E-3 presents information on measured nonradiological pollutant background levels on and around the INEEL.

Results of assessments for carcinogenic (that is, capable of inducing cancer) and noncarcinogenic toxic air pollutants at offsite locations are presented in Table 5.7-7. As described in Section 4.7.4.2.2, Offsite Conditions, toxic air pollutant increments have been promulgated by the State of Idaho for the control of toxic pollutants in ambient air. These increments, however, apply only to new or modified sources and would only require the evaluation of cumulative impacts for those sources that become operational after May 1, 1994. Thus, the contribution from baseline sources is not included when comparing toxic air pollutant impacts to these increments. In all cases, the maximum incremental impacts of carcinogenic and noncarcinogenic air pollutants are projected to occur at INEEL boundary locations, and levels of all substances would be well below the applicable standards.

Under the Proposed Action or Treatment and Storage Alternative, the highest incremental level of any carcinogenic substance would be less than 0.3 percent of the applicable standard (for carbon tetrachloride). All noncarcinogenic levels would be less than about 0.1 percent of applicable standards. Carcinogenic impacts under the Non-Thermal Treatment Alternative would not exceed 0.1 percent of any standard, while noncarcinogenic levels would not exceed 0.001 percent of the standard for each substance.

5.7.4.2 Concentrations of Pollutants at Onsite Locations. Onsite concentrations of toxic air pollutants are presented in Table 5.7-8. These results represent the maximum predicted levels at any point within the RWMC, averaged over an 8-hour period, to which workers might be exposed. These results are compared to occupational standards recommended by either the American Conference of Governmental Industrial Hygienists (ACGIH) or the Occupational Safety and Health Administration (OSHA), whichever standard is lower. The highest onsite concentrations (as a percentage of applicable limits) are projected for formaldehyde, which is produced by diesel fuel combustion and would only be present during periods when the emergency generators are running. Under the Proposed Action and Treatment and Storage Alternative (which include two diesel generators), formaldehyde levels could reach about 7 percent of the applicable standard. This level would be about 5 percent under the Non-Thermal Treatment Alternative (which includes only one diesel generator). Onsite levels of all other substances under any of the alternatives would be about 1 percent or less of applicable occupational limits. When the cumulative effect of baseline levels at the RWMC (including foreseeable increases) are considered, concentrations of toxic air pollutants would remain well below applicable occupational limits.

5.7.4.3 Regulatory Compliance Evaluation. The CAA and the State of Idaho have established ambient air quality standards for designated criteria air pollutants. Proposed major projects or modifications must demonstrate that project emissions would not cause an established ambient air quality standard to be exceeded. While cumulative annual emission rates associated with many pollutants do not exceed the threshold level to be designated as major according to the State of Idaho Rules for the Control of Air Pollution in Idaho (IDHW 1997), the impact of each criteria pollutant has been assessed.

In addition to the comparison to ambient air standards presented in Section 5.7.4.1, evaluations have been performed for other regulatory issues and air quality-related values. These include (1) potential for ozone formation, (2) PSD increment consumption, (3) impacts due to secondary growth (indirect or induced impacts), (4) stratospheric ozone depletion, (5) acidic deposition, (6) global warming, (7) secondary aerosol formation, (8) emissions opacity, and (9) potential visibility degradation. These analyses are summarized in the following subsections.

5.7.4.3.1 Ozone Formation. In addition to the previously mentioned criteria pollutants, current Idaho regulations designate ozone as a criteria air pollutant and establishes a National Ambient Air Quality Standard (NAAQS) of 0.12 ppm (235 micrograms per cubic meter) for a 1-hour averaging period. Recently, a more restrictive ozone standard of 0.08 ppm for an 8-hour averaging time has been established by EPA, and this new standard will apply at the INEEL ozone, unlike the other criteria pollutants, is not emitted directly from facility sources but is formed in the atmosphere through photochemical reactions involving nitrogen oxides and VOCs (also referred to as non-methane hydrocarbons). Therefore, the regulation of ozone is effected by the control of emissions of ozone-producing compounds or precursors, that is, nitrogen oxides and VOCs.

Table 5.7-6. Cumulative criteria pollutant emissions at public access locations for proposed AMWTP alternatives.

		Baseline plus increases (ug/m^3) [a]			Impact of alternative(ug/m^3)			Cumulative emissions (ug/m^3) [b]				Percent of standard		
Pollutant	Averaging time	Site boundary	Public roads	Craters of the Moon	Site Boundary	Public roads	Craters of the Moon	Site boundary	Public roads	Craters of the Moon	Applicable standard [c] (ug/m3)	Site boundary	Public roads	Craters of the Moon
No Action Alternative														
Carbon monoxide	1-hour	418	1219	137	0	0	0	418	1219	137	40,000	1	3	<1
	8-hour	122	285	29	0	0	0	122	285	29	10,000	1	3	<1
Nitrogen dioxide	Annual	7	11	0.6	0	0	0	7.1	11	0.58	100	7	11	<1
Sulfur dioxide	3-hour	180	580	61	0	0	0	180	580	61	1,300	14	45	5
	24-hour	45	135	11	0	0	0	45	135	11	365	12	37	3
	Annual	2.3	6	0.3	0	0	0	2.3	6.1	0.33	80	3	8	<1
Particulate matter [d]	24-hour	14	33	3	0	0	0	14	33	3.1	150	9	22	2
	Annual	0.8	3.5	0.1	0	0	0	0.77	3.5	0.12	50	2	7	<1
Lead	Quarterly	0.002	0.005	0.0001	0	0	0	0.002	0.005	0.0001	1.5	<1	<1	<1
Proposed Action with microencapsulation or vitrification [e]														
Carbon monoxide	1-hour	418	1219	137	115	71	1.6	533	1290	139	40,000	1	3	<1
	8-hour	122	285	29	0.85	0.31	0.014	123	285	29	10,000	1	3	<1
Nitrogen dioxide	Annual	7	11	0.6	0.34	0.10	0.010	7	11	0.59	100	7	11	<1
Sulfur dioxide	3-hour	180	580	61	25	11	0.43	205	591	61	1,300	16	45	5
	24-hour	45	135	11	4.5	1.5	0.10	49	137	11	365	14	38	3

	Annual	2.3	6	0.3	0.012	0.0027	0.0003	2.3	6	0.33	80	3	8	<1
Particulate matter [d]	24-hour	14	33	3	4.6	1.6	0.10	19	35	3.2	150	12	23	2
	Annual	0.8	3.5	0.1	0.006	0.001	0.0001	0.81	3.5	0.12	50	2	7	<1
Lead	Quarterly	0.002	0.005	0.0001	1.4E-10	3.3E-11	4.7E-12	0.002	0.005	0.0001	1.5	<1	<1	<1
Non-Thermal Treatment Alternative														
Carbon monoxide	1-hour	418	1219	137	57	35	0.79	475	1254	138	40,000	1	3	<1
	8-hour	122	285	29	0.19	0.057	0.0029	122	285	29	10,000	1	3	<1
Nitrogen dioxide	Annual	7	11	0.6	0.043	0.010	0.0010	7.1	11	0.59	100	7	11	<1
Sulfur dioxide	3-hour	180	580	61	12	5.4	0.21	185	585	61	1,300	15	45	5
	24-hour	45	135	11	2.2	0.75	0.051	46	136	11	365	13	37	3
	Annual	2.3	6	0.3	0.004	0.0008	0.0001	2.3	6.1	0.33	80	3	8	<1
Particulate matter [d]	24-hour	14	33	3	2.3	0.78	0.051	16	34	3.2	150	11	23	2
	Annual	0.8	3.5	0.1	0.002	0.0006	0.00005	0.77	3.5	0.12	50	2	7	<1
Lead	Quarterly	0.002	0.005	0.0001	1.2E-10	3.0E-11	4.3E-12	0.002	0.005	0.0001	1.5	<1	<1	<1

a. Baseline plus increases are assumed to be as assessed for maximum baseline case plus the Preferred Alternative in the DOE INEL EIS.

b. Cumulative emissions are assessed as the sum of the baseline plus increases and the impact of alternative for a given receptor category. This is conservative since in most cases the highest concentration for each would occur at different locations or times.

c. All standards are Idaho Primary Ambient Air Quality Standards (AAQS) except for 3-hour sulfur dioxide, which is a secondary AAQS. Primary AAQS are designed to protect public health, whereas secondary standards are intended to protect public welfare.

d. Assumes that all particulate matter is of respirable size (10 microns or less); does not include contributions of secondary aerosol formation or fugitive dust.

e. Concentrations due to the Treatment and Storage Alternative would be identical to those of Proposed Action (with either microencapsulation or vitrification of ash); however the potential storage impacts identified in Section 5.21 would be in addition to impacts for treatment.

Impacts for Proposed Action apply for either microencapsulation or vitrification of ash. Treatment impacts for the Treatment and Storage Alternative would be identical to the Proposed Action Alternative; however, the potential storage impacts identified in Section 5.21 would be in addition to impacts for treatment.

Figure 5.7-2. Cumulative criteria pollutant impacts at INEEL boundary (left) and public road locations (right), as percentages of the applicable Ambient Air Quality Standards.

Table 5.7-7. Ambient air concentrations of toxic air pollutants for proposed AMWTP treatment alternatives.

		Proposed Action with microencapsulation [a]				Proposed Action with vitrification [a]				Non-Thermal Treatment Alternative			
	Applicable	INEEL site boundary[c]		Craters of the Moon		INEEL site boundary[c]		Craters of the Moon		INEEL site boundary[c]		Craters of the Moon	
	standard[b]	Impact	% of	Impact	% of	Impact	% of	Impact	% of	Impact	% of	Impact	% of
Pollutant	(ug/m^3)	(ug/m^3)	standard	(ug/m^3)	standard	(ug/m^3)	standard	(ug/m^3)	standard	(ug/m^3)	standard	(ug/m^3)	standard
Carcinogens													
Arsenic	0.00023	5.8E-11	<0.001%	1.8E-12	<0.001%	5.7E-11	<0.001%	1.8E-12	<0.001%	8.5E-12	<0.001%	3.4E-13	<0.001%
Asbestos	0.00012	2.9E-10	<0.001%	1.2E-11	<0.001%	2.9E-10	<0.001%	1.2E-11	<0.001%	2.9E-10	<0.001%	1.2E-11	<0.001%
Benzene	0.12	1.0E-04	0.084%	2.5E-06	0.002%	1.0E-04	0.084%	2.5E-06	0.002%	6.9E-05	0.057%	1.5E-06	0.001%
Beryllium	0.0042	7.0E-10	<0.001%	2.0E-11	<0.001%	3.0E-09	<0.001%	8.7E-11	<0.001%	8.5E-12	<0.001%	3.4E-13	<0.001%
Cadmium	0.00056	2.8E-11	<0.001%	9.4E-13	<0.001%	2.8E-11	<0.001%	9.3E-13	<0.001%	8.5E-12	<0.001%	3.4E-13	<0.001%
Carbon tetrachloride	0.067	1.9E-04	0.28%	5.5E-06	0.008%	1.9E-04	0.28%	5.5E-06	0.008%	1.4E-05	0.02%	5.0E-07	<0.001%
Chloroform	0.043	3.7E-05	0.086%	1.1E-06	0.003%	3.7E-05	0.086%	1.1E-06	0.003%	2.7E-06	0.006%	1.0E-07	<0.001%
Chromium (hexavalent)	0.00008	2.1E-11	<0.001%	6.0E-13	<0.001%	9.1E-11	<0.001%	2.6E-12	<0.001%	2.6E-13	<0.001%	1.0E-14	<0.001%
1,2-Dichloroethane (Ethylene dichloride)	0.038	3.7E-05	0.098%	1.1E-06	0.003%	3.7E-05	0.098%	1.1E-06	0.003%	2.7E-06	0.007%	1.0E-07	<0.001%
1,1-Dichloroethylene	0.02	3.7E-05	0.19%	1.1E-06	0.006%	3.7E-05	0.19%	1.1E-06	0.006%	2.7E-06	0.014%	1.0E-07	<0.001%
Dioxin/furans [d]	2.2E-08	2.7E-11	0.12%	7.8E-13	0.004%	2.7E-11	0.12%	7.8E-13	0.004%	-[e]	-[e]	-[e]	-[e]
Formaldehyde	0.077	1.3E-04	0.17%	2.7E-06	0.003%	1.3E-04	0.17%	2.7E-06	0.003%	7.0E-05	0.09%	1.4E-06	0.002%
Methylene chloride	0.24	2.6E-06	0.001%	7.8E-08	<0.001%	2.6E-06	0.001%	7.8E-08	<0.001%	1.9E-07	<0.001%	7.0E-09	<0.001%
Nickel	0.0042	9.8E-12	<0.001%	3.1E-13	<0.001%	9.8E-12	<0.001%	3.1E-13	<0.001%	1.9E-12	<0.001%	7.6E-14	<0.001%
Polychorinated Biphenyls (Arochlor)	0.01	9.7E-06	0.097%	2.9E-07	0.003%	9.7E-06	0.097%	2.9E-07	0.003%	3.5E-11	<0.001%	1.4E-12	<0.001%
Tetrachloroethylene	2.1	3.7E-05	0.002%	1.1E-06	<0.001%	3.7E-05	0.002%	1.1E-06	<0.001%	2.7E-06	<0.001%	1.0E-07	<0.001%
1,1,2-Trichloroethane	0.062	3.7E-05	0.06%	1.1E-06	0.002%	3.7E-05	0.06%	1.1E-06	0.002%	2.7E-06	0.004%	1.0E-07	<0.001%
Trichloroethylene[f]	0.077	3.7E-05	0.048%	1.1E-06	0.001%	3.7E-05	0.048%	1.1E-06	0.001%	2.7E-06	0.004%	1.0E-07	<0.001%
Noncarcinogens													
Acetone	89,000	5.9E-04	<0.001%	1.1E-05	<0.001%	5.9E-04	<0.001%	1.1E-05	<0.001%	3.4E-05	<0.001%	1.0E-06	<0.001%
Barium	25	8.3E-10	<0.001%	1.8E-11	<0.001%	8.3E-10	<0.001%	1.8E-11	<0.001%	9.5E-11	<0.001%	3.3E-12	<0.001%
Butyl alcohol	7,500	5.9E-07	<0.001%	1.1E-08	<0.001%	5.9E-07	<0.001%	1.1E-08	<0.001%	3.4E-08	<0.001%	1.0E-09	<0.001%
Chlorine	150	1.6E-01	0.11%	3.0E-03	0.002%	1.6E-01	0.11%	3.0E-03	0.002%	-[e]	-[e]	-[e]	-[e]
Chlorobenzene	17,500	5.9E-04	<0.001%	1.1E-05	<0.001%	5.9E-04	<0.001%	1.1E-05	<0.001%	3.4E-05	<0.001%	1.0E-06	<0.001%
Chromium (trivalent)	25	9.6E-11	<0.001%	3.4E-12	<0.001%	1.1E-08	<0.001%	2.0E-10	<0.001%	9.4E-11	<0.001%	3.3E-12	<0.001%

Cyanide	250	1.0E-03	<0.001%	1.9E-05	<0.001%	1.0E-03	<0.001%	1.9E-05	<0.001%	2.2E-11	<0.001%	7.6E-13	<0.001%
Cyclohexane	50,750	5.9E-04	<0.001%	1.1E-05	<0.001%	5.9E-04	<0.001%	1.1E-05	<0.001%	3.4E-05	<0.001%	1.0E-06	<0.001%
2-Ethoxyethanol	950	5.9E-04	<0.001%	1.1E-05	<0.001%	5.9E-04	<0.001%	1.1E-05	<0.001%	3.4E-05	<0.001%	1.0E-06	<0.001%
Ethyl benzene	21,750	5.9E-04	<0.001%	1.1E-05	<0.001%	5.9E-04	<0.001%	1.1E-05	<0.001%	3.4E-05	<0.001%	1.0E-06	<0.001%
Hydrogen chloride	375	3.5E-01	0.092%	6.3E-03	0.002%	3.5E-01	0.092%	6.3E-03	0.002%	- [e]	- [e]	- [e]	- [e]
Hydrogen fluoride	125	1.4E-05	<0.001%	2.6E-07	<0.001%	1.4E-05	<0.001%	2.6E-07	<0.001%	- [e]	- [e]	- [e]	- [e]
Mercury	5	4.8E-03	0.096%	9.8E-05	0.002%	4.8E-03	0.096%	9.8E-05	0.002%	1.3E-10	<0.001%	4.6E-12	<0.001%
Methanol	13,000	3.8E-06	<0.001%	9.0E-08	<0.001%	3.8E-06	<0.001%	9.0E-08	<0.001%	1.0E-07	<0.001%	3.0E-09	<0.001%

Table 5.7-7. Ambient air concentrations of toxic air pollutants for proposed AMWTP treatment alternatives (continued).

		Proposed Action with microencapsulation [a]				Proposed Action with vitrification [a]				Non-Thermal Treatment Alternative			
	Applicable	INEEL site boundary[c]		Craters of the Moon		INEEL site boundary[c]		Craters of the Moon		INEEL site boundary[c]		Craters of the Moon	
	standard[b]	Impact	% of	Impact	% of	Impact	% of	Impact	% of	Impact	% of	Impact	% of
Pollutant	(ug/m^3)	(ug/m^3)	standard	(ug/m^3)	standard	(ug/m^3)	standard	(ug/m^3)	standard	(ug/m^3)	standard	(ug/m^3)	standard
Noncarcinogens (Continued)													
Methyl ethyl ketone	29,500	5.9E-04	<0.001%	1.1E-05	<0.001%	5.9E-04	<0.001%	1.1E-05	<0.001%	3.4E-05	<0.001%	1.0E-06	<0.001%
Nitrobenzene	250	5.9E-04	<0.001%	1.1E-05	<0.001%	5.9E-04	<0.001%	1.1E-05	<0.001%	3.4E-05	<0.001%	1.0E-06	<0.001%
Selenium	10	4.6E-10	<0.001%	1.1E-11	<0.001%	4.6E-10	<0.001%	1.1E-11	<0.001%	9.7E-11	<0.001%	3.4E-12	<0.001%
Silver	5	1.5E-10	<0.001%	4.6E-12	<0.001%	1.5E-10	<0.001%	4.6E-12	<0.001%	9.7E-11	<0.001%	3.4E-12	<0.001%
Toluene	18,750	5.9E-04	<0.001%	1.1E-05	<0.001%	5.9E-04	<0.001%	1.1E-05	<0.001%	3.4E-05	<0.001%	1.0E-06	<0.001%
1,1,1-Trichloroethane	95,500	8.9E-03	<0.001%	1.7E-04	<0.001%	8.9E-03	<0.001%	1.7E-04	<0.001%	5.1E-04	<0.001%	1.5E-05	<0.001%
Trichloroethylene[f]	13,450	5.9E-04	<0.001%	1.1E-05	<0.001%	5.9E-04	<0.001%	1.1E-05	<0.001%	3.4E-05	<0.001%	1.0E-06	<0.001%
Xylene	21,750	3.0E-06	<0.001%	5.6E-08	<0.001%	3.0E-06	<0.001%	5.6E-08	<0.001%	1.7E-07	<0.001%	5.0E-09	<0.001%

a. Impacts of Treatment and Storage Alternative would be same as those for Proposed Action regarding the treatment of waste, however the potential storage impacts identified in Section 5.21 would be in addition to impacts for treatment.

b. The State standards for non-carcinogens are given in milligrams/cubic meter. These have been converted to micrograms/cubic meter for consistency. Carcinogens are evaluated using the annual average emission rate which is based on an operating rate of 365 days per year. Annual average carcinogenic impacts of new sources are compared to the State of Idaho Acceptable Ambient Concentration for Carcinogens (AACC). Non-carcinogens are evaluated using the maximum hourly emission rate. Twenty-four-hour maximum noncarcinogenic impacts of new sources are compared to the State of Idaho Acceptable Ambient Concentration (AAC).

c. Annual average impacts are evaluated only for offsite locations (i.e., the site boundary and beyond); 24-hour impacts are evaluated for both offsite and public road locations. In all cases, boundary impacts are greater than public road impacts, so only the former are listed.

d. The design efficiency of the incinerator air pollution control system is based on meeting the proposed MACT standard for dioxin and furans (as 2,3,7,8 TCDD equivalent). The emission rate and impacts listed for dioxin and furans are maximum values; actual emissions and impacts are expected to be less.

e. Substance would not be emitted by non-thermal treatment.

f. Trichloroethylene is listed as both a carcinogen and noncarcinogen in the Idaho regulations.

Table 5.7-8. Onsite concentrations of toxic air pollutants for proposed AMWTP treatment alternatives.

	Maximum concentration (ug/m^3) [a]				Percent of occupational standard		
	Proposed Action [b]		Non-Thermal		Proposed Action		Non-Thermal
	With micro-	With	Treatment		With micro-	With	Treatment

Toxic air pollutant	encapsulation	vitrification	Alternative	Occupational standard [c]	encapsulation	vitrification	Alternative
Carcinogens							
Arsenic	6.2E-09	6.2E-09	6.1E-10	1.0E+01	<0.001%	<0.001%	<0.001%
Asbestos [d]	2.1E-08	2.1E-08	2.1E-08	3.0E+00	<0.001%	<0.001%	<0.001%
Benzene	6.8E+00	6.8E+00	7.2E-01	3.0E+03	0.228%	0.228%	0.024%
Beryllium	6.2E-10	2.4E-07	6.1E-10	2.0E+00	<0.001%	<0.001%	<0.001%
Cadmium	2.8E-09	2.8E-09	6.1E-10	2.0E+00	<0.001%	<0.001%	<0.001%
Carbon tetrachloride	2.7E-02	2.7E-02	1.1E-03	1.3E+04	<0.001%	<0.001%	<0.001%
Chloroform	5.5E-03	5.5E-03	2.1E-04	9.8E+03	<0.001%	<0.001%	<0.001%
Chromium (hexavalent)	1.9E-11	7.1E-09	1.8E-11	5.0E+01	<0.001%	<0.001%	<0.001%
1,2-Dichloroethane	5.5E-03	5.5E-03	2.1E-04	4.0E+04	<0.001%	<0.001%	<0.001%
1,1-Dichloroethylene	5.5E-03	5.5E-03	2.1E-04	2.0E+04	<0.001%	<0.001%	<0.001%
Dioxins and furans	4.2E-09	4.2E-09	0.0E+00	-[e]	-[e]	-[e]	-[e]
Formaldehyde	1.3E+01	1.3E+01	1.4E+00	9.0E+02	1.5%	1.5%	0.15%
Methylene chloride	3.8E-04	3.8E-04	1.5E-05	1.7E+05	<0.001%	<0.001%	<0.001%
Nickel	1.1E-09	1.0E-09	1.4E-10	1.0E+02	<0.001%	<0.001%	<0.001%
Polychlorinated biphenyls	1.3E-03	1.3E-03	2.5E-09	-[e]	-[e]	-[e]	-[e]
Tetrachloroethylene	5.5E-03	5.5E-03	2.1E-04	1.7E+05	<0.001%	<0.001%	<0.001%
1,1,2-Trichloroethane	5.5E-03	5.5E-03	2.1E-04	5.5E+04	<0.001%	<0.001%	<0.001%
Trichloroethylene[f]	5.5E-03	5.5E-03	2.1E-04	2.7E+05	<0.001%	<0.001%	<0.001%
Noncarcinogens							
Acetone	5.5E-03	5.5E-03	2.1E-04	1.8E+06	<0.001%	<0.001%	<0.001%
Barium	6.2E-09	6.2E-09	5.9E-10	5.0E+02	<0.001%	<0.001%	<0.001%
Butyl alcohol	5.5E-06	5.5E-06	2.1E-07	1.5E+05	<0.001%	<0.001%	<0.001%
Chlorine	1.6E+00	1.6E+00	0.0E+00	1.5E+03	0.11%	0.11%	<0.001%
Chlorobenzene	5.5E-03	5.5E-03	2.1E-04	4.6E+04	<0.001%	<0.001%	<0.001%
Chromium (trivalent)	6.0E-10	2.3E-07	5.9E-10	5.0E+02	<0.001%	<0.001%	<0.001%
Cyanide	8.7E-03	8.7E-03	1.4E-10	5.0E+03	<0.001%	<0.001%	<0.001%
Cyclohexane	5.5E-03	5.5E-03	2.1E-04	1.0E+06	<0.001%	<0.001%	<0.001%
2-Ethoxyethanol	5.5E-03	5.5E-03	2.1E-04	1.8E+04	<0.001%	<0.001%	<0.001%
Ethyl benzene	5.5E-03	5.5E-03	2.1E-04	4.3E+05	<0.001%	<0.001%	<0.001%
Hydrogen chloride	3.4E+00	3.4E+00	0.0E+00	7.0E+03	0.048%	0.048%	<0.001%
Hydrogen fluoride	1.4E-04	1.4E-04	0.0E+00	2.5E+03	<0.001%	<0.001%	<0.001%
Lead	1.3E-08	1.3E-08	1.2E-08	5.0E+01	<0.001%	<0.001%	<0.001%
Mercury	3.9E-02	3.9E-02	8.3E-10	5.0E+01	0.078%	0.078%	<0.001%
Methanol	3.3E-05	3.3E-05	6.3E-07	2.6E+05	<0.001%	<0.001%	<0.001%
Methyl ethyl ketone	5.5E-03	5.5E-03	2.1E-04	5.9E+05	<0.001%	<0.001%	<0.001%
Nitrobenzene	5.5E-03	5.5E-03	2.1E-04	5.0E+03	<0.001%	<0.001%	<0.001%
Selenium	3.2E-09	3.2E-09	6.1E-10	2.0E+02	<0.001%	<0.001%	<0.001%
Silver	8.9E-10	8.9E-10	6.1E-10	1.0E+01	<0.001%	<0.001%	<0.001%
Toluene	5.5E-03	5.5E-03	2.1E-04	1.9E+05	<0.001%	<0.001%	<0.001%
1,1,1-Trichloroethane	8.2E-02	8.2E-02	3.2E-03	1.9E+06	<0.001%	<0.001%	<0.001%
Trichloroethylene[f]	5.5E-03	5.5E-03	2.1E-04	2.7E+05	<0.001%	<0.001%	<0.001%
1,1,2-Trichloro-1,2,2-trifluoroethane	2.7E-02	2.7E-02	1.1E-03	7.6E+06	<0.001%	<0.001%	<0.001%
Xylene	2.7E-05	2.7E-05	1.1E-06	4.3E+05	<0.001%	<0.001%	<0.001%

a. All maximum values occur within the RWMC.

b. Impacts of Treatment and Storage Alternative would be same as those for Proposed Action regarding the treatment of waste, however the potential storage impacts identified in Section 5.21 would be in addition to impacts for treatment.

c. Occupational exposure limits are 8-hour averages established by ACGIH or OSHA; the lower of the two is used.

d. Value reported for asbestos standard is mass equivalent of most restrictive National Institute of Occupational Safety and Health standard of 0.1 fibers per cubic centimeter.

e. There is no applicable occupational exposure limit for PCBs or dioxins/furans.

f. Trichloroethylene is listed as both a carcinogen and noncarcinogen in the Idaho regulations.

The National Park Service (NPS) has recently established an ozone monitoring program at Craters of the Moon. Data for the 1992 calendar year show a peak 1-hour concentration of 0.051 ppm (about 100 micrograms per cubic meter), which is well below the standard. Levels at Craters of the Moon are also expected to remain well below the new 8-hour standard (0.085 ppm or about 160 micrograms per cubic meter). The Idaho Division of Environmental Quality is not aware of problematic ozone levels in the area (Andrus 1994) and does not require evaluation of projected increases in ambient ozone concentrations under application procedures for major stationary sources, unless a new or modified major facility will result in a net increase in VOCs of 100 tons per year or greater (Andrus 1994, IDHW 1997). Part of the reason for the lack of required analysis at lesser emittant levels is because no simple, well-defined methods exist to evaluate ozone generation potential (Wilson 1993).

Emissions of VOCs have been estimated to establish the need to perform detailed ozone generation modeling. Under the Proposed Action Alternative, the projected VOC annual emission rate is 481 kilograms, or about one-half ton per year. The maximum cumulative emission rate, which includes baseline emissions and projected increases, is about 20 tons per year. This level is well below the threshold emission level of 100 tons per year for which analyses are required by the State and the 40-ton-per-year threshold for designation as a major VOC source. Therefore, ozone precursor emissions of VOCs are expected to be minor contributors to ozone generation and no further analyses have been conducted.

5.7.4.3.2 Prevention of Significant Deterioration Increment Consumption. PSD regulations require that proposed major projects or modifications, together with minor sources that become operational after PSD baseline dates are established, be assessed for their incremental contribution to increases of ambient pollutant levels. A proposed major project, together with the sum of other major and minor net emissions increases that occur after the specified baseline date in the same impact area, may not contribute to an increase in attainment pollutants above an allowable increment. The baseline date is triggered by regulation or the submittal of a permit application. Increments have been established for specific averaging times associated with nitrogen dioxide, sulfur dioxide, and particulate matter. PSD requirements also apply for radionuclides if the projected radiation dose exceeds 0.1 millirem per year.

The INEEL is in a Class II area as designated by PSD regulations, while the nearest Class I area is Craters of the Moon Wilderness Area. Previous PSD permits for INEEL site projects have consumed a portion of the available Class I and II increments (see Section 4.7.4.2.2). Projected emissions associated with the proposed AMWTP and other future projects would contribute to further increment consumption. For both Class I and Class II areas, essentially identical results are obtained under the Proposed Action with either microencapsulation or vitrification of incinerator ash or Treatment and Storage Alternatives. Somewhat lower results are obtained under the Non-Thermal Treatment Alternative, while no impacts above baseline levels would result from the No Action Alternative.

Table 5.7-9 presents estimated increment consumption at Craters of the Moon for the combined effects of existing sources, the DOE INEL EIS Preferred Alternative and the proposed AMWTP. The combined increment consumption at this Class I area would not exceed 38 percent, which is projected for the 3-hour sulfur dioxide concentration, while the highest annual average increment consumption (also for sulfur dioxide) is 4.5 percent. Table 5.7-10 shows PSD evaluation results for Class II areas. For these areas (which include INEEL boundary and public road locations), the highest short-term increment consumption is about 56 percent for 24-hour particulate matter. Sulfur dioxide increment consumption is about 27 and 34 percent for 3-hour and 24-hour sulfur dioxide concentrations, respectively. The highest annual average increment consumption is for sulfur dioxide and is about 12 percent, while annualized nitrogen dioxide and particulate matter are roughly half that level.

Table 5.7-9. PSD increment consumption at Craters of the Moon Wilderness Area for the combined effects of existing sources, foreseeable increases, and the proposed AMWTP.

		Allowable PSD increment	Baseline sources plus increases[a]		Impact of AMWTP alternatives		Cumulative PSD increment consumed	
Pollutant	Averaging time	(ug/m^3)	Impact (ug/m^3)	% of increment	Impact (ug/m^3)	% of increment	Impact (ug/m^3)	% of increment
Proposed Action with microencapsulation [b]								
Sulfur dioxide	3-hour	25	5.9	24%	0.43	1.7%	6.2	25%
	24-hour	5	1.8	36%	0.10	2.1%	1.9	38%
	Annual	2	0.09	4.5%	0.0003	0.02%	0.09	4.5%
Particulate matter (PM-10) [c]	24-hour	8	0.6	7.5%	0.10	1.3%	0.7	8.8%
	Annual	4	0.008	0.20%	0.0001	0.003%	0.008	0.20%
Nitrogen dioxide	Annual	2.5	0.04	1.8%	0.010	0.38%	0.05	2.1%
Proposed Action with vitrification [b]								
Sulfur dioxide	3-hour	25	5.9	24%	0.43	1.7%	6.2	25%
	24-hour	5	1.8	36%	0.10	2.1%	1.9	38%
	Annual	2	0.09	4.5%	0.0003	0.02%	0.09	4.5%
Particulate matter (PM-10) [c]	24-hour	8	0.6	7.5%	0.10	1.3%	0.7	8.8%
	Annual	4	0.008	0.20%	0.0001	0.003%	0.008	0.20%
Nitrogen dioxide	Annual	2.5	0.04	1.8%	0.010	0.38%	0.05	2.1%
Non-Thermal Treatment Alternative								
Sulfur dioxide	3-hour	25	5.9	24%	0.21	0.8%	6.0	24%
	24-hour	5	1.8	36%	0.05	1.0%	1.8	37%
	Annual	2	0.09	4.5%	0.00009	0.004%	0.09	4.5%
Particulate matter (PM-10) [c]	24-hour	8	0.6	7.5%	0.05	0.6%	0.6	8.1%
	Annual	4	0.008	0.20%	0.00006	0.001%	0.008	0.20%
Nitrogen dioxide	Annual	2.5	0.04	1.8%	0.001	0.04%	0.05	1.8%

a. Foreseeable increases are assumed to be represented by the DOE INEL EIS Preferred Alternative, modified as described in Section 4.7.3.2.

b. Impacts of Treatment and Storage Alternative would be same as those for Proposed Action (with either microencapsulation or vitrification of ash), however the potential storage impacts identified in Section 5.21 would be in addition to impacts for treatment.

c. Assumes that all particulate matter is of respirable size (10 microns or less); does not include contributions of secondary aerosol formation or fugitive dust.

The maximum projected radiation dose to an offsite individual occurs under the Proposed Action with vitrification of ash or the Treatment and Storage Alternative. The dose is 0.09 millirem per year, which is below the significance level of 0.1 millirem per year. Under these alternatives, the cumulative dose from projected AMWTP emissions plus the baseline dose from existing sources and foreseeable increases to the baseline is about 0.23 millirem per year. Although Idaho regulations do not specify an allowable increment for radiation dose, these doses are small fractions of the applicable NESHAP standard of 10 millirem per year. The projected radiation dose for the Non-Thermal Treatment

Alternative is 0.0031 millirem per year, which is well below the significance level.

Table 5.7-10. PSD increment consumption at INEEL boundary and public road locations (Class II areas) for the combined effects of existing sources, foreseeable increases, and the proposed AMWTP.

		Allowable	Baseline sources plus increases [a]			Impact of alternative			increment consumed		
		PSD	Site	Public	% of	Site	Public	% of	Site	Public	% of
	Averaging	increment	Boundary	roads	PSD	boundary	roads	PSD	boundary	roads	PSD
Pollutant	time	(ug/m^3)	(ug/m^3)	(ug/m^3)	Increment [b]	(ug/m^3)	(ug/m^3)	increment [b]	(ug/m^3)	(ug/m^3)	increment [b]
Proposed Action with microencapsulation [c]											
Sulfur dioxide	3-hour	512	74	132	26%	24	11	4.6%	94	139	27%
	24-hour	91	12	29	32%	4.5	1.5	4.9%	17	31	34%
	Annual	20	1.8	2.4	12%	0.009	0.003	0.05%	1.9	2.4	12%
Particulate matter (PM-10) [d]	24-hour	30	3.8	15	51%	4.6	1.6	15%	8.4	17	56%
	Annual	17	0.10	0.92	5.4%	0.005	0.0014	0.03%	0.10	0.92	5.4%
Nitrogen dioxide	Annual	25	1.3	1.4	5.7%	0.27	0.10	1.1%	1.6	1.5	6.2%
Proposed Action with vitrification [c]											
Sulfur dioxide	3-hour	512	74	132	26%	24	11	4.6%	94	139	27%
	24-hour	91	12	29	32%	4.5	1.5	4.9%	17	31	34%
	Annual	20	1.8	2.4	12%	0.009	0.003	0.05%	1.9	2.4	12%
Particulate matter (PM-10) [d]	24-hour	30	3.8	15	51%	4.6	1.6	15%	8.4	17	56%
	Annual	17	0.10	0.92	5.4%	0.004	0.0013	0.03%	0.10	0.92	5.4%
Nitrogen dioxide	Annual	25	1.3	1.4	5.7%	0.27	0.10	1.1%	1.6	1.5	6.2%
Non-Thermal Treatment Alternative											
Sulfur dioxide	3-hour	512	74	132	26%	12	5.4	2.3%	84	135	26%
	24-hour	91	12	29	32%	2.2	0.75	2.5%	15	30	33%
	Annual	20	1.8	2.4	12%	0.003	0.0008	0.014%	1.8	2.4	12%
Particulate matter (PM-10) [d]	24-hour	30	3.8	15	51%	2.3	0.78	7.7%	6.1	16	54%
	Annual	17	0.10	0.92	5.4%	0.002	0.0006	0.01%	0.10	0.92	5.4%
Nitrogen dioxide	Annual	25	1.3	1.4	5.7%	0.033	0.01	0.13%	1.3	1.4	5.8%

a. Foreseeable increases are assumed to be represented by the DOE INEL EIS Preferred Alternative, modified as described in Section 4.7.3.2.

b. The higher of the site boundary and public road locations is used.

c. Impacts of Treatment and Storage Alternative would be same as those for Proposed Action (with either microencapsulation or vitrification of ash), however the potential storage impacts identified in Section 5.21 would be in addition to impacts for treatment.

d. Assumes that all particulate matter is of respirable size (10 microns or less); does not include contributions of secondary aerosol formation or fugitive dust.

5.7.4.3.3 Impacts Due to Secondary Growth. The construction and operation of the proposed AMWTP would be associated with a minor growth in employee population and would not result in any air quality impacts due to general commercial, residential, industrial, or other growth.

5.7.4.3.4 Stratospheric Ozone Depletion. The 1990 amendments to the CAA address the protection of stratospheric ozone through a phaseout of the production and sale of stratospheric ozone-depleting substances. Ozone-depleting substances would be produced or emitted by the proposed AMWTP in very small quantities, and there would be no effect on stratospheric ozone depletion.

5.7.4.3.5 Acidic Deposition. Emissions of sulfur and nitrogen compounds and, to a lesser extent, other pollutants, including VOCs, contribute to a phenomenon known as acidic deposition (more commonly known as "acid rain"). Under the Proposed Action or Treatment and Storage Alternative, emissions of nitrogen dioxide from the proposed AMWTP would be about 27 tons per year, while emissions of sulfur dioxide would be about 0.8 ton per year. Under the Non-Thermal Treatment Alternative, annual nitrogen dioxide emissions would be about 3 tons, while sulfur dioxide emissions would be about 0.2 ton. Emissions of these levels are very small fractions of levels that are known to be associated with acid rain. For comparison, a large coal-fired power plant may emit many thousands of tons per year of both sulfur dioxide and nitrogen dioxide. In the Midwestern U.S., where acid rain is a significant problem, there may be numerous such plants concentrated in a region. The potential for an acid rain problem also increases if the releases occur in a prevailing humid environment. In the case of the proposed AMWTP (located in a relatively dry climate), the degree of acid rain formation, if any, would be very small and not of a level to produce adverse ecological effects.

5.7.4.3.6 Global Warming. Emissions of carbon dioxide, methane, nitrous oxides, and chlorofluorocarbons (commonly known as greenhouse gases) are associated with potential for atmospheric global warming. Of these, only carbon dioxide would be emitted by the proposed AMWTP in potentially significant amounts. Under the Proposed Action or Treatment and Storage Alternative, annual emissions of carbon dioxide (a combustion byproduct of thermal treatment and fuel combustion in boilers, heaters, and emergency generators) would be about 10,800 tons. Under the Non-Thermal Treatment Alternative, roughly one-fourth this amount¾ about 2,520 tons¾ would be emitted from boilers, a water heater and a generator. For comparison, total U.S. carbon dioxide emissions are over 5.5 billion tons per year (USA 1997). There are currently no requirements that limit emissions of carbon dioxide from the proposed facility (USA 1997).

5.7.4.3.7 Secondary Particulate Matter Formation. The emissions data and evaluation results presented earlier in this section included data and results for particulate matter (PM). Those data and results apply only to "primary" PM, which refers to particles directly emitted to the atmosphere in particulate form. PM may be formed in the atmosphere from reactions between gas-phase precursors in the exhaust stream, and this is referred to as "secondary" PM. This secondary PM can either form new particles or add PM to pre-existing particles. Secondary PM is usually characterized by small particle sizes and thus can make up a significant fraction of very fine particulate matter (i.e., PM with a particle size less than 2.5 microns, for which new standards are likely to be implemented).

Predicting the amount of secondary PM formation is difficult. Secondary PM usually takes several hours or days to form, and the resultant concentrations are not necessarily proportional to the amount of precursors emitted (STAPPA 1996). Of the pollutants that are expected to exist in AMWTP exhaust streams, sulfur dioxide and nitrogen oxides are precursors for some types of secondary particles. Air pollution program officials have used values of 10 percent for the conversion of gaseous sulfur dioxide into secondary sulfate aerosol, and 5 percent for conversion of gaseous nitrogen oxides into secondary nitrate aerosol (STAPPA 1996). If conversion values of this magnitude are assumed for projected AMWTP emissions, and considering the relatively long time required for conversion, there would be little effect on the predicted ability of the facility to comply with existing or projected PM standards.

5.7.4.3.8 Emissions Opacity. Idaho regulations (IDAPA 16.01.01.625) limit the amount of visible emissions such that an opacity level of 20 percent, as determined by prescribed procedures, may not be exceeded for 3 minutes during any 60-minute period. The air pollution control features of the AMWTP waste systems would keep opacity levels well below the regulatory limit. Also, opacity requirements would likely be specified as conditions of operating permits.

5.7.4.3.9 Visibility Degradation. Conservative visibility screening analysis indicates that emissions from the proposed AMWTP will not result in deleterious impacts on scenic views at the Craters of the Moon Wilderness Area or Fort Hall Indian Reservation. An evaluation of contrast and color shift parameters indicates that the numerical criteria associated with potential objectionable impacts would not be exceeded. Under the Proposed Action Alternative (microencapsulation or vitrification of ash), the absolute value of the sky contrast parameter is about 0.002 compared to the recommended screening criterion of 0.5, while the highest color shift value is 0.288 compared to the screening criterion of 2.0. Values at Fort Hall are about one-third to of the Craters of the Moon values for each of these parameters and are not expected to impair the view to Middle Butte, an important cultural resource to the Shoshone-Bannock Tribes.

5.7.5 Air Resource Impacts from Alternatives Due to Mobile Sources

The ambient air quality impacts at offsite receptor locations due to the INEEL bus fleet operations, INEEL fleet light- and heavy-duty vehicles, privately owned vehicles, and heavy-duty commercial vehicles servicing the INEEL site facilities were assessed in the DOE INEL EIS. The mobile source impacts associated with the proposed AMWTP are bounded by those associated with the Preferred Alternative described in the DOE INEL EIS. The assessment findings indicate that the Preferred Alternative would result in some minor increase in service vehicles and employee vehicles, especially during construction activities. The peak cumulative impacts (baseline plus future projects) were due almost entirely to existing traffic conditions and were found to be well below applicable standards. The proposed AMWTP is expected to have little or no impact on traffic volume at the INEEL and would produce only a small increase in vehicular-induced air quality impacts.

5.7.6 Air Resource Impacts from Alternatives Due to Construction

The primary impact related to construction activities would be the generation of fugitive dust, which includes respirable PM. While dust generation would be mitigated by the application of water, relatively high levels of particulates could still occur in localized areas. Emissions of other criteria pollutants from construction-related combustion equipment may also result in localized impacts to air quality. Impacts of construction were assessed in the DOE INEL EIS for projected construction for the period 1995 through 2005 under each of the environmental restoration and waste management alternatives. For the DOE INEL EIS Preferred Alternative, annual average concentrations of respirable PM would not exceed 1 percent and 3 percent of the applicable standard at the maximum INEEL boundary and public road locations, respectively. Over shorter periods (24-hour averaging time), respirable and total particulate levels would be 1 percent or less of the standards at the INEEL boundary. However, it is typical of major construction activities to intermittently produce relatively high levels of fugitive dust in the vicinity of the activity, and short-term, localized levels of PM, which, if not mitigated, could exceed applicable standards. Levels of other criteria pollutants are predicted to be a small fraction of applicable standards.

The impacts of construction of the proposed AMWTP would result primarily from the disturbance of up to 7 acres of land, resulting in the generation of fugitive dust, and from the emission of combustion byproducts from construction equipment. As specified by Sections 650 and 651 of Rules for the Control of Air Pollution in Idaho (IDHW 1997), all reasonable precautions will be taken to prevent the generation of fugitive dust. Dust generation would be mitigated by the application of water, use of soil additives, and possibly administrative controls (such as halting construction during high-wind conditions) (IDHW 1997). Construction-related impacts for the proposed AMWTP are expected to fall within the bounds of impacts identified in the DOE INEL EIS.

5.7.7 Advanced Mixed Waste Treatment Project Design Measures to Minimize Impacts

The proposed AMWTP has been designed to minimize the potential environmental impacts associated with releases of air contaminants and to operate within the specifications of current and proposed regulations for combustion of hazardous waste. In particular, the following design and operational features will minimize the production and release of air pollutants (BNFL 1997a):

- Controlled feed streams to the incinerator, including limits on hourly feed rate, and maximum chlorine, ash, and regulated metals feed rates;
- Controlled combustion with temperature, pressure, gas velocity, residence time, waste feed rate, and other combustion parameters continuously monitored and controlled as a means to achieve the minimum required destruction and removal efficiency for organic hazardous constituents;

- Independent air pollution control systems for the incinerator, vitrifier, non-thermal treatment, and other ancillary processes;
- Good Engineering Practice stack design to minimize concentrations of contaminants in the building cavity and provide good dispersion of airborne effluents (MK 1997);
- Various controls and parameter monitoring and recording to ensure proper system operation and compliance with standards; and
- Trial burn, startup, and testing of incinerator operations which will occur for a period of several months with simulant chemicals and materials that are not regulated as hazardous wastes.

The incinerator air pollution control system includes a combination of dry filtration and wet scrubbing systems, including the following:

- Venturi scrubber
- Two absorbers in series (one acidic and one neutral to slightly basic)
- Condensing wet electrostatic precipitator (WESP)
- Offgas reheater
- Redundant first-stage HEPA filtration
- Carbon adsorbers
- Redundant second- and third stage HEPA filtration
- Associated pumps and blowers, and exhaust flues.

Detailed information on the air pollution control systems of the incinerator and other systems or areas (vitrifier, pretreatment and non-thermal treatment, sampling and analytical gloveboxes, etc.) is provided in Chapter 3 and Appendices B and E.

5.8 Water Resources

This section discusses potential environmental consequences to water resources inside and outside the INEEL site boundaries under each of the four alternatives. Each alternative was evaluated with respect to its impacts on surface and subsurface water quality and water use. Previous groundwater computer modeling of the vadose zone and saturated contaminant transport and groundwater monitoring shows that existing plumes would not greatly affect the regional groundwater quality because no contaminants have migrated offsite in concentrations above the EPA drinking water standards (DOE INEL EIS, Volume 2, Section 5.8.2.2 [DOE 1995a]). Since the existing major facility area (RWMC) would be affected most by the Proposed Action, the water resources for the RWMC and area surrounding the RWMC are emphasized.

5.8.1 Methodology

The methodology used to assess the impacts to water resources from treatment and storage activities identified under the alternatives was to integrate available studies and technical information with available computer modeling studies to evaluate aquifer contaminant transport and predict future trends in water quality during the implementation period for the proposed alternatives.

The primary assumption used to evaluate consequences to water resources under any of the alternatives was that no future intentional discharge of radioactive liquid effluents to subsurface or surface waters would occur exceeding the standards established in DOE Order 5400.5 (DOE 1993) and applicable Federal and State regulations. Activities proposed under the alternatives have been reviewed to identify potential waste streams and water usage. No alternative would result in the intentional discharge of radioactive liquid effluents to the vadose zone (DOE INEL EIS, Volume 2, Section 5.8.2.2). There are no radioactive discharges directly to the Snake River Plain Aquifer from existing operations, and deep well injection of radioactive waste at the Idaho Nuclear Technology and Engineering Center (INTEC) was discontinued in 1985. In addition, the existing lagoons at the facility are used exclusively for retention of sanitary sewage effluent from the support facilities at RWMC and do not accept process waste. Liquid effluent discharges from RWMC activities to the surface and subsurface waters via ponds are monitored (see Section 4.8, Water Resources) for the presence of radioactive and chemical constituents and would be in compliance with applicable Federal and State regulations.

Any process effluents generated under the alternatives at the proposed facility would be contained in tanks or sumps and, under normal operating conditions, radioactive and chemical discharges to the soil or directly to the aquifer would not occur.

5.8.2 Water Resource Impacts from the No Action Alternative

Under the No Action Alternative, existing waste management operations, facilities, and projects would continue for the management of TRU, alpha LLMW, and LLMW on the INEEL. No near-term discharges of hazardous or radioactive wastes to the vadose zone would be expected to occur. Over the long-term, however, the potential for chronic leakage and contamination of the vadose zone would increase (see Section 5.21). The evaluation of water resources consequences for the No Action Alternative involves assessing the impacts from past activities and estimating what might occur in the future.

For surface water, no direct impact would result to the Big Lost River, Little Lost River, or Birch Creek from continuation of existing activities and normal operations at the RWMC. Current operating and monitoring practices would continue for National Pollution Discharge Elimination System (NPDES) storm water and liquid effluent discharges from associated facilities within the RWMC.

DOE INEL EIS (Volume 2, Section 5.8.2) conducted an extensive review of the INEEL's environmental consequences for the No Action Alternative as well as portions of other alternatives. In lieu of duplication of that discussion in this EIS, Volume 2, Section 5.8 and Appendix Section F-2.2 of the DOE INEL EIS are referenced for surface and subsurface water and water use.

For subsurface waters, very small impacts would result from potential future sources of contamination compared with sources from previous practices (Becker et al. 1996). Past groundwater modeling indicates that current contaminant plumes will continue to migrate, but contaminant concentrations within the plumes would continue to decrease with time (DOE INEL EIS, Section 5.8.2.2). Currently, VOC contamination at the RWMC is being actively remediated with the vapor vacuum extraction system. As a result of these remediation activities, these contaminants would pose a negligible impact to the groundwater or vadose zone (DOE-ID 1997c).

A radiological performance assessment for the low-level waste buried at the RWMC from 1984 through 1995 and projected to be disposed of through 2020 indicated that the maximum total pathway exposure occurring by 2060 at the INEEL site boundary would be less than 0.60 millirem/year (Maheras et al. 1994).

Waste retrieved from the Transuranic Storage Area Retrieval Enclosure (TSA-RE), along with newly generated waste, would be stored onsite or offsite.

The consumption of water from the Snake River Plain Aquifer under the No Action Alternative would continue at the current level (DOE INEL EIS, Volume 2, Section 5.8.2.2).

5.8.3 Water Resource Impacts from the Proposed Action

Under the Proposed Action with microencapsulation of ash, water consumption would increase as a result of construction activities, operational activities, and increased workers at the facility. The total water consumption of 4.22 million gallons per year under this alternative is a small percentage increase compared to INEEL's current water usage (1.9 billion gallons per year) or the consumptive use water rights of 11.4 billion gallons per year (Yaklich 1998). Water would be required for waste treatment processes as part of the AMWTP operations (BNFL 1997a).

The existing grade of the AMWTP would be 1.2 feet above the probable maximum flood elevation of 5,016.8 feet above mean sea level (BNFL 1997a). The AMWTP would not be located within a 100-year floodplain based on probable maximum precipitation (Dames & Moore 1993).

Excess water used for dust control purposes during construction activities would be collected and routed through erosion and sedimentation control measures prior to discharging to the existing approved NPDES outfall (BNFL 1997b) and would be monitored according to the current Storm Water Pollution Prevention Plan. For surface water, no liquid effluent would be discharged. Storm water would flow from the AMWTP facility's sloped roof to an exterior catch basin as part of the storm water drainage system (BNFL 1997a). Storm drain culverts in the vicinity of the AMWTP facility are designed to discharge peak flows from a 25-year storm event. To satisfy the Design Basis Flood event, ponding, or backwater elevation of the 100-year storm does not exceed 5,017 feet (1 foot below the finished grade of the AMWTP facility) (BNFL 1997a). The storm water would be collected ultimately within one of the storm water sampling collection points and appropriately monitored according to the Storm Water Pollution Prevention Plan currently operating at the INEEL prior to leaving the RWMC. Compliance with the RWMC NPDES Permit and *Idaho Administrative Procedures Act* (IDAPA) 16.01.02.299 Wastewater Treatment Regulations would be maintained. Current operating and monitoring practices would continue for NPDES storm water at associated facilities within the RWMC.

No liquid effluents from waste treatment processes would be discharged to the subsurface; therefore, no impacts would be expected. All waste handling, storage, and treatment would be conducted in areas of the facility that are covered with a base that consists of a secondary spill containment system (e.g., engineered system constructed for detection and collection of spills) to prevent leaks and spills of waste until the accumulated materials are detected and removed, preventing releases to the environment that could potentially impact groundwater (BNFL 1997a). Because all waste handling, storage, and treatment occurs within a building, impacts to groundwater would not occur for the Proposed Action with microencapsulation of ash. Construction activities would increase the number of workers and water usage, but the amount of water usage during construction would be minimal.

The AMWTP design would include storage provisions to isolate containerized waste from the environment and prevent deterioration of container integrity. Additionally, secondary containment would be provided to prevent any inadvertent releases from entering the environment (BNFL 1997a). Waste packages having a potential for residual liquid would have an absorbent agent added to ensure immobilization of potential liquid (BNFL 1997a). In order to prevent contamination of the water supply, no restrooms or drinking water fountains would be located within the operational areas of the AMWTP (BNFL 1997a).

Water resource impacts due to the substitution of vitrification of ash would be similar to those described for the Proposed Action with microencapsulaton of ash. Total water consumption of 2.7 million gallons per year for the Proposed Action with the vitrification of ash is a small percentage increase compared to INEEL current water usage.

5.8.4 Water Resource Impacts from the Non-Thermal Treatment Alternative

Total water consumption of 3.88 million gallons per year for the Non-Thermal Treatment Alternative is less than the water consumption for the Proposed Action with microencapsulation of ash. Therefore, impacts to water resources would be less than those described above for the Proposed Action with microencapsulation of ash. Total water consumption of 3.88 million gallons per year is a small percentage of increase compared to INEEL current water usage.

5.8.5 Water Resource Impacts from the Treatment and Storage Alternative

Impacts to water resources would be the same for the Treatment and Storage Alternative as for the Proposed Action regarding the treatment of waste; however, the potential storage impacts identified in Section 5.21 would be in addition to impacts for treatment.

5.9 Ecological Resources

This section discusses the potential effects of the construction and operation of the AMWTP and alternatives on ecology on the INEEL, the RWMC, and the surrounding area.

5.9.1 Methodology

The assessment of potential effects is based on an evaluation of the location of activities for constructing and operating the AMWTP at the RWMC and the alternatives in relation to the presence of biological attributes. Impacts have been assessed based on studies of impacts of similar types of activities on the biota at INEEL and in the surrounding area. Construction activities associated with land and animal disturbance (e.g., earth-moving and equipment noise) would be the primary source of impacts.

5.9.2 Ecological Impacts from the No Action Alternative

Potential effects of existing waste management operations, facilities, and projects under the No Action Alternative include traffic noise, human presence, radiological and nonradiological emissions from waste treatment, and restoration operations. All No Action Alternative activities would be conducted within or immediately adjacent to existing operating facilities. Existing noise, human presence, night lighting, and emissions would not change. Plant and animal species currently occupying or using areas near these facilities already have some tolerance to human presence and waste management operations and activities. Therefore, adverse effects to plants and animals near the RWMC due to human presence, noise, night lighting, and emissions are expected to be minor.

Under the No Action Alternative, the potential to affect Federal-listed plant and animal species or species identified by other Federal and/or State agencies as sensitive, rare, or unique is not likely, because the existing waste management operations occur in developed industrial areas.

No Action Alternative activities would continue within the developed industrial areas designated for these functions; therefore, no activities that could potentially affect wetlands and surface waters would be expected.

Under the No Action Alternative, biota would continue to be exposed to existing levels of radionuclides in water and soil. Small mammal and vegetation studies conducted within and near existing waste management facility areas indicate that observable radiological effects have been noted (Section 4.9.5); however, no effects on populations or transport of radionuclides by vegetation or animals have been observed (Arthur 1982, Morris 1993).

5.9.3 Ecological Impacts from the Proposed Action

The Proposed Action would disturb approximately 7 acres to construct the AMWTP and support infrastructure. All of the project area within the RWMC has been previously disturbed as a result of ongoing waste management and environmental restoration activities. Since the construction site is a large area of packed gravel, there is little or no vegetation and no wildlife cover or food. The utilization of previously disturbed habitat within the boundary of the RWMC would have a negligible impact on INEEL wildlife habitat. The undisturbed native vegetation surrounding the RWMC provides much more important and higher quality habitat than that of the project site.

Construction of the AMWTP and support infrastructure modifications (i.e., electric substation and power line extension) could have a minor adverse impact on small, less mobile, mammals during project site construction activities. Birds in the project site area may be displaced to adjacent similar habitat within the RWMC or offsite. Large mammals would not be affected because the majority of activities associated with the Proposed Action would occur within the fenced boundary of the RWMC. Because of the proximity of the new power line extension to the boundary and fence of the RWMC, large mammals would not be adversely affected.

The operation of the AMWTP could slightly increase human presence, night lighting, and noise within the RWMC. However, the disturbance would not eliminate or restrict the use of habitat by animals surrounding the RWMC.

The Proposed Action would not affect Federal- or State-listed protected, sensitive, rare, or unique species because none occur inside the fenced boundary of the RWMC. Before construction, pre-activity surveys of the new facility areas, including the potential sewage lagoon site, would be conducted to identify any protected or sensitive species. The power line extension corridor would be surveyed before construction and could be re-routed if necessary to avoid damage to biological and cultural resources. Because there are no wetlands within the RWMC where the AMWTP would be constructed or along the proposed power line extension corridor, wetlands would not be affected by the Proposed Action.

Expansion of the existing RWMC sewage lagoon system located south of the TSA outside the RWMC fenced boundary may be required to support AMWTP operation. If needed, the existing sewage lagoons would be augmented with a new 0.5-acre lagoon. Construction of the lagoon would occur within an existing 1-acre disturbed portion of land used as a construction laydown area next to the existing sewage lagoons. If constructed, the new lagoon would represent an increase in surface water and would have a small beneficial effect on some wildlife species with access to the lagoons.

Due to the projected minor increases in ambient criteria pollutant concentrations, no impacts to local soils or vegetation, including the local sagebrush vegetation community, gazing habitats, or distant agricultural areas are expected. The NPS has issued interim guidelines for protection of sensitive resources relative to air quality concerns (DOI 1994). For sulfur dioxide, the NPS recommendation to maximize protection of all plant species is to maintain levels below 40 to 50 ppb for a 24-hour averaging time, and 8 to 12 ppb for annual average levels. The lower end of these irnages correspond to about 100 to 20 micrograms per cubic meter, respectively. The NPS guideline for annual average nitrogen dioxide is less than 15 ppb, which corresponds to about 28 micrograms per cubic meter.

For the proposed AMWTP operating under either the Proposed Action or Treatment and Storage Alternative, the maximum ambient air levels to sulfur dioxide would be about 8 micrograms per cubic meter. The projected annual average nitrogen dioxide level at the maximally impacted offsite or public road location would also be about 0.2 micrograms per cubic meter. When the additive impacts of baseline plus foreseeable projects are included, sulfur dioxide concentrations remain well within these guidelines for offsite locations, but modeling results indicate that 24-hour levels could exceed the guidelines for locations along public roads traversing the INEEL. This exceedance is due almost entirely to levels associated with existing sources (including foreseeable increases). The annual average guideline for nitrogen dioxide would not be exceeded at any INEEL boundary or public road locations, even when the contributions from existing sources are added.

The State of Idaho has established air quality standards intended to limit the concentration of fluoride in vegetation used for feed and forage (IDHW 1997). Monitoring of fluoride levels would be required unless analysis shows that fluoride concentrations in ambient air, averaged over 24-hour periods, would not exceed 0.25 micrograms per cubic meter. Analyses were performed to estimate the projected fluoride levels at the nearest grazing areas as a result of hydrogen fluoride emissions from the proposed AMWTP. Under the Proposed Action, the maximum 24-hour averaged level is estimated at 0.23 micrograms per cubic meter and would occur within the INEEL at a location 3 kilometers south-southwest of the proposed AMWTP location. From this, it can be reasonably concluded that fluoride levels in feed and forage outside INEEL boundaries would be within the Idaho standards. The State of Idaho may or may not require monitoring to ensure compliance with these standards.

Potential radionuclide exposure of plant and animal species within the RWMC and in the adjacent surrounding area may increase slightly due to the operation of the AMWTP; however, potential radionuclide emissions from the facility are well below regulatory limits (see Section 5.7.3) and are not expected to significantly affect biotic populations and communities in the area. The long-term exposure and uptake by plant and animal species within the RWMC and adjacent surrounding area are surveyed and reported annually in the INEEL Site Environmental Report in accordance with DOE Order 5400.1 (DOE 1990). Any measurable change in exposure or uptake due to the AMWTP would be identified by the environmental surveillance program and assessed to determine any measurable long-term impacts.

There would be no change in ecological impacts due to the substitution of the vitrification of ash from those described for the Proposed Action with microencapsulation of ash.

5.9.4 Ecological Impacts from the Non-Thermal Treatment Alternative

The ecological effects under the Non-Thermal Treatment Alternative would be similar to those described for the Proposed Action except for the potential radionuclide emissions exposure and uptake by plant and animal species, and there would be no fluoride emission. Radionuclide emissions predicted for the Non-Thermal Treatment Alternative (see Section 5.7.3) are lower than for the AMWTP using the thermal treatment process under the Proposed Action, and indicate a smaller potential for exposure and uptake by plant and animal species within the RWMC and in the adjacent surrounding area. Any measurable increase in long-term exposure and uptake by plant and animal species within the RWMC and adjacent surrounding area would be reported in the INEEL Site Environmental Report in accordance with DOE Order 5400.1. Potential ecological impacts under the Non-Thermal Treatment Alternative due to construction of the power line extension and the potential expansion of the existing RWMC sewage lagoons would be the same as described for the Proposed Action.

5.9.5 Ecological Impacts from the Treatment and Storage Alternative

Activities associated with the Treatment and Storage Alternative would have the same potential impacts on ecological resources as described for the Proposed Action regarding the treatment of waste; however, the potential storage impacts identified in Section 5.21 would be in addition to impacts for treatment.

5.10 Noise

This section discusses the potential effects of the four proposed AMWTP alternatives on noise levels at the INEEL site and in the surrounding area.

5.10.1 Methodology

Outdoor noise source terms associated with the proposed AMWTP alternatives are provided in Table 5.10-1. The table presents AMWTP sound sources within the human hearing frequency range and their associated attenuation with distance. For comparison, a maximum permissible outdoor sound level near a hospital or church would be 55 decibels A-weighted (dBA) (i.e., referenced to the A-scale, approximating human hearing response) during the day and 45 dBA at night. The U.S. Department of Housing and Urban Development has classified sources exceeding 65 dBA for a total of less than 8 hours per 24 hours as normally acceptable (HUD 1971). Facility noises generated on the INEEL do not propagate offsite at levels that impact the general population, since all public areas are at least 4 miles away from site facility areas. Therefore, INEEL noise impacts for each alternative would derive from transportation noises generated during the movement of personnel and materials to and from the proposed AMWTP and within nearby communities.

Plant operating noises, as well as roadway, aircraft, and railroad noises have been considered. The roadway noises considered are noises caused by busing personnel to and from the proposed AMWTP and transporting construction materials and waste by truck. Blasting may be necessary during the construction phase.

Table 5.10-1. Predicted noise impact from sources related to the proposed AMWTP.

		Predicted noise level ranges (dBA) at various distances from sources			
Activity	Source strength (dBA)/reference distance	500 ft	1,000 ft	0.5 mile	1 mile
Construction equipment	85-90 / 50 ft	65 - 75	59 - 69	51 - 61	45 - 55
Rail engine	86-96 / 100 ft	76 - 86	71 - 81	64 - 74	58 - 68
Rail car (40 mph)	80-86 / 100 ft	68 - 74	62 - 68	53 - 59	48 - 54
Bus, truck	85-90 / 50 ft	65 - 75	59 - 69	51 - 61	45 - 55
Sources: adapted from VTN 1977 and EPA 1975.					

5.10.2 Noise Impacts from Alternatives

Noise impacts for the No Action Alternative are addressed in Section 5.10 of the DOE INEL EIS and are found to be insignificant.

Noise impacts from the Proposed Action described in this section would be the same with microencapsulation of incinerator ash or vitrification of incinerator ash.

Because the proposed AMWTP workforces are expected to be a small component of the proposed INEEL workforce, the overall noise level resulting from AMWTP construction and operations traffic in the Proposed Action, the Non-Thermal Treatment Alternative, and the Treatment and Storage Alternative would be expected to be generally lower than the DOE INEL EIS noise baseline.

The number of trucks carrying construction materials or waste under the Proposed Action, the Non-Thermal Treatment Alternative, and the Treatment and Storage Alternative, respectively, is expected to be, at most, a few per day (see Section 5.11, Traffic and Transportation). These trucks would be indistinguishable from existing (No Action Alternative) traffic that travels to and from the INEEL each day. Construction and operation of the proposed AMWTP would have little effect on existing levels of highway use. Because current noise levels are well within acceptable values, noise impacts due to the proposed AMWTP personnel transportation would not be expected.

With regard to aircraft noises, the modest changes in the workforce for the Proposed Action, the Non-Thermal Treatment Alternative, and the Treatment and Storage Alternative, respectively, would be insufficient to change the combined number of aircraft landings in the Idaho Falls and Pocatello Airports.

Likewise, regional freight trains would not be expected to increase or decrease in number as a result of any AMWTP alternative. Construction and operation of the proposed AMWTP would have little effect on existing levels of rail use.

Previous studies of the effects of noise on wildlife indicate that the projected noise levels associated with all alternatives for the proposed AMWTP (less than 65 dBA at 3,000 feet for all activities) would have no deleterious effect on wildlife sensitive receptors (ERT 1980, Leonard 1993b).

In summary, adverse noise impacts associated with any construction and operation of the proposed AMWTP or any of the alternatives would not be expected.

5.11 Traffic and Transportation

This section summarizes the methods of analysis and potential impacts related to traffic and transportation associated with the construction and operation of the proposed AMWTP. The impacts are presented by alternative and include doses and health effects where applicable. Transportation impacts associated with shipments to WIPP are addressed in the SEIS-II and are not part of the scope of this EIS (DOE 1997d). Transportation impacts associated with possible shipment of LLMW from offsite DOE locations to the INEEL were assessed both in DOE INEL EIS and in the WM PEIS (DOE 1997c).

5.11.1 Methodology

Transportation of people and materials required due to increased construction and operational activities could impact the regional traffic system around the INEEL and could result in increases in traffic accidents, injuries, and fatalities. These impacts, such as increased vehicle mileage, accidents, and traffic congestion, are measured using the level of service for each road segment.

The Level-of-Service concept is defined as a qualitative measure describing operational conditions within a traffic stream and their perception by motorists and passengers. A Level-of-Service is defined for each roadway or section of roadway in terms of speed and travel time, freedom to maneuver, traffic interruptions, comfort and convenience, and safety (TRB 1994).

For purposes of evaluating impacts of increased traffic and usage, the capacity of the roadway in terms of vehicles per hour for a given level of service is first established using the procedure in the Transportation Research Board's Highway Capacity Manual (TRB 1994). The level of service based on existing traffic flow is then established. A new level of service is calculated, based on the number of shipments of waste and construction materials and the number of workers associated with each alternative. These levels of service are compared to determine if the capacity of the highway is exceeded or if the level of service has changed.

The baseline level of service for the road system surrounding the INEEL is Level-of-Service A, or free-flowing, as reported in Section 5.11, Traffic and Transportation, of Volume 2 of the DOE INEL EIS (DOE 1995a). This was based on data for U.S. Highway 20, which has the highest use around the INEEL. The peak number of vehicles per hour would have to increase from 122 to 291 to re-classify U.S. Highway 20 from Level-of-Service A to Level-of-Service B, where the presence of other users in the traffic system begins to be noticeable. The peak number of vehicles per hour on U.S. Highway 20 would have to increase from 122 to 2,126 to exceed the capacity of the highway.

5.11.2 Traffic and Transportation Impacts from the No Action Alternative

There would be no traffic or transportation impacts associated with the proposed AMWTP under the No Action Alternative since the facility would not be constructed. Shipment of TRU waste to WIPP would continue on a schedule that meets the milestone date of December 31, 2002. Shipments to WIPP would continue only as could be supported by existing facilities at the INEEL. Transportation impacts associated with shipments to WIPP are addressed in the SEIS-II and are not part of the scope of this EIS (DOE 1997d).

5.11.3 Traffic and Transportation Impacts from the Proposed Action

Under the Proposed Action, construction of the proposed facility would begin as early as 1999 and would be completed before the end of 2002. The proposed AMWTP construction would involve less than 50 offsite truck trips as assessed in Section C-4.4.1 of Volume 2 of the DOE INEL EIS. The peak workforce associated with the proposed AMWTP is 254 jobs and would occur during the construction phase of the project as noted in Section 5.3, Socioeconomics.

The increased movement of materials and workers under the Proposed Action would increase the maximum number of vehicles per hour by less than 50, which is still within the range of Level-of-Service A and would result in no change to the level of service associated with U.S. Highway 20. The number of vehicles per hour would have to increase by a factor of over 10 to exceed the capacity of the highway. Based on these results, the impacts to the regional traffic system around the INEEL would be minimal under the Proposed Action.

Increased truck traffic associated with transportation of propane to the AMWTP comprises approximately 18,630 annual vehicle miles (round-trip), or approximately 8/100 of one percent of the 23,657,200 annual vehicle miles associated with INEEL activities.

Shipments to WIPP of up to 29,000 cubic meters of contact-handled (CH) TRU waste and up to 1,920 cubic meters of remote-handled (RH) TRU waste from INEEL and Argonne National Laboratory-West (ANL-W) were assessed in the WIPP SEIS-II (DOE 1997d). The transportation impacts associated with the shipment of these treated TRU waste volumes from INEEL to WIPP are not part of the scope of this EIS.

Transportation impacts associated with possible shipment of LLMW from offsite DOE locations to the INEEL were assessed both in DOE INEL EIS and in the WM PEIS (DOE 1997c). A decision regarding the treatment and disposal alternatives for LLMW assessed in the WM PEIS has not been issued.

There would be no change in traffic and transportation impacts due to the substitution of vitrification of ash from those described for the Proposed Action with microencapsulation of ash.

5.11.4 Traffic and Transportation Impacts from the Non-Thermal Treatment Alternative

Under the Non-Thermal Treatment Alternative, the proposed treatment facility would not use any thermal treatment technology but would use the treatment options of supercompaction and macroencapsulation. Construction of the proposed AMWTP facility would still begin as early as 1999 and be completed before the end of 2002. The impacts on the regional transportation system and impacts associated with the transportation of TRU waste are the same as discussed in Section 5.11.3 for the Proposed Action.

The treatment of offsite waste, such as LLMW, in the proposed facility is expected to be minimal. A decision regarding the treatment and disposal alternatives for LLMW assessed in the WM PEIS has not been issued. The assessment of the transportation impacts associated with LLMW is outside the scope of this EIS.

5.11.5 Traffic and Transportation Impacts from the Treatment and Storage Alternative

Under the Treatment and Storage Alternative, construction of the proposed AMWTP facility would still begin in 1999 and be completed before the end of 2002. The impacts on the regional transportation system during construction are the same as discussed in Section 5.11.3 for the Proposed Action. There would be no offsite transportation impacts associated with TRU waste because INEEL TRU waste would remain in storage at the RWMC after treatment.

Transportation impacts associated with possible shipment of LLMW from offsite DOE locations to the INEEL have been assessed both in the DOE INEL EIS and in the WM PEIS. A decision regarding the treatment and disposal alternatives for LLMW assessed in the WM PEIS has not been issued. The assessment of the transportation impacts associated with LLMW is outside the scope of this EIS.

5.12 Occupational and Public Health and Safety

This section presents potential health effects to both workers and the public from implementation of the four proposed waste management alternatives under consideration for treatment of LLMW currently stored at the RWMC. The potential health effects assessed in this section consider the following receptors:

- Involved workers — workers directly involved with proposed treatment alternatives;
- Highest onsite (worker) location — location with the highest health impacts within the INEEL boundary;
- MEI — location with the highest health impacts outside of the INEEL boundary;
- Population — collective offsite population in the INEEL region; and
- Construction worker — labor force associated with construction activities.

Radiological and chemical health effects and industrial safety hazards are considered in the analysis. The methodology used for this assessment parallels that used in the DOE INEL EIS. Additional details on assessment methods, assumptions, and related information are contained in Appendix Section E-4, Occupational and Public Health and Safety, and in Section 5.12 and Appendix Section F-4 of the DOE INEL EIS.

5.12.1 Radiological Exposure and Health Effects

The measure of impact used for evaluation of potential health effects from radiation exposure is risk of fatal cancer. Worker and MEI effects are reported as individual radiation dose (in millirem) and the estimated lifetime probability of cancer fatality. Population effects are reported as collective radiation dose (in person-rem) and the estimated number of latent cancer fatalities in the affected population. For the calculation of health effects from radiation exposure, radiation doses are multiplied by the appropriate International Commission on Radiological Protection (ICRP) risk factors. Tables 5.12-1, 5.12-2, and 5.12-3 summarize the annual and operating lifetime radiological health effects calculations for the No Action, Proposed Action, and Non-Thermal Treatment Alternative, respectively. The impacts from the Treatment and Storage Alternative would be similar to those for the Proposed Action regarding the treatment of waste; however, the potential storage impacts identified in Section 5.21, Long-Term Storage Impacts, would be in addition to impacts for treatment.

The human health risk associated with radiological exposure is assessed based on risk factors contained in the ICRP Recommendations (ICRP 1991). For the calculation of health effects from exposure to airborne radionuclides, the annual doses provided in Section 5.7, Air Resources, were multiplied by the appropriate risk factors presented in Tables 4.12-1 and 4.12-2 of Section 4.12, Occupational and Public Health and Safety. Receptor doses were modeled using GENII (Napier et al. 1988) with meteorological and population data specific to the INEEL together with projected emission rates. The meteorological data, population distribution, and emission rates are presented in Section 5.7, Air Resources. The ISC-3 dispersion model (EPA 1995b) is used to estimate dispersion factors used in the radiological dose calculation for MEI and onsite worker chemical hazard evaluation. The estimated fatal cancer incidence in Tables 5.12-1, 5.12-2, and 5.12-3 is for annual and operating lifetime cumulative radiological exposure that includes (1) the baseline dose associated with the existing operations at INEEL, (2) projected increases that would occur from INEEL activities aside from the proposed AMWTP, and (3) the dose contribution that would occur from the proposed alternatives. The contribution from each of these sources and the cumulative doses and associated human health impacts are presented in Appendix Section E-4. The annual and operating lifetime cumulative dose and fatal cancer information in Tables 5.12-1, 5.12-2, and 5.12-3, is from INEEL sources only and do not include natural background doses presented in Table E-4-5 of Appendix Section E-4, Occupational and Public Health and Safety.

The involved worker is an individual who would work at the proposed AMWTP. The dose received by this worker results from direct exposure and is assumed to be equal to that received by workers involved in current RWMC operations. The dose to the MEI worker is assumed to not exceed the current annual INEEL administrative limit of 1.5

rem. The average dose to the involved worker is calculated based on the average dose measured from 1992 to 1997 for the RWMC workers. These data are presented in Appendix Section E-4.

Because there would be no discharges to surface or groundwater under the Proposed Action and other alternatives, the human health risk from radiological contaminants in the drinking water for onsite workers and the public would be the same as described in Section 4.12, Occupational and Public Health and Safety.

Table 5.12-1. Fatal cancer risk from radiological exposure resulting from annual AMWTP operations and radiological emissions. [a]

	No Action		Proposed Action[b]				Non-Thermal Treatment	
Receptor	Alternative		With microencapsulation		With vitrification		Alternative	
	Dose (millirem or person-rem) [c]	Fatal cancer risk	Dose (millirem or person-rem) [c]	Fatal cancer risk [d]	Dose (millirem or person-rem) [c]	Fatal cancer risk [d]	Dose (millirem or person-rem) [c]	Fatal cancer risk [d]
MEI involved worker [e]	-	-	1500	6.00E-04 (1 in 1,600)	1500	6.00E-04 (1 in 1,600)	1500	6.00E-04 (1 in 1,000)
Average involved worker [f]	-	-	81	3.24E-05 (1 in 30,000)	81	3.24E-05 (1 in 30,000)	81	3.24E-05 (1 in 30,000)
MEI onsite	-	-	0.058	2.32E-08 (1 in 43 million)	0.36	1.44E-07 (1 in 7 million)	0.003	1.20E-09 (1 in 830 million)
MEI offsite	-	-	0.022	1.10E-08 (1 in 90 million)	0.09	4.50E-08 (1 in 22 million)	0.0031	1.55E-09 (1 in 620 million)
Population	-	-	0.0089	4.45E-06 (LCF)	0.048	2.40E-05 (LCF)	0.00085	4.25E-07 (LCF)

a. Except for involved worker, dose results are based on results presented in Table 5.7-3 of Section 5.7, Air Resources. Doses and risks do not include contributions from baseline sources and foreseeable increases to the baseline.

b. Doses and risks from Treatment and Storage Alternatives (with either microencapsulation or vitrification of incinerator ash) would be same as Proposed Action (with either microencapsulation or vitrification of incinerator ash) for airborne radionuclides; other additional risks associated with long-term storage are described in Section 5.21.

c. All doses are in units of millirem except for population dose, which is in units of person-rem.

d. Risk numbers are presented as the individuals chance of a fatal cancer except for the population which is the number of fatal cancers calculated to occur in the population.

e. The involved worker dose is 1500 mrem and is based on the INEEL administrative dose limit. This is a conservative assumption and the involved worker would not be expected to reach this dose limit in any year of continuous routine operation.

f. Th average involved worker dose is the average dose measured from year 1992—1997 for RWMC radiation workers (see Appendix Section E-4 Table E-4-7 for detail) and is based on the assumption that the doses for activities under the Proposed Action Alternative would be similar to the doses measured during waste management activities at the RWMC.

Note: LCF = Latent Cancer Fatality.

Table 5.12-2. Summary of cumulative radiation dose and human health impacts associated with annual radiological airborne emissions from the AMWTP.[a]

	No Action		Proposed Action[b]				Non-Thermal Treatment	
Receptor	Alternative		With microencapsulation		With vitrification		Alternative	
	Dose (millirem or person-rem) [c]	Fatal cancer risk [d]	Dose (millirem or person-rem) [c]	Fatal cancer risk[d]	Dose (millirem or person-rem) [c]	Fatal cancer risk [d]	Dose (millirem or person-rem) [c]	Fatal cancer risk [d]
MEI involved worker [e]	1500	6.00E-04 (1 in 1,600)	1500	6.00E-04 (1 in 1,600)	1500	6.00E-04 (1 in 1,600)	1500	6.00E-04 (1 in 1,600)
Average involved worker [f]	81	3.24E-05 (1 in 30,000)	81	3.24E-05 (1 in 30,000)	81	3.24E-05 (1 in 30,000)	81	3.24E-05 (1 in 30,000)
MEI onsite	0.23	9.20E-08 (1 in 10 million)	0.29	1.16E-07 (1 in 8 million)	0.59	2.24E-07 (in 4 million)	0.24	9.60E-08 (1 in 10 million)
MEI offsite	0.14	7.00E-08 (1 in 14 million)	0.16	8.00E-08 (1 in 12 million)	0.23	1.15E-07 (1 in 8 million)	0.14	7.00E-08 (1 in 14 million)
Population	0.50	2.50E-04 (LCF)	0.50	2.50E-04 (LCF)	0.54	2.70E-04 (LCF)	0.50	2.50E-04 (LCF)

a. Except for involved worker, dose results are based on results presented in Table 5.7-4 of Section 5.7, Air Resources. Doses and risks include contributions from baseline levels, foreseeable increases to the baseline, and projected AMWTP emissions.

b. Doses and risks from Treatment and Storage Alternatives (with either microencapsulation or vitrification of incinerator ash) would be same as Proposed Action (with either microencapsulation or vitrification of incinerator ash) for airborne radionuclides; other additional risks associated with long-term storage are described in Section 5.21.

c. All doses are in units of millirem except for population dose, which is in units of person-rem.

d. Risk numbers are presented as the individuals chance of a fatal cancer except for the population which is the number of fatal cancers calculated to occur in the population.

e. The involved worker dose is 1500 mrem and is based on the INEEL administrative dose limit. This is a conservative assumption and the involved worker would not be expected to reach this dose limit in any year of continuous routine operation.

f. The average involved worker dose is the average dose measured from year 1992-1997 for RWMC radiation workers (see Appendix Section E-4, Table E-4-7 for detail) and is based on the assumption that the doses for activities under the Proposed Action would be similar to the doses measured during waste management activities at the RWMC.

Note: LCF = Latent Cancer Fatality.

Table 5.12-3. Summary of radiation dose and human health impacts associated with airborne emissions over the projected operating lifetime of the AMWTP [a]

	13-year facility lifetime		30-year facility lifetime	

Receptor	Dose (millirem or person-rem) [b]	Fatal cancer Risk [c]	Dose (millirem or person-rem) [b]	Fatal cancer Risk [c]
Proposed Action — with microencapsulation [d]				
MEI Onsite	3.8	1.5E-06 (1 in 666,000)	8.7	3.5E-06 (1 in 285,000)
MEI Offsite	2.1	1.1E-06 (1 in 909,000)	4.9	2.5E-06 (1 in 400,000)
Population	8.5	4.2E-03 (LCF)	23	1.1E-02 (LCF)
Proposed Action — with vitrification [d]				
MEI Onsite	7.7	3.1E-06 (1 in 320,000)	18	7.1E-06 (1 in 140,000)
MEI Offsite	3.0	1.5E-06 (1 in 666,000)	6.9	3.5E-06 (1 in 285,000)
Population	9.0	4.5E-03 (LCF)	24	1.2E-02 (LCF)
Non-Thermal Treatment Alternative				
MEI Onsite	3.1	1.2E-06 (1 in 833,000)	e	e
MEI Offsite	1.9	9.4E-07 (1 in 1 million)	e	e
Population	8.4	4.2E-03 (LCF)	e	e

a. Doses are from Table 5.7-4 and Table 5.7-5 of Section 5.7, Air Resources.

b. All doses are in units of millirem except for population dose, which is in units of person-rem.

c. Risk numbers are presented as the individuals chance of a fatal cancer except for the population which is the number of fatal cancers calculated to occur in the population.

d. Doses and risks from Treatment and Storage Alternatives (with either microencapsulation or vitrification of incinerator ash) would be same as Proposed Action (with either microencapsulation or vitrification of incinerator ash) for airborne radionuclides; other additional risks associated with long-term storage are described in Section 5.21.

e. AMWTP would not operate beyond 13 years under this alternative.

Note: LCF = Latent Cancer Fatality.

5.12.2 Nonradiological Exposure and Health Effects

The projected AMWTP emissions data listed in Table 5.7-3 of Section 5.7, Air Resources, were used to evaluate health impacts associated with potential exposure to criteria and toxic air pollutants. Maximum concentrations of criteria pollutants and toxic pollutants in ambient air for the maximum levels predicted to occur at the INEEL boundary, along public roads, and at Craters of the Moon are presented in Tables 5.7-6 and 5.7-7 of Section 5.7, Air Resources. As in the case of radiological impacts, the consequences described for nonradiological impacts include contributions from existing (baseline) sources and projected increases. For all cases, the predicted cumulative impacts for criteria pollutants would be well within the Ambient Air Quality Standard contained in Idaho regulations (IDHW 1997). This corresponds to a hazard quotient of less than one, indicating that no adverse health effects would occur as a result of criteria pollutant emissions. Hazard quotients for noncarcinogenic toxic air pollutants are much less than one in all cases, indicating that offsite levels are well below the acceptable ambient concentrations established by the State of Idaho (IDHW 1997).

Table 5.12-4 presents the lifetime cancer risks from the concentration of carcinogenic air pollutants at the INEEL boundary location and at Craters of the Moon. Table 5.12-4 provides the maximum concentration, inhalation unit risk, and calculated cancer risk from chemicals in air. The inhalation unit risk for carcinogens is assessed using EPA inhalation slope factors. The highest offsite cancer risk under the Proposed Action is for carbon tetrachloride (released from the treatment facility) at the site boundary (1 cancer incidence in 360 million). The total cancer risk under the Proposed Action for all nonradiological carcinogenic chemicals would be 1.2×10^{-8} (1 in 85 million) at the site boundary and 3.3×10^{-10} (1 in 3 billion) at Craters of the Moon. The total cancer risk under the Non-Thermal Treatment Alternative for all nonradiological carcinogenic chemicals would be 2.8×10^{-9} (1 in 360 million) at the site boundary and 7.0×10^{-11} (1 in 14 billion) at Craters of the Moon. The impacts from the Treatment and Storage Alternative would be the same as those for the Proposed Action regarding the treatment of waste; however, the potential storage impacts identified in Section 5.21, Long-Term Storage Impacts, would be in addition to impacts for treatment.

Because there would be no discharges to surface water or groundwater under the Proposed Action and other alternatives, the human health risk from chemical contaminants in the drinking water for onsite workers and the public would be the same as described in Section 4.12, Occupational and Public Health and Safety.

5.12.3 Industrial Safety

This section describes the following impacts for workplace hazards: (1) total reportable injuries and illness and (2) fatalities in the workforce. This analysis considered injury and fatality rates for construction workers from Section 4.12, Occupational and Public Health and Safety, and applied them to the estimated number of worker hours for each proposed alternative. The estimated nonradiological impacts to workers at the proposed AMWTP by alternative for the duration of facility construction and operations are presented in Table 5.12-5. The activities that workers would perform under each of the proposed alternatives would be similar to those currently performed at the INEEL and RWMC. Therefore, the potential hazards encountered in the workplace would be similar to those that currently exist at the INEEL and RWMC. The impacts from the Treatment and Storage Alternative would be the same as those for the Proposed Action regarding the treatment of waste; however the potential storage impacts identified in Section 5.21, Long-Term Storage Impacts, would be in addition to impacts for treatment.

Table 5.12-4. Lifetime cancer risk for annual release of nonradiological carcinogenic air pollutants.

	Concentration m g/m^3		Inhalation unit risk factor [m g/m^3]$^{-1}$	Cancer risk (cancer incidence)	
Pollutant	Site boundary	Craters of the Moon		Site boundary	Craters of the Moon
Proposed Action — with microencapsulation					

Arsenic	5.75E-11	1.83E-12	4.3E-03	2.47E-13	7.88E-15
Asbestos	2.94E-10	1.19E-11	2.3E-01	6.75E-11	2.73E-12
Benzene	1.00E-04	2.51E-06	8.3E-06	8.34E-10	2.08E-11
Beryllium	8.69E-12	3.49E-13	2.4E-03	2.09E-14	8.37E-16
Cadmium	2.81E-11	9.35E-13	1.8E-03	5.06E-14	1.68E-15
Carbon tetrachloride	1.85E-04	5.53E-06	1.5E-05	2.78E-09	8.30E-11
Chloroform	3.71E-05	1.11E-06	2.3E-05	8.53E-10	2.55E-11
Chromium (hexavalent)	2.60E-13	1.04E-14	1.2E-02	3.12E-15	1.25E-16
1,2-Dichloroethane	3.71E-05	1.11E-06	2.6E-05	9.64E-10	2.88E-11
1,1-Dichloroethylene	3.71E-05	1.11E-06	5.0E-05	1.85E-09	5.54E-11
Dioxins and furans[a]	2.66E-11	7.80E-13	42.9	1.14E-09	3.35E-11
Formaldehyde	1.28E-04	2.69E-06	1.3E-05	1.66E-09	3.50E-11
Methylene chloride	2.59E-06	7.75E-08	4.7E-07	1.22E-12	3.64E-14
Nickel	9.80E-12	3.15E-13	2.4E-04	2.35E-15	7.36E-17
Polychlorinated biphenyls	9.70E-06	2.89E-07	1.0E-04	9.70E-10	2.89E-11
Tetrachloroethylene	3.71E-05	1.11E-06	NA[b]	NA[b]	NA[b]
1,1,2-Trichloroethane	3.71E-05	1.11E-06	1.6E-05	5.93E-10	1.77E-11
Trichloroethylene	3.71E-05	1.11E-06	NA[b]	NA[b]	NA[b]
Proposed Action — with vitrification					
Arsenic	5E-11	1.83E-12	4.3E-03	2.47E-13	7.88E-15
Asbestos	2.94E-10	1.19E-11	2.3E-01	6.75E-11	2.73E-12
Benzene	1.00E-04	2.51E-06	8.3E-06	8.34E-10	2.08E-11
Beryllium	6.96E-10	2.02E-11	2.4E-03	1.67E-12	4.84E-
Cadmium	2.81E-11	9.35E-13	1.8E-03	5.06E-14	

Carbon tetrachloride Chloroform Chromium (hexavalent) 1,2-Dichloroethane 1,1-Dichloroethylene Dioxins and furans[a] Formaldehyde Methylene chloride Nickel Polychlorinated biphenyls Tetrachloroethylene 1,1,2-Trichloroethane Trichloroethylene	1.85E-04 3.71E-05 2.09E-11 3.71E-05 3.71E-05 2.66E-11 1.28E-04 2.59E-06 9.78E-12 9.70E-06 3.71E-05 3.71E-05 3.71E-05	5.53E-06 1.11E-06 6.05E-13 1.11E-06 1.11E-06 7.80E-13 2.69E-06 7.75E-08 3.14E-13 2.89E-07 1.11E-06 1.11E-06 1.11E-06	1.5E-05 2.3E-05 1.2E-02 2.6E-05 5.0E-05 42.9 1.3E-05 4.7E-07 2.4E-04 1.0E-04 NA[b] 1.6E-05 NA[b]	2.78E-09 8.53E-10 2.50E-13 9.64E-10 1.85E-09 1.14E-09 1.66E-09 1.22E-12 2.35E-15 9.70E-10 NA[b] 5.93E-10 NA[b]	14 1.68E-15 8.30E-11 2.55E-11 7.26E-15 2.88E-11 5.54E-11 3.35E-11 3.50E-11 3.64E-14 7.54E-17 2.89E-11 NA[b] 1.77E-11 NA[b]

Table 5.12-4 Lifetime cancer risk for annual release of nonradiological carcinogenic air pollutants (continued).

		Concentration m g/m^3		Inhalation unit risk factor [m g/m^3]$^{-1}$	Cancer risk (cancer incidence)	
Pollutant		Site boundary	Craters of the Moon		Site boundary	Craters of the Moon

Non-Thermal Treatment Alternative					
Arsenic Asbestos Benzene Beryllium Cadmium Carbon tetrachloride Chloroform Chromium (hexavalent) 1,2-Dichloroethane 1,1-Dichloroethylene Dioxins and furans[a] Formaldehyde Methylene chloride Nickel Polychlorinated biphenyls Tetrachloroethylene 1,1,2-Trichloroethane Trichloroethylene	8.54E-12 2.94E-10 6.90E-05 8.54E-12 8.54E-12 1.36E-05 2.75E-06 2.56E-13 2.75E-06 2.75E-06 c 1.28E-04 1.91E-07 1.92E-12 3.52E-11 2.75E-06 2.75E-06 2.75E-06	3.44E-03 1.19E-11 1.50E-06 3.44E-13 3.44E-13 4.98E-07 1.01E-07 1.03E-14 1.01E-07 1.01E-07 c 2.69E-06 7.04E-09 7.60E-14 1.40E-12 1.01E-07 1.01E-07 1.01E-07	4.3E-03 2.3E-01 8.3E-06 2.4E-03 1.8E-03 1.5E-05 2.3E-05 1.2E-02 2.6E-05 5.0E-05 42.9 1.3E-05 4.7E-07 2.4E-04 1.0E-04 NA[b] 1.6E-05 NA[b]	3.67E-14 6.75E-11 5.72E-10 2.05E-14 1.54E-14 2.03E-10 6.32E-11 3.08E-15 7.15E-11 1.37E-10 c 1.66E-09 9.00E-14 4.61E-16 3.52E-15 NA[b] 4.40E-11 NA[b]	1.48E-15 2.73E-12 1.25E-11 8.26E-16 6.19E-16 7.48E-12 2.33E-12 1.24E-16 2.63E-12 5.06E-12 c 3.50E-11 3.31E-15 1.82E-17 1.40E-16 NA[b] 1.62E-12 NA[b]

a. The unit risk factor for dioxins and furans was conservatively based on the most toxic congener 2,3,7,8-

Tetrachloro dibenzo dioxin (TCDD).

b. NA refers to not available at this time.

c. Substance would not be emitted under the Non-Thermal Treatment Alternative.

Note: The Treatment and Storage Alternative impacts would be the same as the Proposed Actions regarding the treatment of waste, however, the potential storage impacts identified in Section 5.21 would be in addition to impacts for treatment.

Table 5.12-5. Estimated industrial safety impacts by alternative for duration of construction and operation.

		Proposed Action and Treatment and Storage Alternative			Non-Thermal Treatment Alternative		
Category	1996 INEEL Injury/illness and fatality rates	Operation	Construction	All workers	Operation	Construction	All workers

Annual workers	6,645	146	108[a]	254	133	108[a]	241
Annual hours[b]	1.26E+07	2.72E+05	2.16E+05	4.88E+05	2.47E+05	2.16E+05	4.63E+05
Annual injury/illness[c]	192	4.5	7	11.5	4.1	7	11
Annual fatalities[d]	1	0.022	0.017	0.039	0.020	0.017	0.037
Total injury/illness	-	135	28	163	53	28	81
Total fatalities	-	0.652	0.069	0.722	0.257	0.069	0.326

a. Construction annual workers is the average of the number of workers 31, 122.6, 224.1, and 53.5 for year 1999, 2000, 2001 and 2002 respectively.

b. Total injury/illness and total fatalities are calculated for treatment facility duration of 30 years for the Proposed Action and 13 years for Non-Thermal Treatment, and construction activity duration of 4 years.

c. Annual injury/illness rates for INEEL operation and construction are 3.3 and 6.4 per 200,000 hours, respectively (DOE rates are 3.7 and 6.4 per 200,000 hours, respectively) (DOE 1996a).

d. Annual fatality rates for INEEL operation and construction are 0.016 fatalities per 200,000 hours (DOE rate is 0.0034).

13. Idaho National Engineering and Environmental Laboratory Services

5.13.1 Methodology

This section describes the impact on INEEL services for the four proposed AMWTP alternatives: No Action, Proposed Action, Non-Thermal Treatment, and Treatment and Storage. These impacts are evaluated by comparing engineering estimates of service usage for the proposed AMWTP with the INEEL and RWMC usage rates described in Section 4.13, INEEL Services, and comparing potential total usage rates with physical and regulatory limits where appropriate.

5.13.2 Idaho National Engineering and Environmental Laboratory Services Impacts from the No Action Alternative

There would be minimal service impacts from the No Action Alternative. Essentially, the service requirements would continue to be the same for managing the waste that is in the TSA. Some amount of additional storage space might be required for waste generated in the future. TRU waste would continue to be shipped to the WIPP; but, since waste would continue to be stored at the RWMC, the change in service usage would not be significant. Additional shipments to WIPP would be supported using current INEEL facilities. Retrieval of waste from the TSA-RE would require storage in RCRA-compliant storage, resulting in minimal additional service usage. The Waste Experimental Reduction Facility would continue to operate (until 2003 or 2006) to treat LLMW. Some additional services would be used in the future, if this facility continued to operate longer than currently planned.

5.13.3 Idaho National Engineering and Environmental Laboratory Services Impacts from the Proposed Action

The usage rates for various services for the Proposed Action are based on engineering estimates provided in the "Advanced Mixed Waste Treatment Project's submittal of Compa's request for Utility Loads in support of the AMWTP Environmental Impact Statement (EIS)-AM-BN-L-124" (Yaklich 1998). Except for the potential requirement for a new sewage lagoon, and the requirement for a new substation and power line, no additional new facilities would be required to provide these services to the proposed AMWTP. Most of these new services represent a small increase from current INEEL services and would not cause negative impacts to RWMC services. These estimated AMWTP service requirements are compared with current INEEL and RWMC service usage and INEEL capacities in Table 5.13-1.

With the exception of propane use, water, and wastewater, the increase in usage relative to current INEEL usage is small and would not approach INEEL site capacities. The large propane usage increase results primarily from the use of propane in the AMWTP incinerator. Propane storage tanks would be part of the proposed AMWTP. The large water increase is a result of the quantity of water used to solidify the ash in 55-gallon drums. The estimated increase in water from current INEEL usage is 4.22 million gallons per year. With an increase in water usage there is also an increase in the amount of wastewater produced (see Table 5.13-1).

The AMWTP would hook into the current RWMC water system. The current water system has adequate capacity to support the proposed AMWTP.

The AMWTP may require new wastewater disposal facilities. Existing sewage lagoons south of the RWMC might be used, or a new approximately 0.5-acre lagoon may be added to operate in parallel with the existing lagoons. The need for the additional 0.5-acre lagoon has not been determined. The expanded sewage system would be tied into an existing sewage line.

Table 5.13-1. AMWTP services compared to INEEL services.

Service	INEEL capacity[a]	INEEL usage[b]	AMWTP usage with micro- encapsulation of ash[b,c]	AMWTP % increase using microencapsulation	AMWTP usage with vitrification of ash[b,c]	AMWTP % increase using vitrification	AMWTP usage using Non-Thermal Treatment	AMWTP % increase using Non-Thermal Treatment	RWMC usage
Water	11.4 billion gal/yr	1.3 billion gal/yr	4,220,000 gal/yr[d]	0.3	2,700,000 gal/yr	0.2	3,880,000 gal/yr[e]	0.3	4,190,000 gal/yr
Electricity	394,000 MWH/yr[f]	173,862 MWh/yr	33,000 MWh[g]	19	35,000 MWh	20	24,850 MWh[h]	14	6,206 MWh/yr
Diesel	NA	617,947 gal/yr	16,000 gal/yr	2.6	16,000 gal/yr	2.6	16,000 gal/yr	2.6	NA[a,i]
Propane	NA	130,249 gal/yr	1,100,000 gal/yr[j]	845	925,000 gal/yr	710	360,000 gal/yr[k]	276	48,019 gal/yr
Wastewater	NA	149,000,000 gal/yr	2,560,000 gal/yr[l]	1.7	1,870,000 gal/yr	1.3	2,560,000 gal/yr[m]	1.7	1,270,000 gal/yr

a. Based on physical, contractual, and regulatory limits as described in Section 4.13. NA means "not applicable" or "unknown."

b. Based on usage in Section 4.13 for INEEL and RWMC, not including Idaho Falls facilities.

c. The Treatment and Storage alternative generates the same utility requirements as the AMWTP usage with microencapsulation and the AMWTP usage with vitrification depending on which method is being used.

d. Increased operating personnel and added HVAC humidification.

e. Increased operating personnel. Deleted incineration, microencapsulation, and off gas treatment and added HVAC humidification.

f. MWh = megawatt-hour.

g. Deleted melter and added microencapsulation.

h. Deleted melter, incineration, microencapsulation, and off gas treatment.

i. Very small unknown amount is used.

j. Added steam humidification load.

k. Added steam humidification load. Deleted incineration, microencapsulation, and off gas treatment.

l. Increased operating personnel.

m. Increased operating personnel. Deleted incineration, microencapsulation, and off gas treatment.

Only sewage and clean wastewater would be collected by the sanitary waste system and discharged to the sewage lagoons. Process water, such as that used in the incinerator, and potentially radioactive contaminated water from decon showers would be processed in evaporators.

The proposed AMWTP would require a new electrical substation and a new approximately 3,000-foot aboveground power line (DOE-ID 1998). The new substation would be placed in the southeast corner of the RWMC, and an underground line would connect to the AMWTP facility. The aboveground power line would run from the new substation east and north to tap into an existing 138-kilovolt line.

The phone and data communication lines for the AMWTP would be tied into the current INEEL system. Radio communications would be integrated into the current INEEL system. No capacity issues or negative impacts would be anticipated on the current INEEL systems.

Existing security and emergency protection site services would provide adequate services for the AMWTP. No significant expansion of these site services is anticipated as a consequence of constructing and operating the proposed AMWTP. AMWTP-specific security and emergency protection programs would be developed and provided by the

AMWTP staff and would meet the equivalent requirements and provide similar capabilities as described in Section 4.13.5, Security and Emergency Protection.

All onsite contractors and DOE-ID are part of a site-wide system for providing security and emergency protection. The proposed AMWTP would be integrated into this system and formal, documented interfaces would be developed between the AMWTP and the other onsite contractors and DOE-ID.

The proposed AMWTP would have a Waste Minimization Plan which would outline methods to minimize wastes generated and would have elements on pollution prevention awareness. The plan’s implementation would minimize the quantity and toxicity of wastes generated and would provide for reporting waste minimization/pollution prevention progress. The project would advance DOE’s waste minimization/pollution prevention goals by reducing the volume and toxicity of current wastes stored at RWMC. The waste would also be packaged to comply with final disposal requirements. There would be a short-term increase in pollution emissions and a small additional amount of waste generated during operation of the facility. But the long-term environmental risk of the currently stored waste would be greatly reduced.

It would be premature to identify energy and water conservation features that might be incorporated into this project. As the design progresses, studies would be performed and conservation features would be incorporated into the facility if there is a reasonable financial payback. Some preliminary examples are multiple glazing on windows; a heat recovery system on the heating ventilation, and air conditioning system; a process water recovery system; and maximizing the use of energy efficient lighting.

There would be minimal change in INEEL services due to the substitution of vitrification of ash from those described for the Proposed Action with microencapsulation of ash. With the exception of water, wastewater, and propane, the increase in usage relative to current INEEL services is small (see Table 5.13-1). The water usage using vitrification would increase by 2.70 million gallons per year compared to 4.22 million gallons per year using microencapsulation. Wastewater requirements would increase by 1.87 million gallons per year using vitrification compared to 2.56 million gallons per year increase using microencapsulation. Propane use would increase by 1.1 million gallons per year using microencapsulation of ash compared to 925,000 gallons per year increase using vitrification of ash.

5.13.4 Idaho National Engineering and Environmental Laboratory Services Impacts from the Non-Thermal Treatment Alternative

The significant difference for the services requirements for the Non-Thermal Treatment Alternative relative to the Proposed Action is that there would be no incinerator or vitrification/ microencapsulation system. This would mean a reduction in water, electricity, and propane usage for the proposed AMWTP. There would be no significant change in other service requirements.

Water usage for the vitrifier/microencapsulator, incinerator, and evaporators would be eliminated. This would have an insignificant effect because it is only about one percent of the current INEEL waste use. Since most of the process water eliminated would have been evaporated and not discharged to the sewage system, this would notaffect requirements for the sewage system. If less personnel were employed at the facility, the potential need for an addition to the sewage lagoons would be lessened.

Electricity requirements would increase by 24,850 megawatt hours per year compared to 33,000 megawatt hours per year increase required for the Proposed Action and Treatment and Storage Alternative. The facility would still exceed the power capacity currently available at the RWMC. The new electrical substation and power line would still be required (Hanson 1998). Part of the waste stream would not be treatable and would require storage. There may be slight increases in electricity usage for other operations because a greater part of the waste stream might be subjected to non-thermal treatment, but this increase would be small compared to the decreased electricity use without thermal treatment.

The propane usage would increase by 360,000 gallons per year compared with the 1,100,000 gallons per year increase required for the Proposed Action and Treatment and Storage Alternative. The use or non-use of this propane would not be expected to significantly impact the INEEL or RWMC.

5.13.5 Idaho National Engineering and Environmental Laboratory Services Impacts from the Treatment and Storage Alternative

This alternative is the same as the Proposed Action regarding the treatment of waste; however, the potential storage impacts identified in Section 5.21, Long-Term Storage Impacts, would be in addition to impacts for treatment. The current storage facilities at the RWMC would be utilized, but additional onsite storage facilities would probably have to be built. The services impacts would be the same as for the Proposed Action with small increases in the use of energy for heating and lighting to support storage. This energy would probably be in the form of electricity or propane. No new facilities to provide services beyond those for the Proposed Action would be anticipated to be required, except that the eventual shipping of the stored waste to a final repository might require additional services.

5.14 Facility Accidents

This section addresses potential environmental consequences inside and outside of the INEEL site boundaries from facility accidents under each of the alternatives. Since the RWMC would primarily be affected by the alternatives, accidents at the RWMC are emphasized.

An accident is defined here as an unexpected or undesirable event that leads to a release of hazardous or radioactive material within a facility or into the environment. Events that could lead to an accidental release of hazardous or radioactive material fall into three broad categories: external events, internal events, and natural phenomena events. External events (e.g., aircraft crashes) originate outside a facility. Internal events (e.g., equipment failures or human errors) originate within a facility. Natural phenomena events include weather-related and geological occurrences (e.g., high winds, earthquakes, and volcanism). All of these events could lead to a release of hazardous or radioactive material from a facility.

The DOE INEL EIS (DOE 1995) conducted an extensive review and analysis of environmental consequences, which can be applied here. In particular, the potential impacts of facility accidents under various alternatives are addressed. As a result, Section 5.14 and Appendix Section F-5 of Volume 2 of the DOE INEL EIS are incorporated by reference in this EIS. Specifically, the bounding accident from the DOE INEL EIS, a lava flow over the RWMC, is presented as a baseline. Then, the bounding accidents from the updated RWMC Safety Analysis Report (SAR) are presented which provide a focused evaluation of consequences from RWMC operations. Preliminary screening results from the AMWTP Preliminary Safety Analysis Report (PSAR) are used to provide an estimate of expected additional risk from the proposed facility.

5.14.1 Historical Perspective

Information on accidents that have occurred in INEEL waste activities is based on review of SARs and the INEL Historical Dose Evaluation Project (DOE-ID 1991b). The airborne pathway is the principal pathway by which radioactive materials released on the INEEL can reach an offsite member of the public.

Three fires have occurred at the RWMC. Two occurred in 1966 due to exposed waste material in trenches, thought to be caused by alkali metals in disposed waste. Disposal in trenches was later discontinued at the RWMC. The third fire occurred in 1970 in a drum of stored waste from the Rocky Flats Plant, postulated to have been caused by radiant solar heating of the black drum surface. Monitoring and accident recovery activities from the fires indicated that releases and spread of radionuclides was undetectable (EG&G 1986). As a result of this waste container fire, the drums are now painted white to reduce the absorption of heat from the sun. There has not been a fire in a waste container at the RWMC since the 1970 incident (LMITCO 1997c).

One accident involving a spill and release of radioactive material occurred on January 9, 1978. In a handling accident, a drum was penetrated by a forklift tine, spilling a portion of the drum contents. The spilled waste was immediately contained, and no detectable airborne release of radionuclides occurred (EG&G 1986). A second spill occurred on April 21, 1988, when a damaged waste box was moved by forklift from the TSA-RE pad into the Certified and Segregated (C&S) Building. The original damage was apparently caused by a forklift when the waste box was initially stored. The subsequent movement spread contamination into the C&S Building.

The DOE INEL EIS presented data on the rate of worker fatalities that showed the worker fatality rate was very low compared to the rates from industry groups, such as agriculture and construction, and was comparable to those for trade and services groups. The average worker fatality rate at the INEEL from 1983-1992 was 2.5×10^{-5} per worker per year.

5.14.2 Methodology

The DOE INEL EIS methodology employed a screening approach that focused detailed analysis on scenarios that posed the greatest risk to the public. Those scenarios were termed bounding, and the calculations that supported the estimates of risk were performed such that the estimates are unlikely to be exceeded in the event of an actual accident. The hypothetical accidents analyzed were selected so that they would produce effects that would be as severe or more severe than any other accidents that might reasonably be foreseen (Slaughterbeck et al. 1995). In this bounding consequence, approach, frequency and consequence results are presented to provide a perspective on risk.

The RWMC SAR (LMITCO 1997c) and the AMWTP PSAR (BNFL 1998d) both performed a similar screening approach in which potential accidents were grouped into four categories corresponding to different likelihood ranges. The frequency of an accident is defined based on the quantitative assessment of how many times a year a particular accident is expected to occur. Table 5.14-1 illustrates this concept for the four categories: anticipated events, unlikely events, extremely unlikely events, and beyond extremely unlikely events.

Table 5.14-1. Likelihood categories of potential accidents.

Category	Frequency (accidents per year)
Anticipated events (A)	Frequency $\geq 1 \times 10^{-2}$
Unlikely events (U)	$1 \times 10^{-2} >$ frequency $\geq 1 \times 10^{-4}$
Extremely unlikely events (E)	$1 \times 10^{-4} >$ frequency $\geq 1 \times 10^{-6}$
Beyond extremely unlikely events (B)	Frequency $< 1 \times 10^{-6}$

The AMWTP PSAR accident selection criteria are consistent with guidance in DOE-STD-3009-94, "Preparation Guide for U.S. Department of Energy Nonreactor Nuclear Facility Safety Analysis Reports." The methodology begins with the accident scenarios identified by a detailed hazards evaluation. Those scenarios are then used to select candidate accidents for more detailed analysis.

The hazard evaluation identifies a set of accident scenarios that can result in the uncontrolled release of radioactive and/or hazardous material from AMWTP facilities. The objective of the accident selection process is to identify a subset of these accident scenarios that bounds the consequences and represents the various release situations for the purpose of characterizing the level of safety of the AMWTP. Candidate accidents are selected based on the following criteria: (1) accidents that bound those of lesser but similar potential consequences; (2) accidents that represent the highest risk based on qualitative estimates of likelihood and consequences; and (3) other accidents, while not necessarily bounding, that represent accidents presenting some unique but important challenge to system safety.

Selected accidents provide an envelope of accident conditions to which AMWTP operations can be evaluated. They represent a variety of accident causes and locations, involving different materials at risk. Included are internal events, external events, and events caused by natural phenomena. This set of accidents represents all other accidents with high and moderate consequences and is known as the candidate design basis accidents. It should be noted that there are numerous credible accidents that do not appear in the list of design basis accidents. That is because they are essentially duplicates or accidents that were bounded by another of a similar type. Details of this accident selection process can be found in the AMWTP PSAR.

Radiological exposure to the public resulting from accidents are calculated and presented in units of rem or millirem. Resulting health effects from the potential exposure are then calculated using risk factors taken from the 1990 ICRP Recommendations (ICRP 1991). The risk factor for a member of the public is defined as the probability of contracting a fatal cancer, which is 0.0005 per rem. These results are given (when available) for an individual at the nearest public access location, the MEI, and the offsite population within a 50-mile radius of the facility. The risk factorsfor contracting a nonfatal cancer or genetic effect are a factor of 5 and 4 less, respectively, than the risk factor for fatal cancers. Fatal cancers thus are the dominant risk measure.

Nonradiological exposures to the public were also considered by the DOE INEL EIS for the bounding lava flow accident. The consequences are presented in Section 5.14.5.

Details of the facility accident methodology are given in Appendix Section E-5, Facility Accidents.

5.14.3 Facility Accident Impacts from the No Action Alternative

The DOE INEL EIS indicated that there was enough radioactive material at the RWMC to potentially cause consequences to the public under accident conditions. That was the case for TRU waste, low-level waste, and LLMW. Table 5.14-2 lists the accidents that were determined to be the bounding scenarios. Bounding, in this sense, means being the largest potential contributors of dose to the public. The use of bounding scenarios in this EIS summarizes the calculation of frequency and consequences (see Appendix Section E-5.2.1) to enhance the reader’s understanding of relative risk and consequences of all possible scenarios. The hypothetical MEI is that individual whose residence is assumed to be located at the nearest site boundary which is about 6 kilometers south of the RWMC. The SAR utilized for the explosion and fire accidents did not provide the population risk of fatal cancers, because DOE Orders do not specifically require this information. As demonstrated by the dose to the MEI, however, public consequences from those accidents are bounded by the lava flow accident.

The highest consequences are reported for the lava flow scenario that is estimated to have the lowest frequency. The frequency of this scenario reported in support of the DOE INEL EIS would place the event in the extremely unlikely category (2.5×10^{-5} per year). However, the latest SAR for the RWMC ([LMITCO 1997], pg. A-7) has refined this frequency. The conditional probability of thermal or physical disruption of the wastes at RWMC is estimated to be one or more order of magnitude lower than 2.5×10^{-5} per year, because not all lava flows would reach RWMC.

Using the accepted risk factor of 0.0005 deaths per rem to the general public from the 1990 ICRP Recommendations (ICRP 1991), the risk of contracting a fatal cancer for a member of the public living at the nearest site boundary can be calculated. For the lava flow scenario, that risk is less than 1 in 10,000. When the probability of occurrence of that scenario is accounted for, the risk of fatal cancer to the MEI is less than 1 in a billion per year.

Table 5.14-2. Bounding RWMC accidents for TRU wastes.

				Number of fatal cancers	
Accident	Frequency category	Dose to MEI (rem)	Likelihood of fatal cancer to MEI	Population, 50% meteorology	Population, 95% meteorology
Waste box spill	Anticipated	6.5×10^{-3}	3.3×10^{-6}	a	a
Drum explosion	Anticipated	4.0×10^{-3}	2.0×10^{-6}	a	a
Earthquake	Unlikely	5.0×10^{-2}	2.5×10^{-5}	a	a
Lava flow over RWMC	b, c	9.4×10^{-2}	4.7×10^{-5}	1.2×10^{-2}	4.8×10^{-2}

Sources: LMITCO 1997c, pg. 3-47; Slaughterbeck et al. 1995, pg. 5-16.

a Less than the number of fatal cancers calculated for the lava flow over the RWMC.

b. E: extremely unlikely.

c. B: beyond extremely unlikely.

Doses to the co-located worker at a downwind distance of 100 meters were also determined for the bounding accidents for the RWMC SAR (LMITCO 1997c) and are presented in Table 5.14-3. The lava flow scenario was not assessed because the co-located worker would have ample time to evacuate prior to the lava flow covering the RWMC. The risk factor for contracting a fatal cancer from radiation exposure to a worker population is 0.0004 deaths per rem from the 1990 ICRP Recommendations (ICRP 1991). The risk factor for a worker population is slightly smaller than for the general population because of the difference in age distribution between the two population groups.

Table 5.14-3. Bounding RWMC accident results for 100-meter co-located worker.

Accident	Frequency category	Dose to 100-m co-located worker (rem)	Likelihood of fatal cancer to co-located worker
Waste box spill	Anticipated	0.032	1.3×10^{-5}
Drum explosion	Anticipated	2.77	1.1×10^{-3}
Earthquake	Unlikely	5.69	2.3×10^{-3}
Source: LMITCO 1997c, pg. 3-47.			

The accident with the most severe consequences from hazardous chemical release would be the lava flow over the RWMC. The chemical concentrations of greatest concern are due to mercury and nitric acid. As shown in Table 5.14-4, exposure guidelines are only exceeded for the lava flow accident, which is now considered to be a beyond extremely unlikely event. No Emergency Response Planning Guideline (ERPG) values have been established for mercury and nitric acid. However, the toxicological guidelines developed for these chemicals are intended to have the same definitions as the ERPGs. Both mercury and nitric acid exceed the TOX-2 limits for the lava flow scenario. Based on the ERPG definitions, TOX-2 is the maximum airborne concentration below which nearly all individuals could be exposed for up to 1 hour without experiencing or developing irreversible or other serious health effects or symptoms that could impair their abilities to take protective action.

5.14.4 Facility Accident Impacts from the Proposed Action

The PSAR for the proposed AMWTP has identified 12 scenarios as part of its design basis (BNFL 1998d). These accident scenarios, as well as a vitrifier explosion scenario, are described in Table 5.14-5. The fire scenario for the box line and drum line is contained within the proposed AMWTP facility so that no release occurs outside the facility. The waste box drop is the same accident identified in the No Action Alternative but would occur at a higher frequency due to the greater number of annual handling operations during operation of the proposed AMWTP facility. The waste box drop is the scenario with the highest consequences within the anticipated frequency category. For the unlikely frequency category, the waste transfer vehicle fire and the incinerator explosion scenarios have the highest consequences. The Type II storage module fire and the propane-fueled fire scenarios have the highest consequences within the extremely unlikely frequency category. The remaining accident scenarios have offsite consequences and are either specific to the proposed AMWTP facility or a potential result of AMWTP operations.

Table 5.14-4. Bounding RWMC accident results for toxicological releases.

		Chemical concentration at MEI (mg/m^3)	
Accident	Frequency category	Nitric acid TOX-2[a]: 6.4	Mercury TOX-2 [a]: 1.0

		TOX-1[a]: 5	TOX-1 [a]: 0.05
Waste box spill	Anticipated	3.26×10^{-7}	1.27×10^{-8}
Drum explosion	Anticipated	2.04×10^{-8}	3.79×10^{-8}
Earthquake	Unlikely	5.51×10^{-4}	2.16×10^{-5}
Lava flow over RWMC	Extremely unlikely to beyond extremely unlikely	16.0 > TOX-2	3.0 > TOX-2
Sources: LMITCO 1997c, pgs. 3-37 thru 3-46; Slaughterbeck et al. 1995, pg. 7-11. a. For anticipated events, the offsite consequences should be less than the PEL-TWA or the TLV-TWA, whichever is more restrictive. TOX-1 is the applicable evaluation guideline for unlikely events, and TOX-2 is applied for more extreme unlikely events. (See Appendix Section E-5.2.3)			

Table 5.14-5. Accident scenario frequency categories.

Accident description	Frequency category
Fire involving waste in the box line	Anticipated
Fire involving waste in the drum line	Anticipated
Loss of all AC power	Anticipated
Dropped waste box outdoors during transfer	Anticipated
Fire in TRU waste in the TSA-RE	Unlikely
Incinerator explosion	Unlikely
Wind-borne missile breach of AMWTP facility	Unlikely
Fire involving waste transfer vehicle	Unlikely
Design basis seismic event	Unlikely
Nuclear criticality in a microencapsulation ash drum	Unlikely
Vitrifier explosion	Extremely unlikely
Type II module fire	Extremely unlikely
Propane-fueled fires	Extremely unlikely

Accident consequences based on total effective dose equivalent (TEDE, rem), are shown in Table 5.14-6 (BNFL 1998d). Calculated doses (rem) for each accident scenario at four different locations fall within the evaluation guidelines provided in Appendix Section E-5.2.3. Impacts shown in the "100 meter" column are most applicable to involved workers at the AMWTP.

Criticality in the microencapsulation ash drum is the bounding scenario for impacts involving AMWTP workers. Although workers are not routinely in the vicinity of the microencapsulation process, if a criticality did occur any workers in the microencapsulation room, the microencapsulation cure area, the adjacent electrical room, or in the corridor outside the microencapsulation room could receive fatal or near-fatal exposures (BNFL 1998d). Other scenarios result in lesser impact. The vitrifier explosion scenario provides a higher accident consequence to off-plant site locations than the nuclear criticality in a microencapsulation waste drum scenario whereas the nuclear criticality shows worse consequences at locations closer to the source. This is to be expected as the criticality accident is a highly localized accident. Specifically, doses from a criticality accident are dominated by a different exposure mechanism (i.e. direct radiation) than those for other accidents which result from atmospheric releases and transport. The nuclear criticality accident is deemed to be in the unlikely frequency category while the vitrification accident is in the extremely unlikely frequency class. Additional controls can place the criticality accident in an even lower frequency class since it is considered here without controls (unmitigated).

Table 5.14-6. AMWTP accident consequences: calculated TEDE, rem.

Accident description	Locations (evaluation guidelines in parenthesis)				
	100 meters (100 rem)	EBR-I[a]	Hwy 20/26 rest stop[a]	Nearest INEEL boundary (25 rem)	Population (estimated LCF)
Fire involving waste in the box line	1.25E-04	5.14E-01	1.70E-01	2.20E-01	0.05
Fire involving waste in the drum line	2.01E-05	8.28E-02	2.74E-02	3.54E-02	0.11
Loss of all AC power	8.74E-02	3.08E-03	1.31E-03	1.59E-03	0.02
Dropped waste box outdoors during transfer[b]	5.69E-01	2.01E-02	8.53E-03	1.04E-02	0.001
Fire in TRU waste in the TSA-RE[b]	2.07E-02	5.83E+00	2.91E+00	3.53E+00	0.005
Incinerator explosion	1.43E-03	4.12E-01	2.01E-01	2.38E-01	1.8
Wind-borne missile breach of AMWTP facility	4.77E-02	2.30E-04	7.39E-05	9.60E-05	0.12
Fire involving waste transfer vehicle[b]	1.15E-02	3.31E+00	1.61E+00	1.91E+00	0.00005
Design basis seismic event	2.62E+00	9.31E-02	3.95E-02	4.82E-02	0.98
Nuclear criticality in a microencapsulation ash drum	2.02E+01	6.80E-03	2.40E-03	2.36E-02	0.03

Vitrifier explosion	4.80E-04	1.50E-01	7.90E-02	8.90E-02	0.01
Type II module fire[b]	1.27E-02	3.64E+00	1.78E+00	2.23E+00	0.05
Propane-fueled fires[c]	2.62E+00	3.64E+00	1.78E+00	2.23E+00	1.14

a. Evaluation guidelines do not exist for these locations. The exposures are compared with the evaluation guideline for the nearest INEEL site boundary (Appendix Section E-5.2.2).

b. Could occur under all alternatives including the No Action Alternative.

c. Accidents for incinerator explosion, Type II module fire, and design basis seismic event bound the propane-fueled fires.

Microencapsulation and vitrification scenarios include passive containment barriers that isolate the waste from workers as the primary defense against inhalation or ingestion. The lava flow scenario for the No Action Alternative would have a potential source term of 0.231 grams of americium-241 (Am-241); 18,400,000 grams of mercury; and 9,900,000 grams of nitric acid.

Chemical concentrations at the nearest INEEL border, calculated in milligrams per cubic meter for the six most limiting hazardous materials, are provided in Table 5.14-7. All accident scenarios result in exposures that fall well below the regulatory guidelines. It is assumed that the majority of toxic compounds will be removed from the material at risk in the incineration process. Therefore, no hazardous materials calculations are provided in Table 5.14-7 for the vitrifier explosion and nuclear criticality scenarios.

Analysis for criticality has been performed in the PSAR for the AMWTP, and risks associated with criticality in the supercompactor area have been calculated and are contained in Chapters 3 and 6 and Appendix A of the PSAR. Because of large quantities of waste processed in the treatment facility, total quantities of fissile material passing through the facility during its lifetime constitute more than a critical mass. Most of the fissile material in the incoming and outgoing waste streams, however, is dispersed throughout large volumes of the waste material. Thus at any given time, there is a low concentration of fissile material in the processes. Briefly stated, stringent engineering and administrative controls are necessary for criticality control. Wherever practical, the preferred approach to criticality control is to maintain inherently sub-critical geometries. Total fissile mass in each area will also be controlled to meet the "double-contingency" principle. These limits will be developed for the final SAR. In the supercompaction and encapsulation areas, drums received are positively identified and confirmed to have been assayed and to have a fissile content of less than 200 grams. Pucks accumulated for transfer to the macroencapsulation area will be stored in **Table 5.14-7.** Accident consequences at nearest INEEL border (calculated milligrams per cubic meter) (evaluation guideline: ERPG-2, given in parentheses, except for loss of all AC power, which is TLV-TWA).

Accident description	Six most limiting hazardous materials					
	Asbestos (5.00E-02)	Beryllium[a] (2.50E-02)	Cadmium (4.00E+00)	Lead (2.50E-01)	Mercury (1.00E-01)	PCBs (5.00E-03)
Fire involving waste in the box line	2.70E-04	4.20E-06	5.70E-06	3.90E-04	6.10E-08	3.60E-07
Fire involving waste in the drum line	9.20E-05	2.10E-06	2.60E-06	2.10E-04	3.20E-08	1.60E-07
Loss of all AC power	2.40E-07	4.30E-09	4.60E-08	4.20E-07	6.50E-09	2.60E-08

Dropped waste box outdoors during transfer	7.60E-05	1.20E-06	1.90E-05	1.10E-04	1.60E-07	6.20E-06
Fire in TRU waste in the TSA-RE	1.30E-02	9.00E-05	8.90E-06	7.90E-05	2.60E-06	5.20E-06
Incinerator explosion	0.00E+00	0.00E+00	8.90E-06	7.90E-05	2.60E-06	5.20E-06
Wind-borne missile breach of AMWTP facility	6.20E-08	9.60E-10	1.60E-08	8.90E-08	2.90E-11	1.10E-09
Fire involving waste transfer vehicle	8.90E-04	1.40E-05	1.90E-05	1.20E-03	4.10E-07	2.50E-06
Design basis seismic event	3.50E-04	5.50E-06	9.60E-05	5.90E-04	3.30E-06	3.40E-05
Nuclear criticality in a microencapsulation ash drum[b]	c	c	c	c	c	c
Vitrifier explosion[b]	c	c	c	c	c	c
Type II module fire	2.50E-02	7.40E-05	1.20E-04	3.30E-03	4.20E-06	1.50E-05
Propane-fueled fires[d]	2.50E-02	7.40E-05	1.20E-04	3.30E-03	2.60E-05	3.40E-05

a. Evaluation guidelines for beryllium are 7.3E-03 milligrams per cubic meter for these accident scenarios: (a) fire involving waste in the box line, (b) fire involving waste in the drum line, and (c) wind-borne missile breach of AMWTP facility.

b. Assumption is that majority of significant toxic compounds will have been removed from the MAR in the incineration process.

c. No hazardous material calculations are provided; it is assumed that the majority of toxic compounds are removed from the MAR for these accidents.

d. Accidents for incinerator explosion, Type II module fire, and design basis seismic event bound the propane-fueled fires.

a critically safe geometry (a horizontal one-high array). Before a puck is added to a product container, it will be determined that the new combined fissile mass in the container will remain below the product specification limit (200 grams per drum and 325 per box). In addition, even though the waste is expected to generally contain only low concentrations of fissile material, AMWTP will maintain a formal criticality safety program implemented by an AMWTP Criticality Safety Manual and controlled by a Criticality Safety Organization to ensure nuclear criticality safety.

Additional details on the AMWTP accidents and associated source terms are provided in Appendix Section E-5, Facility Accidents.

Increased truck traffic associated with transportation of propane to the AMWTP comprises approximately 18,630 annual vehicle miles (round trip), or approximately 8/100 of one percent of the 23,657,200 annual onsite and offsite vehicle miles associated with INEEL activities. Based on historical INEEL traffic statistics (Section 4.11.4, DOE INEL

EIS) of 1.5 accidents per million miles for INEEL vehicles, this would imply one traffic accident involving a propane truck in 50 years of facility operation.

Because the scope of this EIS has been limited to onsite (RWMC) waste transportation only, no consequence analysis for incidents occurring offsite is included in this section. The consequences of a propane fire either at AMWTP or elsewhere along the transport route have been bounded, however, by accidents which are described in the EIS. Section 3.4.2.12 of the PSAR (BNFL 1998d) includes an assessment of propane-fueled fires (Accident ID 115). Consequences for a boiling liquid, expanding vapor explosion (BLEVE) involving propane storage at AMWTP (the ID 115 scenario), would be much greater than, for example, a vapor cloud explosion and fire involving a propane transport truck involved in a traffic accident, since the fuel volumes are as much as 20 times greater. The BLEVE accident is, in turn, bounded by the incinerator explosion scenario, the Type II module fire scenario, and the design basis seismic event scenario. Each of these bounding cases involve associated fires, and details for each are provided in Appendix Section E-5. Risk assessment requirements associated with the recent amendments to the *Clean Air Act* (40 CFR 68) will also require that an additional offsite consequence analysis be performed for propane transportation. AMWTP will demonstrate compliance with these requirements when the air quality operating permit for the facility is finalized.

5.14.5 Facility Accident Impacts from the Non-Thermal Treatment Alternative

Under the Non-Thermal Treatment Alternative, the proposed treatment facility would not use any thermal treatment technology but would use the treatment options of supercompaction and macroencapsulation. Although the waste inventories and the amount of handling of waste should be very similar between the two alternatives, the Non-Thermal Treatment Alternative would not have any incinerator or microencapsulation accidents as in the Proposed Action.

5.14.6 Facility Accident Impacts from the Treatment and Storage Alternative

The impacts from facility accidents for the Treatment and Storage Alternative would be the same as the impacts from the Proposed Action regarding the treatment of waste. There would be no risk reduction from the offsite shipment of stored TRU waste. The potential storage impacts identified in Section 5.21, Long-Term Storage Impacts, would be in addition to impacts for treatment.

5.15 Cumulative Impacts

Impacts from the Proposed Action are cumulative when added to impacts from other existing and planned activities at the INEEL. An assessment incorporating the impacts from these other activities is important because cumulative impacts can result from several smaller actions that by themselves do not have significant impacts.

A cumulative impact is defined as the "impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time" (40 CFR 1508.7). This section describes potential impacts resulting from other facilities, operations, and activities (see Table 5.15-1) described and analyzed for Alternative B (Ten-Year Plan) and Alternative D (Maximum Treatment, Storage, and Disposal) in Section 5.15 of the DOE INEL EIS that in combination with the Proposed Action and additional area projects may contribute to cumulative impacts. The AMWTP was included in the DOE INEL EIS as a component evaluated in Alternative B and D, but because of the conceptual design and lack of a specific siting location the potential impacts of the facility were very conservative. The more refined analyses presented in this document indicate fewer and much smaller potential adverse impacts. Therefore, the approach to evaluate cumulative impacts was to tier from the DOE INEL EIS cumulative impact analysis and identify the project-specific impact increment attributed to the Proposed Action analyzed in this document. This resulted in an overall reduction in the cumulative impacts identified in the DOE INEL EIS analyses.

The INEEL is now included as a potential site for facilities and activities associated with DOE surplus plutonium disposition. Alternatives 7 and 8 of the *Surplus Plutonium Disposition Draft Environmental Impact Statement* (SPD EIS) (DOE/EIS-0283) published in July 1998, proposes use of the Fuel Processing Facility for pit disassembly and conversion processing and construction of a new MOX fuel fabrication facility in the INTEC area at INEEL.

Construction would commence in about 2001, with modifications to the Fuel Processing Facility for the pit conversion facility, and would continue through completion of the MOX facility in about 2006. Operations would commence in about 2004, with pit conversion, and would continue until about 2015, when the MOX facility has completed its mission.

Reasonably foreseeable offsite actions evaluated in the DOE INEL EIS are shown in Table 5.15-2. Because of its proximity to the INEEL and the use of the Scoville siding on INEEL near the RWMC, the proposed System Integration Corporation quartzite mining operation in Arco Hills was included as a reasonably foreseeable action that could potentially contribute to cumulative impacts in this analysis.

Since publication of the AMWTP Draft EIS, three additional projects have been proposed which may contribute to cumulative impacts at the INEEL. Two projects are DOE projects proposed by the Office of Nuclear Energy, Science and Technology (NE) and the third is a commercial project that involves the use of INEEL.

The proposed NE project for the Production of Plutonium-238 for Use in Advanced Radioisotope Power Systems for Future Space Missions includes the INEEL as a potential site for activities associated with the irradiation of Np-237 targets in the Advanced Test Reactor (ATR). The ATR is an operating test reactor with a main programmatic mission to support the Naval Reactor Fuels Program. Public scoping for the project is currently being conducted for the preparation of an EIS. Preliminary review of the project indicates that potential cumulative impacts

Table 5.15-1. Projects at the INEEL associated with Alternative B (Ten-Year Plan) and

Alternative D (Maximum Treatment, Storage, and Disposal).

Project name	Project name
Expended Core Facility Dry Cell Project	Mixed/Low-Level Waste Treatment

	Facility
Increased Rack Capacity for CPP-666	Mixed/Low-Level Waste Disposal Facility[a]
Additional Increased Rack Capacity (CPP-666)	Nonincinerable Mixed Waste Treatment[a]
Dry Fuel Storage Facility; Fuel Receiving Canning/Characterization and Shipping[a]	Remote Mixed Waste Treatment Facility
Fort St. Vrain Spent Nuclear Fuel Receipt and Storage	Sodium Processing Project
Spent Fuel Processing[b]	Greater-Than-Class-C Dedicated Storage
Experimental Breeder Reactor-II Blanket Treatment	Hazardous Waste Treatment, Storage, and Disposal Facilities
Electrometallurgical Process Demonstration (formerly known as Actinide Recycle Project)	Industrial/Commercial Landfill Expansion
Central Liquid Waste Processing Facility Decontamination and Decommissioning (D&D)	Gravel Pit Expansions[a]
Engineering Test Reactor D&D	Central Facilities Area Clean Laundry and Respirator Facility
Materials Test Reactor D&D	Calcine Transfer Project (Bin Set #1)
Fuel Processing Complex (CCP-601) D&D	Plasma Health Process Project
Fuel Receipt and Storage Facility (CCP-603) D&D	Test Area North Pool Fuel Transfer
Headend Processing Plant (CCP-604) D&D	Remediation of Groundwater Contamination
Waste Calcine Facility (CPP-633) D&D	Pit 9 Retrieval
Tank Farm Heel Removal Project	Vadose Zone Remediation
Waste Immobilization Facility[c]	Auxiliary Reactor Area (ARA)-II D&D
High-Level Tank Farm New Tanks[b]	Boiling Water Reactor Experiment (BORAX)-V D&D
b	High-Level Tank Farm Replacement

New Calcine Storage	(upgrade phase)
Radioactive Scrap/Waste Facility	Transuranic Storage Area Enclosure and Storage Project
Private Sector Alpha-Contaminated Mixed Low-Level Waste Treatment	Waste Characterization Facility
Radioactive Waste Management Complex Modifications to Support Private Sector Treatment of Alpha-Contaminated Mixed Low-Level Waste	Waste Handling Facility
Idaho Waste Processing Facility[a]	Health Physics Instrument Laboratory
Experimental Reduction Facility Incineration[a]	Radiological and Environmental Sciences Laboratory Replacement

a. These projects would be expanded for Alternative D (Maximum Treatment, Storage, and Disposal).

b. Alternative D only.

c. Sodium-bearing and calcine waste treatment technology selection would be implemented through this facility.

Table 5.15-2. Offsite activities included in the assessment of cumulative impacts in the DOE INEL EIS.

Activity	Description
Housing development, Idaho Falls	Three-hundred-unit single family housing development planned on approximately 150 acres of vacant land.
Business park, Rexburg	Fifty acres of vacant land between two light industrial facilities are planned for an expansion into a light industrial/business park for 30-40 businesses.
Manufacturer, Pocatello	Existing manufactured home factory to expand from approximately 50 to between 140 and 150 employees. Expansion of 22 acres in Pocatello Airport Industrial Park.
Food, Machinery, and Chemical Corp., Pocatello	FMC phosphate manufacturing plant to reduce number of furnaces from 4 to 3 within the next two years; 25-30 jobs could be lost.
Target Department Store,	Opening of Target discount store and associated

Idaho Falls	commercial development planned on vacant land near the Teton Mall in Idaho Falls.
System Integration Corporation Arco Hills Quartzite Mine[a]	Quartzite mining operation and ore processing near Arco Hills on 56 acres. Fourteen acres would be disturbed by the quarry operation and a small waste ore dump, 22 acres, would be disturbed by the construction of a haul road, 11 acres would be disturbed by the ore crushing facilities, and 9 acres would be disturbed by the loading facilities on the INEEL. The project would employ 40 workers.
a. New project added since the DOE INEL EIS was published.	

would primarily be associated with worker health and safety due to the loading and unloading of the targets in the ATR and handling of irradiated targets for packaging and shipping.

The other NE project for the Proposed Transfer of the Heat Source/Radioisotope Thermoelectric Generator (HS/RTG) Assembly and Test Operations From the Mound Site include the INEEL as a potential site for this mission. The INEEL site location proposed for HS/RTG assembly and test activities is at Test Area North in Building TAN-607. Public scoping for this project is currently being conducted for the preparation of an EIS. Preliminary review of the project indicates that because of the nature of the mission (assembly and testing of RTG within an existing building), negligible wastes and hazardous emissions, and the small additional workforce (less than 50 direct and indirect) the potential cumulative impacts would be negligible.

The commercial project (VentureStar) involves a commercial spin-off of NASA's Reusable Launch Vehicle research program that will replace the existing Space Shuttle program. The INEEL is considered to be a potential candidate site for both the launch and landing of this next generation space craft. The project is in the very early stages of development and does not appear to be near term (five to ten year) project that would have cumulative impacts.

The following sections discuss the cumulative impacts identified for the AMWTP evaluated in this EIS. In order to show the highest potential cumulative impacts, the maximum impacts of the Proposed Action are used in the discussion. In addition to the impacts of these alternatives, impacts from other proposed projects that may contribute to a cumulative impact are also discussed. Detailed discussions of the resources are provided only when potentially notable cumulative impacts were identified. Table 5.15-3 shows a summary of the related cumulative impacts by resource area for the resources that have the potential to result in significant cumulative impacts.

Land Resources. Construction activities associated with the proposed AMWTP at INEEL would result in land resource impacts due to site preparation. The INEEL would receive additional land resource impacts from the other projects evaluated in the cumulative impact analysis presented in the DOE INEL EIS and the SPD EIS. Cumulatively, the proposed AMWTP facilities would use a small percentage of the INEEL's available land. Additionally, the Proposed Action activities would be located in the RWMC which conducts the same or very similar types of activities. The Proposed Action activities and land use would be consistent with the existing land use plans and policies of the INEEL.

Aesthetic and Scenic Resources. The potential for cumulative impacts on atmospheric visibility at Craters of the Moon Wilderness Area was indicated in the DOE INEL EIS (Section 5.7.4.3, Regulatory Compliance) using worst-case modeling conditions and no abatement controls for Alternatives B and D. While contrast evaluations showed no potential for objectionable impact, the criterion for acceptable color shift (delta E 2.0) would be exceeded. When maximum abatement was included in the analysis (70 percent on the Waste Characterization Facility and the AMWTP and 90 percent on the Waste Immobilization Facility and the Pit 9 Waste Retrieval) cumulative emissions resulted in an acceptable level (less than delta E 2.0) of visibility degradation at the Craters of the Moon under Alternatives B and D. The contribution of the AMWTP to the color shift value based on analysis present in this EIS is 0.18 delta E. Air quality analysis prepared for the quartzite mine operation indicated no visual impacts would result at the Crater of the

Moon Wilderness Area. No significant cumulative visual impacts are expected.

Geology and Soils. Construction activities associated with the proposed AMWTP facility at INEEL would result in soil disturbances and a potential for temporary increases in erosion. The INEEL would receive additional impacts to geology and soils from the other projects evaluated in the cumulative impact analysis presented in the DOE INEL EIS and the SPD EIS. Cumulatively, the potential for significant impacts as a result of soil disturbances would be minor since the AMWTP site has been previously disturbed. Standard construction, soil erosion, and stormwater control measures would mitigate any erosion from disturbed areas.

Ecological Resources. Construction activities associated with the AMWTP facility at the INEEL could potentially disturb biotic resources. The construction and operation of other facilities evaluated in the cumulative impact analysis presented in the DOE INEL EIS and the SPD EIS could also impact biotic resources at the INEEL. Cumulatively, the total area of the habitats potentially affected would be small in comparison to the entire area of habitat available and actually less than analyzed in the DOE INEL EIS because it considered a 200-acre undisturbed site for the AMWTP outside the RWMC. The habitat losses would not be expected to affect any threatened or endangered species.

Cultural and Paleontological Resources. No known cultural resources would be affected by any of the proposed AMWTP action alternatives. The optional expansion of the RWMC sewage lagoon would potentially impact a known archeological site; however, archeological testing has indicated that the site is not likely eligible for nomination to the NRHP. A formal determination of eligibility of this site has not yet been made. Archeologists would monitor the site during any ground-disturbing activities. The Systems Integration Corporation quartzite mining area was surveyed and identified no significant archeological sites or archeological values that need to be protected. Because the DOE INEL EIS assumed the AMWTP facility would be located on 200 acres of undisturbed land, the potential cumulative impacts to cultural resources are actually less than indicated in that document.

Waste Management. Construction and operation wastes attributed to the AMWTP facility were included in the B and D Alternatives in the DOE INEL EIS. The TRU, low-level, and LLMW generated during operation would be managed in accordance with the INEEL STP. The surplus plutonium disposition facilities proposed in the SPD EIS would also generate TRU (783 cubic meters), low-level waste (1,816 cubic meters), LLMW (35 cubic meters), and hazardous (112 cubic meters) waste over the 15-year period of operation. These additional wastes, when combined with waste volumes generated from other site activities would be well within the INEEL site treatment, storage, and disposal capacity. Industrial waste generated during construction and operation would be disposed of in the INEEL Landfill Complex, based on the anticipated INEEL industrial waste quantities expected to be generated from the DOE INEL EIS Modified Ten-Year Plan Alternative and the other reasonably foreseeable DOE actions shown in Table 5.15-4. The INEEL Landfill Complex would provide adequate capacity for the next 30 to 50 years.

Transportation Radiological Impacts. The following discussion of cumulative impacts of transportation of radioactive material is tiered from the DOE INEL EIS analysis. The AMWTP was included in the analyses of the B and D Alternatives for transportation radiological impacts in the DOE INEL EIS. The analysis assumed 48 offsite construction truck trips, and, during operations, 9 nonradiological offsite truck trips per year and 1,022 radiological offsite truck trips per year. Therefore, the transportation radiological impacts of the project-specific analysis presented in this document have not been added here and are not cumulative.

The cumulative impacts of the transportation of radiological material consist of impacts from (1) historical shipments of waste and spent nuclear fuel to the INEEL site, (2) the alternatives evaluated in the DOE INEL EIS, (3) reasonably foreseeable actions that include transportation of radioactive material, and (4) general radioactive materials transportation that is not related to a particular action. The assessment of cumulative transportation impacts concentrated on the cumulative impacts of offsite transportation, because offsite transportation yields larger doses to the general population than does onsite transportation. The collective dose to the general population and workers was the measure used to quantify cumulative transportation impacts. The measure of impact was chosen because it can be directly related to estimates of cancer fatalities using a cancer risk coefficient and because of the difficulty in identifying a MEI for shipments that occur, and would occur, all over the U.S. over an extended period of time, 1953 through 2005 (53 years).

The historical waste shipments consisted of shipments from offsite waste generators to the INEEL RWMC from 1957 through 1993. These data were linearly extrapolated back to 1954, the year that TRU waste was first shipped to the RWMC from the Rocky Flats Plant, because data for 1954 through 1956 were not available.

The historical shipments of spent nuclear fuel to the INEEL site consisted of shipments of naval spent nuclear fuel and test specimens from 1957 through 1995. Historical spent nuclear fuel also consisted of shipments of other DOE spent nuclear fuel to the INEEL besides naval shipments, such as research reactor spent nuclear fuel, commercial spent nuclear fuel, and Three Mile Island core debris. Data for these shipments were available for 1973 through 1993 and were linearly extrapolated back to 1953, the start of operations at the INTEC, because data for 1953 through 1972 were not available.

For workers, historical offsite shipments of waste and spent nuclear fuel to the INEEL yielded a collective dose of 110 person—rem or 0.044 cancer fatalities. For the general population, historical offsite shipments of waste and spent nuclear fuel to the INEEL site yielded a collective dose of 60 person-rem or 0.030 cancer fatalities.

Table 5.15-3. Cumulative impacts by resource area and alternative.

Discipline	DOE INEL EIS Alternative B (Ten-Year Plan)	DOE INEL EIS Alternative D (Maximum Treatment, Storage, and Disposal)	AMWTP	Systems Integration Corporation Quartzite Mine	Comments
Land use/disturbance	823 acres	1339 acres	7 acres[a]	56 acres[b]	The B&D alternatives analyzed use of 200 acres of undisturbed land located on INEEL 2.5 miles east of the RWMC for the AMWTP.
Socioeconomics/ Change in number of total jobs	Overall decrease of 2,250	Overall decrease of 1,449	Increase of 125 direct during construction and 146 direct during operation	Increase of 40 direct	The B&D alternatives analyzed 768 direct during construction and 71 direct during operation for the AMWTP.
Cultural resources/minimum number of potentially historic structures/archaeological sites disturbed[a]	70 structures and 22 sites	70 structures and 22 sites	No structures and 1 site	No structures or sites	Under alternatives B&D, the overall number of cultural resources would be reduced.
Air resources	Below applicable standards	Below applicable standards	Below applicable standards (<1 percent increase)	No impact	
Water resources/water usage	Negligible (79 million gal/year). Increase of 0.04 percent over current water use. Cumulative approximately 0.4 percent of available groundwater rights.	Negligible (67 million gal/year). Increase of 0.03 percent over water use. Cumulative approximately 0.4 percent of available groundwater rights.	Maximum 4.2 million gallon — 0.3 percent increase over current water use. Cumulatively the INEEL would use approximately 11 percent of available groundwater rights.	2,000 gal/day —200 work days/yr. Cumulative approximately 0.4 percent of available groundwater rights.	The B&D alternative analyzed 9 million gal/yr for the AMWTP.
Ecological resources/acreage loss	1,068	1,584	7 acres[b]	56 acres	The B&D alternatives analyzed disturbance of 200 acres of undisturbed land 2.5 miles east of RWMC for the AMWTP.

a. 7 acres of disturbed land within the RWMC.

b. 47 acres on BLM lands and 9 acres on land withdrawn to the DOE.

Collective doses for waste shipments associated with Alternatives B and D are summarized in Section 5.11, Traffic and Transportation, of the DOE INEL EIS. For truck shipment, the collective dose to workers was 870 person-rem (Alternative B, Ten-Year Plan) and 1700 person-rem (Alternative D, Maximum Treatment, Storage, and Disposal), or 0.35 to 0.68 cancer fatalities. Collective dose to the general population would be 460 person-rem (Alternative B) and 940 person-rem (Alternative D), or 0.23 to 0.47 cancer fatalities.

For train shipments, the collective dose to workers was 20 person-rem (Alternative B) and 48 person-rem (Alternative D), or 0.0080 to 0.019 cancer fatalities. Collective dose to the general population was 29 person-rem (Alternative B) and 58 person-rem (Alternative D), or 0.015 to 0.029 cancer fatalities.

Collective doses for spent nuclear fuel shipments associated with Alternatives B and D are summarized in Section 5.11, Traffic and Transportation, of the DOE INEL EIS. For truck shipments, the collective dose to workers was 360 person-rem (Alternative B) to 1,000 person-rem (Alternative D, Centralization at Savannah River), or 0.14 and 0.4 cancer fatalities. Collective dose to the general population was 810 person-rem (Alternative B) and 2,400 person-rem (Alternative D, Centralization at Savannah River), or 0.41 to 1.2 cancer fatalities.

Transportation impacts may also result from reasonably foreseeable projects. Two major proposed projects that would involve transportation of radioactive material are (1) shipments of spent nuclear fuel and defense high-level waste to a geologic repository and (2) proposed shipments of TRU waste to the WIPP, located in Carlsbad, New Mexico. DOE is presently studying the Yucca Mountain, Nevada site to determine its suitability for a geologic repository for commercial spent nuclear fuel and defense high-level waste; therefore, the geologic repository was assumed to be located in Yucca Mountain, Nevada, for the transportation cumulative impacts analysis.

Based on previous transportation dose assessments for the transportation of commercial radioactive waste, the worker collective dose for truck shipments to a repository was 8,600 person-rem or 3.4 cancer fatalities. The collective dose to the general population from truck shipments to a repository was 48,000 person-rem or 24 cancer fatalities. The worker collective dose for train shipments to a repository was 750 person-rem or 0.3 cancer fatalities. The collective dose to the general population from train shipments to a repository was 740 person-rem or 0.37 cancer fatalities.

Based on the transportation dose assessments prepared for the WIPP, the worker collective dose from truck shipments to the WIPP was 1,900 person-rem or 0.76 cancer fatalities. The collective dose to the general population from truck shipments to the WIPP was 1,500 person-rem or 0.75 cancer fatalities. The worker collective dose from train shipments to the WIPP was 990 person-rem or 0.4 cancer fatalities. The collective doses include the 5-year Test Phase and the 20-year Disposal Phase.

Transportation impacts would also occur from the SPD EIS shipments to and from the proposed pit conversion and MOX facilities. The number of shipments to and from INEEL is estimated to be 2,500 additional truck shipments during the approximately 15-year timeframe the surplus plutonium disposition facilities would be built and operated. The annual dose to the MEI from these shipments would be expected to increase from 1.05 mrem per year to about 1.1 mrem per year. This dose corresponds to an LCF risk from 15 years of transportation of 8.3×10^{6}, which does not significantly increase the risk to the public.

There are also general transportation activities that take place that are unrelated to the alternatives that were evaluated in the DOE INEL EIS or to reasonably foreseeable actions. Examples of these activities are shipments of radiopharmaceuticals to nuclear medicine laboratories and shipment of commercial low-level radioactive waste to commercial disposal facilities. The U.S. Nuclear Regulatory Commission (NRC) evaluated these types of shipments based on a survey of radioactive materials transportation in 1997 (NRC 1997). Categories of radioactive material evaluated by the NRC included (1) limited quantity shipments, (2) medical, (3) industrial, (4) fuel cycle, and (5) waste. NRC estimated that the annual collective worker dose for these shipments was 5,600 person-rem or 2.2 cancer fatalities. The annual collective general population dose for these shipments was estimated to be 4,200 person-rem or 2.1 cancer fatalities. Because comprehensive transportation doses were not available, these collective dose estimates were used to estimate transportation collective doses for 1953 through 1982 (30 years). These dose estimates included spent nuclear fuel and radioactive waste shipments.

Based on the transportation dose assessments by the NRC (1997), the cumulative transportation collective doses for 1953 through 1982 were 170,000 person-rem for workers and 130,000 person-rem for the general population. These collective doses correspond to 68 cancer fatalities for workers and 65 cancer fatalities for the general population.

Weiner et al. (1991a) evaluated eight categories of radioactive material shipments by truck: (1) industrial, (2) radiography, (3) medical, (4) fuel cycle, (5) research and development, (6) unknown, (7) waste, and (8) other. Based on a median external exposure rate, an annual collective worker dose of 1,400 person-rem, and an annual collective general population dose of 1,400 person-rem were estimated. These collective doses correspond to 0.56 and 0.7 cancer fatalities/year for workers and the general population, respectively.

Weiner et al. (1991b) also evaluated six categories of radioactive materials shipments by plane: (1) industrial, (2) radiography, (3) medical, (4) research and development, (5) unknown, and (6) waste. Based on a median external exposure rate, an annual collective worker dose of 290 person-rem and an annual collective general population dose of 450 person-rem were estimated. These collective doses correspond to 0.12 and 0.23 cancer fatalities/year for workers and the general population, respectively. Over the 23-year time period from 1983 through 2005, the collective worker dose would be 6,700 person-rem and the general population collective dose would be 10,000 person-rem or 2.7 and 5 cancer fatalities for workers and the general population, respectively.

The total worker and general population collective doses are summarized in Table 5.15-4.
Total collective worker doses from all types of shipments (historical, the alternatives, reasonably foreseeable actions, and general transportation) were estimated to be 220,000 person-rem (88 cancer fatalities), for the period of time 1953 through 2005 (53 years). Total general population collective doses were also estimated to be 220,000 person-rem (110 cancer fatalities). The majority of the collective dose for workers and the general population was due to general transportation of radioactive material. The total number of cancer fatalities from 1953 through 2005 was estimated to be 200. Over this same period of time (53 years), approximately 16,000,000 people will die from cancer, based on 300,000 cancer deaths/year (NRC 1977). The transportation-related cancer deaths are 0.0013 percent of this total.

Transportation Vehicular Accidents Impacts. Facilities that involve the shipment of radioactive materials were surveyed for 1971 through 1993 using accident data from the U.S. Department of Transportation, NRC, DOE, and state radiation control offices. For 1971 through 1993, 21 vehicular accidents involving 36 fatalities occurred. These were fatalities that resulted from vehicular accidents and were not associated with the radioactive nature of the cargo; no radiological fatalities due to transportation accidents have ever occurred in the U.S. During the same period of time, over 1,000,000 persons were killed in vehicular accidents in the U.S.

Transportation Regional Traffic Impacts. The baseline level of service for the road system surrounding the INEEL is Level-of-Service A or free flowing. This was based on data for U.S. Highway 20, the regional highway with the highest use around the INEEL and a likely route for materials that are transported to and from the INEEL. The peak number of vehicles per hour would have to increase from 122 to 291 to exceed the capacity of the highway.

Table 5.15-4. Cumulative transportation-related radiological collective doses and cancer fatalities (1953 to 2005).

Category[a]	Collective occupational dose (person-rem)	Collective general population dose (person-rem)
Historical	47	28
Waste (1954-1995)	56	30

DOE spent nuclear fuel (1953-1995) Naval spent nuclear fuel (1957-1995)	6.2	1.6
<u>Alternatives B-D</u> Waste shipments for Alternatives B-D Truck (100 percent) Train (100 percent)	870-1,700 20-48	460-940 29-58
Spent nuclear fuel shipments for Alternatives B-D Truck (100 percent) Train (100 percent)	7.3-1,000 7.3-1,000	2.1-2,400 2.1-190
<u>Reasonably Foreseeable Actions</u> Geologic Repository Truck Train	8,600 750	48,000 740
Waste Isolation Pilot Plant Test Phase Disposal Phase Truck Train	110 1,900 180	48 1,500 990
<u>General Transportation</u> 1953-1982 1983-2005	170,000 39,000	130,000 42,000
<u>Summary</u> Historical	110	60
Waste shipments for Alternatives B-D Truck (100 percent) Train (100 percent)	870-1,700 20-48	460-940 29-58
Spent nuclear fuel shipments for Alternatives B-D Truck (100 percent) Train (100 percent)	7.3-1,000 7.3-130	2.1-2,400 2.1-190

Reasonably Foreseeable Actions Truck Train	11,000 750	50,000 1,730
General transportation (1953-2005)	210,000	170,000
Total collective dose	220,000	220,000
Total cancer fatalities	88	110
Source: DOE 1995a. a. TRU waste, alpha LLMW, and LLMW.		

The increased movements of materials and people due to Alternative D analyzed in the DOE INEL EIS would increase the maximum number of vehicles per hour to 150, which is still within the range of Level-of-Service A and would result in no change to the level of service associated with U.S. Highway 20. The Systems Integration Corporation quartzite mine project would add only 18 round trips per day to traffic along an 18-mile stretch of Highway 20 between the proposed mine and Scoville siding; an increase of 2 to 4 percent while ore is being transported. The additional truck traffic associated with the SPD EIS activities would add approximately 166 vehicle trips per year to the regional traffic system. Based on these results, the impacts to the regional traffic system around the INEEL would be minimal for all alternatives.

For Alternatives B and D in the DOE INEL EIS, 2.7 and 4.8 vehicular accident fatalities were estimated to occur. During the 10-year time period from 1995 through 2005, approximately 400,000 people will be killed in vehicular accidents in the U.S.

Health and Safety. A number of potential exposure pathways exist by which radioactive materials from INEEL operations could affect workers onsite or could be transported to offsite environments. The airborne pathway is the principal pathway by which radioactive materials released on the INEEL site could reach an offsite member of the public.

A summary of the health effects from these individual exposure pathways is presented in Table 5.15-5. The health effects from radiation exposure are presented as the estimated number of fatal cancers in the affected population. The health effects for chemical carcinogens are presented as the estimated number of lifetime cancers in the affected population. For exposure to noncarcinogenic chemicals, the health effects are presented as estimated fatalities.

Occupational Health. The activities to be performed by workers under the B and D Alternatives analyzed in the DOE INEL EIS, which includes the AMWTP, are similar to those currently performed at the site. Therefore, the potential hazards encountered in the work place would be similar to those that currently exist. For these reasons, the average measured radiation dose and the number of reportable cases of injury and illness are anticipated to be proportional to the number of workers employed under each alternative. The airborne pathway, by which radioactive materials released on the INEEL site could affect workers, was modeled in the DOE INEL EIS, but was found to add negligible amounts to actual measured data.

Based on occupational radiation monitoring results, the average reportable radiation dose to an INEEL worker (includes both RWMC and non-RWMC workers) is about 0.027 rem (27 millirem) per year. In addition, there is a potential for small additional radiation dose due to atmospheric releases from INEEL facilities. For the maximally exposed worker, the additional dose would be 4.6 millirem for Alternative B (Ten-Year Plan) and 4.9 millirem for Alternative D (Maximum Treatment, Storage, and Disposal). The AMWTP project-specific analyses presented in this document (Section 5.12) for the Proposed Action indicates the potential radiological dose to the maximally exposed worker would be 1.0 millirem. These potential radiation doses would be in addition to natural background radiation which averages about 0.35 rem per year.

Workers on the site would be expected to see an increase in the number of latent cancer fatalities due to radiation from normal site operations of 0.14 if the SPD EIS pit conversion and MOX facilities were sited at INEEL.

The occupational radiation dose received by the entire INEEL workforce for 10 years would result in about one fatal cancer. The natural lifetime incidence of fatal cancers in the same population from all other causes would be about 2,000.

For the evaluation of occupational health effects from chemical emissions, the modeled chemical concentration was compared with the applicable occupational standard. Modeled concentrations below the occupational standards were considered acceptable (see Section 5.7.4.2). As a result, no adverse health effects for onsite workers are projected as a result of normal chemical emissions.

Routine workplace safety hazards can also result in injury or fatality. Total injury and illness rates for INEEL workers are comparable to those for DOE and its contractors, which average 3.7 and 6.4 per 200,000 hours worked. About three fatalities would result in the entire INEEL workforce in a 10-year period due to workplace safety hazards. The estimated industrial safety hazard impact for the Proposed Action analyzed in this document for duration of construction (4 years) and operation (30 years) is 28 total injury and illness/0.069 total fatalities and 135 total injury and illness/0.652 total fatalities, respectively. Construction of the plutonium disposition facilities at INEEL would result in approximately 280 cases of nonfatal occupational injury or illness and 0.40 fatality.

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

Public Health. The airborne pathway is the principal pathway by which radioactive materials released on the INEEL can reach an offsite member of the public. The potential for radiation dose to the public in the vicinity of the INEEL site due to atmospheric releases was similar for the B and D Alternatives analyzed in the DOE INEL EIS. For the maximally exposed member of the public, the additional radiation dose would be 1.6 rem for Alternative B and 0.84 rem for Alternative D. The AMWTP project-specific analyses presented in this document (Section 5.12) for the Proposed Action indicates the potential annual radiological dose to the MEI offsite would be 0.11 mrem. The total dose to the maximally exposed member of the public from annual operation of the pit conversion and MOX facilities at INEEL described in the SPD EIS would be 0.016 mrem. From 10 years of operation, the corresponding latent cancer fatalities risk to this individual would be

8.0×10^{-8}. The impacts on the average individual would be lower. These potential radiation doses would be in addition to natural background radiation, which averages about 0.35 rem per year. Less than one fatal cancer would result from radiation dose received by the population within 50 miles (80 km) of the INEEL over 10 years. The natural lifetime incidence of fatal cancers in the same population from all other causes would be about 24,000 out of a population of 120,000. The Treatment and Storage Alternative impacts would be the same as the Proposed Action regarding the treatment of waste; however, the potential storage impacts to public health identified in Section 5.21, Long-Term Storage Impacts, would be in addition to the impacts for treatment.

Other regional sources of atmospheric radioactivity have the potential to contribute to the radiation dose of the public near the INEEL. The primary source is emissions from phosphate processing operations in Pocatello, Idaho. These emissions have been evaluated by the EPA (EPA 1989). The number of fatal cancers in the population within 50 miles (80 km) of Pocatello would be about one over a 10-year period. The population exposed to the cumulative impact of both facilities would be small.

In addition to radiation dose from atmospheric emissions, there is a potential for impacts to the public from exposure to carcinogenic chemicals released to the air. The highest risks calculated for Alternative D in the DOE INEL EIS were small compared to the risks from radioactive releases and imply less than one fatal cancer in the exposed population over a 10-year period. The SPD EIS alternative for pit conversion and MOX facilities would not release carcinogenic chemicals as a result of operation. The Hazard Index for ethylene glycol releases ($4x10^{-5}$) would be much lower than 1, indicating that adverse, noncancer health effects should not be incurred. There is no basis currently available for evaluating risks from chemical exposure from other regional commercial, industrial, and agricultural sources, such as combustion of diesel and gasoline fuels and agricultural use of pesticides, herbicides, and fertilizers.

Table 5.15-5. Health-related cumulative impacts.

	Pathway	Type of impact	Alternative B (Ten-Year Plan)	Alternative D (Maximum Treatment Storage and Disposal)	AMWTP	SPD	Comments
			Radiological				
Public	Atmospheric	Estimated excess fatal cancers	<1	<1	<1 ($2.8x10^{-5}$)	<1 ($1.1x10^{-3}$)	
Workers[a]	Atmospheric	Estimated excess fatal cancers	Negligible	Negligible	<1 ($6.0x10^{-4}$)	<1 (0.14)	Overall cancers expected to be less than baseline because of fewer employees
Public	Atmospheric (carcinogens)	Estimated lifetime cancers	*Nonradiological* <1	<1	<1	0	
	Atmospheric (concarcinogens)	Estimated adverse health effects	0	0	0	0	
Workers	Atmospheric (carcinogens)	Estimated lifetime cancers	<1	<1	<1	0	
	Atmospheric (noncarcinogens)	Estimated adverse health effects	0	0	0	<1	
	Routine workplace safety hazards	Estimated fatalities	3	3	(0.069 construction) (0.652 operation)	0.40	

a. Estimated excess fatal cancers calculated from dosimeter measurements.

5.16 Unavoidable Adverse Impacts

This section summarizes potential unavoidable adverse environmental effects associated with the activities analyzed in this EIS. Unavoidable impacts are impacts that would occur after implementation of all feasible mitigation measures. For this EIS, effects were considered for cultural resources, aesthetic and scenic resources, air resources, water resources, and ecology.

5.16.1 Cultural Resources

The Proposed Action involves the construction and operation of the AMWTP facility, a project that would affect about 7 acres within the TSA located inside of the RWMC. Impacts to cultural resources appear negligible, although a potential for subsurface discoveries of cultural material always exists. Ground disturbance has the potential to affect archaeological, traditional, and paleontological sites located on the surface of the ground or buried beneath recent sediments. In locations that have been intensively surveyed, many areas of concern can be identified; but in unsurveyed locations, the sensitive areas would not be known until field work is completed. Alteration in the setting of a traditional, archaeological, or historic resource through the introduction of additional noise, pollution, contamination, or lighting may adversely affect archaeological, historic, and traditional resources located outside of the RWMC perimeter fence.

5.16.2 Aesthetic and Scenic Resources

Construction of the AMWTP facility would result in ground disturbance and a change in the visual setting at the RWMC. This facility would contain permanent generators and night lights, creating a visual and audible intrusion. Soil erosion could occur during the construction of the facility, as well as the release of fugitive dust particles that might temporarily affect visibility in localized areas. However, dust control measures, such as watering, would be implemented to minimize impacts.

5.16.3 Air Resources

The highest dose from AMWTP emissions to an offsite individual would be 0.11 millirem per year and occurs at the site boundary about 6 kilometers south-southwest of the facility. The most important radionuclide and exposure pathway would be inhalation of americium-241. When added to the baseline dose and projected increases, the cumulative dose would be 0.25 millirem per year. As in the case of each AMWTP alternative, the cumulative dose from AMWTP emissions and other sources would be a very small fraction of that received from natural background sources and is well below the NESHAP dose limit of 10 millirems per year. The maximum collective dose (i.e., the sum of all individual doses) to the entire population residing within 80 kilometers that would result under the Proposed Action is 0.05 person-rems per year. When added to the baseline population dose and projected increases, the collective dose is 0.55 person-rems per year.

Under the Proposed Action, incremental levels of all carcinogenic substances would be less than 1 percent of the applicable standard. All noncarcinogenic levels would be less than 1 percent of applicable standards except for selenium, for which maximum projected levels would be about 1 percent of the standard.

5.16.4 Water Resources

Water consumption would increase as a result of construction activities, operational activities, and increased workers at the facility; however, the total water consumption of 4.2 million gallons per year under this alternative would be much less than the INEEL's current water usage or the consumptive use water rights of 11.4 billion gallons per year (Yaklich 1998). Water would be required for operational activities during pretreatment, supercompaction, and macroencapsulation processes as part of the AMWTP operations (BNFL 1997a).

5.16.5 Ecological Resources

The Proposed Action would disturb approximately 7 acres within the RWMC to construct the AMWTP and support infrastructure. All of the project area within the RWMC has been previously disturbed as a result of ongoing waste management and environmental restoration activities. Since the construction site is a large area of packed gravel, there is little or no vegetation and no wildlife cover or food. The net loss of 7 acres of previously disturbed habitat within the boundary of the RWMC would have a negligible impact on INEEL biodiversity and wildlife habitat. The undisturbed native vegetation surrounding the RWMC provides much more important and higher quality habitat than that of the project site. Construction of the AMWTP and support infrastructure modifications within the RWMC would have a minor adverse impact on small, less mobile, mammals during project site construction clearing activities. Birds in the project site area would move away from the construction activities to adjacent similar habitat within the RWMC or offsite. The operation of the AMWTP would increase slightly human presence, night lighting, and noise within the RWMC. Potential radionuclide exposure to plant and animal species within the RWMC and in the adjacent surrounding area may increase slightly due to the operation of the AMWTP.

5.17 Relationship Between Short-Term Use of the Environment and the Maintenance and Enhancement of Long-Term Productivity

The short-term use of the environment and the associated effects on the maintenance and enhancement of long-term productivity of the environment associated with the AMWTP were addressed in Volume 2, Part A, Section 5.17 of the DOE INEL EIS. Implementation of any of the alternatives, including No Action, would cause some short-term commitments of resources (e.g., air emissions and land) and would permanently commit certain resources (e.g., construction materials, energy). Under all alternatives, the short-term use of the environment would cause some potential long-term enhancements to the environment by decreasing risk to workers, the public, and the surrounding environment from reducing exposure to hazardous and radioactive substances.

5.17.1 No Action Alternative

Under the No Action Alternative, short-term uses of resources would have some change on long-term productivity. LLMW would require space for onsite storage and waste processing and would involve the commitment of associated land, transportation, processing facilities, and other disposal resources. Continuing current waste management operations and activities at INEEL would result in a slight decrease in the risk to workers, the public, and the environment from hazardous and radioactive materials. However, these activities would be interim actions that would not meet the Federal Facility Agreement and Consent Order and provide only a relatively small enhancement of the environment in the long-term.

5.17.2 Proposed Action

Under the Proposed Action, short-term uses of resources would be greater than for the No Action Alternative. Because of the environmental benefits associated with treatment and offsite disposal of mixed waste under the Proposed Action, any short-term commitment of resources associated with the additional land disturbance, air emissions, and waste handling would be in exchange for enhanced long-term productivity compared to the other alternatives.

5.17.3 Non-Thermal Treatment Alternative

Under the Non-Thermal Treatment Alternative, short-term uses of resources–such as land, air emissions, energy, and construction materials–would be greater than for the No Action Alternative and less than for the Proposed Action and the Treatment and Storage Alternative. The Non-Thermal Treatment Alternative would reduce environmental risk slightly less than the Proposed Action and the Treatment and Storage Alternative but greater than the No Action Alternative. Non-Thermal Treatment would still leave some waste types at the INEEL untreated and in temporary storage contributing a slightly higher risk to the environment.

5.17.4 Treatment and Storage Alternative

Under this alternative, short-term uses of resources would be greater than for the No Action Alternative. However, because this alternative would return treated waste to onsite storage at the INEEL, the potential enhanced long-term productivity at INEEL through reduced environmental risk would be less than for the Proposed Action but greater than the Non-Thermal Treatment Alternative.

5.18 Irreversible and Irretrievable Commitments of Resources

Irreversible and irretrievable commitments of resources for each alternative would potentially include land and mineral resources during the life of the project and energy used in treating the waste. The irreversible and irretrievable commitment of resources for the Waste Management Program at INEEL, including resources potentially used for the AMWTP, was addressed as part of the analyses presented in Volume 2, Part A, Section 5.18, of the DOE INEL EIS.

In that analysis, the disposal of radioactive and/or hazardous wastes would cause irreversible and irretrievable commitments of land resources under Alternatives B (Ten-Year Plan) and D (Maximum Treatment, Storage, and Disposal). Under Alternative D, LLMW and low-level waste disposal would irreversibly and irretrievably commit approximately 400 acres of previously open-space land. Hazardous waste treatment, storage, and disposal under the same alternative would irreversibly and irretrievably affect 5 acres of open-space land. Under Alternative B, LLMW and low-level waste disposal would irreversible and irretrievably affect 200 acres of previously open-space land. Services potentially lost from the commitment of these acreage would include lost vegetation productivity and lost multiple-use or alternative-use opportunities (for example, disposal sites would not undergo future decommissioning or decontamination and habitat reclamation).

The aggregate resources (sand, pumice, and landscaping cinders) extracted on the INEEL would be irreversibly and irretrievably committed in support of INEEL spent nuclear fuel and environmental restoration and waste management activities. Aggregate also would be utilized during construction for concrete production, foundation preparation, and road construction and maintenance. Aggregate demands would be highest under Alternative D (Maximum Treatment, Storage, and Disposal) with an estimated volume of approximately 1,772,000 cubic meters (2,317,000 cubic yards). Estimated aggregate demands commensurate with the level of construction activities proposed under Alternative B would be 408,000 cubic meters (534,000 cubic yards).

The DOE INEL EIS also shows that the commitment of energy and other resources would be greatest under Alternative D (Maximum Treatment, Storage, and Disposal). Alternative D would require (above the baseline usage of these resources) about 127,700 megawatt-hours per year of electricity, 5.86 million liters (1.55 million gallons) per year of heating oil, 1.2 million liters (320,000 gallons) per year of diesel fuel, and 2.73 million liters (730,000 gallons) per year of propane. Construction associated with this alternative is estimated to require about 100,000 cubic meters (130,000 cubic yards) of concrete.

Under the alternatives analyzed for the AMWTP in this document, the No Action Alternative would have the least commitment of additional land, mineral resources, and energy resources. The commitment of resources for the Proposed Action and other alternatives is shown in Table 5.18-1. The Treatment and Storage Alternative and the Proposed Action would use the largest amounts of energy resources, respectively. Required land and mineral resources during the life of the project would be the same for the Proposed Action; the Non-Thermal Treatment; and the Treatment and Storage Alternatives.

Table 5.18-1. Commitment of resources by alternative.

Resource	Proposed Action with microencapsulation of ash	Proposed Action with vitrification of ash	Non-Thermal Treatment	Treatment and Storage with micro-encapsulation of ash	Treatment and Storage with vitrification of ash
Land [a,b]	7 acres	7 acres	7 acres	7 acres	7 acres
Energy	--	--	--	--	--

Electricity	33,000 MWh/yr	35,000 MWh/yr	24,850 MWh/yr	33,000 MWh/yr	35,000 MWh/yr
Diesel fuel	16,000 gal/yr	16,000 gal/yr	16,000 gal/yr	16,000 gal/yr	16,000 gal/yr
Propane	1,100,000 gal/yr	925,000 gal/yr	360,000 gal/yr	1,100,000 gal/yr	925,000 gal/yr
Minerals[a]	16,000 cubic yards	16,000 cubic yards	16,000 cubic yards	16,000 cubic yards	16,000 cubic yards

a. Committed during the life of the project only.

b. Though this land would not be open to the public or multiple use, it is currently committed to waste management operations.

5.19 Mitigation

An overview of planned mitigation measures for the proposed activities outlined in this EIS is presented in the following discussion. These measures address impacts that remain after application of design features and operating practices required by permits.

5.19.1 Cultural Resources

The Idaho SHPO has determined that there is little potential for undisturbed archeological materials occurring inside of the current RWMC perimeter fence because of the highly disturbed nature of the facility. Archaeological clearance has been recommended by the SHPO for ongoing and future ground disturbances, with no further archeological survey activities inside of the complex required. Mitigation beyond the clearance resulting from a thorough regulatory review will be achieved through strong "Stop Work" stipulations which have been implemented at the INEEL in the event that cultural resources or human remains are discovered during any project implementation.

5.19.2 Aesthetic and Scenic Resources

Short-term visibility impacts from fugitive dust during construction activities would be minimized using standard dust control measures such as watering. Project-related operational emissions would be controlled using air pollutant control equipment incorporating HEPA filters and Maximum Achievable Control Technology (MACT) in conjunction with administrative controls (see Section 5.19.4). Additional mitigation is not anticipated to be necessary.

5.19.3 Geology

Potential soil erosion in the areas of ground disturbance would be mitigated through minimizing areas of surface disturbance and by utilizing construction engineering measures such as runoff control and soil stockpiling in accordance with permit requirements. Additional mitigation is not anticipated to be necessary.

5.19.4 Air Resources

Specific features have been incorporated into the proposed AMWTP design, which, together with operational controls and practices required by permits, would minimize environmental impacts of releases of air contaminants. Many operating and design features are required by regulations related to hazardous waste treatment, storage and disposal facilities, and State and Federal rules for the control of air pollution. Other mitigation features are specifically required by regulation and are necessary elements of the ALARA program to ensure protection of the public, workers, and the environment.

The maximum projected AMWTP stack concentration estimated for mercury (83 mg/m^3) is higher than the MACT standard (40 mg/m^3). The mercury emission rate used for analysis in predicting air quality impacts was based on the conservative assumption that the AMWTP waste feed contains 1 percent mercury. Waste characterization (Section 3.1.2.2) will occur as retrieved waste is staged for treatment. The ability to detect mercury in the waste and to segregate waste volumes so that mercury content in the treated waste is at or below one-half percent (equivalent to being able to meet the MACT standard) is easily demonstrated with available process-line survey instrumentation, which is capable of detection at the part-per-billion level. As a result, the certainty of being able to attain the MACT standard can be demonstrated at orders of magnitude below acceptable levels in the operating procedures which will be developed for waste characterization. Preliminary waste characterization indicates that the actual mercury content to be much less than 1 percent. Feed rate limits or other restrictions would be used to ensure that actual stack emissions comply with the MACT standard.

Modeled criteria pollutant emissions for the proposed AMWTP (see Sections 5.7.3 and 5.7.4) indicate that potential air quality impacts would be well within (in all scenarios less than 45 percent of) the PSD increment, the most conservative air quality criterion. Air quality mitigation beyond pending permit requirements for air pollution control equipment that meets MACT and associated administrative controls is not anticipated to be necessary. Specific mitigation would be inclined in the facility process design as waste characterization and process information become available.

5.19.5 Water Resources

The proposed AMWTP design, prepared in anticipation of the NPDES and Idaho Waste Water Treatment Regulations (see Section 5.8.3), results in no liquid effluent discharges to surface water. Additionally, no liquid effluents from waste treatment processes would be discharged to the subsurface; therefore, no groundwater impacts would be expected for any proposed AMWTP alternative. A requirement for additional mitigation of impacts is not anticipated.

5.19.6 Ecological Resources

Unavoidable impacts to biota would include disturbance of a small amount of habitat and mortality or displacement of some animals (primarily small mammals, reptiles, and birds). Measures implemented to minimize impacts include limiting ground disturbance and conducting pre-activity surveys of construction areas to determine if candidate or sensitive species or important habitat are present in the area. Potential radionuclide exposure to plant and animal species would be monitored by the INEEL environmental surveillance program.

5.19.7 Transportation

Because the proposed AMWTP will be located within the RWMC of the INEEL, there would be no onsite transportation of radioactive waste outside the RWMC. The transportation impacts associated with the shipment of treated TRU waste from INEEL to WIPP were evaluated in the SEIS-II. The results indicated less than one cancer fatality to worker and the general population. Similarly, transportation impacts associated with possible shipment of LLMW from offsite DOE locations to the INEEL have been assessed in both the DOE INEL EIS and in the WM PEIS (DOE 1997c). Potential cancer fatalities were also very small (<1). These EISs are incorporated by reference and have been included in the cumulative impacts analyses presented in Section 5.15.

Transport requirements identified for each of the proposed AMWTP alternatives are well within the design capacity of the existing transportation system (see Section 5.11, Traffic and Transportation). A requirement for additional mitigation of impacts is not anticipated.

5.19.8 Occupational and Public Health and Safety

Hazards that exceed health and safety limits specified in permits and operating procedures would be mitigated by shutting down the affected facility operation.

5.19.9 Idaho National Engineering and Environmental Laboratory Services

The proposed AMWTP requirements for utility and infrastructure are well within the existing capabilities of INEEL. A requirement for additional mitigation of impacts is not anticipated.

5.19.10 Accidents

INEEL facilities employ emergency response programs to mitigate impacts of accidents to workers and the public in accordance with the 5500 series of DOE Orders.

For the offsite population, the need for any protective action would be based on the predicted radiation doses, with the emergency response based on the guidance provided in the protective action guides developed by the EPA.

Building on regulatory requirements and associated design features, interdiction activities by INEEL accident recovery personnel are expected to take place following an accident to mitigate doses to offsite individuals at risk. This interdiction would limit ingestion exposure so that the MEIs would derive much less than the assumed 10 percent of their diet from locally grown crops and livestock.

5.20 Environmental Justice

Pursuant to Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations* (FR 1994), this section identifies and addresses any disproportionately high and adverse human health or environmental effects on minority or low-income populations from activities described in previous sections of this EIS. This approach is consistent with the guidance prepared by the CEQ regarding the consideration of environmental justice concerns, and DOE's draft guidance.

5.20.1 Methodology

Potential environmental justice impacts are assessed using a phased approach. This approach established three thresholds for assessing whether environmental justice issues are likely to arise as a result of proposed DOE activities. As described in DOE's draft guidance on incorporating environmental justice into the NEPA process, the following three questions form the framework and establish the thresholds for the phased approach to environmental justice analysis:

- Are there any potential impacts to human populations?
- Are there any potential impacts to minority populations or low-income populations?
- Are potential impacts to minority populations or low-income populations disproportionately high and adverse?

Environmental justice guidance developed by the CEQ defines "minority" as individual(s) who are members of the following population groups: American Indian or Alaskan Native, Asian or Pacific Islander, Black, or Hispanic (CEQ 1997). Minority populations are identified when either the minority population of the affected area exceeds 50 percent or the percentage of minority population in the affected area is meaningfully greater than the minority population percentage in the general population or other appropriate unit of geographical analysis. Low-income populations are identified using statistical poverty thresholds from the Bureau of Census' Current Population Reports, Series P-60 on Income and Poverty.

Environmental justice impacts become issues of concern if the proposed activities result in disproportionately high adverse human and environmental effects to minority or low-income populations. Disproportionately high and adverse human health effects are identified by assessing these three factors to the extent practicable:

- Whether the health effects, which may be measured in risks or rates, are significant (as employed by NEPA) or above generally accepted norms. Adverse health effects may include bodily impairment, infirmity, illness, or death.
- Whether the risk or rate of exposure by a minority population or low-income population to an environmental hazard is significant (as employed by NEPA) and appreciably exceeds or is likely to appreciably exceed the risk or rate to the general population or other appropriate comparison group.
- Whether health effects occur in a minority population or low-income population affected by cumulative or multiple adverse exposures from environmental hazards.

Previous sections in Chapter 4 of this EIS describe employment and income, population, housing, and community services surrounding the site. Income distribution is presented in this section. Impacts to the ROI from implementation of proposed alternatives are analyzed in Chapter 5. Selected ROI demographic characteristics for racial/ethnic minority groups and low-income populations are presented in Table 5.20-1.

Any disproportionately high and adverse human health or environmental effects on minority populations or low-income populations that could result from the Proposed Actions being considered are assessed for a 50-mile area surrounding the site. The shaded areas in Figure 5.20-1 show 1990 census tracts where racial or ethnic minorities comprise 25 percent or more of the total population in the census tract. Figure 5.20-2 shows low-income communities generally defined as those where 25 percent or more of the population is characterized as living in poverty (annual income of less than $8,076 for a family of two). The 25 percent population threshold is shown because of the low minority population percentage in the general population.

5.20.2 Potential Impacts on Minority and Low-Income Populations from the Consumption of Fish and Wildlife

Section 4-4 of the Executive Order (FR 1994) directs Federal agencies "whenever practical and appropriate, to collect and analyze information on the consumption patterns of populations who principally rely on fish and/or wildlife for subsistence and that federal governments communicate to the public the risks of these consumption patterns."

As noted in the DOE INEL EIS, fishing and hunting are usually not allowed on the INEEL. Depredation hunts negotiated between the Idaho Department of Fish and Game and DOE do allow hunter access to 0.5 mile inside the northern boundary of the INEEL. In addition to the limited hunting on the INEEL, several game species and birds live on and migrate through the INEEL. Game species residing on the INEEL, sheep that have grazed on the INEEL, locally grown foodstuffs, milk, and native plants around the INEEL are routinely sampled for radionuclides (ESRF 1996). Concentrations of radionuclides in the samples have been small and are seldom elevated above concentrations observed at locations distant from the INEEL where the principal likely source of nonnatural radionuclides is very small amounts of residual atmospheric fallout from past nuclear weapons tests. Data from programs monitoring these sources of food are reported annually in the *INEEL Site Environmental Report* (ESRF 1996). No human populations within the immediate vicinity of the INEEL are known to subsist entirely on locally harvested fish, wildlife, and native plants, so no disproportionately high human health effects would arise in minority populations or low-income populations from subsistence on locally harvested game animals.

5.20.3 Impacts from Advanced Mixed Waste Treatment Project Alternatives

As seen in Figures 5.20-1 and 5.20-2, minority and low-income populations do reside within 50 miles of the INEEL. With the exception of some census districts to the southeast of the site, these populations comprise a relatively small proportion of the total population. As seen in the figures, only Bannock and Power Counties have census tracts in which low-income residents comprise greater than 25 percent of the population and minority residents comprise greater than 25 percent of the population.

Table 5.20-1. Selected demographic characteristics for the INEEL region of influence.

	Bannock County	Bingham County	Bonneville County	Butte County	Clark County	Jefferson County	Madison County	Total region of influence	
Persons by race/ethnicity	(number)	(number)	(number)	(number)	(number)	(number)	(number)	(number)	(percent)
White	61,742	32,439	69,246	2,829	688	15,627	22,741	205,312	93.4
Black	431	39	297	0	0	7	43	817	0.4
American Indian	1,678	2,615	391	22	5	122	108	4,941	2.3
Asian/Pacific Islander	712	273	687	50	0	40	296	2,013	0.9
Other	1,463	2,217	1,586	62	69	747	486	6,630	3.0
Hispanic (of any race)	2,740	3,614	3,010	101	79	1,155	753	11,452	5.2

Total 1990 population[a]	66,026	37,583	72,207	2,918	762	16,543	23,674	219,713	--
Low-income persons below poverty (1989)									
Number	8,944	5,804	7,056	392	71	2,353	6,386	31,006	--
Percent[b]	13.8	15.6	9.9	13.5	9.3	14.3	28.6	--	14.4

Sources: Census 1993, 1994.

a. Persons of Hispanic ethnicity may be of any race and are included in other racial categories; thus, total 1990 population is not a sum of race/ethnicity categories.

b. In calculating percentages, certain categories of individuals are not included as part of the county population, including inmates of institutions, armed forces members, and unrelated individuals under 15 years of age.

Figure 5.20-1. Minority population distribution for INEEL and surrounding counties.

Figure 5.20-2. Low-income distribution by poverty status for INEEL and surrounding counties.

For environmental justice impacts to occur, there must be high and adverse human health or environmental impacts that disproportionately affect minority populations or low-income populations. Environmental monitoring that occurs on the Fort Hall Indian Reservation and to the northwest of Blackfoot (between the INEEL and the minority and low-income populations) show no disproportionately high and adverse impacts, from ongoing INEEL activities. The public health and safety analyses show that air emissions and hazardous chemical and radiological releases from normal operations for all alternatives would be within regulatory limits and that no latent cancer fatalities would result. The public health and safety analyses also indicate that radiological releases from accidents would not result in significant adverse human health or environmental impacts. Therefore, such accidents would not have disproportionately high and adverse impacts on minority and low-income populations.

The analyses also indicate that socioeconomic changes resulting from implementing any of the proposed alternatives would not lead to environmental justice impacts. Under the No Action Alternative, employment and expenditures would remain unchanged from the baseline. Under the other three alternatives, modest economic benefits would arise from the additional jobs created during construction and operation of the new facility. Secondary effects would include small increases in business activity and would likely increase revenues to local governments. Each of these impacts would be positive and would not disproportionately affect any single group.

5.21 Long-Term Storage Impacts

The analyses of the long-term storage of TRU waste at generator sites, including the INEEL, were included in SEIS-II under the No Action Alternative 2, and No Action Alternatives 1A and 1B. The following discussion of long-term environmental and human health effects has been tiered from Section 5.6.12, Appendix I, and Section 5.5.12 of the SEIS-II.

5.21.1 Basis for Long-Term Impact Analyses

Under the SEIS-II No Action Alternative 2, TRU waste is generated at all sites, including small-quantity sites, over the next 35 years. During this period, waste generated at the small-quantity sites would be consolidated and treated at the 10 major treatment sites. Because 99 percent of the estimated TRU waste volume and inventory that would be generated can be accounted for at seven of the 10 major treatment sites, environmental and human health impacts were estimated at these seven sites only: Hanford, INEEL, Lawrence Livermore National Laboratory, Los Alamos National Laboratory, Oak Ridge National Laboratory, Rocky Flats Environmental Technology Site, and the Savannah River Site. Both consolidated and generated TRU waste will be put into retrievable storage consistent with current practices. Current storage configurations include soil-covered asphalt or concrete pads, shallow trenches, earthen berms, covered enclosures, storage buildings for CH TRU waste, and buried caissons for RH TRU waste. TRU waste would remain in these assumed storage configurations for an institutional control period of 100 years, beginning in 2033. During this period of institutional control, effective monitoring, surveillance, and maintenance would be expected to minimize the risk of contaminant release from the storage configurations.

At the end of the 100 years, following a TRU waste-generation period (i.e., 2133), institutional control is assumed to be lost. As facilities begin to degrade, TRU waste would be introduced into the accessible environment.

Calculations of the long-term consequences resulting from environmental releases from the storage facilities were performed for a 10,000-year period after the loss of institutional control. Environmental and human health impacts as a result of storage-facility releases were not evaluated for the period of institutional control.

5.21.2 Impact Assessment for Intrusion into Waste

The following provides a summary of long-term impacts from stored TRU waste at the INEEL for 10,000 years following the loss of institutional control. The analysis of human health impacts estimated the impacts of TRU waste as a source of direct exposure and as a contaminant source for release to surface and subsurface exposure points in the environment. Scenarios analyzed included exposure to waterborne and airborne releases of contaminants from waste stored in shallow earth-covered trenches or covered by earthen berms and to waste stored in exposed surface pads or in surface enclosures and buildings.

Exposure scenarios evaluated included acute exposures to intruders and chronic exposures to settlers. These exposures were assumed to occur at the site of the original waste storage location, with little dispersion of contamination prior to exposure. Exposure scenarios evaluated for buried waste included an acute exposure of a driller intruder and the chronic exposure of a gardener who was assumed to subsequently settle at the drilling site. Exposure scenarios evaluated for surface-stored waste included the acute exposure of a scavenger intruder and the chronic exposure of a farm family settling on the site of the former waste storage area.

Impacts were also evaluated for the long-term environmental release of stored waste over 10,000 years. Evaluated were scenarios for chronic exposure of a MEI and the population living within 80 kilometers (50 miles) of the former waste storage sites. This individual and population could be exposed from releases from both buried and surface-stored waste. The MEI was assumed to be located 300 meters (980 feet) away from the waste storage site, in the direction of groundwater flow. The distribution of the offsite populations were assumed to be characteristic of current populations around the sites.

Descriptions of these exposure scenarios for intruders and settlers and long-term environmental releases are provided in Appendix I of the SEIS-II.

5.21.3 Impacts of Exposure Scenarios

With the loss of institutional control, individuals could come into direct contact or be inadvertently exposed to waste that had been stored in shallow burial or surface storage facilities. The following describes the impacts at the INEEL that could result from exposure to radionuclides and hazardous chemicals in CH TRU and RH TRU waste for exposure scenarios, where individuals were assumed to be exposed at the original storage locations. Individuals were assumed to be exposed immediately after the loss of institutional control, minimizing reduction of impact through radioactive decay.

5.21.4 Impacts from Exposure to Buried Waste

The driller scenario is one where an individual was assumed to drill a well at the site of the waste storage locations and be exposed over a 5-day work week to waste material brought to the land surface by the drilling process.

Radiological impacts to a hypothetical driller exposed acutely for 5 days (1 work week) from CH TRU waste at the INEEL would have a $5x10^{-6}$ probability of a latent cancer fatality. Impacts to the driller from RH TRU waste would be $5x10^{-6}$ probability of a latent cancer fatality. These results are presented in Table 5.21-1. The impacts of CH and RH are similar because, in this acute exposure scenario, the driller would receive a similar exposure to materials in the drilling mud arising from each waste type. Health impacts from hazardous chemicals would be significant. The RH TRU waste concentration for lead could be up to 3,000 times the PEL.

The gardener scenario is one in which an individual was assumed to prepare a garden at the drilling site and grow produce in soil containing waste material brought to the surface by the drilling. This individual was assumed to ingest produce grown in the contaminated soil for a period of 30 years and exposed while working in the garden.

Radiological impacts to a hypothetical gardener would have a 0.01 probability of a latent cancer fatality at INEEL from buried CH TRU waste. Impacts to the gardener would be $9x10^{-3}$ probability of a latent cancer fatality at INEEL from buried RH TRU waste. The hazard index for mercury and lead are 77 and 3,900, respectively, for the gardener for RH TRU waste. The impacts of CH and RH are not similar because, for each waste form in this chronic exposure scenario, the gardener is exposed over a 30-year period to isotopes which have differing food uptake coefficients and half-lives, therefore receiving different exposures from each waste type. The lead hazard index is 36 forCH TRU waste.

5.21.5 Impacts from Exposure to Surface-Stored Waste

The scavenger scenario is one where an individual was assumed to come into direct contact with the TRU waste on the surface for a 24-hour period. This intruder was assumed to be exposed by inhalation of resuspended contamination, external radiation, and inadvertent ingestion of contaminated soil while at the site.

Radiological impacts to a hypothetical scavenger from CH TRU waste at INEEL would have a $2x10^{-3}$ probability of a latent cancer fatality. Impacts to the scavenger would be $2x10^{-3}$ probability of a latent cancer fatality at INEEL from buried RH TRU waste (see Table 5.21-1). Significant impacts would be seen from heavy metals. The concentration of heavy metals ranges from 5 times to 1,400 times the PEL for CH TRU waste and up to 160,000 times the PEL for RH TRU waste.

Table 5.21-1. Radiological impacts to inadvertent intruders following loss of institutional control at INEEL.

	Probability of a Latent Cancer Fatality
CH TRU waste impacts	

Buried waste	
Driller (acute)	5E-6
Gardener (chronic)	0.01
Surface waste	
Scavenger (acute)	2E-03
Family farm (chronic)	0.8
RH TRU waste impacts	
Buried waste	
Driller (acute)	5E-6
Gardener (chronic)	9E-3
Surface waste	
Scavenger (acute)	2E-03
Family farm (chronic)	1

The farmer scenario is one in which a hypothetical farmer lives and farms on a plot of land at the location of the surface-stored waste. The waste was assumed to have degraded to a point where it was indistinguishable from the surrounding land soil. The maximally exposed farmer was assumed to be exposed by ingestion of contaminated food crops grown in the contaminated soil, inhalation of resuspended contamination, external radiation, and inadvertent ingestion of contaminated soil. Under this scenario, the members of the family would receive very high radiation doses in the first year of farming. The probability of a latent cancer fatality at INEEL would be 0.8 for CH TRU waste. The probability of a latent cancer fatality at INEEL for RH TRU waste would be 1 (see Table 5.21-1). Noncarcinogenic effects such as radiation pneumenitis in the lungs could also occur. Health impacts from hazardous chemicals would be significant as well. The hazard index ranges from 10 to 100,000 for CH TRU waste and up to 5,200,000 for RH TRU waste.

5.21.6 Impacts of Long-Term Environmental Release

For TRU waste stored in shallow burial trenches and surface storage facilities at INEEL contaminants would eventually be released to the surrounding environments after loss of institutional control. Contaminants within the buried or surface-stored waste would be leached and released to underlying soils and aquifer systems in depth. The contaminants would eventually reach groundwater and migrate laterally to a downgradient receptor location. Contaminants might also eventually be discharged into nearby surface water bodies. Once in these surface-water systems, the public would be exposed to dilute concentrations of the contaminants in public water supplies.

Waste stored in surface facilities would also degrade and disperse contaminants in the environment by the processes of direct waste and air erosion, deposition onto soils surrounding the site, and resuspension of contaminated soils in air. The surrounding populations would be exposed to these contaminants as they were redistributed into the environment by these cyclic and ongoing processes.

Radiological and chemical impacts were evaluated for MEIs and the populations surrounding INEEL. Impacts to the MEI were evaluated for a groundwater exposure scenario and an air pathway exposure scenario. Under the groundwater exposure scenario, the MEI was assumed to be a member of a farm family living 300 meters downgradient of the waste storage areas at the INEEL. It was assumed that the family would engage in farming activities such as growing and consuming its own crops and livestock and would use contaminated groundwater as a source of drinking water and for watering the crops and animals. Under the air pathway exposure scenario the MEI was assumed to live at the point of maximum airborne contaminant concentration. This individual could be exposed via inhalation of resuspended contamination, ingestion of contaminated food crops grown in the contaminated soil, external exposure to the soil, and inadvertent ingestion of contaminated soil.

Impacts to offsite populations were also evaluated from long-term environmental releases to surface water and to air. For analyses of buried waste releases, all CH TRU and RH TRU waste was combined into a single waste disposal unit, and only the groundwater pathway was considered. For analyses of surface-stored waste releases, all CH TRU and RH TRU waste was combined into a single waste storage unit and was allowed to be released to all pathways.

Impacts to the MEIs for the maximum 70-year lifetime over 10,000 years of environmental release of contaminants are presented in Table 5.21-2 for the INEEL. Radiological impacts to the MEI would be $4x10^{-3}$ probability of a latent cancer fatality at INEEL. Carcinogenic hazardous chemical impacts to the MEI would have a $5x10^{-3}$ probability of cancer incidence at INEEL due to ingestion of groundwater containing 1,1,2,2-tetrachloroethane. Noncarcinogenic hazardous chemical impacts at the INEEL were estimated using an HI of 0.3 from carbon tetrachloride due to groundwater ingestion. No noncarcinogenic health effects would occur for a HI less than 1.

Table 5.21-2. Maximum lifetime MEI and population impacts at INEEL under No Action Alternative 2.

	Radiological Impacts			Chemical Carcinogenic Impacts	
Major sites	Lifetime latent cancer fatalities[a]	Dominant pathway		Lifetime cancer incidence	Dominant pathway
MEI impacts					
INEEL	4E-03	Groundwater ingestion		5E-03	Groundwater ingestion
Population impacts					
INEEL	0.07	Inhalation		3E-06	Resuspended soil ingestion

a. Probability of a latent cancer fatality for the MEIs; number of latent cancer fatalities for the populations.

Impacts to populations for the maximum 70-year lifetime over 10,000 years of environmental release of contaminants are also presented in Table 5.21-2 for the INEEL. Exposures from the air and groundwater to surface water pathways were included.

Radiological impacts to populations at the INEEL would be 0.07 latent cancer fatalities. Carcinogenic hazardous chemical impacts would be $3x10^{-6}$ cancers at INEEL.

The aggregate number of latent cancer fatalities that could occur in offsite populations around the INEEL over 10,000 years (approximately 142 70-year lifetimes) from release of the No Action Alternative 2 Basic Inventory was estimated. The aggregate number of latent cancer fatalities for INEEL was estimated to be 3.8 latent cancer fatalities. In addition to the impact from release of the No Action Alternative 2 Basic Inventory, the number of aggregate latent cancer fatalities at the INEEL was estimated for the Additional Inventory of Action Alternative 1 which would also remain in place at the sites under the No Action Alternative 2. An additional 7.7 aggregate latent cancer fatalities were estimated to occur at INEEL from release of the Additional Inventory. Release of the combined inventories would result in about 11.4 latent cancer fatalities at the INEEL. The aggregate hazardous chemical impact at INEEL over

10,000 years was estimated to be about $5.4x10^{-3}$ cancers. These impacts were estimated based on current population distributions. These distributions may change substantially, creating the potential for significant increases over these estimates of aggregate latent cancer fatalities.

5.21.7 Impacts of Long-Term Environmental Release After Thermal Treatment

The SEIS-II analyzed the long-term impacts associated with treatment and storage of TRU waste at the treatment site similar to that described for the AMWTP Treatment and Storage Alternative presented in this EIS.

Under the SEIS-II, No Action Alternatives 1A and 1B, TRU waste would continue to be generated and put into monitored, retrievable storage. There would be no shipment of waste to WIPP. DOE would indefinitely maintain institutional control and provide long-term monitoring and maintenance of storage facilities. As a consequence, adverse health effects for the general public while DOE maintained control would be minimal, and the principal adverse effects, which also would be small, would be related to occupational activity at the facility. Health effects would continue at such levels for the indefinite future.

The loss of institutional control is a possibility for any long-term storage alternative. Therefore, an analysis of the potential impacts from long-term environmental release under No Action Alternative 1A and 1B was conducted. (INEEL was a site included in both alternatives 1A and 1B). The analysis was similar to that presented for the No Action Alternative 2; however, the waste form generated by the thermal treatment process would substantially reduce those potential impacts. Radionuclides and heavy metals would be incorporated into a more dense and durable waste form that would limit the release of waste into the accessible environment. VOCs would be removed in the treatment process and would not be present in emplaced waste. Once waste containers degrade, direct release from a thermally-treated waste form (e.g., metal slag or glass) would depend on the rate of corrosion and dissolution of metal or glass and natural forces responsible for erosion rather than leaching.

No radiological or hazardous chemical impacts to individuals or populations would be expected over 10,000 years. The number of aggregate latent cancer fatalities for Hanford, INEEL, Los Alamos National Laboratory, Savannah River Site, Rocky Flats Environmental Technology Site, and Oak Ridge National Laboratory over 10,000 years was estimated to be less than $8x10^{-4}$ latent cancer fatalities for No Action Alternative 1A; and $3x10^{-4}$ latent cancer fatalities for Hanford, INEEL, Savannah River Site, and Oak Ridge National Laboratory under the No Action Alternative 1B for the Total Inventory.

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7. STATUTES, REGULATIONS, CONSULTATIONS, AND OTHER REQUIREMENTS

7.1 Statutes and Regulations

This section identifies and summarizes the major laws, regulations and requirements that may apply to the different alternatives analyzed in this Advanced Mixed Waste Treatment Project (AMWTP) Environmental Impact Statement (EIS). Section 7.1.1 first lists those laws, regulations and requirements previously analyzed in the *Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs Final Environmental Impact Statement* (DOE INEL EIS)*;* this section then describes how those requirements may apply to this project specifically. In addition to laws, regulations, and requirements discussed below, there may be additional project-specific contractual requirements in any contract entered into between the U.S. Department of Energy (DOE) and BNFL Inc. if one of the "action" alternatives is selected. The rules and regulations that govern the transportation of all goods and commodities on our nation's highways, and more specifically in Idaho, can be found in 49 CFR § 100-199 and the Western Governor's Association WIPP Program Implementation Guide.

7.1.1 Federal and State Environmental Statutes and Regulations

National Environmental Policy Act of 1969 (NEPA), as amended (42 U.S.C.§4321 et seq.), the Council on Environmental Quality Implementing Regulations (40 C.F.R. § 1500 et seq.) and DOE Implementing Regulations (10 C.F.R. §1021 et seq.) This EIS is being prepared to comply with NEPA - the Federal law that requires agencies of the Federal government to study the possible environmental impacts of major Federal action significantly affecting the quality of the human environment. Although the proposed project is envisioned as one that would be executed primarily by a private entity, this EIS assesses potential impacts before DOE decides whether to proceed with the project. The unique process described in §1021.216 allows DOE to compare potential environmental impacts between approaches suggested by competing offerors when in the process of a private sector procurement. DOE compares these impacts in the Environmental Critique. Those environmental considerations that are detailed in the Critique are made available to the Source Evaluation Board considering the procurement and become a part of the technical criteria against which the competing offerors are evaluated during the procurement process.

As a result of this competition and the comparison of potential environmental impacts associated with the competing proposals the Source Evaluation Board chose BNFL Inc. as the winning contractor for Phase I of the project.

This EIS considers whether BNFL Inc. should be allowed to continue with the remainder of the project as it was proposed to DOE or whether one of the various alternative courses of action is the better decision for DOE. As required by NEPA, the potential environmental impacts of each alternative are analyzed and being considered in this EIS.

Atomic Energy Act of 1954 (AEA), as amended (42 U.S.C. §2011 et seq.) The AEA is that statute that requires DOE to establish standards to protect health and safety with respect to atomic materials. Ordinarily, this is accomplished through DOE Orders, standards, and procedures to ensure the safe operation of its facilities. In the project under consideration in this EIS, because the proposed AMWTP would not be considered a DOE facility, but instead would be a privately owned and operated facility, DOE orders, standards, and procedures are not necessarily applicable. Nonetheless, DOE remains ultimately responsible for its atomic or nuclear materials. Thus, the environmental, safety, and health standards that would apply to this proposed project are those established in the contract between DOE and BNFL Inc., particularly those set out in the Environmental Safety and Health Program Operating Plan that would result from negotiations between BNFL Inc. and DOE.

Clean Air Act (CAA), as amended (42 U.S.C. §7401 et seq.) This Federal statute and its regulations are important to this proposed project and its alternatives. In addition, the Idaho statute and regulations promulgated under the CAA authority are also important. The heart of the CAA is the National Ambient Air Quality Standards

(NAAQS). These are national standards set by the U.S. Environmental Protection Agency (EPA) for certain pervasive pollutants; the standards are set at a level designed to protect human health with a conservative margin of safety. States have the primary responsibility of assuring that the air quality within state borders is maintained at a level that meets the NAAQS. This is achieved by states through the establishment of source-specific state requirements that are described in State Implementation Plans. Also under the Federal law is the requirement that new sources of air pollutants meet established New Source Performance Standards (NSPS) set by EPA. These NSPS can be described as design standards, equipment standards, work practices, or operational standards, in addition to the other approach of numerical emission limitations.

Because of the significance of this body of law, these different concepts will be examined in the discussion in Section 7.2 according to each alternative being considered.

Resource Conservation and Recovery Act (RCRA), as amended (42 U.S.C. §6901 et seq.), and the ***Idaho Hazardous Waste Act***, I.C. 39-4400 et seq. This body of law regulates the treatment, storage, and disposal of hazardous wastes. Regulation under these laws is by permit, meaning that the State of Idaho and EPA study the alternative chosen by DOE and then establish a permit specific to the project that describes how the project is to be carried out. Whether DOE chooses the No Action Alternative or any other alternative under consideration in this EIS, some type of RCRA permit will be required. As with the CAA discussion above, the discussion in Section 7.2 considers each alternative and the likely RCRA permitting scheme that would exist for each alternative.

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended (42 U.S.C. §9601 et seq.). This body of law does not play a predominant role in the proposed project; however it may factor in to all of the alternatives, primarily after any activity is completed because the geographic area selected for the proposed AMWTP is within an area already determined to be a "CERCLA site". Thus, ultimate cleanup of the area must be according to any applicable CERCLA requirements. In addition, when shipping wastes generated under a CERCLA decision document from off-site, DOE will comply with CERCLA regulations. Therefore, some discussion of this statute is warranted.

The choice of geographic location of the proposed AMWTP on the Idaho National Engineering and Environmental Laboratory (INEEL) has been approved by the State of Idaho during the preliminary process of obtaining a Siting License as required by the *Idaho Hazardous Waste Facility Siting Act*, I.C. 39-5801 et seq. The license for siting the proposed project within the Radioactive Waste Management Complex boundaries was granted by the State of Idaho in 1997.

For purposes of this EIS and the consideration of possible environmental impacts, DOE has assumed that the AMWTP facility will be subject to RCRA closure activities that are described in the draft RCRA Closure Plan submitted to the State of Idaho in September 1998 for approval. A copy of that draft RCRA Closure Plan is included in the Administrative Record for this EIS. It is important to realize that RCRA closure activities focus upon the hazardous constituents in the mixed waste, rather the radioactive compounds of the contaminants. Traditionally, DOE has referred to the cleanup of facilities contaminated with radioactive materials as "decontamination and decommissioning" (D&D). In the present proposed project, if closure is conducted according to the draft RCRA Closure Plan, much of the radioactive contamination will be removed as well as the hazardous constituents. Any remaining D&D activities would either be carried out according to RCRA requirements, or CERCLA requirements, as applicable, depending upon future negotiations with the State of Idaho and EPA.

Emergency Planning and Community Right-to-Know Act of 1986 (EPCRA) (42 U.S.C. §11001 et seq.) This statute requires that inventories of specific chemicals used or stored in either the storage facility or the proposed AMWTP would be communicated to the State of Idaho for purposes of emergency response planning. If DOE chooses the No Action Alternative, the responsibility for this reporting activity will lie with the management and operating (M&O) contractor for the INEEL. Alternatively, if DOE chooses one of the "action" alternatives, BNFL Inc. will have the responsibility of reporting to the State and preparing emergency response plans.

Toxic Substances Control Act (TSCA)(15 U.S.C. §2601 et seq.) This statute plays a role in this proposed project because some of the waste materials contain small amounts of polychlorinated biphenyl (PCB), which are regulated by TSCA. Depending upon the alternative chosen, these substances will be either incinerated or else repackaged. Under either circumstance, compliance with TSCA will require a permit from EPA. An application for a TSCA permit was submitted by BNFL Inc. to the State of Idaho and EPA jointly on December 5, 1997.

Occupational Safety and Health Act of 1970, as amended (29 U.S.C. §651 et seq.) If DOE chooses any of the "action" alternatives, compliance with the *Occupational Safety and Health Act* will be the responsibility of BNFL Inc. according to *Occupational Safety and Health Act* standards. If DOE chooses the No Action Alternative, protection of the workforce will remain with the M&O contractor and DOE. The occupational safety requirements of the U.S. Department of Labor's Occupational Safety and Health Administration (OSHA) are not directly applicable to DOE's government-owned contractor-operated facilities by virtue of Section 4(b)(i) of the *Occupational Safety and Health Act* of 1970. However DOE requires a written worker protection program that integrates all requirements contained in DOE 440.1;29 CFR Part 1960, "Basic Program Elements for Federal Employee Occupational Safety and Health Programs and Related Matters;" and other related site specific worker protection activities.

7.1.2 Other Pertinent Laws or Requirements

Site Treatment Plan Consent Order. This is a mandatory Order that was negotiated between DOE and the State, pursuant to the *Federal Facility Compliance Act*, an amendment to RCRA that requires federal facilities to identify all of their hazardous wastes and to develop, and follow up on, plans to treat these wastes. The wastes under analysis in this EIS have been identified and described in the *INEEL Site Treatment Plan*; treatment of these wastes has been made a requirement in the ensuing Settlement Agreement/Consent Order. If DOE selects the No Action Alternative, it will have to request relief from the Settlement Agreement/Consent Order and, if granted, will have to renegotiate the *INEEL Site Treatment Plan* to somehow exempt these specific wastes from treatment.

Idaho Settlement Agreement/Consent Order. This is a Federal court order that incorporates all of the terms and conditions agreed to among DOE, the State of Idaho, and the Department of the Navy (see Appendix C for details). One of the terms and conditions in that Settlement Agreement/Consent Order is that: "DOE shall ship all transuranic waste now located at the INEL (Idaho National Environmental Laboratory), currently estimated at 65,000 cubic meters in volume, to the Waste Isolation Pilot Plant (WIPP) or other such facility designated by DOE, by a target date of December 31, 2015 and in no event later than December 31, 2018." See paragraph "B" of the Settlement Agreement/Consent Order. The Settlement Agreement/Consent Order also states that "DOE shall, as soon as practicable, commence the procurement of a treatment facility for the treatment of mixed waste, transuranic waste and alpha-emitting mixed low level waste." See paragraph "E.2" of the Settlement Agreement/Consent Order. If DOE were to select the No Action Alternative, it would have to request relief from this Settlement Agreement/Consent Order from the Federal court and would have to renegotiate a modified agreement with the State and the Navy, which would then have to be approved by the court.

Executive Order 12898: Environmental Justice. This Executive Order is applicable to DOE for any of the alternatives being considered; therefore, an analysis of the possible impacts to minority and low-income communities has been done in this tiered EIS (Section 5.20).

Executive Order 13007: Indian Sacred Sites. This Executive Order is applicable to DOE for any of the alternatives being considered; therefore, an analysis of the possible impacts to land use and cultural resources has been completed in this EIS (Sections 5.2 and 5.4).

7.2 Additional Comparisons Between Alternatives

If the No Action Alternative is selected by DOE, a RCRA Storage Facility permit would be required; this hypothetical permit would require that EPA and the State of Idaho grant DOE a special and unique exception to the laws because under RCRA it is illegal to store hazardous wastes indefinitely. Because the wastes contain small amounts of PCBs, a TSCA indefinite storage permit would also have to be obtained from EPA. Also problematic is the issue of when indefinite storage becomes "de facto disposal" under EPA CAA regulations at 40 C.F.R.§191. These regulations control permissible air emissions from radioactive waste, including TRU waste. If the present storage location was reviewed according to the standards set in 40 C.F.R. §191, it is highly unlikely that EPA would certify that facility as an adequate radioactive waste disposal facility.

If the Proposed Action is selected, BNFL Inc. will have to acquire a RCRA permit for a storage and treatment facility. The treatment aspect of the RCRA permit would be for the operation of an incinerator, with numerous other RCRA subunits. A RCRA incinerator permit application is one of the most carefully reviewed applications by both EPA and the State. In addition to a rigorous RCRA permitting process, if the Proposed Action is selected, a permit under the CAA will be required. It is anticipated that the CAA permit would also be quite rigorous — EPA regulations in effect will include a requirement that the facility meet the "Maximum Achievable Control Technology (MACT) rule." Currently in the status of a proposed rule, this rule by EPA is expected to become final very shortly and will require that new incinerators meet more rigorous emission standards than are currently in existence. The proposed MACT rule requires the use of MACT to minimize emissions from the incinerator.

If DOE selects the Non-Thermal Treatment Alternative, a RCRA permit for a storage and treatment facility will still be required, but the type of permit will be less rigorous than one for an incinerator. Likewise, although a permit under the CAA will be required, the proposed MACT rule would not be applicable, and therefore the permit would be less rigorous. A TSCA permit will also be required under this alternative. As with the Treatment and Storage Alternative, because some of the waste would be left at the INEEL indefinitely, an exceptional RCRA/TSCA storage permit would have to be obtained from the EPA and the State of Idaho.

Under the Treatment and Storage Alternative, the regulatory framework would be quite complex. A RCRA treatment facility permit would still be required, as would a TSCA permit and a CAA permit, but because the waste would be left at the INEEL indefinitely, an exceptional RCRA storage permit would have to be obtained from EPA and the State. A CAA permit would be required for the treatment facility. Also, as discussed previously in the No Action Alternative discussion, certification by EPA of the INEEL as a TRU waste disposal facility under 40 C.F.R. §191 would be extremely unlikely.

7.3 Consultation

NEPA requires that, during the preparation of this EIS, DOE consult with all Federal agencies with jurisdiction or special expertise in the topics being analyzed in the EIS. In addition, NEPA requires agencies to request comments from state and local agencies that are authorized to develop and enforce environmental standards. Early in this NEPA process, the County Commissioners from Butte County were notified of this proposed project and were consulted regarding any concerns they might have with the possibility of siting, constructing, and operating a hazardous waste facility within Butte County. This notification and discussion with the Butte County Commissioners was part of the public involvement process that was required of DOE when it was involved in applying to the State of Idaho for its Hazardous Waste Facility Siting License under the *Idaho Hazardous Waste Facility Siting Act*.

In addition, consultation was initiated early in the NEPA process between DOE and the Shoshone-Bannock Tribes. For more detail regarding these consultations, please refer to DOE-Idaho Operations Office (DOE-ID) correspondence with the Tribes in the Administrative Record for this EIS. The State of Idaho has also been involved in early consultations with DOE on this proposed project. First, the State of Idaho, through the office of the Governor, was actively involved in negotiating the Idaho Settlement Agreement with DOE in order to settle NEPA litigation. The Settlement Agreement negotiations and the resulting Agreement reflect great concern on behalf of the State that the waste that is the subject of this EIS leave Idaho as soon as possible. Second, the State of Idaho required an application for a Hazardous Waste Facility Siting License at the onset of procurement activities for this proposed project. In the course of making application to the State, DOE-ID submitted information regarding various possible locations for the proposed AMWTP, as well as technical information regarding the physical characteristics of the different proposed sites. The State process includes review of the application by State hazardous waste facility siting experts prior to approval of the particular site that was approved by the State.

Third, the State has been very actively involved in ongoing discussions and technical reviews of the RCRA and TSCA permit applications. This ongoing process has allowed for a significant amount of professional discussion and consultation regarding hazardous waste facility issues.

7.4 Advanced Mixed Waste Treatment Project Environment, Safety and Health Oversight

7.4.1 Overview

BNFL Inc. is responsible for achieving compliance with all applicable environment, safety and health (ES&H) laws and regulations, and regulatory agencies are responsible for monitoring the contractor efforts in implementing programs to achieve compliance. The State of Idaho and the EPA regulate BNFL Inc. according to permits under their purview. DOE regulates occupational safety and health and nuclear safety according to a specific ES&H authorization. Figure 7.4-1 depicts the regulatory bodies for this project, and the acts, programs, or authorizations that they administer.

7.4.2 Advanced Mixed Waste Treatment Project Environment, Safety and Health Authorization Process

Under the AEA, DOE-ID is the responsible agency with regulatory authority for INEEL operations for radioactive/nuclear materials and for onsite worker safety and health. DOE-ID exercises this responsibility through an AMWTP ES&H authorization process. This process is fully described in Appendix D of Section J of the AMWTP contract between DOE and BNFL Inc.

Basically, the authorization process consists of three steps.

1. BNFL Inc. identifies requirements, based on guidance in Section J, Appendix D of the contract, with assistance and input by DOE. DOE reviewed this document. The document is referred to as the Requirements Document.

2. BNFL Inc. develops an ES&H Program Operating Plan (ESHPOP). This plan is developed during Phase 1 by the contractor. It constitutes the authorization application for the project. It describes how the contractor intends to operate during the life of the contract to achieve a high level of ES&H performance in a cost-effective manner and in compliance with all applicable requirements as identified in the Requirements Document. The ESHPOP is available in the AMWTP EIS Administrative Record.

3. Once the ESHPOP is determined complete by DOE-ID, both the contractor and DOE-ID sign it, and a formal statement of completeness and authorization to commence operations per the contract (Authorization) will be issued by the Contracting Officer, assuming DOE has made a decision, under NEPA, to proceed with this project. The ESHPOP is incorporated into the BNFL Inc. contract by reference.

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Authorization Approval by DOE-ID

The ES&H Authorization consists of an authorization letter from DOE-ID establishing formal authorization conditions, including a co-signed and approved AMWTP ESHPOP. This represents the formal authorization to conduct operations and handle DOE radioactive materials. It presents the requirements from which DOE-ID will conduct oversight of ES&H for the contract.

Oversight of ES&H Activities

ES&H oversight will be conducted according to the conditions identified in the Authorization. Specific oversight and deficiency/violation response provisions will be identified in the Authorization. Failure of the contractor to maintain formal authorization conditions or properly respond to deficiencies identified by oversight may result in loss of the contractor's authorization to handle radioactive materials for DOE, and may be considered as a breach of the contract. The following specific conditions apply.

Environmental Activities: Environmental activities associated with the AMWTP will be controlled and monitored by the State of Idaho or EPA via normal permitting mechanisms between the regulator and the contractor. DOE-ID reserves the right to conduct unannounced visits to observe the operation of the contractor to meet RCRA waste owner responsibilities (e.g., ensuring RCRA waste is being handled and treated in accordance with regulations). Such visits are not expected to be more than twice yearly.

The air permit for the AMWTP and the use of DOE-ID's water rights are monitored by DOE-ID. Because DOE-ID has one air permit with the State of Idaho covering the whole INEEL, all facilities on the INEEL impact the air permit. Since the AMWTP will be located on the INEEL, its emissions could potentially impact all other facilities on the INEEL. Therefore, in the case of air emissions only, DOE-ID will require the following from the AMWTP contractor:

a. The AMWTP contractor must copy DOE-ID on all correspondence with, and reports to, the State of Idaho and EPA concerning the AMWTP air permit. Additionally, the contractor must respond to concerns that may arise due to DOE-ID review of supplied documentation.

b. The AMWTP contractor must allow DOE-ID to be an observer/participant in all negotiations with the State of Idaho and EPA concerning the AMWTP air permit. DOE-ID will be observing to ensure that the interest of the other INEEL facilities is not impacted by the AMWTP air permit, and DOE-ID participation will be limited to concerns on impact to the overall INEEL air permit.

c. DOE-ID will conduct an annual surveillance of the AMWTP activities associated with the AMWTP air permit in order to verify AMWTP activities are compliant with the permit, and therefore will not impact other INEEL facilities.

Worker Health and Safety: DOE is responsible for nonradiological occupational safety and health for onsite, DOE regulated facilities.

DOE-ID will monitor nonradiological occupational safety and health as follows:

a. Nonradiological occupational safety and health requirements will be as stated in the AMWTP contractor's ESHPOP, which the contractor developed from OSHA regulations (e.g., 10 CFR 1910 and 1929), and applicable portions of DOE Directives, as identified in the ESHPOP.

b. The AMWTP contractor's occupational safety and health program is explained in the contractor's ESHPOP, and is approved by DOE-ID via the ES&H authorization process.

c. DOE-ID will review the AMWTP contractor's nonradiological occupational safety and health self-assessment program semiannually, and will conduct an audit of the program annually.

a. Any OSHA reportable occurrences (fatalities, serious injuries, etc. as identified in the ESHPOP) will be reported to DOE-ID immediately. The contractor will invite DOE to be an observer on any resulting investigations, and will copy DOE on any reports resulting from OSHA reportable occurrences. If DOE-ID needs to conduct an investigation of an OSHA reportable occurrence, the contractor will support the DOE investigation by providing access to facilities, supplying requested documents, and making employees available for interviews.

b. If at any time DOE believes work conditions are unsafe at the facility, DOE will request that the contractor stop work activities until the situation is resolved. DOE has the right to invoke contract clause H.15, "STOP-WORK AND SHUT DOWN AUTHORITY-ENVIRONMENT, SAFETY AND HEALTH," if DOE believes AMWTP activities cannot be safely accomplished.

Nuclear and Radiological Safety and Health: DOE-ID controls and monitors nuclear and radiological safety in accordance with the following:

a. Nuclear and radiological safety requirements will be as stated in the AMWTP contractor's ESHPOP.

a. DOE-ID approved the contractor ESHPOP, which certified that DOE-ID believes the contractor has identified the necessary programs and controls to achieve sufficient nuclear and radiological safety.

c. DOE will conduct semiannual reviews of the contractor's self-assessment programs in nuclear and radiological safety, and will conduct an annual audit of nuclear and radiological safety.

d. The contractor will report any serious violations of nuclear and radiological safety (criticality, over exposures, losses of radioactive material, etc., as identified in the ESHPOP) to DOE-ID. The contractor will invite DOE-ID to be an observer on any resulting investigations, and will copy DOE-ID on any resulting reports. If DOE-ID needs to conduct an investigation of the situation, the contractor shall support the DOE-ID investigation by providing access to facilities, supplying requested documents, and making employees available for interviews.

e. If at any time DOE-ID believes work conditions are unsafe at the facility, DOE-ID will request that the contractor stop work activities until the situation is resolved. *DOE has the right to invoke contract clause H.15, "STOP-WORK AND SHUT DOWN AUTHORITY-ENVIRONMENT, SAFETY AND HEALTH," if DOE believes AMWTP activities cannot be safely accomplished.*

DOE Monitoring

DOE will monitor compliance with the contract and ES&H responsibilities during construction and operations with DOE personnel permanently stationed at the RWMC site, and with specified DOE ES&H professionals who are afforded unlimited access to BNFL Inc's facilities and operations.

Figure 7.4-1. Regulation of the AMWTP.

8. INDEX

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X

No Entries

Y

No Entries

Z

No Entries

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