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COVER SHEET

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

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

Location: Idaho National Engineering and Environmental Laboratory (INEEL)

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Abstract: The AMWTP DEIS assesses the potential environmental impacts associated with four alternatives related to the construction and operation of a proposed waste treatment facility at the INEEL. Four alternatives were analyzed: the No Action Alternative, the Proposed Action, the Non-Thermal Treatment Alternative, and the Treatment and Storage Alternative. The proposed AMWTP facility would treat low-level mixed waste, alpha-contaminated low-level mixed waste, and transuranic waste in preparation for disposal. 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 approval 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. The AMWTP DEIS identifies as the Preferred Alternative the Proposed Action, which is the construction and operation of the AMWTP facility.

Public Involvement: Comments on this Draft EIS may be submitted through the end of the comment period, September 11, 1998. Comments received after September 11, 1998, will be considered to the extent possible. Comments may be submitted in writing to: DOE-Idaho Operations Office, Attn: John Medema, AMWTP EIS Document Manager, 850 Energy Drive, MS 1117, Idaho Falls, Idaho 83401; or by sending a facsimile (fax) message to DOE at (208) 526-0160.

The Idaho Operations Office will conduct two public meetings in Idaho cities to receive comments and answer questions on the DEIS. These meetings will be held on August 18, 1998, in Idaho Falls at the Multipurpose Building Cafeteria, Eastern Idaho Technical College, 1600 South 2500 East, from 7:00 to 9:30 p.m. and August 20, 1998, in Twin Falls at the Student Union Building, College of Southern Idaho, 315 Falls Avenue, from 6:30 to 9:00 p.m.

ACRONYMS AND ABBREVIATIONS

alpha LLMW	alpha-contaminated low-level mixed waste
AAC	acceptable ambient concentrations
AACC	acceptable ambient concentration for a carcinogen
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
ARF	airborne release fraction
BACT	Best Available Control Technology
BLM	Bureau of Land Management
BNFL	BNFL Inc.
CAA	*Clean Air Act*
C&S	Certified and Segregated
CEDE	Committed effective dose equivalent
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
D&D	Decontamination and decommissioning
dBA	Decibel A-weighted
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 Environmental Impact Statement*
DOT	Department of Transportation
DR	damage ratio
EA	Environmental Assessment
EBR	Experimental Breeder Reactor
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
FFCAct	*Federal Facility Compliance Act*
FONSI	Finding of No Significant Impact
FR	Federal Register
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*
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 operation
MACT	maximum allowable control technology
MAR	material at risk
MCL	maximum contaminant level
MEI	maximally exposed individual
MOU	memorandum of understanding
MSDS	material safety data sheet
NAAQS	National Ambient Air Quality Standard
NAGPRA	*Native American Grave Protection and Repatriation Act*
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
OPC	ordinary Portland cement

OSHA	Occupational Safety and Health Administration
PBF	Power Burst Facility
PCB	polychlorinated biphenyl
PCC	primary combustion chamber
PEIS	programmatic environmental impact statement
PEL	permissable exposure limit
PFA	pulverized fuel ash
PLO	Public Land Orders
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
RSCA-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
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)
SRS	Savannah River Site
ST	source term
STEL	short term exposure limit
STP	Site Treatment Plan
SWEPP	Solid 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 Packaging 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
WCF	Waste Characterization Facility
WERF	Waste Experimental Reduction Facility
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

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	Conversion Factor	Unit
Acres	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

SUMMARY

The U.S. Department of Energy (DOE) proposes to implement a contract with BNFL Inc. (BNFL) to construct and operate the proposed Advanced Mixed Waste Treatment Project (AMWTP) facility at the Idaho National Engineering and Environmental Laboratory (INEEL). The AMWTP, as proposed by BNFL, would retrieve, sort, characterize, and treat approximately 65,000 cubic meters of transuranic (TRU), alpha-contaminated LLMW (alpha LLMW), low-level mixed waste (LLMW), and waste currently stored at the INEEL Radioactive Waste Management Complex (RWMC), and package the treated waste for shipment offsite for disposal. The AMWTP facility could also treat an additional 120,000 cubic meters of waste from INEEL and other DOE sites. A summary of the waste volumes by waste categories that are being considered for treatment at the proposed AMWTP facility currently stored at the RWMC is presented in Table S-1.

The 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 Bitterroot, Lemhi, and Lost River mountain ranges. The land comprising the INEEL is used to support 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 which occupy 2,032 acres. The remaining land (567,103 acres) is largely undeveloped and used for environmental research, ecological preservation, and livestock grazing.

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

Condition of Waste at the Idaho National Engineering and Environmental Laboratory

The 65,000 cubic meters of the INEEL waste described above is TRU, alpha LLMW, and LLMW waste stored at the RWMC. 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 berm. The earthen-covered berm is enclosed within a metal building called the Transuranic Storage Area Retrieval Enclosure (TSA RE), a *Resource Conservation and Recovery Act* (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. The drums and boxes have a 20-year design life and were not intended to provide permanent containment of the waste. The drums and boxes have been in the earthen berm since 1970 and are subject to breaching and failure through corrosion or decomposition, which results in the potential for the wastes to be released to the environment.

PROJECT HISTORY

DOE has been storing TRU waste at the INEEL since the early 1980s. In the early 1990s, DOE considered plans to retrieve the 52,000 cubic meters of stored waste from the earthen covered berm, segregate the alpha LLMW from the TRU waste, and build and operate a treatment facility. Alpha LLMW would be treated to comply with RCRA land disposal restrictions (LDR) requirements and the TRU waste would be treated to meet the Waste Isolation Pilot Plant (WIPP) waste acceptance criteria (WAC). (WIPP is a disposal facility for TRU waste that DOE has developed near Carlsbad, New Mexico.) Additional RCRA storage modules were also planned for the retrieved and/or treated waste.

Table S-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	57,230

a. The sum of the waste in this table is less than 65,000 m^3 because: 1) this list includes only mixed waste (hazardous and radioactive) and therefore does not include waste to be treated that is radioactive only; and 2) 65,000 m^3 is an estimate from 1988 that was developed before the inventory included in Appendix F was available.

In 1992 and 1993, DOE requested 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 7 years from that proposed by the Management and Operations (M&O) contractor if treatment of the 65,000 cubic meters of waste were privatized. 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. After extensive evaluation by DOE, a decision was made to pursue the procurement of treatment, assay, and characterization services for alpha LLMW and TRU mixed waste from the private sector. At the same time, 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). In the DOE INEL EIS Record of Decision (ROD), DOE decided to construct treatment facilities at INEEL necessary to comply with the *Federal Facility Compliance Act*. Treatment of TRU waste at a minimum will be for the purpose of meeting the WAC for disposal at WIPP and will occur on a schedule to be negotiated with the State of Idaho.

In 1996, a final request for proposal for treatment of TRU, alpha LLMW and LLMW waste was issued. Bids were received from four teams, three of which were determined to be in the competitive range. DOE performed an extensive evaluation of the competitive bids, including consideration of the potential environmental impacts of each proposal. This evaluation was performed in accordance with DOE *National Environmental Policy Act* (NEPA) regulations (10 CFR 1021.216), the results of which are summarized in an Environmental Synopsis that was made available to the public. In December 1996, DOE awarded a three-phase contract for a treatment facility to BNFL. Phase I of the contract addresses permitting, NEPA review, and an environment, safety and health authorization process. Before deciding whether to authorize

BNFL to proceed with construction (Phase II), DOE must complete this Environmental Impact Statement (EIS). If, after completing this EIS, DOE decides not to move forward with Phase II (construction) and Phase III (operation) of the project, the contract will be terminated.

PURPOSE AND NEED FOR AGENCY ACTION

DOE currently stores approximately 65,000 cubic meters of TRU, alpha LLMW, and LLMW waste at the RWMC on the INEEL. Approximately 95 percent of this waste is classified as mixed waste which, because it contains both radioactive and chemically hazardous constituents, is regulated as hazardous waste under RCRA. Some of the wastes also contain polychlorinated biphenyls (PCB), 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 WIPP 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 Oct. 17, 1995] [Consent Order]).

DOE also anticipates that it may need to treat up to an additional 120,000 cubic meters of these same kinds of wastes in preparation for disposal. 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. Any future decisions regarding transfers of TRU waste would involve revision of the TRU ROD that DOE issued on the *Final Waste Management Programmatic Environmental Impact Statement* (WM PEIS), and be subject to agreements, such as those between DOE and states, relating to the treatment and storage of TRU waste.

RELATIONSHIP TO OTHER *NATIONAL ENVIRONMENTAL POLICY ACT* DOCUMENTS

In the WM PEIS DOE evaluated the transfer of 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 for treatment and interim storage, pending disposal. In a separate ROD based on the *Waste Isolation Pilot Plant Disposal Phase Final Supplemental Environmental Impact Statement* (SEIS-II), DOE decided to dispose of defense TRU waste at WIPP and to accept for disposal grouted TRU waste, thermally treated TRU waste, or TRU waste treated by any other process that meets the WIPP WAC.

ADVANCED MIXED WASTE PROJECT FACILITY DESCRIPTION AND ALTERNATIVES

Advanced Mixed Waste Treatment Project Facility Description

The proposed AMWTP facility would be located at the RWMC in the southwestern corner of the INEEL. The AMWTP facility would be designed, built, and operated by BNFL under a privatized contract with DOE. 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 after the 65,000 cubic meters of waste stored at the RWMC is treated. Details of the

AMWTP facility design can be found in the AMWTP RCRA Part B Permit Application located in the INEEL Technical Library at Idaho Falls, Idaho.

The proposed AMWTP facility is designed as a two-story industrial type structure with a rooftop mechanical penthouse. Overall dimensions for the first (ground) floor are approximately 210 feet x 290 feet. The general building height is about 42 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 60 feet above ground level at the eave. The facility stack extends from the north 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 10 feet in diameter and approximately 90 feet high.

Depending on the alternative, the AMWTP facility would include non-thermal treatment only or a combination of non-thermal treatment and thermal treatment processes. Under the Proposed Action and the Treatment and Storage Alternative, the facility would include both non-thermal and thermal treatment in the form of supercompaction, macroencapsulation, incineration, and vitrification. The Non-Thermal Treatment Alternative would include supercompaction and macroencapsulation.

Supercompaction. The supercompaction process would receive drums of sorted debris waste from the pretreatment lines where sorting, segregation, and size reduction are performed or direct feed drums from the waste receiving and staging area. 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. Under this extreme pressure, gas is vented and processed through the facility air pollution control system. The volume reduction for each drum is dependent on the drum contents and packing fraction but is expected to be an average of 80 percent. The pucks would be placed into a puck drum. The puck drums would then be transferred to the macroencapsulation process. The puck drum would be the final waste form's outermost container.

Macroencapsulation. The macroencapsulation system would be used to encapsulate pucks or large pieces of metal debris not suitable for compaction. Waste would be fed into the macroencapsulation process in two forms: containers of pucks and noncompactible debris waste sent directly from the pretreatment lines.

The macroencapsulation process uses grout 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, located adjacent to the macroencapsulation process area. The drum cure area can 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 will be radioassayed and certified for final disposal. The throughput for the macroencapsulation system is approximately 20 loaded puck drums per day.

Incineration. Wastes destined for incineration would be transferred to and placed into a shredder, located at the head of the incineration process. The shredder would shred the waste and feed it into a waste hopper, from which it would be fed at a controlled rate into the incinerator. The incinerator as currently proposed is a dual-chamber auger hearth system fired by propane gas. The primary combustion chamber operates at 1,400 to 1,800^{o}F and the secondary chamber at 1,800 to 2,200^{o}F. The incinerator has a feed capacity of 650 pounds per hour of solid waste.

Vitrification. Resultant ash from the incinerator would be fed into transfer drums, which are then closed and transported to the vitrification unit feed staging area. Ash for vitrification would be placed into a hopper and fed at a controlled rate into the vitrification unit. Glass-forming chemicals would be continuously fed with the ash to enhance the glass quality of the final waste form. A Joule melter is currently considered for the vitrification unit.

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 waste, on the INEEL. The M&O contractor would continue preparation to ship TRU waste to the WIPP, using existing facilities. Retrieval of waste from the TSA RE would be initiated with re-storage of the retrieved waste in RCRA-compliant storage facilities as described in the *Environmental Assessment for Retrieval and Re-Storage of TSA Waste at the Idaho National Laboratory* (DOE/EA-0692). Shipments to WIPP would continue only as could be supported by existing facilities at the INEEL. Waste that could not meet the WIPP WAC would be returned to the storage modules on the RWMC.

Proposed Action

Under this alternative, the construction (Phase II) and operation (Phase III) of the proposed AMWTP facility would proceed in accordance with DOE's contract with BNFL. Construction of the treatment facility would begin at the permitted site, beginning with the 1999 construction season. Construction of the proposed AMWTP facility would be completed no later than December 2002. The facility would begin operation no later than March 2003. Preparation of the TRU waste for shipment to WIPP by the M&O contractor would continue in support of the milestones identified in the Settlement Agreement/Consent Order. 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 AMWTP facility would be built and operated using the proposed treatment options of supercompaction, macroencapsulation, incineration, and vitrification. The facility would have sufficient operating capacity to treat approximately 6,500 cubic meters of waste per year. This alternative would accommodate the treatment of 65,000 cubic meters of waste from INEEL during the initial time frame (by 2015) and up to another 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 facility WAC and, for non-INEEL waste that satisfies the requirements of the Site Treatment Plan Consent Order for receipt and treatment, can be accepted. A description of the proposed AMWTP facility can be found in Section 3.1 of this Draft EIS.

Non-Thermal Treatment Alternative

Under the Non-Thermal Treatment Alternative, some treatment of TRU, alpha LLMW, and LLMW waste would still occur. Wastes such as PCBs, which require thermal treatment, and other waste destined for thermal treatment (e.g., waste with high volatile organic compound content) to meet disposal criteria would be repackaged for storage. 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 Treatment facility size and layout would be the same as described in the Proposed Action. The facility would differ from the Proposed Action AMWTP facility in that the thermal treatment processes (incineration and vitrification) and corresponding supporting equipment would not be installed. Areas of the facility described in the Proposed Action 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 decided on in the future. This facility would still receive waste retrieved from the TSA RE and newly generated INEEL waste. 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. Although it could receive waste from other DOE sites, treatment of non-INEEL waste in this facility is anticipated to be minimal to zero. 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.

Treatment and Storage Alternative

Under the Treatment and Storage Alternative, the treatment facility would be built in the same location, contain the same treatment processes, and produce the same waste forms as in the Proposed Action. Thus the potential environmental impacts associated with the treatment facility are the same as the Proposed Action. 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 facility but, instead, would be put into RCRA-permitted storage units at the RWMC. This alternative is being evaluated as a contingency in the event WIPP is unable to receive and dispose of INEEL waste. Wastes from other DOE sites could still come to the AMWTP facility for treatment. Such offsite wastes would only come to the AMWTP facility for treatment with the approval of the State of Idaho, and the treated waste would be returned to the waste generator or sent to an approved disposal facility.

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 described in Section 3.3) as the preferred alternative based on information developed so far (e.g., environmental impacts from the DOE INEL EIS, feasibility studies, NEPA 216 process and procurement process).

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

PUBLIC SCOPING PROCESS

DOE published the Notice of Intent to prepare an EIS for the AMWTP in the *Federal Register* on November 20, 1997 (62 FR 62025). 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 and alternatives, 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 comment submittals 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.

Results of Public Scoping

The major issues of concern expressed by the public are summarized below.

Commentors asked that the AMWTP EIS fully describe the impacts of operating the proposed facility on air, water, soil, and vegetation including the impacts of normal and off-normal facility operations.

Some commentors made specific suggestions or posed general questions concerning various aspects of the Proposed Action. For example, they asked that DOE describe in detail the proposed treatment technologies as well as other candidate technologies that may potentially be effective but are not proposed. Some commentors questioned the need for the AMWTP while others opposed portions of the Proposed Action, such as employing incineration as a treatment technology. In several cases, commentors asked that DOE examine a wider range of storage and disposal options for treated waste.

Finally commentors wanted to know the relationship of the AMWTP EIS and other recent EISs and related DOE decisions. In many instances they requested analyses more appropriately conducted or already included in other DOE NEPA documents. Examples of these requests included analyses of the impacts of the transportation of treated waste from the INEEL to WIPP; analyses of the impacts of transportation of waste from other DOE sites to the INEEL for treatment, and the return of treated waste to the waste generating facility; and providing detailed inventories and descriptions of existing waste within the DOE Complex which might eventually be brought to the INEEL for treatment.

DOE has placed key related reference materials in the INEEL Technical Library at the DOE office in Idaho Falls, Idaho. Copies of these materials are available to the public upon request. Other DOE reference materials are routinely made available in Idaho public libraries and DOE-supported reading rooms. Additionally, DOE and the DOE Idaho Operations Office have posted many common references on the World Wide Web, at locations found through http://www.tis.eh.doe.gov/, http://doe.inel.gov, http://www.doe.gov/, and other web sites.

AFFECTED ENVIRONMENT

The INEEL sits on the Eastern Snake River Plain and is bordered by the Bitterroot, Lemhi, and Lost River mountain ranges. Local rivers and streams drain the mountain watersheds, but most surface water is diverted for irrigation before it reaches the site boundaries.

The INEEL overlies the Snake River Plain Aquifer, the largest aquifer in Idaho. Previous waste discharges to unlined ponds and deep wells have introduced radionuclides, nonradioactive metals, inorganic salts, and organic compounds into the subsurface. Because of improved waste management practices, these discharges no longer occur and groundwater quality continues to improve.

INEEL activities result in radiological air emissions; however, these are very low, less than background radiation, and well within standards.

The INEEL primarily consists of open, undeveloped land covered predominantly by sagebrush and grasslands with animal communities typical of these vegetation types. One Federal endangered and one threatened animal species have the potential for occurring, and ten animal species of special concern (State listing) occur at the INEEL. Four plant species identified as sensitive, rare, or unique by other Federal agencies and the Idaho Native Plant Society also occur at the INEEL. Radionuclides have been found above background levels in individual plants and animals adjacent to facilities, but have not been observed at the population, community, or ecosystem levels.

Land areas of importance to the Shoshone-Bannock Tribes include the buttes, wetlands, sinks, grasslands, juniper woodlands, Birch Creek, and the Big Lost River.

The INEEL has a varied inventory of cultural resources. These include fossil localities, prehistoric archaeological sites, historic sites, and facilities associated with the development of nuclear science in the United States. Similarly, because Native American people hold the land sacred, in their terms the entire INEEL is culturally important.

Most land within the site boundaries is used for grazing or is general open space. Only about 2 percent of the INEEL is used for facilities and operations, with another 6 percent devoted to public roads and utility rights-of-way. Over 97 percent of INEEL employees live in the seven counties surrounding the site. The regional economy relies on farming, ranching, and mining. The INEEL accounts for approximate 10 percent of the total regional employment.

ENVIRONMENTAL IMPACTS

The environmental impacts of the alternatives have been assessed for the INEEL and surrounding region. To aid the reader in understanding the differences in environmental impacts among the various alternatives, this section presents comparisons of the alternatives, concentrating on the major resources addressed in the EIS.

In addition to the No Action Alternative, three “action” alternatives are being considered for the AMWTP: (1) the Proposed Action, which would construct and operate the AMWTP facility and employ both non-thermal and thermal treatment processes, (2) the Non-Thermal Alternative, which would construct the AMWTP facility employing only non-thermal treatment processes, and (3) the Treatment and Storage Alternative, which would construct and operate the AMWTP facility identical to the Proposed Action, but store the treated waste at the INEEL as a contingency in the event WIPP is unable to receive and dispose of INEEL waste. Under No Action, the AMWTP facility would not be constructed.

Resource Impacts

Under No Action, there would be no impacts to land use, cultural resources, aesthetic and scenic resources, ecology, and INEEL services. There would be minor adverse impacts to geologic resources due to the extraction of aggregate, clay, sand, and soil to support environmental restoration and waste management activities. Criteria pollutant, radiological and toxic pollutant levels would be well within applicable standards. No contamination to the vadose zone would be expected to occur due to storage of hazardous and radioactive waste in the short-term. In the long-term, the potential for chronic leakage and contamination of the vadose zone would increase.

For the three "action" alternatives, construction impacts are expected to be similar and minor. An estimated 7 acres of land would be disturbed to construct the AMWTP facility. The project site is located within the RWMC and has been previously disturbed by RWMC waste management activities. Therefore, the potential to impact cultural, aesthetic and scenic, and biotic resources is not expected to be significant.

All three "action" alternatives would have the same minor adverse impacts on the geology and geologic resources at the INEEL. Construction of the AMWTP facility would require the excavation of approximately 16,000 cubic yards of material and possibly 1,033 cubic yards for expansion of the existing sewage lagoons system. Construction activities would also require approximately 20,000 cubic yards of aggregate, clay, and sand from INEEL borrow areas.

Because the Proposed Action and the Treatment and Storage Alternative would utilize the same facilities, procedures, resources, and number of workers during operation, both alternatives would produce similar environmental impacts for most resource areas. The Non-Thermal Treatment Alternative would not include incineration and vitrification as part of the facility and would have fewer air quality impacts and lower water and energy resource requirements.

Impacts to air quality were modeled for construction and operation, and results indicate minimal impacts for all three "action" alternatives. Projected criteria pollutant levels associated with each of the alternatives are well below the limits of applicable standards (<1 percent). On a comparative basis, impacts of the Proposed Action and Treatment and Storage Alternative are greater than the Non-Thermal Treatment Alternative, since the former include incinerator emissions as well as higher boiler and diesel generator emission rates.

The maximum increment of carcinogenic and noncarcinogenic air pollutants is projected to occur at the INEEL boundary, and levels of all substances would be well below the applicable standards. When the increment is combined with baseline carcinogenic and noncarcinogenic air pollutant levels, the cumulative levels would still be well below applicable standards (1 percent or less). Under the Proposed Action or Treatment and Storage Alternative, 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, which would be about 1 percent of the standard. Carcinogenic incremental levels under the Non-Thermal Treatment Alternative would not exceed 0.1 percent of any standard, while noncarcinogenic levels would be less than 0.001 percent of applicable standards.

Water use for the Proposed Action and Treatment and Storage Alternative would be the same (2.7 million gallons per year). Electricity and propane use would also be the same, 35,022 megawatt hours per year and 925,000 gallons per year, respectively. The Non-Thermal Treatment Alternative would use less water, electricity, and propane because the AMWTP facility would not have incineration and vitrification as part of the treatment process. Water usage for the incinerator, vitrifer, and evaporators would be eliminated. Electricity requirements would be 23,980 megawatt hours per year and propane use would be 185,000 gallons per year. Electricity requirements would be well within the INEEL existing infrastructure capabilities.

Socioeconomic Impacts

Under No Action, there would be no impacts to socioeconomic or community services.

Socioeconomic impacts from construction of the AMWTP facility would be the same for all "action" alternatives. The project would generate a total of 254 jobs (125 direct and 129 indirect) in the Region of Influence (ROI) during the peak year of construction. These 254 jobs would result in an increase of less than 1 percent in the ROI employment.

Socioeconomic impacts from operation of the AMWTP facility would be the same for the Proposed Action and the Treatment and Storage Alternative, and less for the Non-Thermal Treatment Alternative. Operation of the Proposed Action and Treatment and Storage Alternative would require 146 workers and would generate 406 jobs (146 direct and 260 indirect) in the ROI. Operation of the Non-Thermal Treatment Alternative facility would requirement 133 workers and would generate 369 jobs (133 direct and 236 indirect) in the ROI. There would be no impacts to the ROI's population, housing sector, or community services from any of the alternatives.

Radiation Health Impacts

Under No Action, normal operations at INEEL would result in an estimated fatal cancer incidence range from 6.0×10^{-4} for the maximally exposed individual (MEI) involved worker, to 5.5×10^{-8} for the MEI offsite individual. The population estimated fatal cancer incidence would be 2.05×10^{-4}.

The maximum worker exposure to radiation is expected to be about equal for the Proposed Action and the Treatment and Storage Alternative (approximately 0.73 mrem/yr) and well within regulatory limits. The cancer risk would be 2.92×10^{-7}. The cumulative dose would be 0.96 mrem/yr and still well within the 5,000 mrem per year occupational dose limit. The cumulative cancer risk would be 3.84×10^{-7}. The Non-Thermal Treatment Alternative maximum worker exposure to radiation would be approximately 0.003 mrem/yr. The cancer risk would be 1.20×10^{-9}. The cumulative dose would be 0.24 mrem/yr. The cumulative cancer risk would be 9.60×10^{-8}. The risk to the workforce from these levels of radiation exposure is extremely small.

Radiation exposure to the public from normal operation of the AMWTP would be well within regulatory limits for all the "action" alternatives. The incremental dose to the public (82,000 people by 2010) within 50 miles of the RWMC for the Proposed Action and Treatment and Storage Alternative would be 0.056 person-rem/yr. The latent cancer fatalities for the Proposed Action and Treatment and Storage Alternative would be 2.8×10^{-5}. Over the projected 30-year facility operating lifetime under the Proposed Action and Treatment and Storage Alternative, the estimated population dose would be 1.6 person-rem (8.0×10^{-4} cancer fatalities).

The incremental dose to the public from the Non-Thermal Treatment Alternative would be 0.00037 person-rem/yr. The latent cancer fatalities for the Non-Thermal Treatment Alternative would be 1.8×10^{-7}. Over the projected 13-year facility operating lifetime under the Non-Thermal Treatment Alternative the estimated population dose would be 0.0043 person-rem (2.15×10^{-6} cancer fatalities).

The MEI offsite dose and resulting cancers for the Proposed Action and Treatment and Storage Alternatives would be 0.011 mrem and 5.5×10^{-5} respectively. The MEI offsite dose and resulting cancers for the Non-Thermal Treatment Alternative would be 0.0017 mrem and

8.5×10^{-10}, respectively. The added risk to the public due to these levels of radiation exposure is extremely small.

Accident Impacts

The accident scenario probability and consequences for the RWMC would not change under No Action.

Information from the AMWTP Preliminary Safety Analysis Report (Draft) was used to determine the potential impacts from accidents. A screening process was developed to identify a set of accidents that would bound the consequences of the full range of potential accidents. As a result of this screening, nine scenarios were identified as part of the design basis for the AMWTP facility.

Accident risks and consequences for the Proposed Action and the Treatment and Storage Alternative are the same. Of the accidents analyzed, the waste box drop is the scenario with the highest consequences. The potential dose to the hypothetical maximum exposed offsite individual is 6.5 mrem and the associated likelihood of contracting a fatal cancer is less than 1 in 300,000. The dose to the co-located worker is 32 mrem and the associated risk of contracting a fatal cancer is less than 1 in 75,000.

The accident with the most severe consequences from hazardous chemical release would be the lava flow over the RWMC. The chemical concentrations from nitric acid and mercury are the greatest concern. The concentration at the MEI would be 16.0 mg/m^3 for mercury, which would exceed exposure guidelines.

For the waste box spill accident the chemical concentrations at the MEI would be 3.26×10^{-7} mg/m^3 and 1.27×10^{-8} mg/m^3 for nitric acid and mercury, respectively.

Accident risks for the Non-Thermal Treatment Alternative are bounded by those for the other "action" alternatives. The absence of the incineration and vitrification processes results in some reduction of risk due to lower source terms for Am-241, mercury, and nitric acid.

Non-Radiation Health Impacts

Under No Action, no adverse health effects would occur as a result of criteria and noncarcinogenic emissions. Annual injury and illness rates for INEEL operations would not change.

The health impacts associated with potential exposure to criteria and toxic air pollutants would be well within applicable standards and regulations for all alternatives (Hazard Quotient less than one in all cases indicating that no adverse health effects would be expected). Lifetime cancer risks from concentrations of carcinogenic air pollutants were calculated. The total cancer risk under the Proposed Action and the Treatment and Storage Alternative for all nonradiological carcinogenic chemicals would be 1.3×10^{-8} (1 in 80 million) at the site boundary and 4.4×10^{-10} (1 in 2 billion) at Craters of the Moon. The total cancer risk under the Non-Thermal Treatment Alternative would be 2×10^{-9} (1in 500 million) at the site boundary and 4.5×10^{-10} (1 in 2 billion) at Craters of the Moon.

Industrial safety impacts would be the same during the 2.5 year construction period for the Proposed Action, the Treatment and Storage Alternative, and the Non-Thermal Treatment Alternative. Estimated total injuries and illnesses would be 385 and total fatalities would be approximately 1. For the

30 year operation period, the Proposed Action and Treatment and Storage Alternative would have the same number of estimated total injuries and illnesses (135) and total fatalities (0.65). The Non-Thermal Treatment Alternative would have an estimated 53 total injuries and illnesses and 0.26 total fatalities over the 13 year operation period.

Other Impacts

Under No Action, there would be no noise or traffic and transportation impacts.

For all "action" alternatives, construction noise impacts would be minor and short-term. Operational noise would be negligible since all process activities would be conducted inside the AMWTP facility.

Traffic and transportation impacts due to the three "action" alternatives would be minor and not significant. The Level-of-Service on local access highways would not change, nor would peak hourly traffic increase significantly. Construction related traffic would be the same for all the alternatives. During operation, the Proposed Action would result in slightly higher traffic volumes than the Non-Thermal Treatment Alternative and the Treatment and Storage Alternative because of the greater number of shipments to a disposal facility.

Summary of Alternatives

Based on the environmental analyses presented in this Draft EIS, the No Action Alternative would have the least short-term environmental impacts and the greatest long-term impacts. Construction impacts would be the same for all three "action" alternatives. Impacts due to facility operation would be the same for the Proposed Action and the Treatment and Storage Alternative. The Non-Thermal Treatment Alternative would have slightly less impacts to air quality, water and energy use, worker and public health, and industrial safety.

1. INTRODUCTION AND BACKGROUND

1.1 Introduction

The Idaho National Engineering and Environmental Laboratory (INEEL) stores a variety of radioactive materials, most resulting from national defense programs. In line with its responsibility to manage and dispose of radioactive wastes in an environmentally sound manner, the U.S. Department of Energy (DOE) proposes to construct and operate a facility called the Advanced Mixed Waste Treatment Project (AMWTP) to treat low-level mixed waste (LLMW), alpha-contaminated LLMW (alpha LLMW), and transuranic (TRU) waste at INEEL. The waste would be treated by technologies proposed by BNFL Inc. (BNFL), the owner and operator of the proposed facility. Currently proposed technologies are supercompaction, macroencapsulation, incineration, and vitrification. After treatment[1], 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 Radioactive Waste Management Complex (RWMC) at 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 1984, TRU waste was defined as waste containing more than 100 nanocuries of alpha-emitting transuranic isotopes. That change meant that INEEL wastes which are physically intermingled are subject to different treatment, disposal, and 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 which, under the *Resource Conservation and Recovery Act* (RCRA), are considered hazardous. When a waste material is both "hazardous" under RCRA and radioactive it is referred to 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 1984).

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 currently stored at the RWMC is presented in Table 1.2-1. A more detailed description can be found in Appendix F.

[1] The RCRA definition of treatment includes repackaging. Throughout this document the phrase "treatment and repackaging" may be used for clarity.

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	57,230

a. The sum of the waste in this table is less than 65,000 m^3 because: 1) this list includes only mixed waste (hazardous and radioactive) and therefore does not include waste to be treated that is radioactive only; and 2) 65,000 m^3 is an estimate from 1988 that was developed before the inventory included in Appendix F was available.

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 LLMW, alpha LLMW, and TRU waste which is stored at the RWMC. Of this amount, approximately 52,000 cubic meters of the waste described in Section 1.2.1 at the INEEL (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 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) are stored in adjacent RCRA-permitted facilities at the RWMC. The drums and boxes were not designed for, or intended to provide, permanent containment of the waste. The wastes have been in the earthen berm since 1970; the expected design life of the containers was 20 years. The drums and boxes within the earthen berm are aging and subject to breaching and failure through corrosion or decomposition, which results in the potential for the wastes to be released into the environment.

1.2.4 Additional Quantities of Waste

An additional 120,000 cubic meters of similar waste from the INEEL and other DOE sites could be treated and packaged at the proposed AMWTP facility. The INEEL Site Treatment Plant (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 of waste are: the INEEL Environmental Restoration Program (approximately 60,000 cubic meters of waste is buried in the RWMC pits and trenches); waste from future processing of INEEL high level waste (possibly several hundred cubic meters); INEEL decontamination and decommissioning program waste; 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 AMWTP, and the offsite waste must satisfy the requirements of the STP Consent Order.

1.3 Background

A number of regulatory requirements, program decisions, and other events contribute to the need for the AMWTP. Figure 1.3-1 presents a summary of the *National Environmental Policy Act* (NEPA) activities leading to the AMWTP and explains the relationship between these actions and the proposed action. Recent key events are described in more detail in the following sections.

In the *Waste Isolation Pilot Plant Disposal Phase Final Supplemental Environmental Impact Statement* (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 were 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 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 which 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.

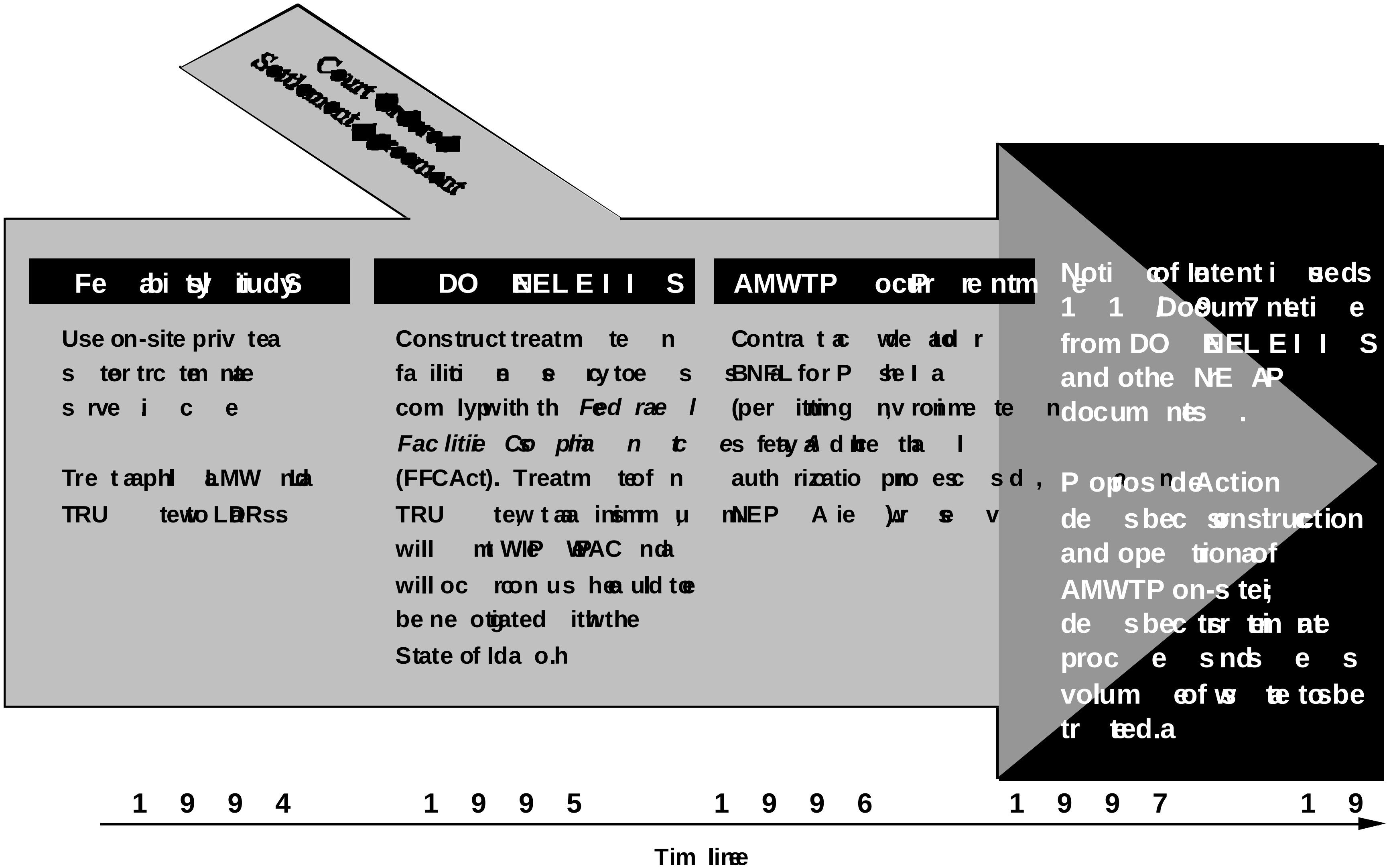


Figure 1 3-1. Decisions leading to the execution of the A WMT EPS .

The waste stored at the RWMC consists of intermingled alpha LLMW and TRU waste. DOE's proposed approach is not to separate the wastes but to co-process the wastes to meet 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 Land Disposal Restriction (LDR) requirements or the 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 LDRs. When WIPP receives a RCRA Part B mixed waste disposal permit, DOE would reconsider the need to retain the LDR treatment capability.

The treatment and disposal of INEEL alpha LLMW and TRU waste were evaluated 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). In May 1995, DOE issued a Record of Decision (ROD) for the DOE INEL EIS. In the ROD, DOE decided that the INEEL would construct treatment facilities necessary to comply with the FFCAct. DOE also decided to treat TRU waste to meet the WIPP WAC at a minimum; this treatment will occur on a schedule to be negotiated with the State of Idaho.

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 LLMW, alpha LLMW, and TRU waste, 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 FFCAct, includes a schedule for constructing treatment capacity for the alpha LLMW and TRU waste, 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. Upon completion of the procurement process and the preparation of an environmental critique under DOE's NEPA Implementing Procedures at 10 CFR 1021.216, DOE executed a phased contract with BNFL. If, after completing this EIS, DOE decides not to proceed with construction of the AMWTP, the contract would be terminated.

1.4 The Proposed Advanced Mixed Waste Treatment Project

The contract between DOE and BNFL has three phases. Phase I involves information-gathering, permitting, and planning activities by BNFL 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 described in more detail in Appendix F.

The completion of Phases II and III is the Proposed Action. Under the Proposed Action, BNFL would construct and operate a facility which would be capable of treating LLMW, alpha LLMW, and TRU waste, according to the treatments required by the WIPP WAC and LDRs. By 2015, the facility would treat the 65,000 cubic meters of waste that is in temporary storage at the INEEL. Additional quantities of similar waste could also be treated. 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. 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 (EG&G Idaho 1988). The RWMC in its entirety comprises about 163 acres. The proposed location of the AMWTP would avoid movement of retrieved waste across public roads because the waste which would be retrieved is stored in the TSA RE (adjacent to the site identified for the AMWTP facility). 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 LDR requirements, as applicable; and (6) certified for shipment to WIPP or other appropriate disposal facility (BNFL 1997). The proposed location of the AMWTP facility in the RWMC is shown in Figure 1.4-1. The AMWTP would employ thermal treatment processes (currently proposed are incineration and vitrification) 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.

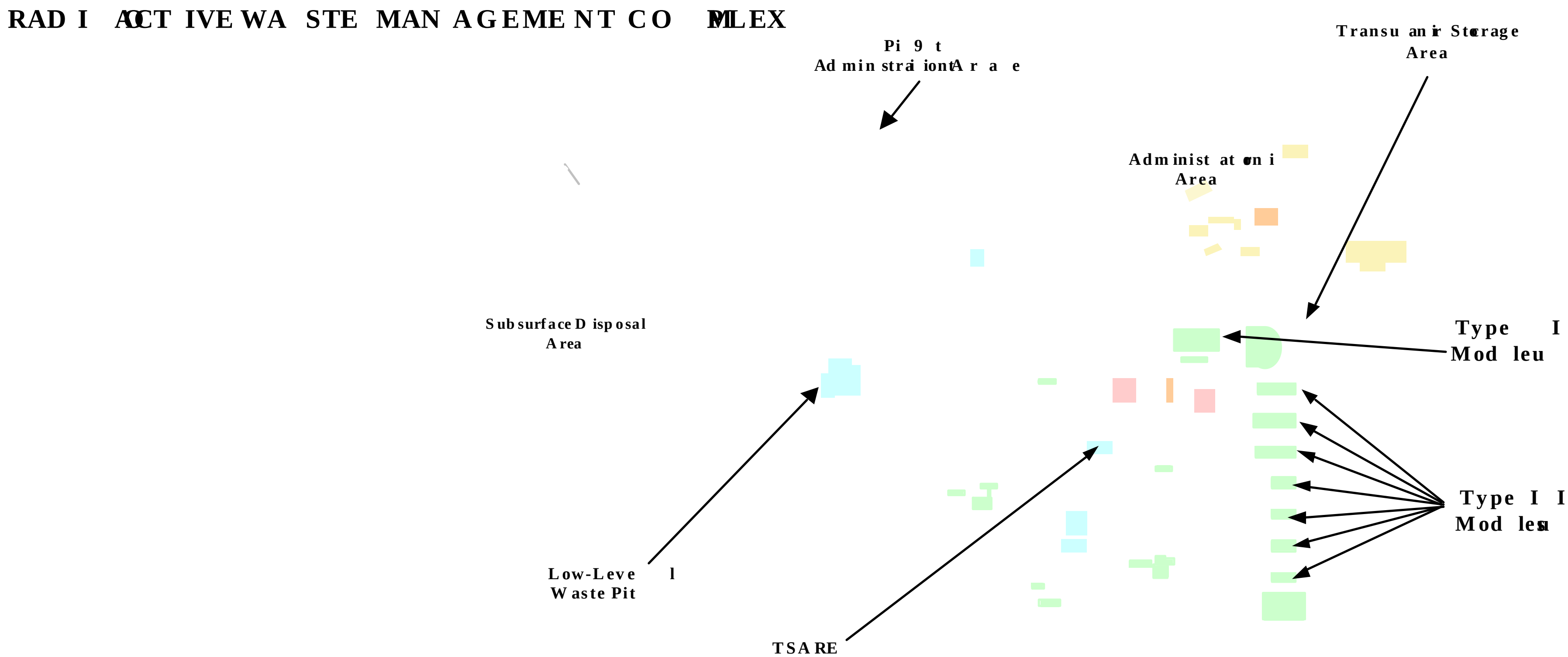


Figure 1.4-1. Layout of the Radioactive Waste Management Complex.

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, 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 the 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 FFCAct 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 FFCAct 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 on site, 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. RODs for the four other waste types (i.e., LLMW, low-level waste, high-level waste, and hazardous waste) analyzed in the WM PEIS have not been issued as of this date.

SEIS-II provides information on environmental impacts associated with DOE's proposed disposal operations at WIPP (DOE 1997d). The 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. 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 SEIS-II ROD (DOE 1998b), DOE will dispose of 175,600 cubic meters of post-1970 defense TRU waste (except PCB-commingled 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 (WSF); 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 *Hazardous Waste Management Act* 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, 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	FONSI issued March 1995		X

1.6 Public Scoping

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 (62 FR 62025). 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 comment submittals 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.

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. 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. 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. In several cases, commentors requested that the AMWTP EIS include a description of the State and Federal regulatory framework under which the proposed facility would be constructed and operated.

Finally, 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 to proceed with the construction and operation of the treatment facility and (2) the No Action Alternative, required by 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. An example 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. A related request, however, that the document include a discussion of industry treatment practices, is relevant to this EIS because the proposed facility would be operated by a private concern and use treatment technologies used in private industry.

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 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 with that 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.

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

1.7 Content of the 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 LLMW, alpha LLMW, and TRU waste
- 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 low-level mixed waste, alpha-contaminated low-level mixed waste, and transuranic (TRU) waste at the Radioactive Waste Management Complex on the Idaho National Engineering and Environmental Laboratory (INEEL). Approximately 95 percent of this waste is classified as mixed waste which, because it contains both radioactive and chemically hazardous constituents, is regulated as hazardous waste 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 also anticipates that it may need to treat up to an additional 120,000 cubic meters of these same kinds of wastes in preparation for disposal. 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. Any future decisions regarding transfers of TRU waste would involve revision of the TRU Record of Decision that DOE issued on the *Final Waste Management Programmatic Environmental Impact Statement*, 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 The 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 Environmental and Engineering Laboratory (INEEL). Figure 3-1 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. (BNFL), under a privatized contract with the U.S. Department of Energy (DOE). Under the BNFL contract, the contractor cannot treat waste from sources other than DOE.

The AMWTP facility would be located in the Transuranic Storage Area (TSA) of the RWMC. Figure 3-1 shows the location of the AMWTP facility at the RWMC. Figure 3-2 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.

The goal of the AMWTP facility is to treat low-level mixed waste (LLMW), alpha-contaminated LLMW (alpha LLMW), and transuranic (TRU) waste to produce final waste forms that are certified for disposal. TRU waste would be disposed of at the Waste Isolation Pilot Plant (WIPP) in Carlsbad, NM. LLMW would be disposed of at an approved disposal facility depending on decision 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 primarily LLWM, alpha LLMW, and contact-handled (CH) TRU 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 after the 65,000 cubic meters of INEEL waste were treated. The AMWTP draft RCRA permit application to operate the AMWTP facility incorporates the requirements for closure and decontamination and decommisioning (D&D) of the facility. However, because of project unknowns such as when the facility will cease operation, and if it can be used for other purposes at the end of this project (e.g., processing other types of DOE wastes) the D&D of the AMWTP facility is not analyzed in detail in this document. When D&D of the facility is anticipated, DOE would conduct an appropiate NEPA review.

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 TSA Retrieval Enclosure (TSA RE) to the west, and the seven RCRA compliant Type II storage modules to the east (Figure 3-1). 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 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 TRUPACT-II Loading Facility, are also located near the AMWTP facility (Figure 3-1). Therefore, waste retrieved from the TSA RE would remain within the boundaries of the TSA until transport to final disposal or to subsequent treatment locations.

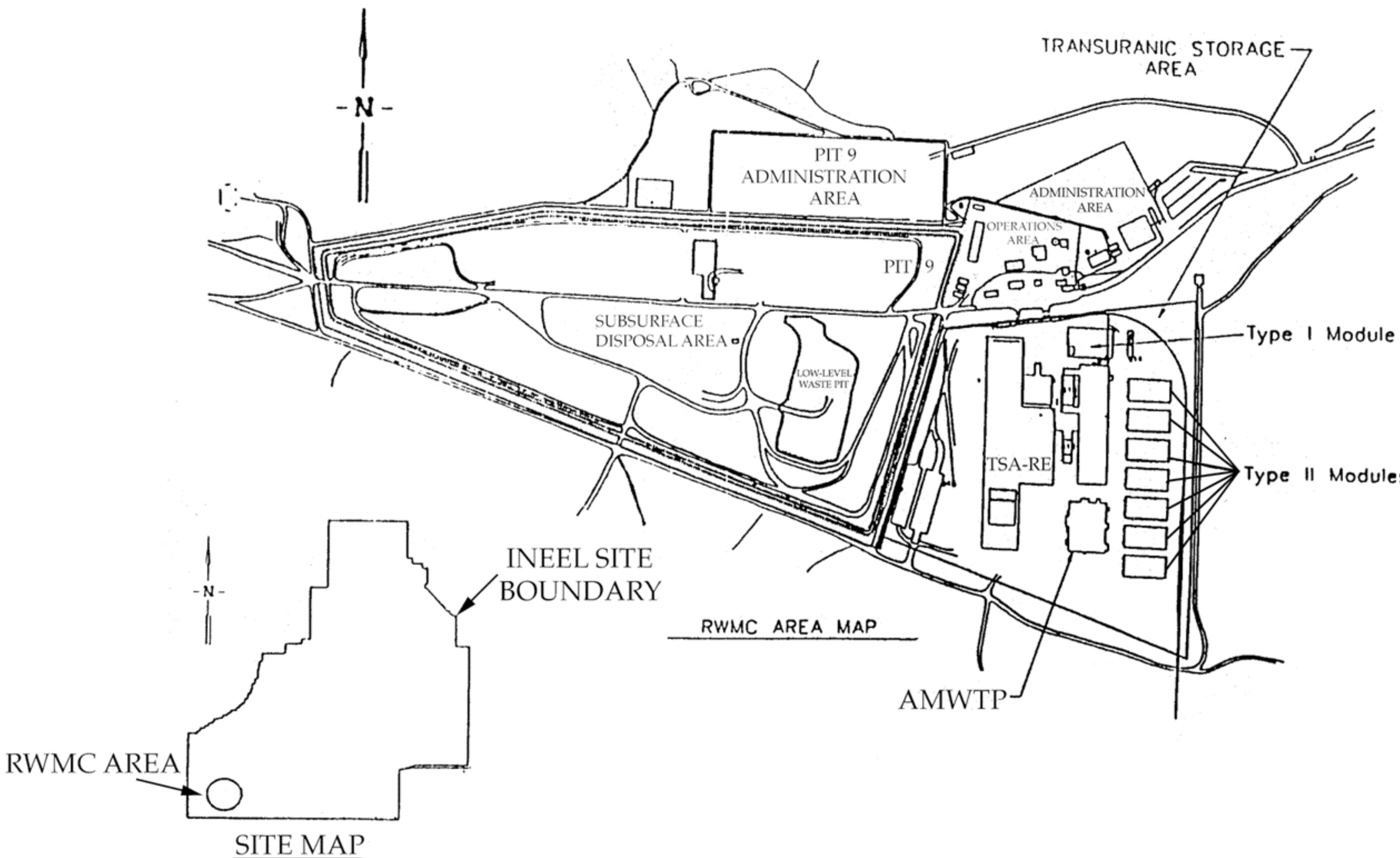


Figure 3-1. Location of the AMWTP facility.

Figure 3-2. Three-dimensional view of the TSA, showing the AMWTP facility.

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 *Resource Conservation and Recovery Act* (RCRA) Part B Permit Application located in the INEEL Technical Library in Idaho Falls, Idaho.

The proposed AMWTP facility would be designed as a two-story industrial type structure with a rooftop mechanical penthouse. Overall dimensions for the first (ground) floor are approximately 210 feet x 290 feet. The general building height is about 42 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 60 feet above ground level at the eave. The facility stack extends from the north 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 10 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 would be divided into three ventilation confinement zones. Use of the three ventilation zones minimizes the potential for air contaminated with either radioactive or hazardous materials to be released to the environment. All air within the AMWTP facility flows from the outside through the administrative areas into Zone 1, which flows into Zone 2, then flows into Zone 3 areas (see Appendix B). All uncontainerized processing waste is located in Zone 3 areas. Zone 1 and 2 areas remain clean and accessible to AMWTP facility workers under all normal operation conditions. 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 creates 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); Vitrifier Feed Staging Area; Glass Former Mixing Area; Vitrification Area; Loading Staging Area; Maintenance Areas (Hot and Cold);

and Mechanical/Electrical Support Areas. A detailed 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, and finally, certified and 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 *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 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. 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.

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.

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 WIPP Waste Acceptance Criteria (WAC) (prohibited items such as liquids greater than one percent and elemental mercury). 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 determined. 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. Details of preliminary characterization activities are described in the AMWTP RCRA Permit Application – Section C.

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 decouple treatment from retrieval and characterization operations and to build up an inventory of waste to facilitate efficient treatment campaigns. Non-debris drums would pass through the Drum Vent Facility in the Type I module for headspace gas venting/sampling and filter installation, prior to routing to the Type II modules for storage. 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, located at the southeast corner of the AMWTP facility. The waste is 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:

- A pretreatment box line area 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 are 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. Pretreatment processes are described in greater detail in the AMWTP RCRA Permit Application, Book 2.

3.1.2.5 Treatment. The AMWTP treatment processes are currently being designed to contract specifications: 65 percent volume reduction, treatment to land disposal restrictions (LDR) requirements, and treatment to meet WIPP WAC requirements. The treatment processes that are being proposed at this time are described below. Changes or substitutions to the proposed processes may occur, provided the performance requirements specified in the contract are met. Any substitution or major change of a treatment process will be evaluated to assure that the potential environmental impacts do not exceed those associated with the alternatives analyzed in the Environmental Impact Statement (EIS). The facility and equipment are designed to process up to 85,000 cubic meters of mixed waste in the first 13 years of operation.

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. Under this extreme pressure, gas is vented and processed through the facility air pollution control system. The volume reduction for each drum is dependent on the drum 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 be used to efficiently size-reduce 55-gallon drums containing debris mixed waste. It is sized to process the required throughput of approximately 58 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. When appropriately repackaged into 55-gallon drums, these wastes would be transferred via the central conveyor system to the supercompaction area. 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 is 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, located adjacent to the macroencapsulation process 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 20 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 are routed to the drum cure area. The drum cure area can 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 will be radioassayed 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.

Special Case Waste Glovebox. Special case waste is defined in this EIS as those wastes which are not suitable for direct treatment via the primary AMWTP facility supercompaction, macroencapsulation, incineration, and vitrification treatment processes. Special case waste includes wastes which may require additional characterization and/or pretreatment (e.g., neutralization and/or absorption) prior to processing via incineration/vitrification or final treatment (e.g., amalgamation to meet LDRs 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 identified as special case waste streams in the AMWTP RCRA Permit Application Table C-1-1 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 B.1 describes in greater detail the non-thermal treatment processes: supercompaction, macroencapsulation, 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. Wastes destined for incineration would be transferred to and placed into a shredder, located at the head of the incineration process. Approximately 25 percent of the 65,000 cubic meters of waste at INEEL is anticipated to be thermally treated. The shredder would shred the waste and feed it into 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 primary combustion chamber operates at 1,400 to 1,800^{o}F and the secondary chamber at 1,800 to 2,200^{o}F. The incinerator has a feed capacity of 650 lb/hr 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 the vitrifier feed staging area. Incineration is described in more detail in Appendix B.2.2 of this document. The incineration air pollution control system is discussed in Appendix B.2.3.

Brine Evaporation. The brine evaporator would receive scrubber blowdown liquids generated from the incinerator air pollution control system and potentially contaminated shower water discharged from the decontamination showers in the subchange rooms. The waste streams would collect in a brine mix tank, where they would be mixed with stabilizing agents prior to evaporation. The brine would be evaporated to a dry salt, collected in a container, and transferred out of the AMWTP facility for disposition.

Vitrification. Feed to the vitrification process would be ash from the incinerator. Ash destined for vitrification would be transferred to and placed into a hopper held until fed at a controlled rate into the vitrification unit. A Joule melter is currently considered for the vitrification unit, but a direct current arc melter may also be used in its place. The selected melter will be identified in the final facility design. 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 B.3.1 of this document.

3.2 No Action Alternative

The Council on Environmental Quality (CEQ) *National Environmental Policy Act* (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. Currently, the INEEL stores approximately 65,000 cubic meters of radioactive waste at the RWMC. Of this amount, approximately 40,000 cubic meters is TRU waste and 25,000 cubic meters is alpha LLMW.

Under this No Action Alternative, the Management and Operations (M&O) contractor would continue preparation to ship TRU waste to WIPP using existing facilities. 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/EA-0692). Shipments to WIPP would continue only as could be supported by existing facilities at the INEEL. 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 on the RWMC for indefinite storage.

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 environment, safety, and health 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* (SEIS II). The potential impacts of long-term storage of TRU waste at INEEL have been summarized in section 5.21 of this EIS.

The use of this long-term storage approach is not legally 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 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 the *Toxic Substances Control Act* (TSCA).

3.3 Proposed Action

Under this Alternative, the construction and operation of an AMWTP facility would proceed in accordance with Phases II and III of the project. Construction of the treatment facility would begin at the permitted siting location, in the 1999 construction season. Construction of the treatment facility would be completed no later than December 2002. The facility would begin operation no later than March 2003. The AMWTP facility will treat to WIPP WAC and LDR requirements. Ongoing preparation of the TRU waste for shipment to WIPP by the M&O contractor would continue in support of the milestones identified in the Settlement Agreement/Consent Order. 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 sufficient backlog to campaign each treatment train with sufficient throughput. 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 satisfies the STP consent order for receipt and treatment, can be accepted.

3.4 Non-Thermal Treatment Alternative

Under the Non-Thermal Treatment Alternative, some treatment of LLMW, alpha LLMW, and TRU waste would still occur. 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. 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 possible offsite waste from other DOE sites. The facility would characterize, treat, and repackage for storage and/or disposal LLMW, alpha LLMW, and TRU waste. This facility would characterize waste the same 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 sorted, sized, and repackaged. The repackaged waste 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, estimated to be 55,000 of the 65,000 cubic meters of waste under current WIPP WAC requirements, 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. Treatment of non-INEEL waste in this facility is anticipated to be minimal if any. If implemented, this alternative would not meet negotiated agreements (i.e., Settlement Agreement/Consent Order) and commitments nor would it meet regulatory requirements under RCRA and TSCA.

3.5 Treatment and Storage Alternative

Under the Treatment and Storage Alternative, the treatment facility described under Section 3.3 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. 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 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 SEIS-II. The potential environmental impacts associated with the treatment facility is the same as the Proposed Action.

The wastes would be treated to RCRA LDRs, 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 campaign 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 ten 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.

Wastes from other DOE sites could still come to the AMWTP facility for treatment. As in the Proposed Action, such off site wastes would only come to the AMWTP facility for treatment with the approval of the State of Idaho, and the treated waste would be returned to the waste generating facility or sent to an approved disposal facility. The transportation of these wastes if not covered by existing NEPA documentation would be subject to further NEPA review before implementation. 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] and WIPP ROD [63 FR 3624]).

3.6 Alternatives Considered But Not Analyzed

The following alternatives were considered in the selection process described in Section 3.6.1 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, 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., the 40,000 cubic meters of TRU plus arsenic, asbestos, and beryllium contaminated materials), 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 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 were 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 legally binding orders and agreements stipulated in the Settlement Agreement and the INEEL Site Treatment Plan under the *Federal Facility Compliance Act*. The SEIS-II Action Alternative 2C included analysis that assumed 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 semivolatile and volatile chemicals would not meet disposal requirements, or LDR requirements, 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 these heterogenerous types of waste, 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 applicable to broad categories of waste and tends to produce reaction products, which may also be very difficult to control and dispose. Although BNFL 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 posses a limited ability to stabilize some metals. Because the waste designated for treatment in the AMWTP have low concentrations of these constituents, biological processing is not feasible or reasonable.

Other Thermal Treatment Processes. DOE has completed numerous assessments of thermal treatment technologies. Several studies have identified potential thermal treatment technologies that are under consideration. The DOE Publication, *Report of the Technical Peer Review of Thermal Treatment Technologies for TRU, TRU Mixed, and Mixed Low-Level Wastes*, November 1995, 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/EIS-0217, 1995) 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.

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 alpha LLMW and TRU waste streams. Therefore, it is not analyzed as a separate alternative in this document, but remains a reasonable thermal treatment process whose potential environmental impacts are comparable to those associated with incineration.

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 to be equivalent to incineration, operational experience is limited, the process has not been tested on radioactive waste, and further developmental work would be required before this alternative can be proven to be a viable commercial 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. Because Joule melters rely to a very high degree on the electrical characteristics of the waste and glass forming additives they 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. A Joule melter is contained within the BNFL process flow sheet for treatment of incinerator ash in the AMWTP. 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.

3.6.1 Advanced Mixed Waste Treatment Project Technology Selection Process

DOE has been storing TRU waste at the INEEL since the early 1980s. In the early 1990s, DOE considered plans to retrieve 65,000 cubic meters of stored waste from the earthen-covered berm, segregate the alpha LLMW from the TRU waste, and build and operate a treatment facility. Alpha LLMW would be treated to comply with RCRA LDR requirements and the TRU waste would be treated to meet the WIPP WAC. Additional RCRA storage modules were also planned for the retrieved and/or treated waste.

In 1992 and 1993 DOE requested 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 7 years, if waste treatment were privatized. 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. After extensive evaluation by DOE, a decision was made to pursue the procurement of treatment, assay, and characterization services for alpha LLMW and TRU waste from the private sector. At the same time, information from the feasibility studies was provided for analysis in the DOE INEL EIS. In the ROD for the DOE INEL EIS, DOE decided that the INEEL would construct treatment facilities necessary to comply with the FFCAct. DOE also decided to treat the waste to meet the WIPP WAC at a minimum; this treatment will occur on a schedule to be negotiated with the State of Idaho.

In 1996, a final request for proposal for treatment of alpha LLMW and TRU was issued. Bids were received from four teams, three of which were determined to be in the competitive range. DOE performed an extensive evaluation of the competitive bids, including a comparative evaluation of the potential environmental impacts of each proposal. This evaluation was performed in accordance with Section 216 of the DOE NEPA regulations, and included a confidential environmental critique, the results of which are summarized in an Environmental Synopsis (DOE 1998e) that is available to the public. Based on the Synopsis, a summary of the environmental comparison of the different technologies proposed by the three offerors for the AMWTP is presented in Table 3.6-1. In December 1996, DOE awarded a three-phase contract for a treatment facility to one of the three offerors, BNFL. Phase I of the contract addresses permitting, NEPA review, and an environmental, safety, and health authorization process, including the completion of this EIS. Before deciding whether to proceed with construction (Phase II), DOE must complete this EIS. If, after completing this EIS, DOE decides not to move forward with Phase II (construction) and Phase III (operation) of the project, the contract will be terminated.

Table 3.6-1. Environmental Comparison of Contractor Proposed AMWTP Technologies.

	Baseline from DOE INEL EIS	Technology A	Technology B	Technology C
Land Use	200 acres of previously undisturbed land would be impacted. Facility to be located outside of the RWMC 2.5 miles to the east.	Less than 10 acres of previously disturbed land within the existing RWMC fence.	Approximately 5 acres of previously disturbed land would be potentially impacted.	40 acres of previously 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 exists.	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.
Flood Plain	Proposed site is not located within the 100/500 year floodplain	Proposed site is not within the probable 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 flood plain.
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	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 INEL is not within the active seismic zone of the	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

Table 3.6-1. Environmental Comparison of Contractor Proposed AMWTP Technologies.

	Baseline from DOE INEL EIS	Technology A	Technology B	Technology C
	earthquakes and ash flows or airborne ash deposits.		intermountain seismic belt. The INEL is a seismic zone 2B of Uniform Building Code.	to volcanic fissuring.
Water and Water Quality	Water use - construction - no information provided. Operation - 20 million liters/year. Effluent - no discharges from normal operations. Some effluent would result from construction.	Water use - some water to be used 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.	Water use - approximately 180gals/min needed for operation. Effluents - no impacts to ground water identified.	No processing effluent, all processing water to be recycled. Water use requirements would be within the INEL permitted capacity.
Air	See Belanger Et al, 1995 for details. The following values are maximum potential impacts taken from both the IWPF 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 3hr limit for sulfur dioxide impact on the class I area, Craters of the Moon. Control	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-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 3.6-1. Environmental Comparison of Contractor Proposed AMWTP Technologies.

	Baseline from DOE INEL EIS	Technology A	Technology B	Technology C
	measures may be needed to mitigate visibility impacts.			
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 2.1×10^{-7} latent cancer fatalities/year. Potential maximum dose to the effected population was calculated to be 1.6 person-rem or 8.0×10^{-4} latent cancer fatalities/yr. Non-Radiological exposure - negligible impact on health effects is expected.	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 information. Plants have been designed and built to minimize worker exposure. The average worker dose will not exceed 500 mrem/yr.	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 operation for the worker is 0.0001 and for the public is 0.03. Non-radiological cancer risk (per person) would be less than 3.0×10^{-10} for workers and 2.0×10^{-9} to the public. The Radiological Cancer risk (per person) is estimated to be less than 1.2×10^{-7} for the worker and 6.8×10^{-8} to the public.	Safety and dose mitigating factors will be incorporated in the design and construction of the facility. Radiological and non-radiological impacts are expected to be less than the potential impacts for the proposed facilities in the DOE-EIS. Potential impacts will be calculated during the Phase I facility design.

3.7 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 described in Section 3.3) as the preferred alternative based on information developed so far (e.g., environmental impacts from the DOE INEL EIS, feasibility studies, NEPA 216 process, and procurement process).

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

3.8 Comparison of Impacts

This section compares the potential environmental impacts of implementing each of the four alternatives described in Sections 3.2 through 3.5. 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 3.8-1 summarizes the potential impacts of each alternative for the various environmental subject areas and lists proposed measures that could mitigate these impacts.

Table 3.8-1. Summary Comparison of Alternative Environmental Impacts (In Addition to Baseline).

Discipline	No Action Alternative	Proposed Action	Non-Thermal Treatment Alternative	Treatment and Storage Alternative
Land Use	No new land disturbance would occur at the RWMC or INEEL.	Disturb approximately 7 acres of previously disturbed land within and adjacent to the RWMC for project construction activities.	Disturb approximately 7 acres of previously disturbed land within and adjacent to the RWMC for project construction activities.	Disturb approximately 7 acres of previously disturbed land within and adjacent to the RWMC for project construction activities.
	Existing and planned land uses within the RWMC and other INEEL facilities would not change.	No effects on surrounding land uses or local land use plans or policies are expected.	No effects on surrounding land uses or local land use plans or policies are expected.	No effects on surrounding land uses or local land use plans or policies are expected.
	Mitigation: None anticipated.	Mitigation: None anticipated.	Mitigation: None anticipated.	Mitigation: None anticipated.
Socio-economics	No increase in new employment or workers would be expected. The employment and population in the region of influence (ROI) would remain the same.	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.	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.	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.	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.	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.	Mitigation: None anticipated.	Mitigation: None anticipated.	Mitigation: None anticipated.
Cultural Resources	Impacts to cultural resources at the RWMC are not expected.	Implementation of the Proposed Action would result in impacts to cultural resources that appear negligible, although a potential for subsurface discoveries exists.	Implementation of the Non-Thermal Treatment Alternative would result in impacts to cultural resources that appear negligible, although a potential	Implementation of the Treatment and Storage Alternative would result in impacts to cultural resources that appear negligible, although a potential for

Table 3.8-1. Summary Comparison of Alternative Environmental Impacts (In Addition to Baseline).

Discipline	No Action Alternative	Proposed Action	Non-Thermal Treatment Alternative	Treatment and Storage Alternative
			for subsurface discoveries exists.	subsurface discoveries exists.
Cultural Resources (continued)		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).	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.	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.	Construction of the new 138-kV power line to support the proposed AMWTP facility would not impact any known archaeological sites.	Construction of the new 138-kV power line to support the proposed AMWTP facility would not impact any known archaeological sites.
	Mitigation: None anticipated	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 consultation if any cultural resources or human remains are discovered during excavation.	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 resources or human remains are discovered during excavation.	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 resources or human remains are discovered during excavation.
Aesthetic and Scenic Resources	The existing INEEL visual setting would not change, nor would area scenic resources be	The AMWTP would not change the visual setting or affect aesthetic resources of the area.	The AMWTP would not change the visual setting or affect aesthetic resources of the area.	The AMWTP would not change the visual setting or affect aesthetic resources of the area.

Table 3.8-1. Summary Comparison of Alternative Environmental Impacts (In Addition to Baseline).

Discipline	No Action Alternative	Proposed Action	Non-Thermal Treatment Alternative	Treatment and Storage Alternative
	affected.			
Aesthetic and Scenic Resources (continued)	Mitigation: None anticipated.	Mitigation: None anticipated.	Mitigation: None anticipated.	Mitigation: None anticipated.
Geology	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.	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.	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 1,033 cubic yards of soil.	If needed, the 0.5-acre sewage lagoon expansion would require excavation of an additional 1,033 cubic yards of soil.	If needed, the 0.5-acre sewage lagoon expansion would require excavation of an additional 1,033 cubic yards of soil.
		Construction of the AMWTP facility would require the extraction of approximately 20,000 cubic yards of aggregate, clay, and sand from INEEL borrow areas.	Construction of the AMWTP facility would require the extraction of approximately 20,000 cubic yards of aggregate, clay, and sand from INEEL borrow areas.	Construction of the AMWTP facility would require the extraction of approximately 20,000 cubic yards of aggregate, clay, and sand from INEEL borrow areas.
	Mitigation: Runoff controls, dust controls, and reuse of stockpiled soil.	Mitigation: Runoff controls, dust controls, and reuse of stockpiled soil.	Mitigation: Runoff controls, dust controls, and reuse of stockpiled soil.	Mitigation: Runoff controls, dust controls, and reuse of stockpile soil.

Table 3.8-1. Summary Comparison of Alternative Environmental Impacts (In Addition to Baseline).

Discipline	No Action Alternative	Proposed Action	Non-Thermal Treatment Alternative	Treatment and Storage Alternative
Air Resources	*Radiological Impacts:* (Radiation dose in millirem/yr.) Onsite Worker: 0.023	*Radiological Impacts:* (Radiation dose in millirem/yr.) Onsite Worker: 0.73	*Radiological Impacts:* (Radiation dose in millirem/yr.) Onsite Worker: 0.003	*Radiological Impacts:* (Radiation dose in millirem/yr.) Onsite Worker: 0.73
	MEI Offsite: 0.11	MEI Offsite: 0.11	MEI Offsite: 0.0017	MEI Offsite: 0.11
	Population: 0.41	Population: 0.056	Population: 0.00037	Population: 0.056
	Non-Radiological Impacts:	*Non-Radiological Impacts:*	*Non-Radiological Impacts:*	*Non-Radiological Impacts:*
	Criteria pollutant and toxic pollutant levels well within applicable standards.	Projected criteria pollutant emission levels less than 1 percent of applicable standards.	Projected criteria pollutant emission levels less than 1 percent of applicable standards.	Projected criteria pollutant emission levels less than 1 percent of applicable standards.
		Projected incremental emission levels of all carcinogenic substances would be 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.	Projected incremental emission levels of all carcinogenic substances would be less than 1 percent of applicable standards.
		All noncarcinogenic emission levels would be less than 1 percent of applicable standards except for selenium, which would be about 1 percent of the standard.	All noncarcinogenic emission levels would be less than 0.001 percent of applicable standards.	All noncarcinogenic emission levels would be less than 1 percent of applicable standards except for selenium, which would be about 1 percent of the standard.
	Mitigation: None anticipated.	Mitigation: None anticipated.	Mitigation: None anticipated.	Mitigation: None anticipated.
Water Resources	No discharges of hazardous or radioactive waste to the vadose zone would be expected to occur in the near-term (2133). In the	No direct discharges of hazardous or radioactive waste would occur.	No direct discharges of hazardous or radioactive waste would occur.	No direct discharges of hazardous or radioactive waste would occur.

Table 3.8-1. Summary Comparison of Alternative Environmental Impacts (In Addition to Baseline).

Discipline	No Action Alternative	Proposed Action	Non-Thermal Treatment Alternative	Treatment and Storage Alternative
Water Resources (continued)	long-term, the potential for chronic leakage and contamination of the vadose zone would increase.			
	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.	No direct discharges to surface water.	No direct discharges to surface water.	No direct discharges to surface water.
	The consumption of 1.9 billion gallons per year of water from the Snake River Plain Aquifer would continue.	Increase in water consumption by 2.7 million gallons per year.	Increase in water consumption of less than 2.7 million gallons per year.	Increase in water consumption by 2.7 million gallons per year.
	Mitigation: None anticipated.	Mitigation: None anticipated beyond project design and administrative controls.	Mitigation: None anticipated beyond project design and administrative controls.	Mitigation: None anticipated beyond project design and administrative controls.
Ecology	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 3.8-1. Summary Comparison of Alternative Environmental Impacts (In Addition to Baseline).

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

Table 3.8-1. Summary Comparison of Alternative Environmental Impacts (In Addition to Baseline).

Discipline	No Action Alternative	Proposed Action	Non-Thermal Treatment Alternative	Treatment and Storage Alternative
Occupational and Public Health and Safety	*Radiological Exposure and Health Impacts:*	*Radiological Exposure and Health Impacts:*	*Radiological Exposure and Health Impacts:*	*Radiological Exposure and Health Impacts:*
	The estimated fatal cancer incidence would range from $6.0x10^{-4}$ for the Maximally Exposed Individual (MEI) involved worker, to $5.5x10^{-5}$ for the MEI offsite individual.	The estimated fatal cancer incidence would range from $6.0x10^{-4}$ for the MEI involved worker to $5.5x10^{-8}$ for the MEI offsite individual.	The estimated fatal cancer incidence would range from $6.0x10^{-4}$ for the MEI involved worker to $8.5x10^{-10}$ for the MEI offsite individual.	The estimated fatal cancer incidence would range from $6.0x10^{-4}$ for the MEI involved worker to $5.5x10^{-8}$ for the MEI offsite individual.
		Over the 30 year operating lifetime the estimated fatal cancer incidence would range from 8.80×10^{-6} for the MEI involved worker to 1.7×10^{-6} for the MEI offsite individual.	Over the 13 year operating lifetime of the Non-Thermal Treatment AMWTP facility the estimated fatal cancer incidence would range from 1.56×10^{-8} for the MEI involved worker to 1.15×10^{-8} for the MEI offsite individual. (The Non-Thermal Treatment AMWTP Facility would not operate for 30 years.)	Over the 30 year operating lifetime the estimated fatal cancer incidence would range from 8.80×10^{-6} for the MEI involved worker to 1.7×10^{-6} for the MEI offsite individual.
	The population estimated fatal cancer incidence would be 2.04×10^{-4}.	The population estimated fatal cancer incidence would be $2.8x10^{-5}$.	The population estimated fatal cancer incidence would be $1.8x10^{-7}$.	The population estimated fatal cancer incidence would be $2.8x10^{-5}$.
	Long-term radiological population risks for the maximum 70-year lifetime over 10,000 years would be 0.07 latent cancer fatalities.	For the 30 year operating lifetime the population estimated fatal cancer incidence would be 8.0×10^{-4}.	For the 13 year operating lifetime the population estimated fatal cancer incidence would be $2.15x10^{-6}$.	For the 30 year operating lifetime the population estimated fatal cancer incidence would be 8.0×10^{-4}.

Table 3.8-1. Summary Comparison of Alternative Environmental Impacts (In Addition to Baseline).

Discipline	No Action Alternative	Proposed Action	Non-Thermal Treatment Alternative	Treatment and Storage Alternative
Occupational and Public Health and Safety (continued)	*Non-Radiological Exposure and Health Impacts:*	*Non-Radiological Exposure Health Impacts:*	*Non-Radiological Exposure Health Impacts:*	*Non-Radiological Exposure Health Impacts:*
	A hazard quotient of less than one, no adverse health effects would occur as a result of criteria and noncarcinogenic emissions.	A hazard quotient of less than one, no adverse health effects would occur as a result of criteria and noncarcinogenic emissions.	A hazard quotient of less than one, no adverse health effects would occur as a result of criteria and noncarcinogenic emissions.	A hazard quotient of less than one, no adverse health effects would occur as a result of criteria and noncarcinogenic emissions.
	Long-term carcinogenic hazardous chemical population risks for the maximum 70-year lifetime over 10,000 years would be $3x10^{-6}$ latent cancer fatalities.	The highest cancer risk is for carbon tetrachloride at the site boundary, at one cancer incidence in 263 million.	The highest cancer risk is for carbon tetrachloride at the site boundary, at one cancer incidence in 263 million.	The highest cancer risk is for carbon tetrachloride at the site boundary, at one cancer incidence in 263 million.
	Industrial Safety:	*Industrial Safety:*	*Industrial Safety:*	*Industrial Safety:*
	Annual injury/illness rates for INEEL operation and construction are 3.3 and 6.4 per 200,000 hours, respectively.	During 2.5 year construction: Estimated total injury/illness would be 385. Estimated total fatalities would be 0.96.	During 2.5 year construction: Estimated total injury/illness would be 385. Estimated total fatalities would be 0.96.	During 2.5 year construction: Estimated total injury/illness would be 385. Estimated total fatalities would be 0.96.
	Annual fatality rates for INEEL operation and construction are 0.016 fatalities per 200,000 hours.	During 30 year operation: Estimated total injury/illness would 135. Estimated total fatalities would be 0.65.	During 13 year operation: Estimated total injury/illness would 53. Estimated total fatalities would be 0.26.	During 30 year operation: Estimated total injury/illness would 53. Estimated total fatalities would be 0.65.
	Mitigation: None anticipated.	Mitigation: None anticipated.	Mitigation: None anticipated..	Mitigation: None anticipated.

Table 3.8-1. Summary Comparison of Alternative Environmental Impacts (In Addition to Baseline).

Discipline	No Action Alternative	Proposed Action	Non-Thermal Treatment Alternative	Treatment and Storage Alternative
INEEL Services	No change to INEEL services.	Electrical usage would increase by 35,022 MWh/yr.	Electrical usage would increase by 23,980 MWh/yr.	Electrical usage would increase by 35,022 MWh/yr.
		Propane use would increase by 925,000 gal/yr.	Propane use would increase by 185,000 gal/yr.	Propane use would increase by 925,000 gal/yr.
	Mitigation: None anticipated.	Mitigation: See water resources and cultural resources.	Mitigation: See water resources and cultural resources.	Mitigation: See water resources and cultural resources.
Accidents	In the anticipated frequency range, the waste box spill is the scenario with the highest consequences.	In the anticipated frequency range, the waste box spill is the scenario with the highest consequences.	In the anticipated frequency range, the waste box spill is the scenario with the highest consequences.	In the anticipated frequency range, the waste box spill is the scenario with the highest consequences.
	The dose to the MEI offsite would be 6.5 $x10^{-3}$ rem. The likelihood of fatal cancer would be 3.3 $x10^{-6}$.	The dose to the MEI offsite would be 6.5 $x10^{-3}$ rem. The likelihood of fatal cancer would be 3.3 $x10^{-6}$.	The dose to the MEI offsite would be 6.5 $x10^{-3}$ rem. The likelihood of fatal cancer would be 3.3 $x10^{-6}$. The absence of incineration and vitrification processes results in some reduction of risk.	The dose to the MEI offsite would be 6.5 $x10^{-3}$ rem. The likelihood of fatal cancer would be 3.3 $x10^{-6}$.
	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.	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.	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.	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.

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. Chapter 4 provides citations in each section to the supporting technical references that contain substantiating data and analysis.

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 Chemical Processing Plant, etc.) which occupy 2,032 acres (Figure 4.2-2). The remaining land (567,103 acres) is largely undeveloped and 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* (LMITCO 1997a).

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 Administrative Area, located in the northeast section of the facility; the Operation Zone, located west of the Administrative 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 (PLOs) (i.e., PLOs 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 Memorandums of Understandings (MOUs) 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 INEEL, acquired from the State and private parties.

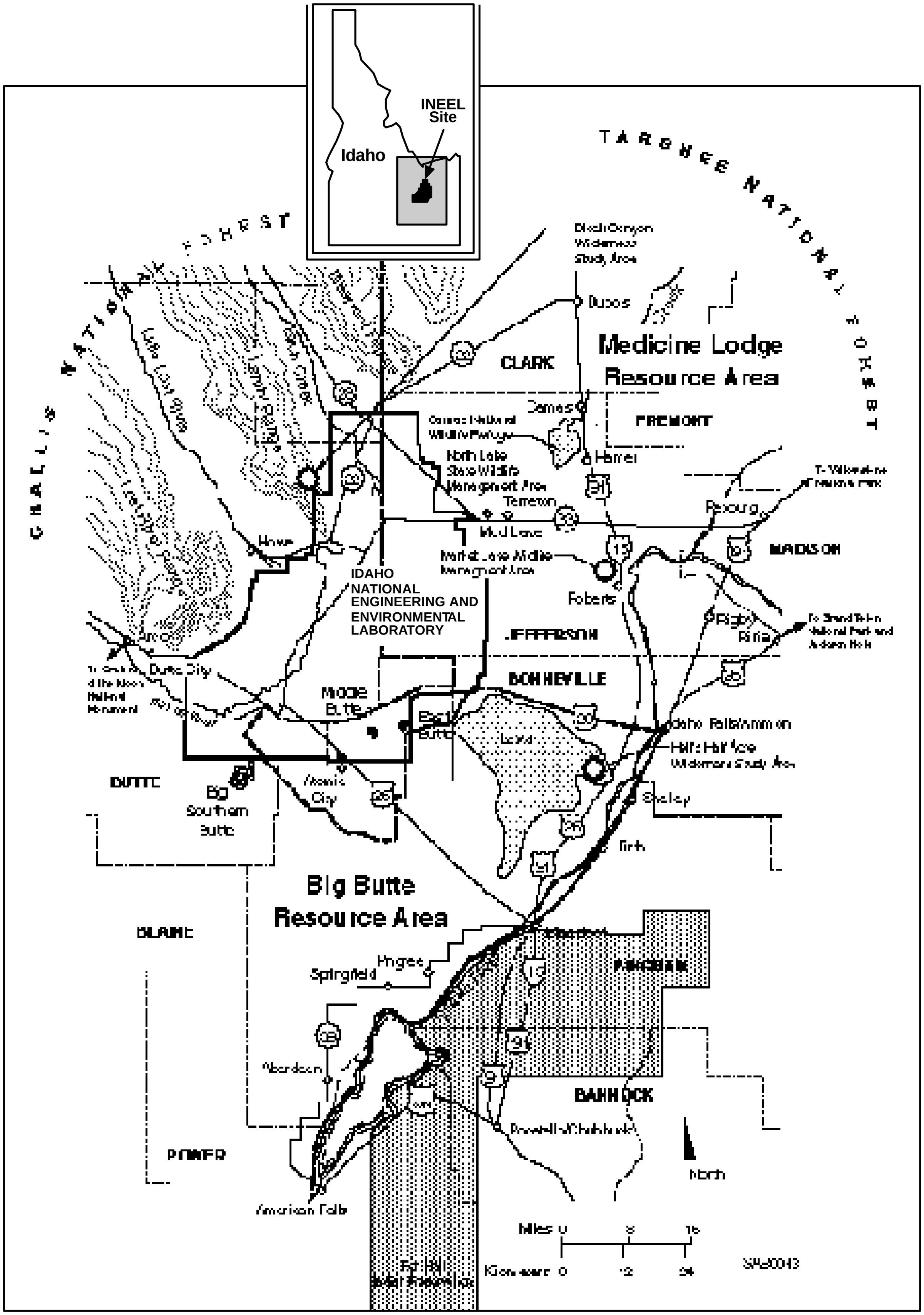


Figure 4.2-1 INEEL site vicinity map.

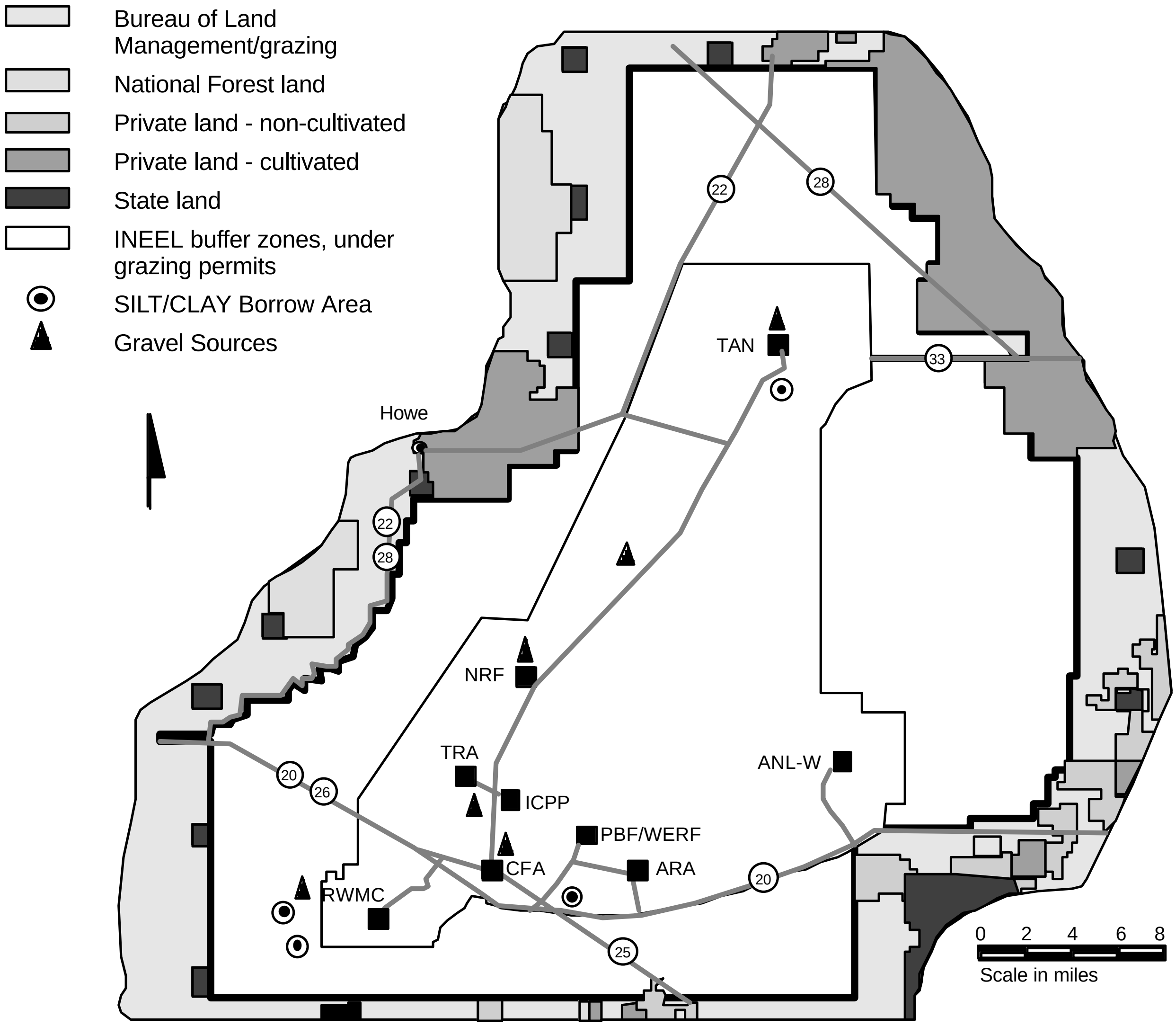


Figure 4.2-2. Selected land uses at the INEEL and in the surrounding region

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. Geologic Survey).
Idaho Chemical Processing Plant	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 5.20, Environmental Justice, and Section 5.4, Cultural Resources.

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 (DOE/INEEL 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 (DOE/INEEL 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 four 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 1998b). 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 four 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 6.6 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 Officer (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 Officer (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 509 buildings and structures inventoried, 213 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 Facilities (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). Memoranda 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 Historic American Building 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.

Whenever possible, locations with a high likelihood of archaeological or Native American resources are avoided when siting new facilities or planning land use actions. Historically significant architectural structures are 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 reserve is culturally important and, in fact, is located within the aboriginal territory of the Shoshone 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 Grave 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 State Archaeologist 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 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 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) (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 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 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.

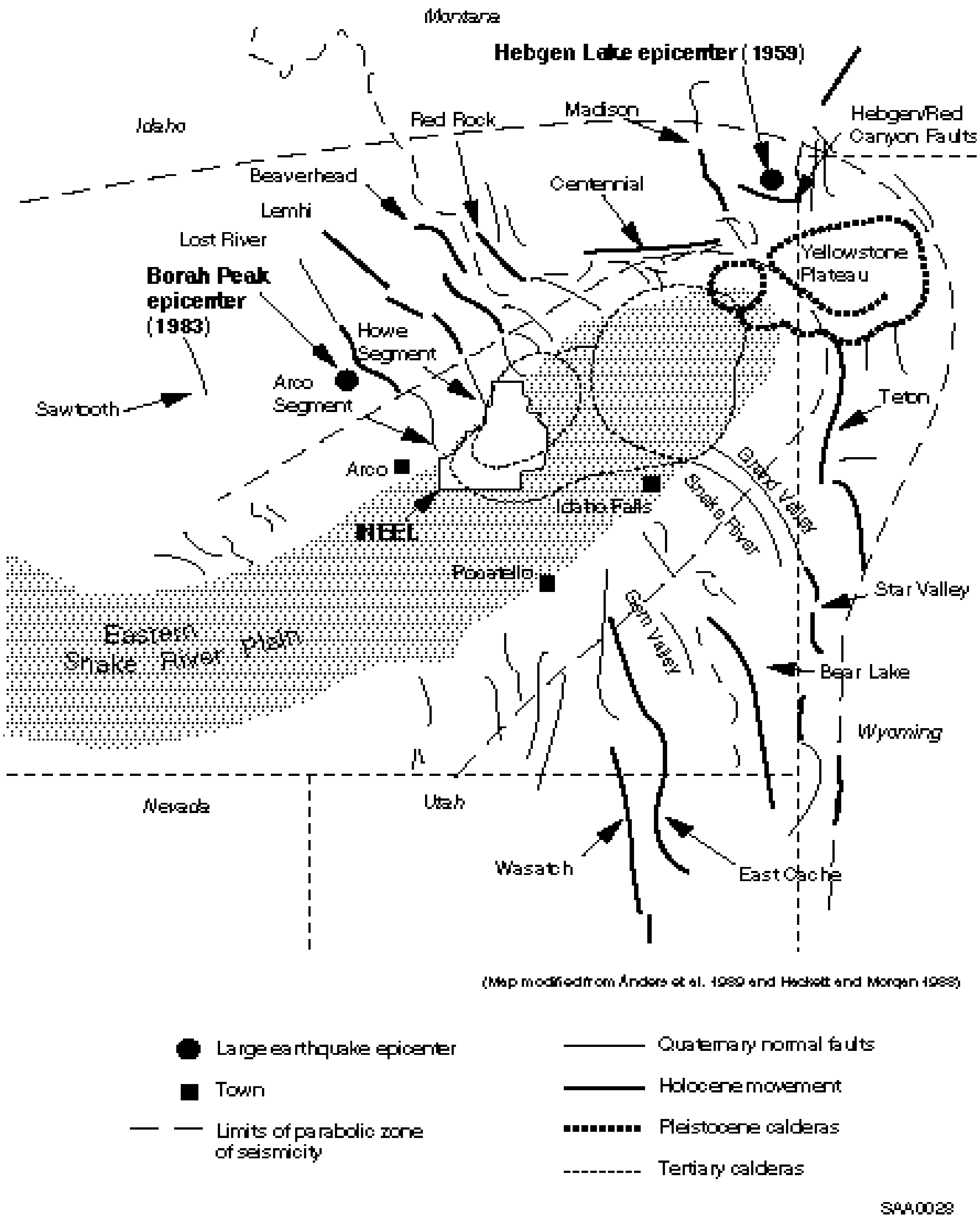


Figure 4.6-1. Geologic features in the region of the INEEL.

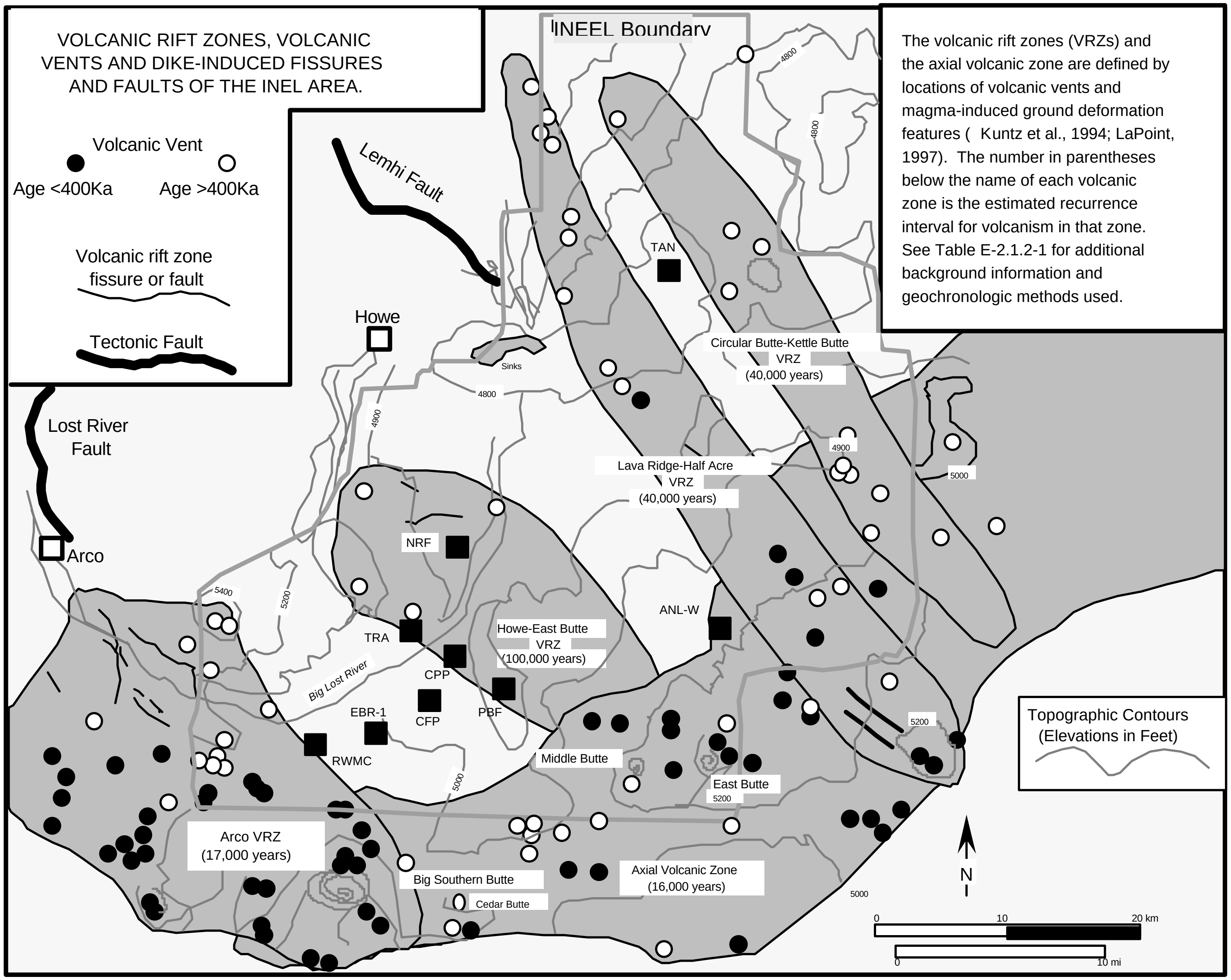


Figure 4.6-2. Map of INEEL, showing locations of VRZs and lava flow hazard zones.

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 (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 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 (accelerations due to 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 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 (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 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 mixed 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 1998)[1].

[1] The visual range at the time the DOE INEL EIS analyses were performed was 97 miles.

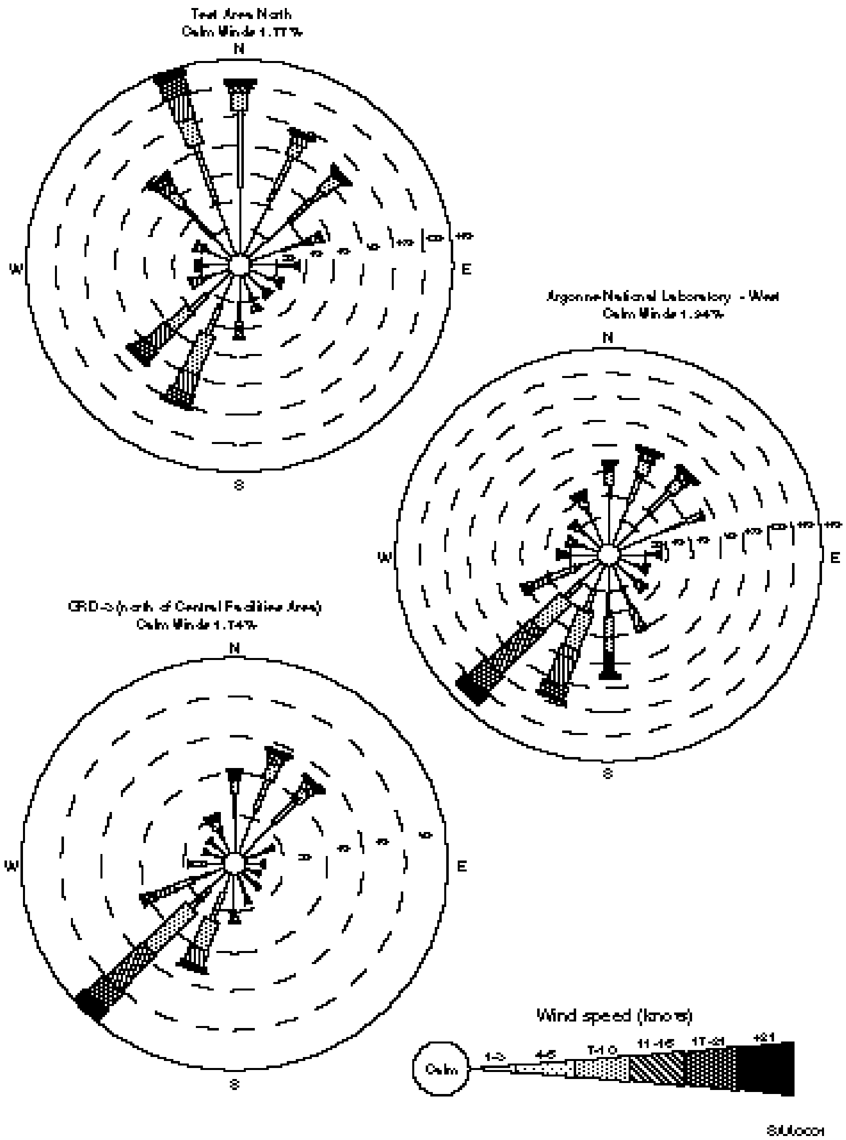


Figure 4.7-1. Annual average wind direction and speed at meteorological monitoring stations on the INEEL.

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* (and amendments) provides the framework to protect the nation's air resources and public health and welfare. In Idaho, the 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 *Clean Air Act*. INEEL activities are subject to air quality regulations and standards established under the *Clean Air Act* 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 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.

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.

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

Area	Tritium/ Carbon-14 1995	Tritium/ Carbon-14 1996	Iodines 1995	Iodines 1996	Noble gases 1995	Noble gases 1996	Mixed fission and activation products[a] 1995	Mixed fission and activation products[a] 1996	U/Th/TRU[b] 1995	U/Th/TRU[b] 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

Source: 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.

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 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 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.

[1] The DOE INEL EIS (Section 5.7) analysis included a short-term, temporary remediation project (operation of a portable water treatment unit) which was projected to result in a localized dose rate of about 4 millirem per year; however, due to its short-term nature, that operation is not considered representative of baseline conditions and has not been included in the current baseline.

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 1996). 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[1]. 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

[1] Ozone is formed by reactions of oxides of nitrogen and oxygen in the presence of sunlight. Volatile organic hydrocarbons, sometimes called precursor organics, contribute to the formation of ozone. Oxides of nitrogen and volatile organic hydrocarbons are, therefore, regulated as precursors to ozone formation.

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 also 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) Maximum baseline case		Actual sitewide emissions					
			1995			1996		
Pollutant	Maximum hourly (kg/hr)	Annual average (kg/yr)	Actual hourly (kg/hr)	Maximum Hourly (kg/hr)	Annual average (kg/yr)	Actual hourly (kg/hr)	Maximum hourly (kg/hr)	Annual average (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	----	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. 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 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 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.

The amount of increment consumed by existing sources subject to PSD regulation has been assessed for all increment-consuming sources operating as of May 1, 1994 (Raudsep et al. 1995), and for projected increases associated with implementation of alternatives described in the DOE INEL EIS (Section 5.7) (Belanger et al. 1995). The amount of increment consumed by existing sources (as of May 1, 1994) operating at maximum allowable emission rates is less than 10 percent of the allowable increment for all annual evaluations but somewhat higher for short-term assessments. The amount of the allowable increment at Craters of the Moon Wilderness Area consumed by INEEL sources is 53 percent for sulfur dioxide levels averaged over any 3-hour period. For the Class II area represented by public access locations on and near the INEEL, the maximum consumption is 43 percent and applies to respirable particulate matter levels averaged over any 24-hour period.

An update of Class II area PSD increment consumption attributable to sources in the south-central portion of the INEEL has been recently performed (Abbott 1997). That assessment included sources subject to PSD regulation that were operational as of June 1996. The results of that assessment (Table 4.7-3) are in general agreement with the results reported in the DOE INEL EIS (Section 4.7), although the amount of Class II increment consumed by short-term sulfur dioxide and annual average nitrogen dioxide levels are higher than the previously assessed values. As can be seen in Table 4.7-3, consumption of the allowable 3-hour and 24-hour sulfur dioxide increments is now assessed at 26 percent and 31 percent, respectively, compared to the DOE INEL EIS values of 14 percent and 22 percent. Nitrogen dioxide increment consumption is now assessed at 1.6 percent compared to the previously assessed value of 0.9 percent.

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.

Table 4.7-3. PSD increment consumption at Class II areas at the INEEL by existing (1996) sources subject to PSD regulation.

Pollutant	Averaging time	PSD increment[a] (μg/m^3)	Maximum predicted concentration: INEEL boundary (μg/m^3)	Maximum predicted concentration: Public Roads (μg/m^3)	Amount of PSD increment consumed[b] (μg/m^3)	Percent of PSD increment consumed: Current assessment	Percent of PSD increment consumed: DOE INEL EIS assessment
	3-hour						
Sulfur dioxide	24-hour	512	96	133	133	26	14
	Annual	91	16	28	28	31	22
		20	1.3	1.8	1.8	9	9
Respirable particulates[c]	24-hour	30	3.0	13	13	43	43
	Annual	17	0.11	0.85	0.85	5	5.3
Nitrogen dioxide	Annual	25	0.036	0.38	0.38	1.5	0.9

Sources: Abbott 1997; DOE 1995.
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).

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.

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 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 areas 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 (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 around the facility 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 and monitoring (Becker et al. 1996).

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) (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.

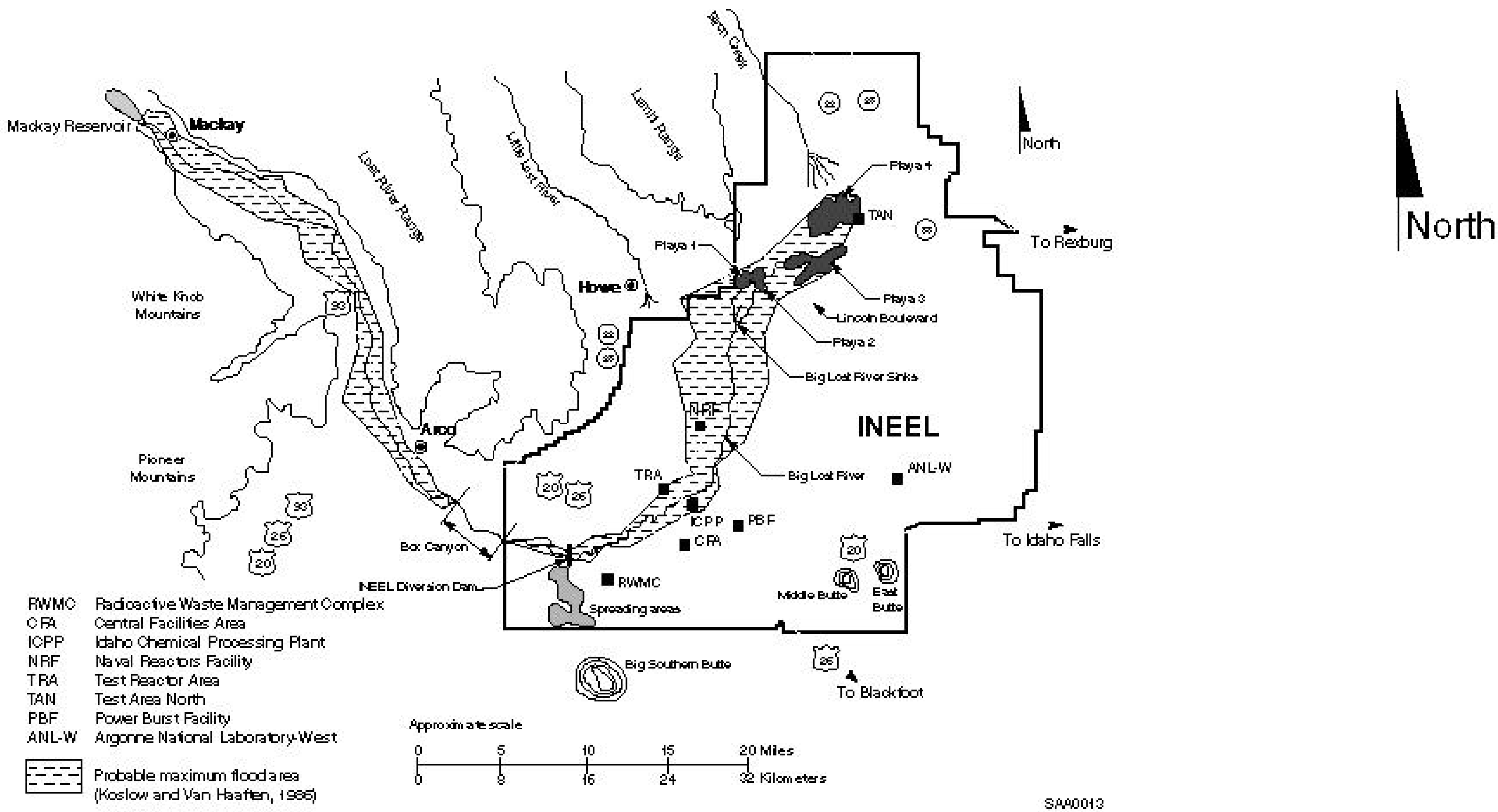


Figure 4.8-1. Locations of selected INEEL facilities shown with the predicted inundation area for the probable maximum flood-inducing overtopping failure of the Mackay Dam (Bennett 1990).

4.8.2.1 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 inadvertently constructed such that water could enter the annular space at depths above the monitoring zone. 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, the following contaminants are monitored in the vicinity of the RWMC: 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).

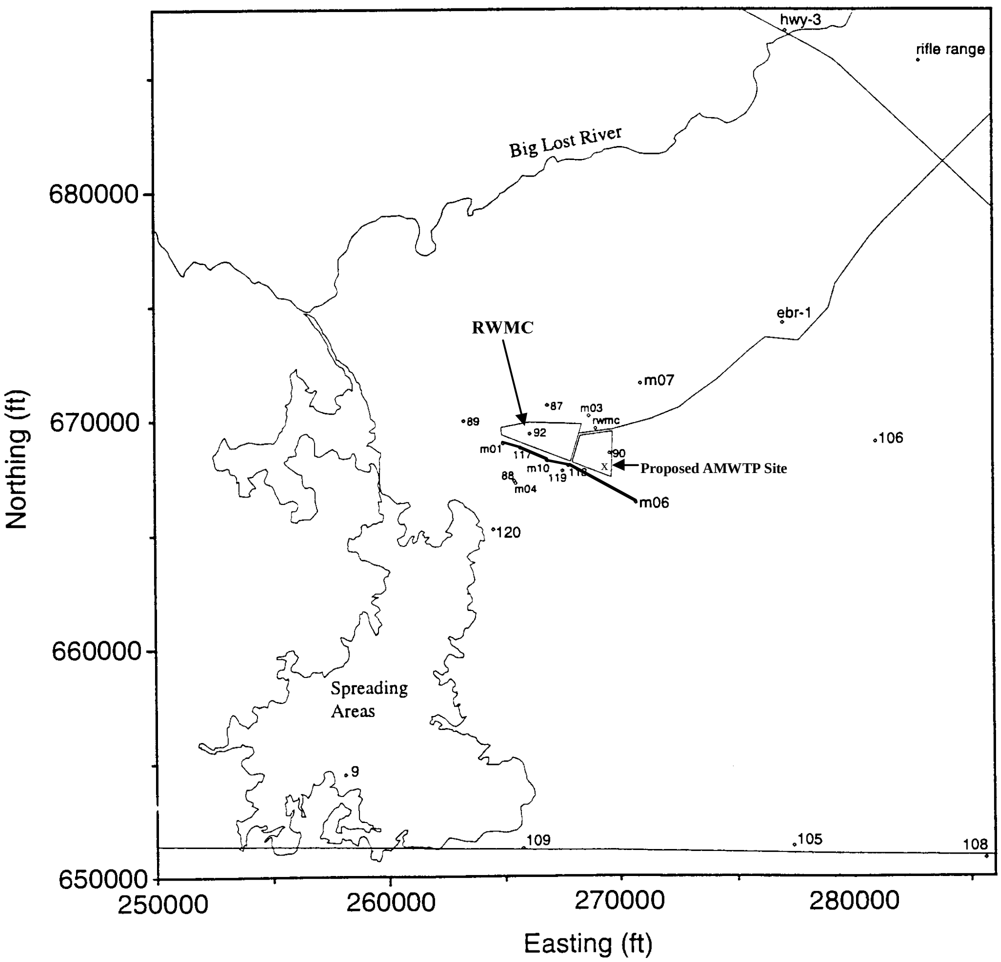
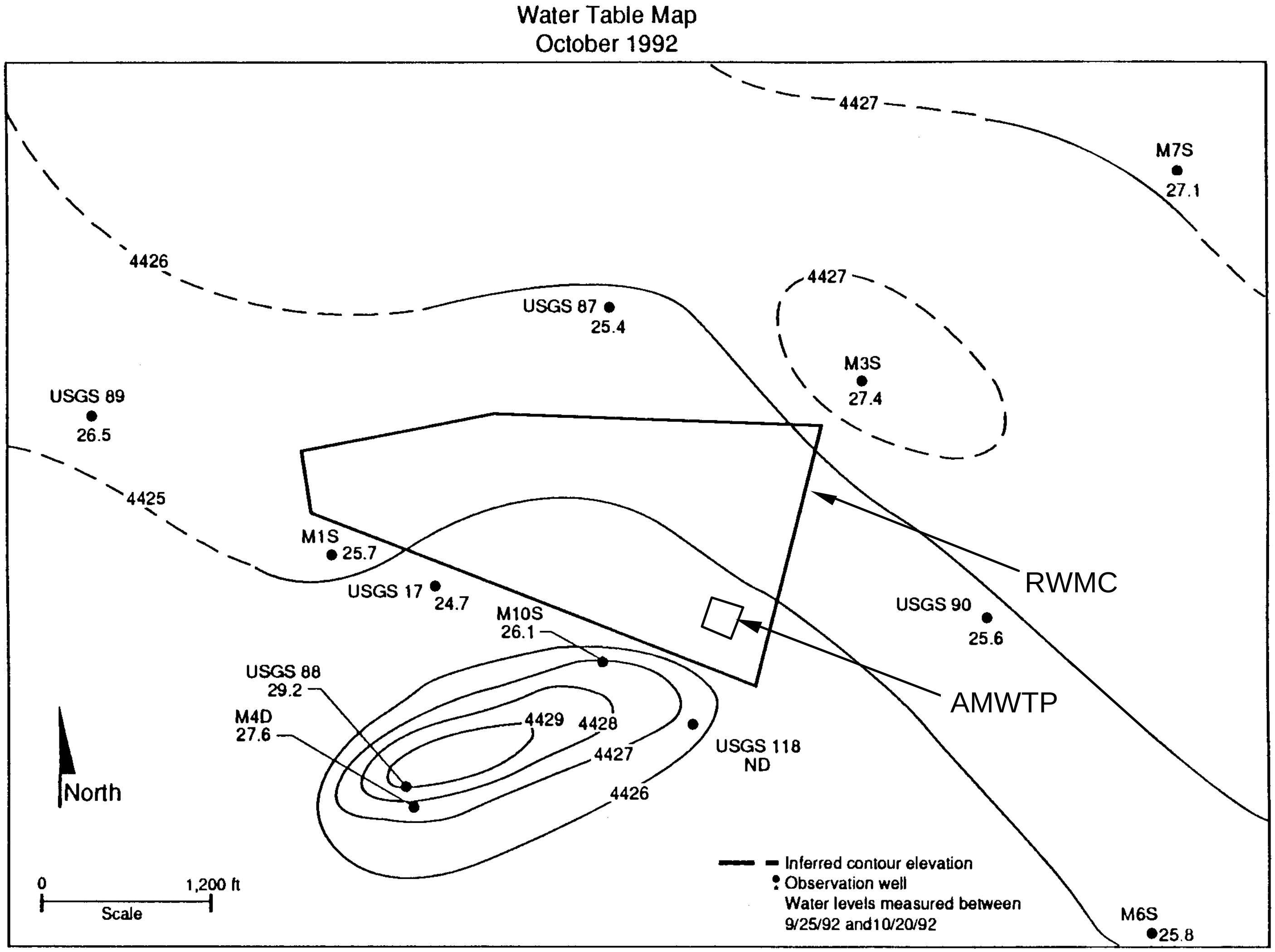


Figure 4.8-2. USGS aquifer water level monitoring wells in the RWMC vicinity.



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.

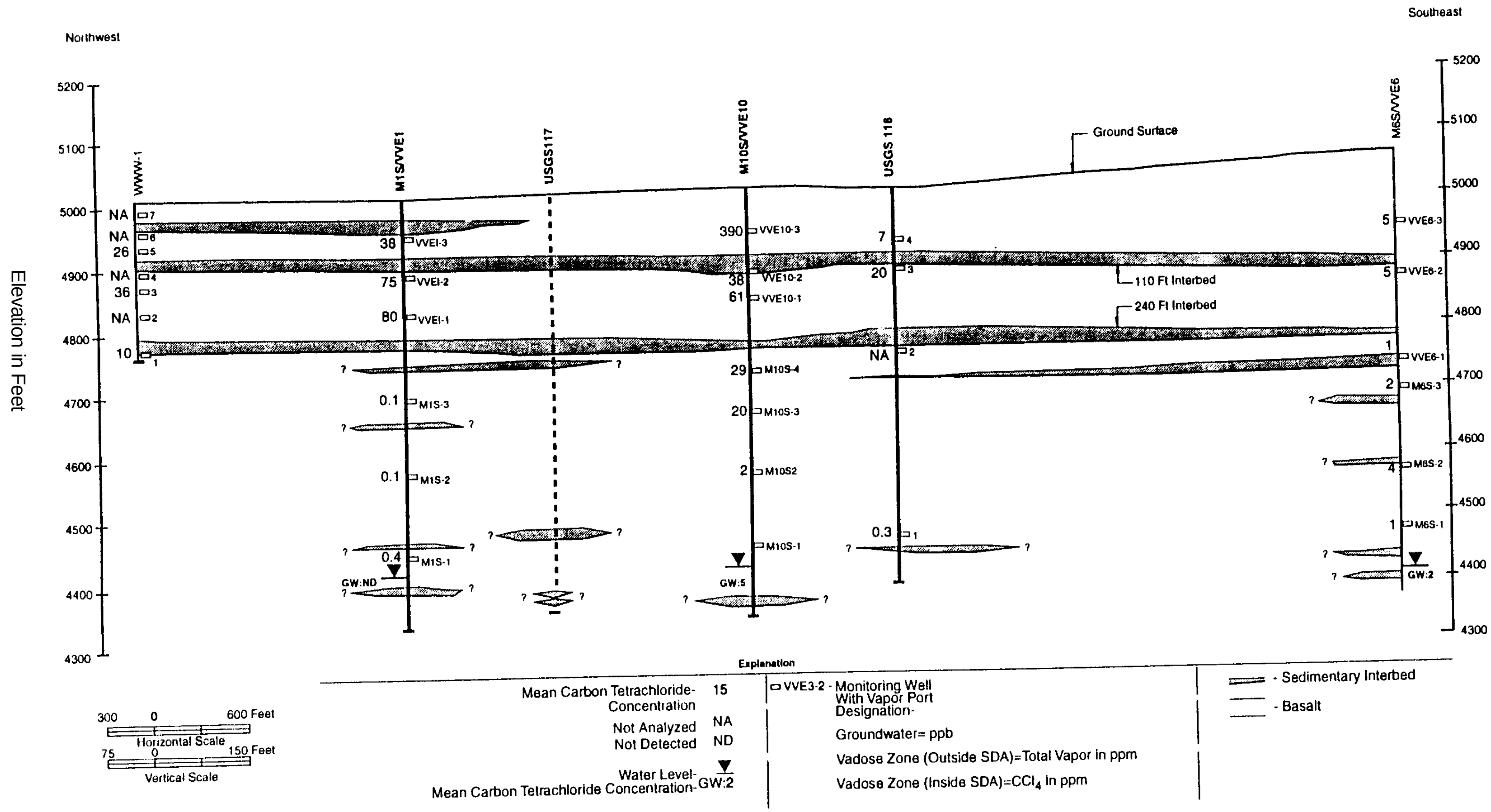


Figure 4.8-4. NW-SE Cross-Section along the RWMC southern boundary (Becker et al. 1996).

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 1996c).

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 (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 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.

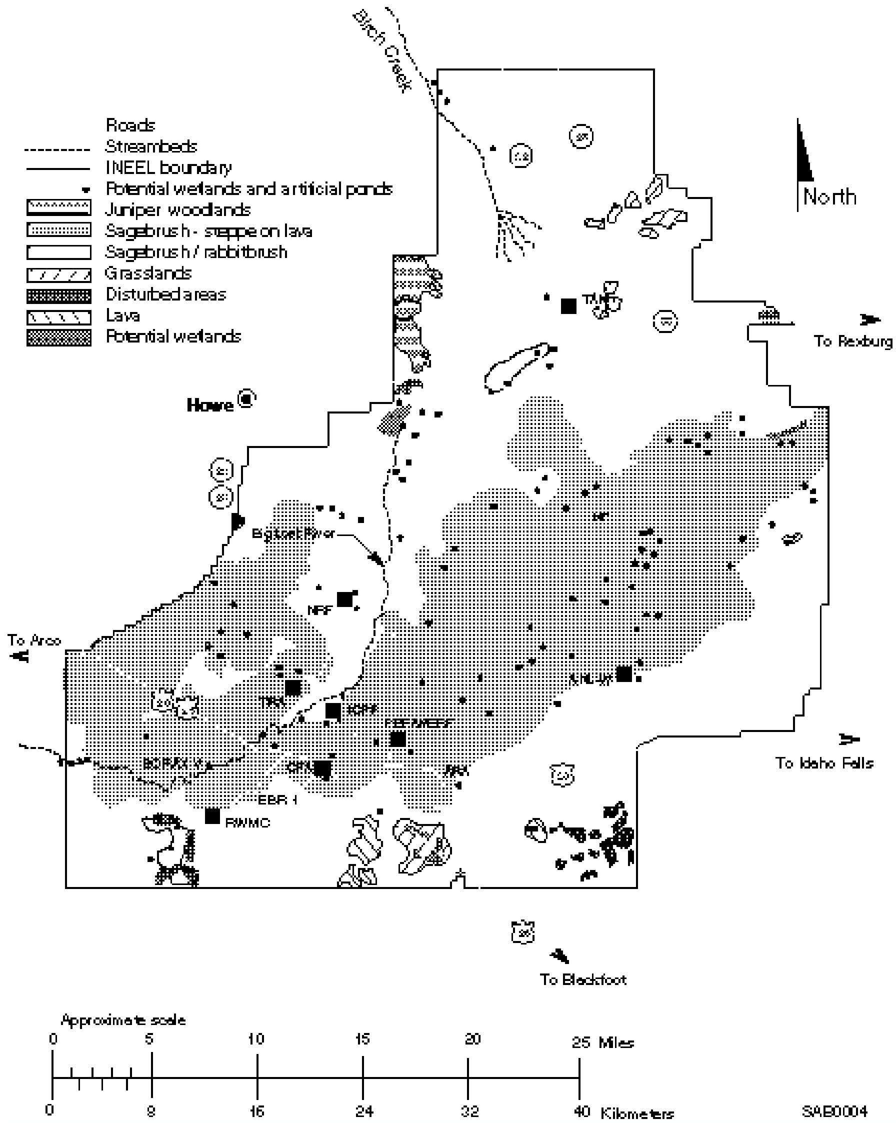


Figure 4.9-1. Approximate distribution of vegetation map at the INEEL.

4.9.3 Threatened, Endangered, and Sensitive Species

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

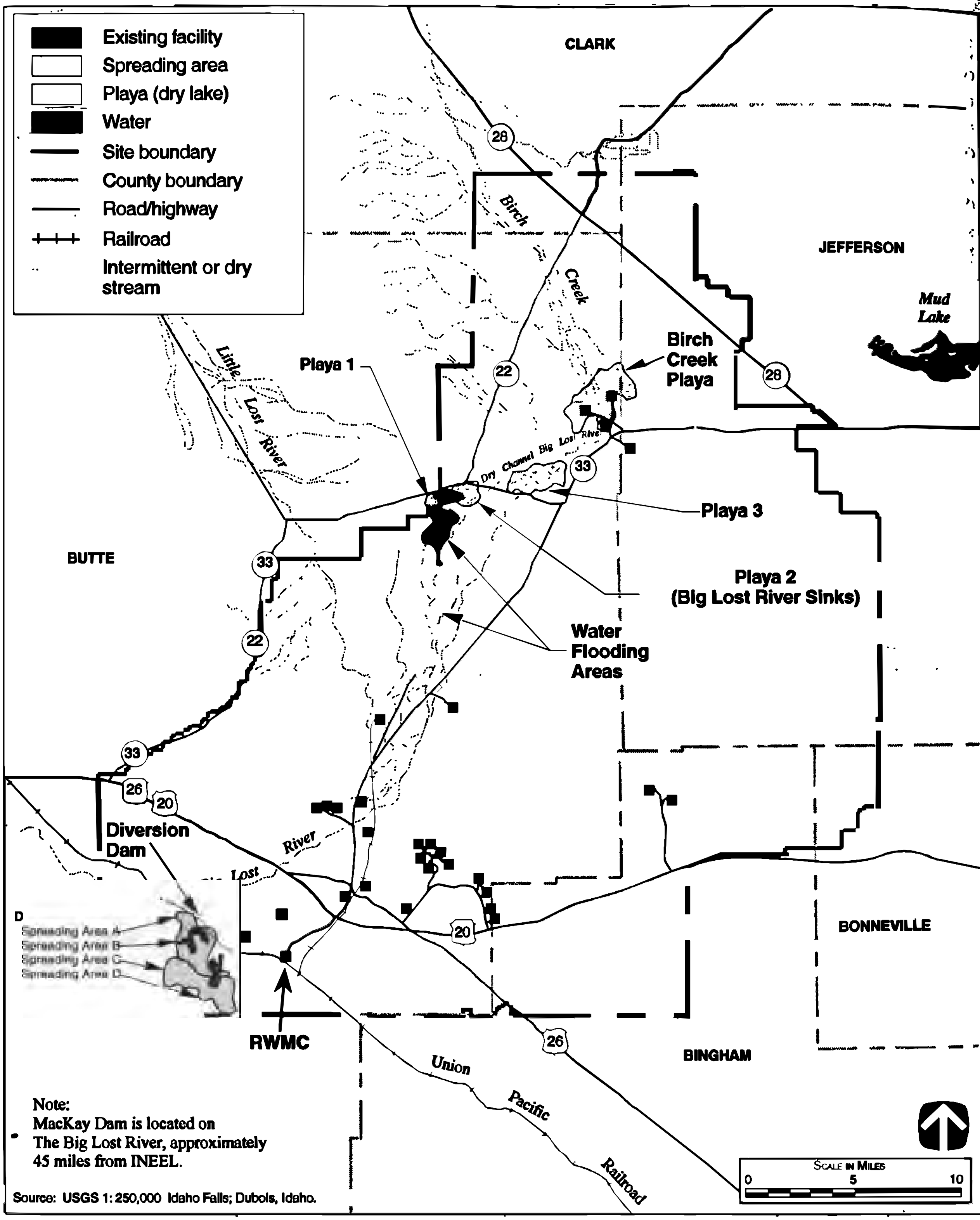
a. The species identified as sensitive, rare, or unique are uncommon on the INEEL because they require unique microhabitat conditions (Idaho CDC 1998a). The plant species are distant from disturbed facilities.
b. BLM = Bureau of Land Management monitored; FS = U.S. Forest Service monitored; INPS-S = Idaho Native Plant Society sensitive; INPS-M = Idaho Native Plant Society monitored; 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 (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.



5138–INEL/007/rev. c

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

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 (<100 pCi/g whole body for raptors and <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).

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 wildlife productivity (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 Shoshone-Bannock 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 1995.

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.

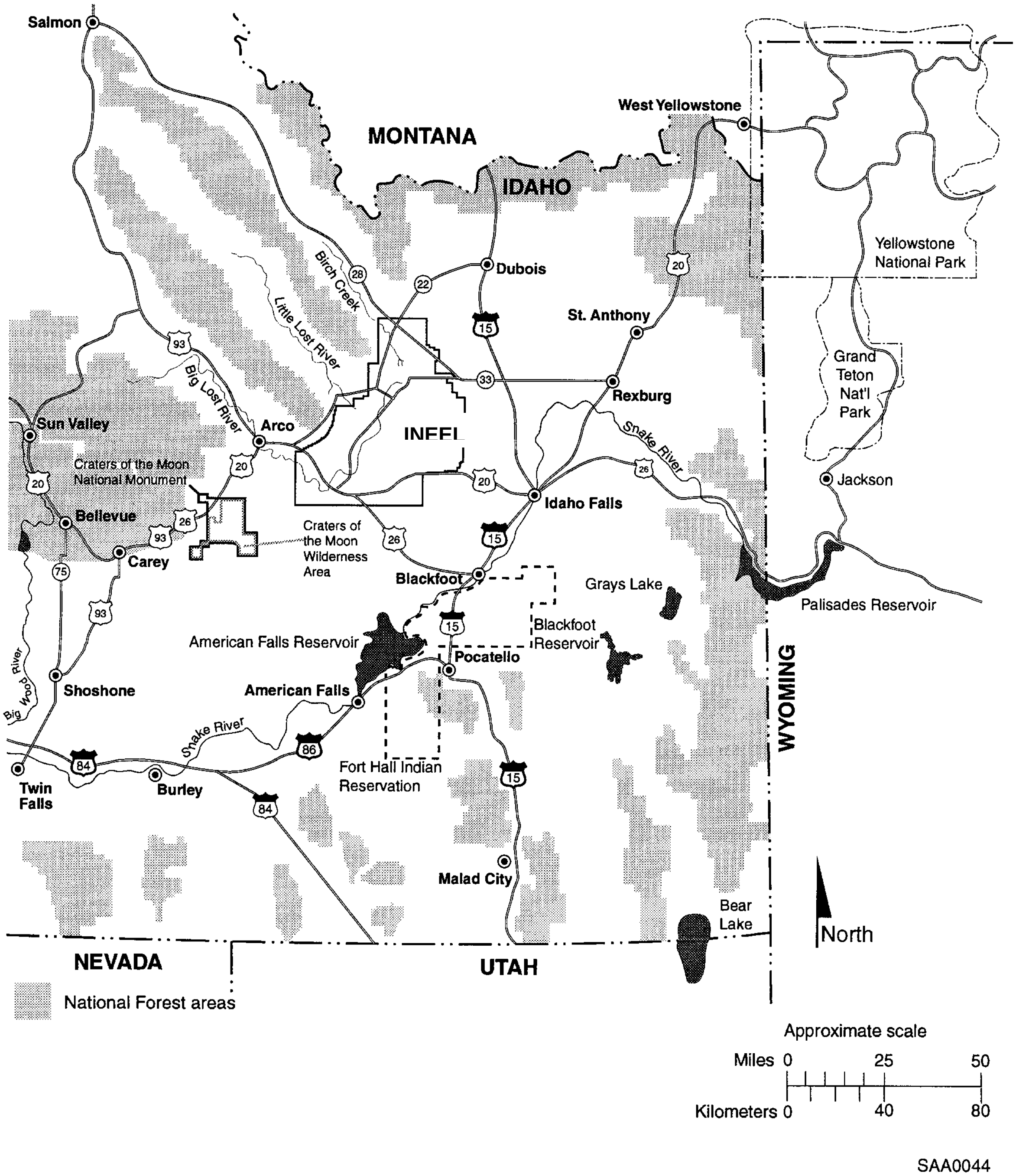


Figure 4.11-1. Regional roadway infrastructure in southeastern Idaho.

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 miles 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 (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.

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 1995.

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 1993 through 1997, the average motor vehicle accident rate was 1.9 accidents per million miles for DOE buses (Carroll 1998), which compares with a nationwide accident rate of 12.8 accidents per million miles for all motor vehicles. There are no recorded air accidents associated with the INEEL.

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 (person-rem)	Estimated cancer fatalities
Occupational	6.6	0.0026
General population	0.14	0.000070

Source: DOE 1995.

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 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 1.5×10^{-4} within the entire population over the next 70 years.

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.

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.

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 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.

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 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 (Teel1993)	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.

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 ICPP, and the Test Reactor Area.

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.

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 1995) 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.

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 NEPA documents 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 the *National Environmental Policy Act* (NEPA) of 1969.

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 low-level mixed waste (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 (DOE-ID 1995b), the *Integration of Environmental Management Activities at the INEL* (LITCO 1995), and the *INEL Comprehensive Facility and Land Use Plan* (LMITCO 1997a). 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* (LMITCO 1997). 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 the *Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs Environmental Impact Statement* (DOE INEL EIS [DOE 1995]), 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.

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 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 E-1, Socioeconomics.

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.

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 *Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs Environmental Impact Statement* (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 likely not 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 Grave 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 noise, 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, 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.

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.

5.4.5 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 aesthetics 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*. 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 Section E-3.3.3.5 Appendix E-3, Air Resources.

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 environmental, safety, and health 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 (Table 5.7-8), 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 E-3.3.3.5) 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 0.001 compared to the recommended screening criterion of 0.5. The highest color shift value is 0.18 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.

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. The air quality analysis (see Section 5.7.4.1) indicates that for criteria pollutant emissions (e.g., nitrogen dioxide, sulfur dioxide, and particulates), ambient air concentrations would be roughly half as high as those for the Proposed Action due to the elimination of incinerator emissions as well as lower boiler and diesel generator emission rates. However, when the cumulative effect of the baseline and projected increases is considered (i.e., with inclusion of potential impacts of other foreseeable projects), there is little difference between the alternatives (see Table 5.7-5). 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 E–2.1. Based on previous studies described in detail in Appendix 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 $2.9x10^{-6}$ per year, $9.3x10^{-6}$ per year, and $2.4x10^{-6}$ 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 1033 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*

Substance 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 are not above background, and
- The concentration of radionuclides does not exceed maximum background levels identified in Technical Procedure (TPR)-713 Radioactive Contamination Added Determination Rev 0, Table 1: Activities in Soil Local to the INEEL.

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 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.

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 resulting from proposed 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 will 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 compared to applicable standards. Public health impacts from expected radiation dose and nonradiological pollutant concentrations are analyzed in Section 5.12, Occupational and Public Health and Safety. Volatile organic compounds, which can lead to the formation of ozone, are characterized. Related impacts such as potential for visibility degradation and air quality impacts due to project-induced secondary growth are discussed. Additional details on assessment methods, assumptions, and related information are contained in Appendix E-3, Air Resources, and in the DOE INEL EIS, Section 5.7 and Appendix F-3.

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 were also considered in defining the methodology. For the most part, the methodology used paralleled that used in the DOE INEL EIS. In a few cases, however, it was necessary to employ more current methods. 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 of 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 (eg., 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.

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, which is the same monitoring location and 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 (such as from the proposed AMWTP main stack), while the 10-meter data are used for ground-level releases.

As in the DOE INEL EIS, the nonradiological assessment did not include methods for quantifying impacts related to ozone formation. Emissions of volatile organic compounds (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

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, 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 Section E-3.3.3.2 of Appendix E-3, Air Resources.) In addition to the main stack, nonradiological pollutants would be emitted from six propane-fueled water boilers (up to four of which could operate at any one time), one hot water heater, and two diesel-fueled emergency generators. The boiler and heater stacks will be located at a utility building situated about 21 meters south of the proposed AMWTP main building. The generators will 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). These emission rates are presented in Table 5.7-1. The incinerator and virtifier emissions listed in Table 5.7-1 would occur under either the Proposed Action or the Treatment and Storage Alternative; the non-thermal emissions estimates apply to those two alternatives and are also considered an upper bound for the Non-Thermal Treatment Alternative.

There would be no radiological emissions from the AMWTP under the No Action Alternative. The methods and assumptions used in deriving these estimates are described in Section E-3.3.1 of Appendix E-3, Air Resources.

Criteria and toxic air pollutant emissions have been estimated for the incinerator, 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 1998b, 1998c). These methods are described in Appendix E-3.3.1 of Appendix E-3, Air Resources, and are summarized in this section.

Table 5.7-1. Radionuclide emission rates (curies per year) for operation of the AMWTP under the Proposed Action and Non-Thermal Treatment Alternative.[a]

	Source				Totals by alternative	
Radionuclide	Incinerator	Vitrifier	Non-thermal glovebox	Non-thermal Zone 3	Proposed Action[b]	Non-Thermal Treatment Alt.[c]
Am-241	5.4×10^{-4}	5.4×10^{-4}	7.3×10^{-8}	1.6×10^{-5}	1.1×10^{-3}	1.6×10^{-5}
Pu-238	5.1×10^{-4}	5.1×10^{-4}	6.9×10^{-8}	1.5×10^{-5}	1.0×10^{-3}	1.5×10^{-5}
Pu-239	3.0×10^{-4}	3.0×10^{-4}	4.1×10^{-8}	9.0×10^{-6}	6.2×10^{-4}	9.0×10^{-6}
Pu-240	7.0×10^{-5}	7.0×10^{-5}	9.5×10^{-9}	2.1×10^{-6}	1.4×10^{-4}	2.1×10^{-6}
Pu-242	4.6×10^{-9}	4.6×10^{-9}	6.2×10^{-13}	1.4×10^{-10}	9.3×10^{-9}	1.4×10^{-10}
Pu-241	7.1×10^{-4}	7.1×10^{-4}	9.6×10^{-8}	2.1×10^{-5}	1.5×10^{-3}	2.1×10^{-5}
Ba-137m	1.0×10^{-5}	1.0×10^{-4}	1.3×10^{-9}	2.9×10^{-7}	1.1×10^{-4}	3.0×10^{-7}
Cs-137	1.0×10^{-5}	1.0×10^{-4}	1.4×10^{-9}	3.0×10^{-7}	1.1×10^{-4}	3.0×10^{-7}
Sr-90	8.9×10^{-6}	8.9×10^{-6}	1.2×10^{-9}	2.6×10^{-7}	1.8×10^{-5}	2.7×10^{-7}
Y-90	8.9×10^{-6}	8.9×10^{-6}	1.2×10^{-9}	2.6×10^{-7}	1.8×10^{-5}	2.7×10^{-7}
U-233	4.5×10^{-6}	4.5×10^{-6}	6.1×10^{-10}	1.3×10^{-7}	9.2×10^{-6}	1.3×10^{-7}
Cm-244	2.4×10^{-6}	2.4×10^{-6}	3.2×10^{-10}	7.0×10^{-8}	4.9×10^{-6}	7.1×10^{-8}
H-3	$1.2 \times 10^{+1}$	$1.2 \times 10^{+0}$	1.6×10^{-4}	3.5×10^{-2}	$1.3 \times 10^{+1}$	3.5×10^{-2}
Cs-134	4.9×10^{-7}	4.9×10^{-6}	6.6×10^{-11}	1.5×10^{-8}	5.4×10^{-6}	1.5×10^{-8}
Co-60	4.4×10^{-7}	4.4×10^{-7}	6.0×10^{-11}	1.3×10^{-8}	9.0×10^{-7}	1.3×10^{-8}

Source: BNFL (1998a).

a. Emissions estimates are based on the radionuclide inventory of waste to be processed and facility operations of 24 hours per day, 330 days per year. See Table E-3-2 of Appendix E-3 for additional details regarding radionuclide emissions estimates.

b. Emissions under the Treatment and Storage Alternative would be same as those for the Proposed Action. Proposed Action totals are the sum of all four columns under Source.

c. Non-Thermal Treatment Alternative totals are the sum of non-thermal glovebox and non-thermal Zone 3 columns.

Nonradiological emissions may arise through two primary mechanisms: (1) release of contaminants which are present in the waste and which are released during treatment or (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:

- 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 1998b). 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 5.7-2. Emissions under the Treatment and Storage Alternative would be the same as the Proposed Action. Additional details regarding these emissions estimates are provided in Table E-3-3 of Appendix E-3, Air Resources.

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 5.7-3). 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 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 are inhalation of americium-241. When added to the baseline dose and projected increases, the cumulative dose to the offsite individual would be 0.25 millirem per year. 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 is 0.73 millirem per year and would occur within the RWMC area about 300 meters south-southwest of the facility. This dose, when added to the baseline dose and projected increases, remains a very small fraction of the occupational dose limit of 5,000 millirem per year.

Table 5.7-2. Projected nonradiological emission rates for the proposed AMWTP and support equipment.[a]

Substance	Proposed Action		Non-Thermal Treatment Alternative	
	Maximum hourly g/hr	Annual average kg/yr	Maximum Hourly g/hr	Annual average kg/yr
Criteria pollutants				
Carbon monoxide	8.4E+03	2.3E+03	4.1E+03	4.9E+02
Oxides of nitrogen	4.0E+04	2.2E+04	1.9E+04	2.6E+03
Sulfur dioxide	5.4E+03	2.0E+04	1.3E+03	2.0E+02
Particulate matter (PM-10)	2.7E+03	3.3E+02	1.3E+03	1.2E+02
Volatile organic compounds	3.0E+03	4.8E+02	1.5E+03	1.7E+02
Lead	4.9E-06	3.9E-05	2.4E-08	1.9E-07
Carcinogens				
Arsenic	2.6E-05	2.1E-04	1.5E-09	1.2E-08
Asbestos	5.0E-09	4.0E-08	5.0E-09	4.0E-08
Benzene	1.2E+02	9.0E+00	6.0E+01	3.5E+00
Beryllium	1.0E-05	8.2E-05	1.0E-09	7.9E-09
Cadmium	2.6E-05	2.1E-04	1.5E-09	1.2E-08
Carbon tetrachloride	3.1E+00	2.5E+01	1.7E-01	1.3E+00
Chloroform	3.6E-01	2.8E+00	6.4E-02	5.0E-01
Chromium (hexavalent forms)	1.0E-05	8.2E-05	7.5E-11	5.9E-10
1,2-Dichloroethane	3.5E-01	2.7E+00	5.0E-02	4.0E-01
1,1-Dichloroethylene	3.6E-01	2.8E+00	6.4E-02	5.0E-01
Dioxin/furans (2,3,7,8 TCDD equivalent)	7.3E-07	5.8E-06	(b)	(b)
Formaldehyde	2.3E+02	1.2E+01	1.2E+02	6.0E+00
Methylene chloride	3.6E-01	2.8E+00	6.4E-02	5.0E-01
Nickel	1.0E-05	8.2E-05	4.5E-10	3.6E-09
Polychorinated biphenyls (PCBs)	8.9E-02	7.0E-01	2.9E-09	2.3E-08
Tetrachloroethylene	8.4E-01	6.7E+00	5.4E-01	4.3E+00
1,1,2-Trichloroethane	3.5E-01	2.7E+00	5.0E-02	4.0E-01
Trichloroethylene[c]	8.4E-01	6.7E+00	5.4E-01	4.3E+00

Substance	Proposed Action		Non-Thermal Treatment Alternative	
	Maximum hourly g/hr	Annual average kg/yr	Maximum hourly g/hr	Annual average kg/yr
Noncarcinogens				
Acetone	3.6E-01	2.8E+00	6.4E-02	5.0E-01
Barium	1.0E-05	8.2E-05	1.5E-09	1.2E-08
Butyl alcohol	3.6E-01	2.8E+00	6.4E-02	5.0E-01
Chlorine	1.8E+01	1.5E+02	(b)	(b)
Chlorobenzene	3.5E-01	2.7E+00	5.0E-02	4.0E-01
Chromium (trivalent forms)	1.0E-05	8.2E-05	1.4E-09	1.1E-08
Cyanide	3.0E-01	2.3E+00	3.6E-10	2.9E-09
Cyclohexane	3.5E-01	2.7E+00	5.0E-02	4.0E-01
2-Ethoxyethanol	3.5E-01	2.7E+00	5.0E-02	4.0E-01
Ethyl benzene	3.5E-01	2.7E+00	5.0E-02	4.0E-01
Hydrogen chloride	2.5E+01	1.9E+02	(b)	(b)
Hydrogen fluoride	1.4E+02	1.1E+03	(b)	(b)
Mercury	9.2E+00	7.3E+01	1.6E-09	1.3E-08
Methanol	3.6E-01	2.8E+00	6.4E-02	5.0E-01
Methyl ethyl ketone	3.5E-01	2.7E+00	5.0E-02	4.0E-01
Nitrobenzene	3.1E-01	2.5E+00	1.5E-02	1.2E-01
Selenium	7.3E+01	5.8E+02	1.5E-09	1.2E-08
Silver	1.0E-05	8.2E-05	1.5E-09	1.2E-08
Toluene	8.4E-01	6.7E+00	4.0E-01	3.2E+00
1,1,1-Trichloroethane	9.3E+00	7.3E+01	5.4E-01	4.3E+00
Trichloroethylene[c]	8.4E-01	6.7E+00	1.7E-01	1.3E+00
1,1,2-Trichloro-1,2,2-trifluoroethane	3.1E+00	2.5E+01	5.4E-01	4.3E+00
Xylene	8.4E-01	6.7E+00	5.4E-01	4.3E+00

a. See Appendix E-3, Table E-3-3, for additional details, assumptions, and notes related to emissions estimates.
b. Substance would not be emitted by non-thermal treatment.
c. Trichloroethylene is listed as both a carcinogen and noncarcinogen in the Idaho regulations.

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-rem per year. When added to the baseline population dose and projected increases, the collective dose is 0.55 person-rem per year. 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). Assuming an annual growth rate of 6 percent, this population within 80 Km of RWMC would grow to about 82,000 people by 2010. If it is conservatively assumed that the cumulative population dose is distributed among 82,000 people, the average individual dose would be less than 0.007 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). The radiological health effects associated with these doses are presented in Section 5.12, Occupational and Public Health and Safety.

Table 5.7-3. Summary of radiation dose associated with airborne radionuclide emissions from the proposed AMWTP alternatives.

Case	Baseline	Projected increases [a]	Dose from AMWTP operation	Cumulative dose
Highest onsite (worker) location	(millirem per year)			
No Action Alternative	0.21 [b]	0.023	0	0.23
Proposed Action [c]	0.21	0.023	0.73	0.96
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 [c]	0.031	0.11	0.11	0.25
Non-Thermal Treatment Alternative	0.031	0.11	0.0017	0.14
Collective population dose	(person-rem per year)			
No Action Alternative	0.085 [b,e]	0.41	0	0.50
Proposed Action [c]	0.085	0.41	0.056	0.55
Non-Thermal Treatment Alternative	0.085	0.41	0.00037	0.50

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. Dose from the Treatment and Storage Alternative would be the same as that from the Proposed Action 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.

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 or vitrification. These emissions and the associated doses (Table 5.7-3) 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 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. These results are presented in Table 5.7-4.

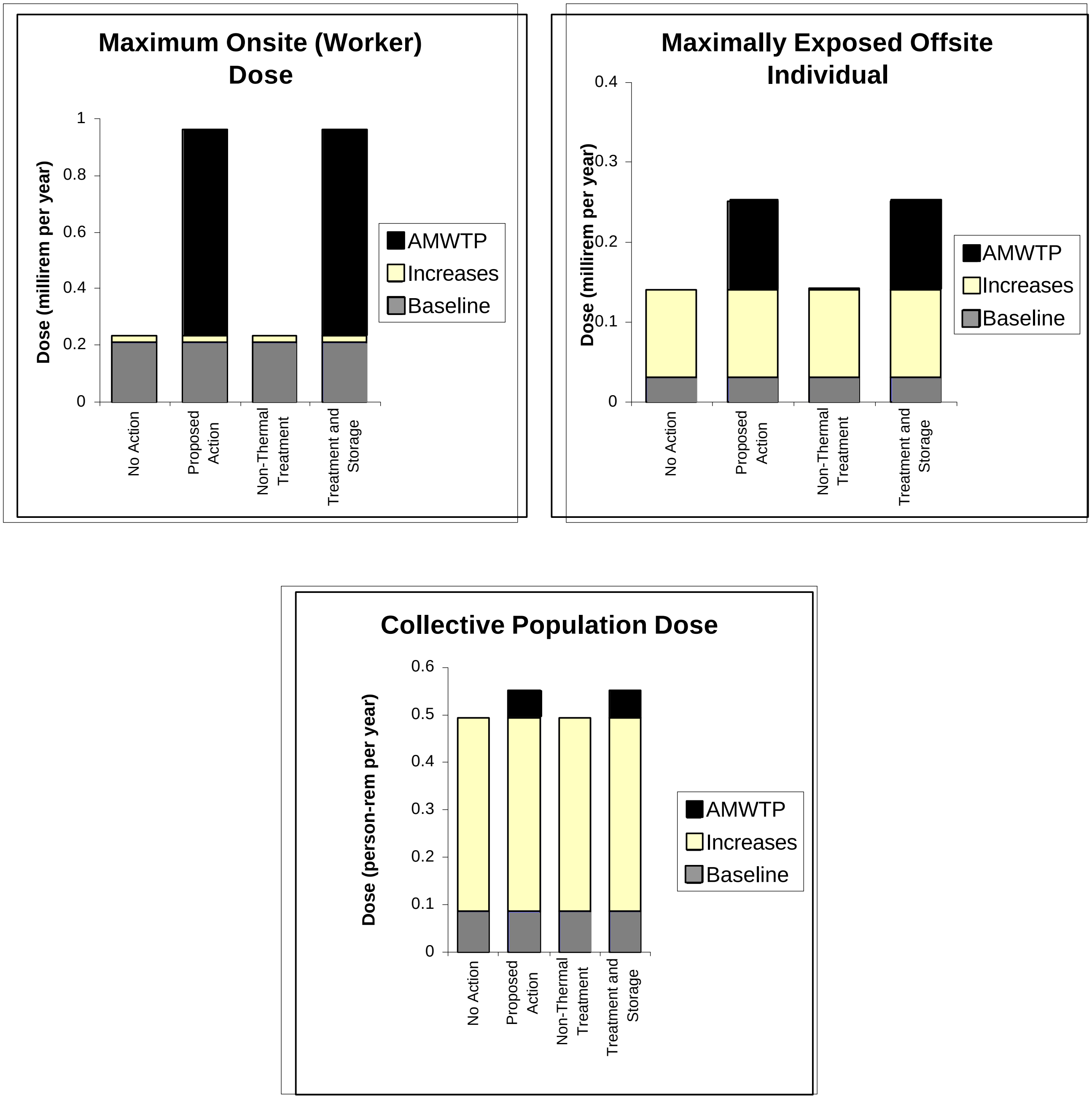
Table 5.7-4. Radiation doses and fatal cancer risk over the projected operating lifetime of the AMWTP.[a]

	Effective dose equivalent		
Dose category	13-year facility lifetime	30-year facility lifetime	Fatal Cancer
		Proposed Action	
Offsite MEI	1.5 millirem	3.4 millirem	1.7E-06
Offsite population	0.65 person-rem[b]	1.6 person-rem[c]	8.00E-04
Onsite worker	9.5 millirem	22 millirem	8.80E-06
		Non-Thermal Treatment Alternative	
Offsite MEI	0.023 millirem	-[d]	1.15E-08
Offsite population	0.0043 person-rem[b]	-[d]	2.15E-08
Onsite worker	0.039 millirem	-[d]	1.56E-08
		Treatment and Storage Alternative[e]	
Offsite MEI	1.5 millirem	3.4 millirem	1.7E-06
Offsite population	0.65 person-rem[b]	1.6 person-rem	8.00E-04
Onsite worker	9.5 millirem	22 millirem	8.80E-06

a. See Chapter 3 for information on projected AMWTP operating lifetime under the proposed alternatives.
b. Assumes average population of 82,000.
c. Assumes average population of 89,000.
d. AMWTP would not operate beyond 13 years under this alternative.
e. 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.

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.



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.

5.7.4.1 Concentrations of Pollutants in Ambient Air a 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 5.7-5. 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.

On a comparative basis, impacts for the Proposed Action and Treatment and Storage Alternative 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.

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 and visibility 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 INEEL site facility contributions and are not indicative of actual background. (INEEL facility contributions are accounted for in this EIS assessment by application of dispersion modeling.)

Table 5.7-5. 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	7.1	11	0.58	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	6.1	0.3	0	0	0	2.3	6.1	0.33	80	3	8	<1
Particulate matter [d]	24-hour	14	33	3.1	0	0	0	14	33	3.1	150	9	22	2
	Annual	0.77	3.5	0.12	0	0	0	0.77	3.5	0.12	50	2	7	<1
Lead	Quarterly	0.002	0.005	0.0001	0	0	0	0.0024	0.005	0.00012	1.5	<1	<1	<1
Proposed Action[e]														
Carbon monoxide	1-hour	418	1219	137	111	93	1.5	529	1312	139	40,000	1	3	<1
	8-hour	122	285	29	50	22	0.61	172	307	30	10,000	2	3	<1
Nitrogen dioxide	Annual	7.1	11	0.58	0.22	0.1	0.007	7	11	0.6	100	7	11	<1
Sulfur dioxide	3-hour	180	580	61	40	24	0.8	220	604	62	1,300	17	46	5
	24-hour	45	135	11	8.3	3.4	0.16	53	138	11	365	15	38	3
	Annual	2.3	6.1	0.3	0.23	0.1	0.008	2.5	6.2	0.3	80	3	8	<1
Particulate matter [d]	24-hour	14	33	3.1	6.0	2.5	0.09	20	35	3.2	150	13	24	2
	Annual	0.77	3.5	0.12	0.004	0.002	0.0001	0.8	3.5	0.1	50	2	7	<1
Lead	Quarterly	0.002	0.005	0.0001	1.8E-09	4.6E-10	5.3E-11	0.002	0.005	0.0001	1.5	<1	<1	<1
Non-Thermal Treatment Alternative														
Carbon monoxide	1-hour	418	1219	137	55	44	0.75	473	1263	138	40,000	1	3	<1
	8-hour	122	285	29	24	11	0.3	146	296	29	10,000	2	3	<1
Nitrogen dioxide	Annual	7.1	11	0.58	0.03	0.02	0.0006	7.1	11	0.6	100	7	11	<1
Sulfur dioxide	3-hour	180	580	61	12.8	8	0.21	193	588	61	1,300	15	45	5
	24-hour	45	135	11	2.8	1.2	0.04	48	136	11	365	13	37	3
	Annual	2.3	6.1	0.3	0.002	0.001	4.5E-05	2.3	6.1	0.3	80	3	8	<1
Particulate matter [d]	24-hour	14	33	3.1	2.9	1.2	0.05	17	34	3.1	150	11	23	2
	Annual	0.77	3.5	0.12	0.001	0.0009	3.0E-05	0.77	3.5	0.12	50	2	7	<1
Lead	Quarterly	0.002	0.005	0.0001	1.2E-12	3.6E-13	5.1E-14	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.] Respirable particulate matter; does not include contributions of fugitive dust.
[e.] Emissions due to Treatment and Storage Alternative would be identical to those of Proposed Action.

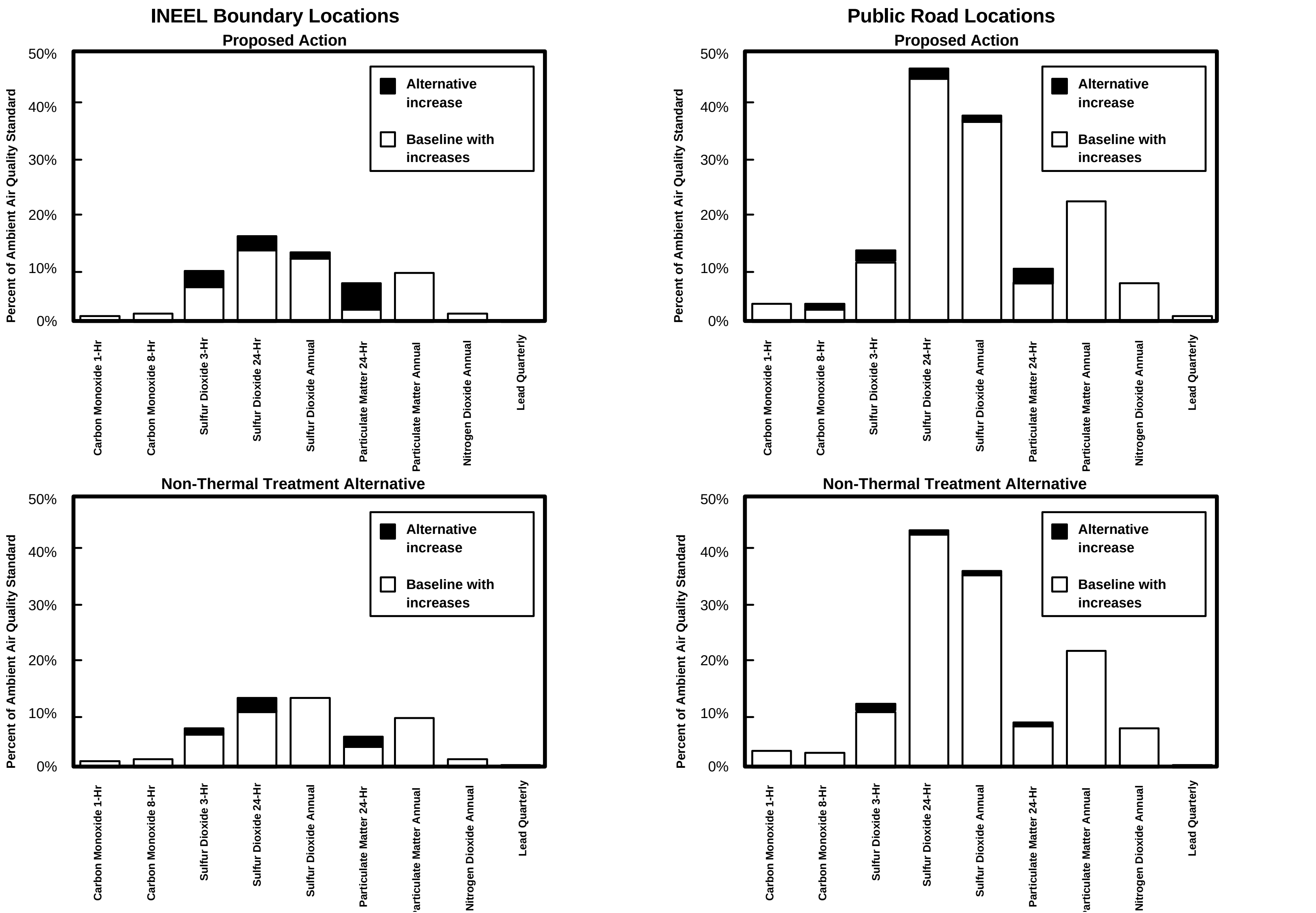


Figure 5.7-2. Cumulative criteria pollutant impacts at INEEL boundary (left) and public road locations (right), as percentages of the applicable Ambient Air Quality Standards. Impacts for the Treatment and Storage Alternative would be identical to the Proposed Action.

Results of assessments for carcinogenic (that is, capable of inducing cancer) and noncarcinogenic toxic air pollutants at offsite locations are presented in Table 5.7-6. 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, 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. Carcinogenic impacts under the Non-Thermal Treatment Alternative would not exceed 0.1 percent of any standard, while noncarcinogenic levels would be less than 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 5.7-7. 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 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.

Table 5.7-6. Ambient air concentrations of toxic air pollutants for proposed AMWTP alternatives.

		Proposed Action[a]				Non-Thermal Treatment Alternative			
		INEEL boundary[c]		Craters of the Moon		INEEL boundary[c]		Craters of the Moon	
Pollutant	Applicable standard[b] (ug/m^3)	Impact (ug/m^3)	% of standard	Impact (ug/m^3)	% of standard	Impact (ug/m^3)	% of Standard	Impact (ug/m^3)	% of standard
<u>Carcinogens</u>									
Arsenic	2.3E-04	2.2E-09	<0.001	7.5E-11	<0.001	9.1E-14	<0.001	4.5E-15	<0.001
Asbestos	1.2E-04	3.1E-13	<0.001	1.6E-14	<0.001	3.1E-13	<0.001	1.6E-14	<0.001
Benzene	1.2E-01	1.0E-04	0.09	2.4E-06	0.002	4.3E-05	0.04	9.4E-07	<0.001
Beryllium	4.2E-03	8.7E-10	<0.001	2.9E-11	<0.001	6.0E-14	<0.001	3.0E-15	<0.001
Cadmium	5.6E-04	2.2E-09	<0.001	7.5E-11	<0.001	9.1E-14	<0.001	4.5E-15	<0.001
Carbon tetrachloride	6.7E-02	2.5E-04	0.4	9.1E-06	0.01	1.0E-05	0.02	5.0E-07	<0.001
Chlorororm	4.3E-02	2.7E-05	0.06	1.1E-06	0.002	3.8E-06	0.009	1.9E-07	<0.001
Chromium (hexavalent)	8.3E-05	8.7E-10	0.001	2.9E-11	<0.001	4.6E-15	<0.001	2.3E-16	<0.001
1,2-Dichloroethane	3.8E-02	2.7E-05	0.07	1.0E-06	0.003	3.1E-06	0.008	1.6E-07	<0.001
1,1-Dichloroethylene	2.0E-02	2.7E-05	0.1	1.1E-06	0.005	3.8E-06	0.02	1.9E-07	<0.001
Dioxins and furans	2.2E-08	5.8E-11	0.3	2.1E-12	0.01	(d)	(d)	(d)	(d)
Formaldehyde	7.7E-02	1.5E-04	0.2	3.2E-06	0.004	7.6E-05	0.1	1.6E-06	0.002
Methylene chloride	2.4E-01	2.7E-05	0.01	1.1E-06	<0.001	3.8E-06	0.002	1.9E-07	<0.001
Nickel	4.2E-03	8.7E-10	<0.001	2.9E-11	<0.001	2.6E-14	<0.001	1.3E-15	<0.001
Polychlorinated biphenyls	1.0E-02	7.1E-06	0.07	2.6E-07	0.003	1.7E-13	<0.001	8.6E-15	<0.001
Tetrachloroethylene	2.1E+00	5.7E-05	0.003	2.5E-06	<0.001	3.4E-05	0.002	1.7E-06	<0.001
1,1,2-Trichloroethane	6.2E-02	2.7E-05	0.04	1.0E-06	0.002	3.1E-06	0.005	1.6E-07	<0.001
Trichloroethylene[e]	7.7E-02	5.7E-05	0.07	2.5E-06	0.003	3.4E-05	0.04	1.7E-06	0.002
<u>Noncarcinogens</u>									
Acetone	8.9E+04	3.5E-03	<0.001	7.9E-05	<0.001	5.6E-05	<0.001	2.2E-06	<0.001
Barium	2.5E+01	1.7E-08	<0.001	3.4E-10	<0.001	1.3E-12	<0.001	5.1E-14	<0.001
Butyl alcohol	7.5E+03	3.5E-03	<0.001	7.9E-05	<0.001	5.6E-05	<0.001	2.2E-06	<0.001
Chlorine	1.5E+02	2.7E-02	0.02	6.1E-04	<0.001	(d)	(d)	(d)	(d)
Chlorobenzene	1.8E+04	3.5E-03	<0.001	7.9E-05	<0.001	4.3E-05	<0.001	1.7E-06	<0.001
Chromium (trivalent)	2.5E+01	1.7E-08	<0.001	3.4E-10	<0.001	1.2E-12	<0.001	4.8E-14	<0.001
Cyanide	2.5E+02	3.5E-03	0.001	7.7E-05	<0.001	3.1E-13	<0.001	1.2E-14	<0.001
Cyclohexane	5.3E+04	3.5E-03	<0.001	7.9E-05	<0.001	4.3E-05	<0.001	1.7E-06	<0.001
2-Ethoxyethanol	9.5E+02	3.5E-03	<0.001	7.9E-05	<0.001	4.3E-05	<0.001	1.7E-06	<0.001
Ethyl benzene	2.2E+04	3.5E-03	<0.001	7.9E-05	<0.001	4.3E-05	<0.001	1.7E-06	<0.001
Hydrogen chloride	3.8E+02	3.7E-02	0.01	8.1E-04	<0.001	(d)	(d)	(d)	(d)
Hydrogen fluoride	1.3E+02	2.1E-01	0.2	4.6E-03	0.004	(d)	(d)	(d)	(d)
Mercury	2.5E+00	1.4E-02	0.5	3.0E-04	0.01	1.4E-12	<0.001	5.3E-14	<0.001
Methanol	1.3E+04	3.5E-03	<0.001	7.9E-05	<0.001	5.6E-05	<0.001	2.2E-06	<0.001
Methyl ethyl ketone	3.0E+04	3.5E-03	<0.001	7.9E-05	<0.001	4.3E-05	<0.001	1.7E-06	<0.001
Nitrobenzene	2.5E+02	3.5E-03	0.001	7.8E-05	<0.001	1.2E-05	<0.001	4.8E-07	<0.001
Selenium	1.0E+01	1.2E-01	1.2	2.4E-03	0.02	1.3E-12	<0.001	5.1E-14	<0.001
Silver	5.0E+00	1.7E-08	<0.001	3.4E-10	<0.001	1.3E-12	<0.001	5.1E-14	<0.001
Toluene	1.9E+04	3.9E-03	<0.001	9.5E-05	<0.001	4.6E-04	<0.001	1.8E-05	<0.001
1,1,1-Trichloroethane	9.6E+04	1.0E-01	<0.001	2.3E-03	<0.001	3.4E-04	<0.001	1.3E-05	<0.001
Trichloroethylene[e]	1.4E+04	3.9E-03	<0.001	9.5E-05	<0.001	4.6E-04	<0.001	1.8E-05	<0.001
Xylene	2.2E+04	3.9E-03	<0.001	9.5E-05	<0.001	4.6E-04	<0.001	1.8E-05	<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. Annual average carcinogenic impacts of new sources are compared to the State of Idaho Acceptable Ambient Concentration for Carcinogens (AACC). 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; 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. Substance would not be emitted by non-thermal treatment.
e. Trichloroethylene is listed as both a carcinogen and noncarcinogen in the Idaho regulations.

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

	Maximum concentration (ug/m^3)[a]			Percent of occupational standard	
Toxic air pollutant	Proposed Action	Non-Thermal Treatment Alt.	Occupational Standard[b]	Proposed Action	Non-Thermal Treatment Alt.
Carcinogens					
Arsenic	8.6E-07	9.4E-12	1.0E+01	<0.001	<0.001
Asbestos[c]	3.1E-11	3.1E-11	3.0E+00	<0.001	<0.001
Benzene	3.4E+01	2.6E+01	3.0E+03	1	1
Beryllium	3.6E-07	6.3E-12	2.0E+00	<0.001	<0.001
Cadmium	8.6E-07	9.4E-12	2.0E+00	<0.001	<0.001
Carbon tetrachloride	4.1E-01	1.0E-03	1.3E+04	0.003	<0.001
Chloroform	4.1E-02	4.0E-04	9.8E+03	<0.001	<0.001
Chromium (hexavalent)	3.6E-07	4.7E-13	5.0E+01	<0.001	<0.001
1,2-Dichloroethane	4.1E-02	3.1E-04	4.0E+04	<0.001	<0.001
1,1-Dichloroethylene	4.1E-02	4.0E-04	2.0E+04	<0.001	<0.001
Dioxins and furans	1.0E-07	0.0E+00	(d)	(d)	(d)
Formaldehyde	6.5E+01	4.8E+01	9.0E+02	7	5
Methylene chloride	4.1E-02	4.0E-04	1.7E+05	<0.001	<0.001
Nickel	3.6E-07	2.9E-12	1.0E+02	<0.001	<0.001
Polychlorinated biphenyls	1.2E-02	1.8E-11	(d)	(d)	(d)
Tetrachloroethylene	4.3E-02	3.3E-03	1.7E+05	<0.001	<0.001
1,1,2-Trichloroethane	4.1E-02	3.1E-04	5.5E+04	<0.001	<0.001
Trichloroethylene[e]	4.3E-02	3.3E-03	2.7E+05	<0.001	<0.001
Noncarcinogens					
Acetone	4.1E-02	4.0E-04	1.8E+06	<0.001	<0.001
Barium	3.6E-07	9.4E-12	5.0E+02	<0.001	<0.001
Butyl alcohol	4.1E-02	4.0E-04	1.5E+05	<0.001	<0.001
Chlorine	3.2E-01	0.0E+00	1.5E+03	0.02	<0.001
Chlorobenzene	4.1E-02	3.1E-04	4.6E+04	<0.001	<0.001
Chromium (trivalent)	3.6E-07	8.9E-12	5.0E+02	<0.001	<0.001
Cyanide	4.1E-02	2.2E-12	5.0E+03	<0.001	<0.001
Cyclohexane	4.1E-02	3.1E-04	1.0E+06	<0.001	<0.001
2-Ethoxyethanol	4.1E-02	3.1E-04	1.8E+04	<0.001	<0.001
Ethyl benzene	4.1E-02	3.1E-04	4.3E+05	<0.001	<0.001
Hydrogen chloride	4.3E-01	0.0E+00	7.0E+03	0.01	<0.001
Hydrogen fluoride	2.4E+00	0.0E+00	2.5E+03	0.1	<0.001
Lead	8.6E-07	1.5E-10	5.0E+01	<0.001	<0.001
Mercury	1.6E-01	9.8E-12	5.0E+01	0.3	<0.001
Methanol	4.1E-02	4.0E-04	2.6E+05	<0.001	<0.001
Methyl ethyl ketone	4.1E-02	3.1E-04	5.9E+05	<0.001	<0.001
Nitrobenzene	4.1E-02	8.9E-05	5.0E+03	<0.001	<0.001
Selenium	2.0E+00	9.4E-12	2.0E+02	1	<0.001
Silver	3.6E-07	9.4E-12	1.0E+01	<0.001	<0.001
Toluene	4.3E-02	3.3E-03	1.9E+05	<0.001	<0.001
1,1,1-Trichloroethane	1.2E+00	2.5E-03	1.9E+06	<0.001	<0.001
Trichloroethylene	4.3E-02	3.3E-03	2.7E+05	<0.001	<0.001
1,1,2-Trichloro-1,2,2-trifluoroethane	4.1E-01	1.0E-03	7.6E+06	<0.001	<0.001
Xylene	4.3E-02	3.3E-03	4.3E+05	<0.001	<0.001

a. All maximum values occur within the RWMC.
b. Occupational exposure limits are 8-hour averages established by either the American Conference of Government Industrial Hygienists (ACGIH) or the Occupational Safety and Health Administration (OSHA); the lower of the two is used.
c. 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.
d. There is no occupational exposure limit for PCBs or dioxins/furans.
e. Trichloroethylene is listed as both a carcinogen and noncarcinogen in the Idaho regulations.
Note: The Treatment and Storage Alternative impacts are the same regarding the treatment of waste, however the potential storage impacts identified in Section 5.21 would be in addition to impacts for treatment.

5.7.4.3 Regulatory Compliance Evaluation. The *Clean Air Act* (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 (IDHW 1997).

In addition to the comparison to ambient air standards presented in Section 5.7.4.1, evaluations have been performed for (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, and (6) global warming. These analyses are summarized in the following subsections.

5.7.4.3.1 Ozone Formation. In addition to the previously mentioned criteria pollutants, the CAA designates ozone as a criteria air pollutant and establishes a National Ambient Air Quality Standard (NAAQS) of 235 micrograms per cubic meter for a 1-hour averaging period. Recently, a more restrictive ozone standard based on an 8-hour averaging time has been promulgated. 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 volatile organic compounds (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.

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 480 kilograms, or about one-half ton per year. The maximum cumulative emission rate, which includes baseline emissions and projected increases, is about 16 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. In the DOE INEL EIS, the maximum amount of future increment consumption associated with the Preferred Alternative was estimated at 76 percent of the allowable Class I increment for 3-hour sulfur dioxide concentrations, with lesser amounts for all other averaging times and pollutants. However, these levels include contributions of the Idaho Waste Processing Facility and other facilities, which were assessed under the DOE INEL EIS Preferred Alternative but which will not be incurred; therefore, the actual values are expected to be substantially lower.

Table 5.7-8 presents estimated increment consumption at Craters of the Moon for the combined effects of the DOE INEL EIS Preferred Alternative and the proposed AMWTP. The combined increment consumption at this Class I area would not exceed 45 percent, which is projected for 3-hour sulfur dioxide concentration, while the highest annual average increment consumption is 16 percent for nitrogen dioxide. Table 5.7-9 shows PSD evaluation results for Class II areas. For these areas (which include INEEL boundary and public road locations), the highest consumption would not exceed 58 percent for any 3-hour or 24-hour increment and 33 percent for any annualized increment.

Table 5.7-8. PSD increment consumption at Craters of the Moon Wilderness Area for the combined effects of existing sources, foreseeable increases, and the proposed AMWTP.

Pollutant	Averaging time	Allowable PSD increment (ug/m^3)	Baseline sources plus increases[a] Impact (ug/m^3)	Baseline sources plus increases[a] % of increment	Impact of AMWTP alternatives Impact (ug/m^3)	Impact of AMWTP alternatives % of increment	Cumulative PSD increment consumed Impact (ug/m^3)	Cumulative PSD increment consumed % of increment
Proposed Action[b]								
Sulfur dioxide	3-hour	25	10.5	42	0.8	3.2	11.3	45
	24-hour	5	2.0	40	0.16	3.2	2.2	43
	Annual	2	0.10	5	0.008	0.4	0.11	5.5
Particulate matter (PM-10)	24-hour	8	1.0	12	0.09	1.1	1.1	13
	Annual	4	0.03	0.6	0.00009	0.002	0.026	0.65
Nitrogen dioxide	Annual	2.5	0.38	15	0.007	0.3	0.39	16
Non-Thermal Treatment Alternative								
Sulfur dioxide	3-hour	25	10.5	42	0.21	0.8	10.7	43
	24-hour	5	2.0	40	0.043	0.9	2.0	41
	Annual	2	0.1	5	0.00005	0.002	0.1	5.1
Particulate matter (PM-10)	24-hour	8	1.0	12	0.05	0.6	1.0	13
	Annual	4	0.03	0.6	0.00003	0.001	0.026	0.65
Nitrogen dioxide	Annual	2.5	0.38	15	0.0006	0.02	0.38	15

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.

The projected radiation dose to the maximally exposed offsite individual under the Proposed Action and Treatment and Storage Alternative slightly exceeds the significance level (0.11 compared to 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 0.25 millirem per year. Although Idaho regulations do not specify an allowable increment for radiation dose, this level is well below the applicable NESHAP standard of 10 millirem per year. The projected radiation dose for the Non-Thermal Treatment Alternative is 0.0017 millirem per year, which is below the significance level.

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.

Table 5.7-9. 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			Cumulative PSD increment consumed		
Pollutant	Averaging time	PSD increment (ug/m^3)	Site Boundary (ug/m^3)	Public roads (ug/m^3)	% of PSD Increment[b]	Site boundary (ug/m^3)	Public roads (ug/m^3)	% of PSD increment[b]	Site boundary (ug/m^3)	Public roads (ug/m^3)	% of PSD increment[b]
Proposed Action[c]											
Sulfur dioxide	3-hour	512	135	147	29	40	24	8	175	171	34
	24-hour	91	29	32	35	8.3	3.4	9	37	35	41
	Annual	20	0.99	2.4	12	0.2	0.1	1.2	1.2	2.5	12
Particulate matter (PM-10)	24-hour	30	7.4	15	50	6.0	2.5	20	13	17	58
	Annual	17	0.32	0.92	5	0.004	0.002	0.02	0.32	0.92	5
Nitrogen dioxide	Annual	25	5.9	8.2	33	0.2	0.1	0.9	6.1	8.3	33
Non-Thermal Treatment Alternative											
Sulfur dioxide	3-hour	512	135	147	29	13	8.0	2	148	155	30
	24-hour	91	29	32	35	2.8	1.2	3	32	33	36
	Annual	20	0.99	2.4	12	0.002	0.001	0.01	1.0	2.4	12
Particulate matter (PM-10)	24-hour	30	7.4	15	50	2.9	1.2	10	10	16	54
	Annual	17	0.32	0.92	5	0.001	0.0009	0.01	0.32	0.92	5
Nitrogen dioxide	Annual	25	5.9	8.2	33	0.03	0.02	0.1	5.9	8.2	33

a. Foreseeable increases are assumed to be represented by the DOE INEL EIS Preferred Alternative (unmodified).
b. The higher of the site boundary and public road locations is used.
c. Impacts of the Treatment and Storage Alternative would be identical to those of the Proposed Action.

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.[1] Under the Proposed Action or Treatment and Storage Alternative, emissions of sulfur dioxide from the proposed AMWTP could reach levels of about 22 tons per year, while emissions of nitrogen dioxide could reach almost 26 tons per year. Under the Non-Thermal Treatment Alternative, nitrogen dioxide emissions would be about 3 tons, while sulfur dioxide emissions would be less than 1 ton. Emissions of these levels are not expected to contribute significantly to acidity levels in precipitation in the region, nor will they have effects over greater distances, such as may occur with very tall stacks associated with large utility power plants.

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 amount—about 2,530 tons—would be emitted from boilers and a generator. 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).

5.7.5 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 particulate matter. 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 particulate matter 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 particulate matter, which, if not mitigated,

[1] One form of acidic deposition is commonly referred to as acid rain.

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, melter, 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 quench air cooling, a high-temperature filter, saturation quencher, packed bed absorber for acid gas and mercury removal, a candle demister, three-stage high-efficiency particulate air (HEPA) filtration, associated pumps and blowers, and an exhaust stack. Detailed information on the incinerator air pollution control system, as well as systems for other pre-treatment, treatment, and sampling processes, is provided in Section E-3.2.8 of Appendix E-3, Air Resources.

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 shows that existing plumes would not greatly affect the regional groundwater quality because no contaminants would migrate offsite in concentrations above the EPA drinking water standards (DOE INEL EIS, Volume 2, Section 5.8.2.2 [DOE 1995]). 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 Chemical Processing Plant (ICPP) 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 Resources 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 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, volatile organic compound 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 TSA 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 Resources Impacts from the Proposed Action

Under the Proposed Action, water consumption would increase as a result of construction activities, operational activities, and increased workers at the facility. The total water consumption of 2.7 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 operational activities during pretreatment, supercompaction, and macroencapsulation 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. 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).

5.8.4 Water Resources Impacts from the Non-Thermal Treatment Alternative

Impacts to water resources would be similar for the Non-Thermal Treatment Alternative as for the Proposed Action.

5.8.5 Water Resources 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 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 (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.

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 (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.

Activity	Source strength (dBA)/reference distance	Predicted noise level ranges (dBA) at various distances from sources: 500 ft.	1,000 ft.	1/2 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

Source: 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.

Because the proposed AMWTP workforces are expected to be a small component of the proposed INEEL workforce, the overall noise level resulting from the proposed 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, 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 *Waste Isolation Pilot Plant Disposal Phase Final Supplemental Environmental Impact Statement* (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 Waste Management Programmatic Environmental Impact Statement (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 1995). 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 in 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.

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 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 1997d). A decision regarding the treatment and disposal alternatives for LLMW assessed in the WM PEIS has not been issued.

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 in 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 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;
- Maximally exposed individual (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 E-4, Occupational and Public Health and Safety, and in Section 5.12 and Appendix 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 rem) 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 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 does not include natural background doses presented in Table E-4.1-5 of Appendix 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 involved 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 E-4.

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

Receptor	No Action Alternative		Proposed Action Alternative		Non-Thermal Treatment Alternative	
	Dose (millirem)	Fatal cancer	Dose (millirem)	Fatal cancer	Dose (millirem)	Fatal cancer
MEI involved worker [b]	1500	6.00E-04	1500	6.00E-04	1500	6.00E-04
Average involved worker [c]	0.081	3.24E-08	0.081	3.24E-08	0.081	3.24E-05
MEI onsite	0.023	9.20E-09	0.73	2.92E-07	0.003	1.20E-09
MEI offsite	0.11	5.50E-08	0.11	5.50E-08	0.0017	8.50E-10
Population [d]	0.41	2.05E-04	0.056	2.80E-05	0.00037	1.85E-07

a. Data including identification of radionuclides responsible for doses from Table 5.7-3 of Section 5.7, Air Resources.
b. 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.
c. The average involved worker dose is the average dose measured from year 1992-1997 for RWMC radiation workers (see Appendix E-4 Table E-4.1-7 for detail) and is based on the assumption that the doses for activities under the proposed
alternative would be similar to the doses measured during waste management activities at the RWMC.
d. The population dose is in person-rem

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

Receptor	Baseline		Projected		AMWTP		Cumulative	
	Dose millirem	Risk [a] (fatality)	Dose millirem	Risk [a] (fatality)	Dose millirem	Risk [a] (fatality)	Dose millirem	Risk [a] (fatality)
No Action Alternative								
MEI Onsite	0.21	8.40E-08	0.023	9.20E-09	0.0	-	0.23	9.20E-08
MEI Offsite	0.031	1.55E-08	0.11	5.50E-08	0.0	-	0.14	7.00E-08
Population [b]	0.085	4.25E-05	0.41	2.05E-04	0.0	-	0.50	2.50E-04
Proposed Action Alternative								
MEI Onsite	0.21	8.40E-08	0.023	9.20E-09	0.73	2.92E-07	0.96	3.84E-07
MEI Offsite	0.031	1.55E-08	0.11	5.50E-08	0.11	5.50E-08	0.25	1.25E-04
Population [b]	0.085	4.25E-05	0.41	2.05E-04	0.056	2.80E-05	0.55	2.75E-04
Non-Thermal Treatment Alternative								
MEI Onsite	0.21	8.40E-08	0.023	9.20E-09	0.003	1.20E-09	0.24	9.60E-08
MEI Offsite	0.031	1.55E-08	0.11	5.50E-08	0.0017	8.50E-10	0.14	7.00E-08
Population [b]	0.085	4.25E-05	0.41	2.05E-04	0.00037	1.85E-07	0.50	2.50E-04

a. The risk fatality for MEI is based on annual dose and one individual, the population risk is based on annual dose and total population of 82,000 within 80 kilometer of the site.
b. The population dose is in person-rem per year.

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	Risk (fatality)	Dose	Risk (fatality)
Proposed Action				
MEI Onsite	9.5 millirem	3.80E-06	22 millirem	8.80E-06
MEI Offsite	1.5 millirem	7.50E-07	3.4 millirem	1.70E-06
Population	0.65 person-rem [b]	3.25E-04	1.6 person-rem [c]	8.00E-04
Non-Thermal Treatment Alternative				
MEI Onsite	0.039 millirem	1.56E-08	d	d
MEI Offsite	0.023 millirem	1.15E-08	d	d
Population	0.0043 person-rem[b]	2.15E-06	d	d
Treatment and Storage Alternative				
MEI Onsite	9.5 millirem	3.80E-06	22 millirem	8.80E-06
MEI Offsite	1.5 millirem	7.50E-07	3.4 millirem	1.70E-06
Population	0.65 person-rem [b]	3.25E-04	1.6 person-rem [c]	8.00E-04

a. Data for dose and lifetime from Table 5.7-4 of Section 5.7, Air.
b. The population dose and risk is based on total population of 82,000.
c. The population dose and risk is based on total population of 89,000.
d. AMWTP would not operate beyond 13 years under this alternative.

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, Health and Safety.

5.12.2 Nonradiological Exposure and Health Effects

The projected AMWTP emissions data listed in Table 5.7-2 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 5.7-5 and 5.7-6 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 263 million). The total cancer risk under the Proposed Action for all nonradiological carcinogenic chemicals would be 1.3×10^{-8} (1 in 80 million) at the site boundary and 4.4×10^{-10} (1 in 2 billion) at Craters of the Moon. The total cancer risk under the Non-Thermal Treatment Alternative for all nonradiological carcinogenic chemicals would be 2.0×10^{-9} (1 in 500 million) at the site boundary and 4.5×10^{-10} (1 in 2 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.

Pollutant	Concentration μg/m^3 Site Boundary	Concentration μg/m^3 Craters of the Moon	Inhalation unit risk [μg/m^3]$^{-1}$ Site Boundary and Craters of the Moon	Cancer risk (cancer incidence) Site Boundary	Cancer risk (cancer incidence) Craters of the Moon
Proposed Action					
Arsenic	2.2E-09	7.5E-11	4.3E-03	9.46E-12	3.2E-13
Asbestos	3.1E-13	1.6E-14	2.3E-01	7.1E-14	3.7E-15
Benzene	1.0E-04	2.4E-06	8.3E-06	8.3E-10	2.0E-11
Beryllium	8.7E-10	2.9E-11	2.4E-03	2.1E-12	7.0E-14
Cadmium	2.2E-09	7.5E-11	1.8E-03	4.0E-12	1.4E-13
Carbon tetrachloride	2.5E-04	9.1E-06	1.5E-05	3.8E-09	1.4E-10
Chloroform	2.7E-05	1.1E-06	2.3E-05	6.2E-10	2.5E-11
Chromium (hexavalent)	8.7E-10	2.9E-11	1.2E-02	1.1E-11	3.5E-13
1,2-Dichloroethane	2.7E-05	1.0E-06	2.6E-05	7.0E-10	2.6E-11
1,1-Dichloroethylene	2.7E-05	1.1E-06	5.0E-05	1.4E-09	5.5E-11
Dioxins and furans[a]	5.8E-11	2.1E-12	42.9	2.5E-09	9.0E-11
Formaldehyde	1.5E-04	3.2E-06	1.3E-05	2.0E-09	4.2E-11
Methylene chloride	2.7E-05	1.1E-06	4.7E-07	1.3E-11	5.2E-13
Nickel	8.7E-10	2.9E-11	2.4E-04	2.1E-13	7.0E-15
Polychlorinated biphenyls	7.1E-06	2.6E-07	1.0E-04	7.1E-10	2.6E-11
Tetrachloroethylene	5.7E-05	2.5E-06	NA[c]	NA[c]	NA[c]
1,1,2-Trichloroethane	2.7E-05	1.0E-06	1.6E-05	4.3E-10	1.6E-11
Trichloroethylene	5.7E-05	2.5E-06	NA[c]	NA[c]	NA[c]
Non-Thermal Treatment Alternative					
Arsenic	9.1E-14	4.5E-15	4.3E-03	3.9E-16	1.9E-17
Asbestos	3.1E-13	1.6E-14	2.3E-01	7.1E-14	3.7E-15
Benzene	4.3E-05	9.4E-07	8.3E-06	3.6E-10	7.8E-12
Beryllium	6.0E-14	3.0E-15	2.4E-03	1.4E-16	7.2E-18
Cadmium	9.1E-14	4.5E-15	1.8E-03	1.6E-16	8.1E-18
Carbon tetrachloride	1.0E-05	5.0E-07	1.5E-05	1.5E-10	7.5E-12
Chloroform	3.8E-06	1.9E-07	2.3E-05	8.7E-11	4.4E-12
Chromium (hexavalent)	4.6E-15	2.3E-16	1.2E-02	5.5E-17	2.8E-18
1,2-Dichloroethane	3.1E-06	1.6E-07	2.6E-05	8.1E-11	4.2E-12
1,1-Dichloroethylene	3.8E-06	1.9E-07	5.0E-05	1.9E-10	9.5E-12
Dioxins and furans[a]	(b)	(b)	42.9	(b)	(b)
Formaldehyde	7.6E-05	1.6E-06	1.3E-05	1.0E-09	2.1×10^{-11}
Methylene chloride	3.8E-06	1.9E-07	4.7E-07	1.8E-12	8.9E-14
Nickel	2.6E-14	1.3E-15	2.4E-04	6.2E-18	3.1E-19
Polychlorinated biphenyls	1.7E-13	8.6E-15	1.0E-04	1.7E-17	8.6E-19
Tetrachloroethylene	3.4E-05	1.7E-06	NA[c]	NA[c]	NA[c]
1,1,2-Trichloroethane	3.1E-06	1.6E-07	1.6E-05	5.0E-11	2.6E-12
Trichloroethylene	3.4E-05	1.7E-06	NA[c]	NA[c]	NA[c]

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. Substance would not be emitted by non-thermal treatment.
c. NA refers to not available at this time.

Note: The Treatment and Storage Alternative impacts would be 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.

Table 5.12-5. Estimated industrial safety impacts by alternative for duration of construction and operation [a].

	Proposed Action			Non-Thermal Treatment Alternative		
Category	Operation	Construction	All Workers	Operation	Construction	All Workers
Annual workers	146	2,400	2,546	133	2,400	2,533
Annual hours[a]	2.72E+05	4.80E+06	5.07E+06	2.47E+05	4.80E+06	5.05E+06
Annual injury/illness[b]	4.5	154	159	4.1	154	158
Annual fatalities[c]	<<1	0.38	0.4	<<1	0.38	0.4
Total injury/illness	135	385	520	53	385	508
Total fatalities	0.65	0.96	1.6	0.26	0.96	1.5

a. 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 2.5 years.
b. 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).
c. Annual fatality rates for INEEL operation and construction are 0.016 fatalities per 200,000 hours (DOE rate is 0.0034).

5.13 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, the increase in usage relative to current INEEL usage is small, and, for water and electricity, 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 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[b]	AMWTP % increase	RWMC usage
Water	11.4 billion gal/yr	1.3 billion gal/yr	2,700,000 gal/yr	0.7	4,190,000 gal/yr
Electricity	394,000 MWh/yr[c]	173,862 MWh/yr	35,022 MWh/yr	20	6,206 MWh/yr
Diesel	NA	617,947 gal/yr	16,000 gal/yr	2.6	(d)
Propane	NA	130,249 gal/yr	925,000 gal/yr	810	48,019 gal/yr
Wastewater	NA	149 million gal/yr	1,870,000 gal/yr	1.0	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. MWh = megawatt-hour.
d. Very small unknown amount is used.

Only sewerage and clean waste water would be collected by the sanitary waste system and discharged to the sewage lagoons. Process water, such as that used in the incinerator and vitrification processes, 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.

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 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, incinerator, and evaporators would be eliminated. This would have an insignificant effect because the RWMC currently has adequate capacity for the Proposed Action. Since most of the process water eliminated would have been evaporated and not discharged to the sewage system, this would not affect 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 23,980 megawatt hours per year compared to 35,022 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 185,000 gallons per year compared with the 925,000 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., tornadoes, earthquakes, and volcanism). All of these events could lead to a release of hazardous or radioactive material from a facility.

The DOE INEL EIS 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 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, will be presented as a baseline. Then, the bounding accidents from the updated RWMC Safety Analysis Report (SAR) will be presented which provide a focused evaluation of consequences from RWMC operations. Preliminary screening results from the AMWTP Preliminary SAR (PSAR) will be 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 safety analysis reports 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 in 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 x 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).

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 which 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 phenomenological 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. These accidents were selected such that they represent others that present some unique but important challenge to AMWTP safety. This set of accidents contains accidents that represent all other accidents with high and moderate consequences and is know 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.

Doses to the public resulting from accidents are mechanistically 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 factors for 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 5.14.3.

Details of the facility accident methodology are given in Appendix E-5, Facility Accidents, of this EIS.

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 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.

Table 5.14-2. Bounding 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}	Not calculated	Not calculated
Drum explosion	Anticipated	4.0×10^{-3}	2.0×10^{-6}	Not calculated	Not calculated
Earthquake	Unlikely	5.0×10^{-2}	2.5×10^{-5}	Not calculated	Not calculated
Fire in C&S	E[a]	7.5×10^{-2}	3.8×10^{-5}	Not calculated	Not calculated
Lava flow over RWMC	E to B[b]	9.4×10^{-2}	4.7×10^{-5}	1.2×10^{-2}	4.8×10^{-2}

Source: LMITCO 1997c, pg. 3-47; Slaughterbeck 1995, pg. 5-16.
a. E: extremely unlikely.
b. B: beyond extremely unlikely.

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 x 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.

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 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 x 10^{-5}
Drum explosion	Anticipated	2.77	1.1 x 10^{-3}
Earthquake	Unlikely	5.69	2.3 x 10^{-3}
Fire in C&S	Extremely unlikely	8.50	3.4 x 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.

Table 5.14-4. Bounding accident results for toxicological releases.

Accident	Frequency category	Chemical concentration at MEI (mg/m^3) Nitric acid TOX-2[a]: 6.4 TOX-1[a]: 5	Mercury TOX-2[a]: 1.0 TOX-1[a]: 0.05
Waste box spill	Anticipated	3.26 x 10^{-7}	1.27 x 10^{-8}
Drum explosion	Anticipated	2.04 x 10^{-8}	3.79 x 10^{-8}
Earthquake	Unlikely	5.51 x 10^{-4}	2.16 x 10^{-5}
Fire in C&S	Extremely unlikely	1.72 x 10^{-4}	3.20 x 10^{-3}
Lava flow over RWMC	Extremely unlikely to beyond extremely unlikely	16.0 > TOX-2	3.0 > TOX-2

Source: LMITCO 1997c, pgs. 3-37 thru 3-46; Slaughterbeck 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 E-5.2.3)

5.14.4 Facility Accident Impacts from the Proposed Action

Preliminary accident screening for the proposed AMWTP has identified nine scenarios as part of its design basis (BNFL 1998d). These accident scenarios are described in Table 5.14-5. The fire scenario in the box/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 has the highest consequences. The Type II storage module fire has the highest consequences within the extremely unlikely frequency category. The remaining eight accident scenarios have offsite consequences and are either specific to the proposed AMWTP facility or a potential result of AMWTP operations.

Table 5.14-5. Preliminary accident screening for proposed AMWTP.

Accident description	Frequency category
Fire involving uncontained waste in the AMWTP box and drum line confinement cell	Anticipated
Loss of pressure differential between confinement zones due to loss of electrical power and backup diesel generator failure	Anticipated
Waste box dropped outdoors and breaks open during transfer between facilities within the TSA	Anticipated
Fire involving TRU waste containers within the TSA RE	Unlikely
Incinerator explosion and confinement cell breach caused by a flameout, buildup of excess volatiles and/or propane, and subsequent ignition and explosion	Unlikely
Wind-borne missile breach of building structure which causes a waste box to break open	Unlikely
Fire involving waste transfer vehicle during transfer between facilities within the TSA	Unlikely
Vitrifier explosion and confinement cell breach due to severe water incursion and subsequent steam explosion	Extremely unlikely
Fire in Type II storage module caused by either a range fire, a propane delivery truck accident, or an internal fire that is not detected or suppressed	Extremely unlikely

Preliminary quantification of the source terms for the eight significant accidents scenarios are presented in Table 5.14-6 (BNFL 1998d). 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. While the radiological consequences of the Type II storage module fire may be similar to the lava flow scenario, the toxicological exposures are expected to be a couple orders of magnitude lower. Quantitative assessments of the consequences to the co-located worker and offsite public will be calculated as part of the preliminary safety analysis report that is under preparation.

Table 5.14-6. Source terms for bounding accident scenarios for Proposed Action.

Accident	Am-241 release (g)	Mercury release (g)	Nitric acid release (g)
Fire box/drum line	3.63×10^{-6}	1.68	2.03
Loss of electrical power	8.78×10^{-6}	2.02×10^{-5}	1.22×10^{-2}
Waste box drop	1.75×10^{-3}	4.04×10^{-3}	2.44
Fire within the TSA RE	4.46×10^{-6}	2.40	2.90
Incinerator explosion	1.97×10^{-5}	2.27×10^{-3}	2.75×10^{-2}
Wind-borne missile breach	1.75×10^{-4}	4.04×10^{-4}	0.244
Waste transfer vehicle fire	9.37×10^{-4}	505	610
Vitrifier explosion	3.29×10^{-4}	—	—
Fire in Type II storage module	0.167	9.00×10^{4}	1.09×10^{5}

Additional details on the AMWTP accidents and associated source terms are provided in Appendix E-5, Facility Accidents.

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 vitrifier 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 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. 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.

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 which 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. 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 conducting 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.

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[b]
Additional Increased Rack Capacity (CPP-666)	Nonincinerable Mixed Waste Treatment[b]
Dry Fuel Storage Facility; Fuel Receiving Canning/Characterization and Shipping[b]	Remote Mixed Waste Treatment Facility
Fort St. Vrain Spent Nuclear Fuel Receipt and Storage	Sodium Processing Project
Spent Fuel Processing[a]	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[b]
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[a]	Boiling Water Reactor Experiment (BORAX)-V D&D
New Calcine Storage[a]	High-Level Tank Farm Replacement (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[b]	Health Physics Instrument Laboratory
Experimental Reduction Facility Incineration[b]	Radiological and Environmental Sciences Laboratory Replacement

a. Alternative D only.
b. These projects would be expanded for Alternative D (Maximum Treatment, Storage, and Disposal).
c. Sodium-bearing and calcine waste treatment technology selection would be implemented through this facility.

Aesthetic and Scenic Resources. The potential for cumulative impacts on atmospheric visibility at Craters of the Moon Wilderness Area were 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 2.0 delta E) 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.

Table 5.15-2. Offsite activities included in the assessment of cumulative impacts in the DOE INEL EIS.

Activity	Description
Housing Development, Idaho Falls	300-unit single family housing development planned on approximately 150 acres of vacant land
Business Park, Rexburg	50 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, Idaho Falls	Opening of Target discount store and associated 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.

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. 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 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 likely not 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 Site Treatment Plan. 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 non-radiological 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 off site 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 maximally exposed individual 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 ICPP, 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 distrubed[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 appropriately 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.	2.7 million gal/yr. Increase of 0.001 percent over current water use. Cumulative approximately than 0.4 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 0.035 to 0.68 cancer fatalities. Collective dose to the general population would be 480 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 2.0 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 2.9 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 7.3 person-rem (Alternative B) to 1,000 person-rem (Alternative D, Centralization at Savannah River), or 0.11 and 0.4 cancer fatalities. Collective dose to the general population was 2.1 person-rem (Alternative B) and 2,400 person-rem (Alternative D, Centralization at Savannah River), or 0.30 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.

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 5.15-3. 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 (DOT), 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		
Waste (1954-1995)	47	28
DOE spent nuclear fuel (1953-1995)	56	30
Naval spent nuclear fuel (1957-1995)	6.2	1.6
Alternatives B-D		
Waste shipments for Alternatives B-D		
Truck (100 percent)	870-1,700	460-940
Train (100 percent)	20-48	29-58
Spent nuclear fuel shipments for Alternatives B-D		
Truck (100 percent)	7.3-1,000	2.1-2,400
Train (100 percent)	7.3-1,000	2.1-190
Reasonably Foreseeable Actions		
Geologic Repository		
Truck	8,600	48,000
Train	750	740
Waste Isolation Pilot Plant		
Test Phase	110	48
Disposal Phase		
Truck	1,900	1,500
Train	180	990
General Transportation		
1953-1982	170,000	130,000
1983-2005	39,000	42,000
Summary		
Historical	110	60
Waste shipments for Alternatives B-D		
Truck (100 percent)	870-1,700	460-940
Train (100 percent)	20-48	29-58
Spent nuclear fuel shipments for Alternatives B-D		
Truck (100 percent)	7.3-1,000	2.1-2,400
Train (100 percent)	7.3-130	2.1-190
Reasonably Foreseeable Actions		
Truck	11,000	50,000
Train	750	1,730
General transportation (1953-2005)	210,000	170,000
Total collective dose	220,000	220,000
Total cancer fatalities	88	110

Source: DOE 1995.
a. LLMW, alpha LLMW, and TRU Waste
b. Information not available

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 not change to the level of service associated with U.S. High 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. 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 ten-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 off-site environments. The airborne pathway is the principal pathway by which radioactive materials released on the INEEL site could reach an off-site 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.

The occupational radiation dose received by the entire INEEL workforce for ten 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 (2.5 years) and operation (30 years) is 385 total injury and illness/0.96 total fatalities and 135 total injury and illness/0.65 total fatalities, respectively.

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 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 maximally exposed individual offsite would be 0.011 millirem. 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 ten-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 was small compared to the risks from radioactive releases and imply less than one fatal cancer in the exposed population over a ten-year period. 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	Comments
			Radiological			
Public	Atmospheric	Estimated excess fatal cancers	<1	<1	<1 ($2.8x10^{-5}$)	
Workers[a]	Atmospheric	Estimated excess fatal cancers	Negligible	Negligible	<1 ($6.0x10^{-4}$)	Overall cancers expected to be less than baseline because of fewer employees
			Nonradiological			
Public	Atmospheric (Carcinogens)	Estimated lifetime cancers	<1	<1	<1	
	Atmospheric (Noncarcinogens)	Estimated adverse health effects	0	0	0	
Workers	Atmospheric (Carcinogens)	Estimated lifetime cancers	<1	<1	<1	
	Atmospheric (Noncarcinogens)	Estimated adverse health effects	0	0	0	
	Routine workplace safety hazards	Estimated fatalities	3	3	(0.96 concentration) (0.65 operation)	

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 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 2.7 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 Proposed Action and Treatment and Storage Alternative but greater than the No Action. 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, strorage, and disposal under the same alternative would be 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 and 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 hearing 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	Non-Thermal Treatment	Treatment and Storage
Land [a,b]	7 acres	7 acres	7 acres
Energy	--	--	--
Electricity	35,022 MWh/yr	23,980 MWh/yr	35,022 MWh/yr
Diesel fuel	16,000 gal/yr	16,000 gal/yr	16,000 gal/yr
Propane	925,000 gal/yr	185,000 gal/yr	925,000 gal/yr
Minerals[a]	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 Best Available Control Technology (BACT) in conjunction with administrative controls. 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 (83mg/m^3) is higher than the Maximum Achievable Control Technology (MACT) standard (40mg/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. 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 BACT 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 ground water 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 EIS's 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 maximally exposed individuals 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* (59 FR 7629 February 16, 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. Because DOE is still in the process of finalizing its environmental justice guidance, the approach taken in this analysis may differ somewhat from whatever final guidance is eventually issued and from the approach taken in other NEPA documents.

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 50 percent or more of the total population or where minorities comprise less than 50 percent, but greater than 25 percent 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).

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 (59 FR 7629 February 16, 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 are 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 Figure 5.20-1, minority and low-income populations do reside with 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 figure, 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 50 percent of the population.

Table 5.20-1. Selected demographic characteristics for the INEEL region of influence.

Persons by race/ethnicity	Bannock County (number)	Bingham County (number)	Bonneville County (number)	Butte County (number)	Clark County (number)	Jefferson County (number)	Madison County (number)	Total region of influence (number)	Total region of influence (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

Source: 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.

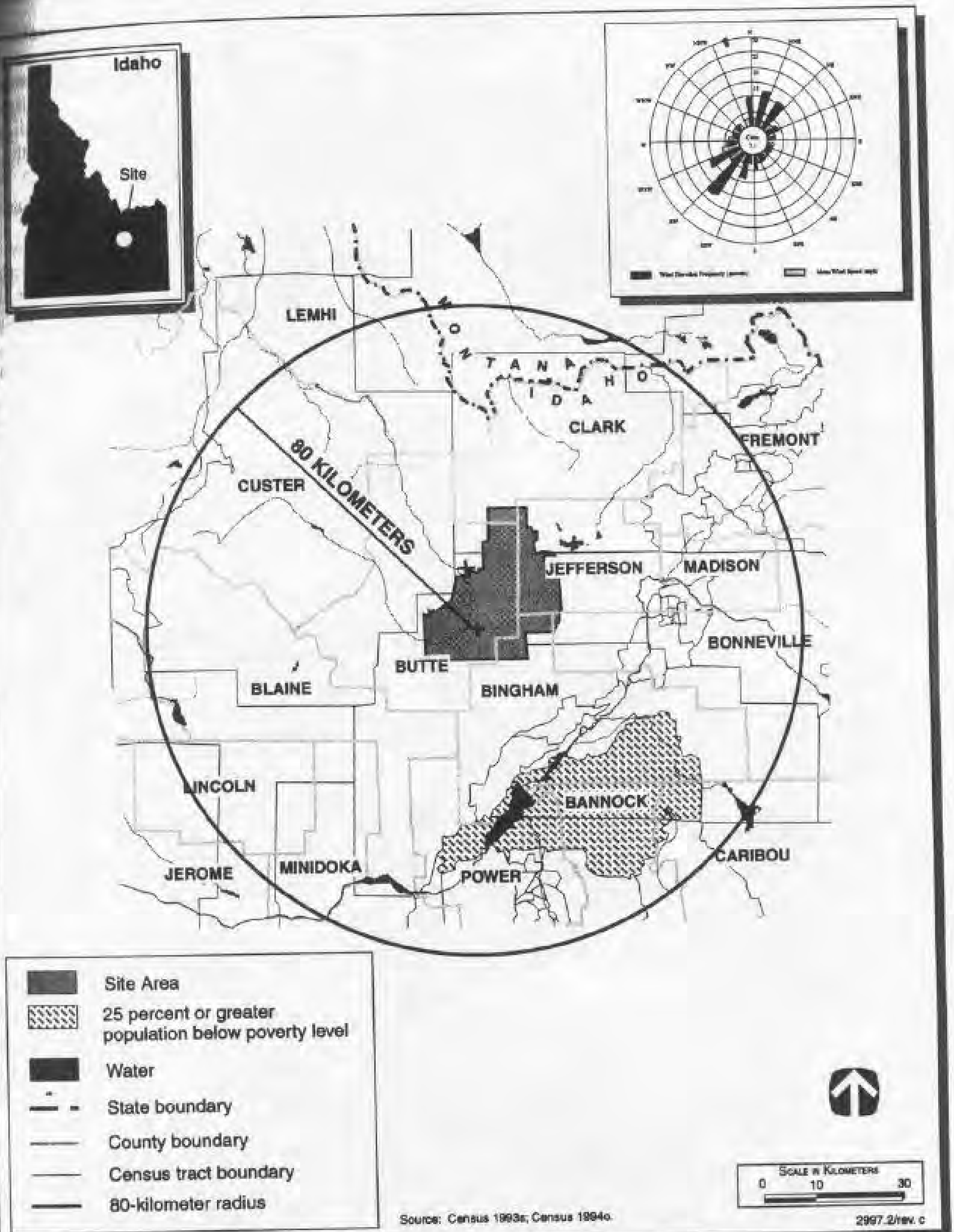


Figure 5.20-2. Low-income distribution by poverty status for INEEL and surrounding counties.

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. 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, was 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.

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 SRS. 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 contact-handled (CH) TRU waste, and buried caissons for remote-handled (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.

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.

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.

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. 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 lead hazard index is 36 for CH TRU waste.

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.

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 environmental 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 5.4×10^{-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.

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 8×10^{-4} latent cancer fatalities for No Action Alternative 1A; and 3×10^{-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 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. (BNFL) if one of the "action" alternatives is selected.

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 as the winning contractor for the Phase I part of the project.

This EIS considers whether BNFL 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 insure 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, particularly those set out in the Environmental Safety and Health Program Operating Plan that would result from negotiations between BNFL 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. For purposes of this proposed project and the wastes that would be treated and/or stored, this set of laws is very significant, regardless of which alternative is chosen by DOE. 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 does factor in to all of the alternatives, primarily after any activity is completed. 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.

The CERCLA statute and regulations become significant 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.

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 operations (M&O) contractor for the INEEL. Alternatively, if DOE chooses one of the "action" alternatives, BNFL 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 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 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. See section entitled “Environmental Justice.”

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 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 “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 Maximum Achievable Control Technology (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.

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, State, and local agencies with jurisdiction or special expertise in the topics being analyzed in the EIS. 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 its 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.

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10. DISTRIBUTION LIST

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Mayor, City of Idaho Falls
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Federal Agencies

BLM
Defense Nuclear Facilities Safety Board
Department of Interior, Office of EP&C
EPA - Office of Ecosystems and Communities
National Oceanic & Atmospheric Administration
NPS Air Resources Division
NPS Craters of the Moon National Monument
U.S. EPA/Federal Facility Section
U.S. EPA/Superfund Cleanup Unit 4

State Agencies

State of ID INEEL Oversight
Division of Environmental Quality-LDR
Idaho Dept of Water Resources
State of ID Dept of H&W Div of Environmental Quality

Organizations

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Ecology & Environment

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Environmental Evaluation Group
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APPENDIX A

CONSULTATION LETTERS

This appendix will include consultation/approval letters between the U.S. Department of Energy and the U.S. Fish and Wildlife Service regarding threatened and endangered species, and between other State and Federal agencies as needed. Letters currently supplied are from the U.S. Fish and Wildlife Service to the U.S. Department of Energy.

United States Department of the Interior

FISH AND WILDLIFE SERVICE

Snake River Basin Office, Columbia River Basin Ecoregion
1387 South Vinnell Way, Room 368
Boise, Idaho 83709

February 23, 1998

Roger Twitchell
National Environmental Policy Act Compliance Officer
Department of Energy
Idaho Operations
850 Energy Drive
Idaho Falls, Idaho 83401-1563

Subject: Advanced Mixed Waste Treatment Project Species List
SP #1-4-98-SP-68 File #506.0000

Dear Mr. Twitchell:

The U.S. Fish and Wildlife Service is writing in response to your request for information about potential impacts to endangered species from the proposed Advanced Mixed Waste Treatment project area. It is our preliminary determination that, given the general nature of the proposal the project is unlikely to adversely impact any species listed under the Endangered Species Act of 1973, as amended. If you determine otherwise or require further assistance, please contact Susan Burch of this office at (208) 378-5265. Thank you for your interest in endangered species conservation.

Sincerely,

Susan B. Martin

Acting Supervisor, Snake River Basin Office

cc: IDFG, Idaho Falls
FWS-ES, Pocatello (Donahoo)

Department of Energy
Idaho Operations Office
850 Energy Drive
Idaho Falls, Idaho 83401-1563
January 12, 1998

Alison Beck Haas
Snake River Basin Office
Columbia River Basin Ecoregion
1387 South Vinnell Way, Room 368
Boise, Idaho 83709

SUBJECT: Request For Species List (ARM-PA-98-004)

Dear Ms Beck Haas:

This is to request a species list to assist the Department of Energy (DOE) in the preparation of an Environmental Impact Statement (EIS). DOE is preparing a draft EIS for The Advanced Mixed Waste Treatment Project at the Idaho National Engineering and Environmental Laboratory (INEEL). The Notice Of Intent (NOI) to prepare this EIS was published in the Federal Register November 20, 1997, (62 FR 62025). The NOI provides background information, gives the purpose and need, and describes the proposed action and agency identified alternatives. Our schedule is to issue the Draft EIS in the spring, and the Final EIS in the summer of 1998. DOE's proposed action and agency identified alternatives would take place on the INEEL which is a 569,295 acre DOE reservation that occupies lands withdrawn from the public domain in south-east Idaho on the eastern Snake River Plain. All actions analyzed in the EIS would take place within or near the Radioactive Waste Management Complex (RWMC). The RWMC is located in the south-west portion of the INEEL in Township 2N, Range 29E, and occupies about 165 acres of the central portion of Section 18. The location and geographic relationship of these areas are shown on the attachment.

This EIS will analyze the environmental impacts of the construction and operation of a facility that would treat approximately 65,000 cubic meters of radioactive waste at the RWMC. The waste is mixed low level waste, alpha-contaminated mixed low level waste, and transuranic waste. The facility would be constructed within the fenced boundaries of the RWMC on previously disturbed ground. Treated waste would be transported to the Waste Isolation Pilot Plant (WIPP) near Calsbad New Mexico. The environmental impacts of transportation and the operation of WIPP were addressed in DOE's Waste Isolation Pilot Plant Disposal Phase Final Supplemental EIS.

Please provide a list of threatened, endangered and candidate species and species proposed to be listed under the Endangered Species Act that may occur on the INEEL, and particularly in the vicinity of the RWMC. Also please identify any designated or proposed critical habitat near the INEEL, and any supplementary information you think may be used in our analyses. If you have any questions concerning this request or if you need further information concerning this EIS or other actions on the INEEL, please call me at (208) 526-0776.

Sincerely,

Roger Twitchell
National Environmental Policy Act
Compliance Officer

Attachment:

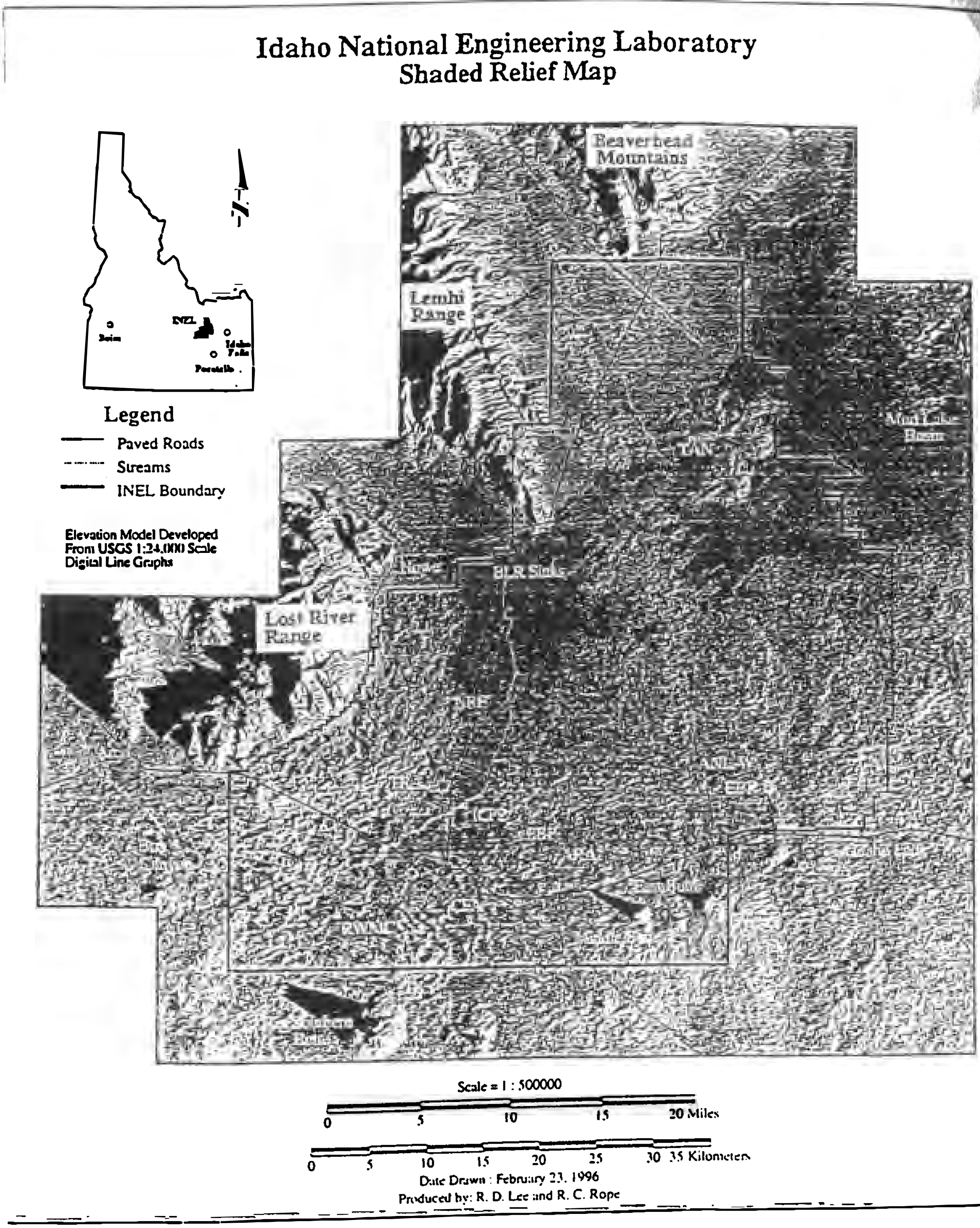

Figure 1. Physiographic setting of the Idaho National Engineering Laboratory. Acronyms show locations of major facilities.

APPENDIX B

FACILITY DESCRIPTION INFORMATION

The following descriptions are taken from BNFL-5232-RCRA-01, Rev. 0, *Hazardous Waste Management Act/Toxic Substances Control Act* (HWMA/TSCA) permit application for the Advanced Mixed Waste Treatment Project (AMWTP) facility.

B-1 Nonthermal Treatment Operations

Waste containers within the nonthermal treatment areas are managed in a manner to prevent container rupture or leakage and to minimize exposure of AMWTP facility personnel. Operating standards used in conducting nonthermal treatment activities include:

- Wastes slated for direct supercompaction have been identified by item description codes, generator-supplied information, and real-time radiography examination. Other wastes for supercompaction and macroencapsulation are sorted, segregated, and size reduced in the pretreatment lines prior to supercompaction and/or macroencapsulation. Waste characterization information is reviewed prior to processing in the nonthermal treatment units to ensure that only compatible wastes are treated.

- All nonthermal treatment activities are performed by operating personnel trained to safely conduct the treatment and to respond to emergency incidents.

- All treatment activities are conducted with the knowledge of a supervisor and according to specific treatment procedures.

- Containers enter the nonthermal treatment areas through a combination of elevators, conveyors, and airlocks. Containers are lidded during compaction and after loading puck drums with waste and grout. Barcode readers throughout the facility verify waste container locations and destinations.

- The presence of liquids in supercompaction feed drums is minimized by liquid removal in the pretreatment lines.

- Special case waste is managed within the single case waste glovebox on a case-by-case basis, typically in small quantities and in a timely manner to reduce waste accumulation.

- No reactive (Hazardous Waste Number [HWN] D003) wastes are processed in the nonthermal treatment units. Waste streams potentially containing ignitable (HWN D001) wastes are processed in a manner to minimize reactions or fires (e.g., campaigning incompatible waste separately, using only non-sparking tools in the treatment areas when processing potentially ignitable wastes).

- The ventilation air is ultimately fed to banks of high efficiency particulate air (HEPA) filters and carbon filters prior to exhausting through the facility stack.

- Secondary waste streams generated in the treatment areas are treated within the facility.

These operating standards are used to prevent releases of hazardous waste constituents, which may have adverse effects on human health or the environment. An overview of typical treatment operations is provided below.

B-1.1 Supercompactor

The 55-gal direct-feed waste drums or 55-gal transfer containers from the pretreatment lines are routed to the supercompactor via the central conveyor system. To maximize the size reduction process, the data management system incorporates an optimization algorithm that automates the waste drum selection for puck drum filling to achieve maximum packing densities. The data management system optimizes puck filling based on fissile content, weight, or puck height. Automatic control sequences to retrieve, deliver, compact, and deposit the waste drum/puck into the puck drum are initiated from the central control room.

At the supercompaction area interface point, a barcode reader identifies the waste drums before they are transferred, via roller conveyor, through an airlock and into the supercompactor infeed glovebox. There are two stations within the infeed glovebox: the drum lidding station and the drum lid crimping/drum piercing station. A roller conveyor is used to move the waste drum from the glovebox entrance to the lidding position. Waste transfer containers from the pretreatment lines require lidding before compaction, since they remain open during transfer through Zone 3 process areas. At the lidding station, a drum handling mechanism is used to center and secure the open waste drum during the lidding process. Lids are automatically fed from outside of the containment into the glovebox using a special seal arrangement. The feeder device fits the lid directly onto the top of the drum.

The drum handling mechanism transfers the lidded drum onto the compaction trolley at the drum lid crimping/drum piercing station, where a crimping head is lowered to fasten the lid into position, while at the same time piercing the drum to prevent overpressurization during compaction. After supercompactor feed drums have been lidded, crimped, and pierced, the drum handler arms are opened leaving the drum centrally located on the compaction trolley. The trolley moves the drum into the supercompactor glovebox to a position beneath the supercompactor.

With the drum and trolley in position, the mold is lowered around the drum and engaged onto the trolley. The lower press plate of the supercompactor is mounted on the top of the trolley and acts as a guide for the mold, which controls the puck diameter during the compaction cycle. The compaction process proceeds in two phases. First, the main ram is lowered, initially powered by a low-force ram, which forces the air out of the top section of the drum at a preset pressure. After the first compaction phase, high-pressure fluid is supplied to the main high-force compaction ram and is maintained at a higher pressure for a set period of time (1 to 5 minutes, depending on the waste being compacted). Preset compaction pressures are used to control the compaction process. Both rams are fed from a hydraulic power pack situated outside the glovebox. The resultant force reduces the puck height (on average) to one-fifth of the original drum height. On completion of the compaction cycle the mold and ram are raised, and the compaction trolley transfers the puck to the postcompaction glovebox.

Although dry waste is being compacted, a sloped glovebox floor and an adequately sized sump are provided to collect any liquids produced during the compaction process. The sump has a capacity of approximately 4 L and is equipped with a sensor to detect liquid at two levels (low level to detect any liquid collected and an alarm level at 90 percent full). If liquid is detected, it is removed using a pump and placed into collection containers, which are transferred out of the glovebox and delivered to the special case waste glovebox for treatment, as required.

The data management system measures the height and weight of the puck using the puck handler (puck handler includes a load cell for weight measurement and an encoder for puck height measurement). If the puck is unsuitable for direct deposit into the puck drum, it is diverted to the puck staging area and a more suitable puck is retrieved from this area. The puck staging area (holding up to 5 pucks) allows for the pucks to be temporarily staged, if required. The puck handler transfers the pucks into puck drums at the grout filling station at the eastern end of the postcompaction glovebox.

From the central control room the operator continues to feed drums until the puck drum is ready for grouting. Central control room-initiated control sequences also allow the importing of empty puck drums into the area as required. Barcode readers are employed throughout the supercompaction area to verify the integrity of the waste tracking system. Software based interlocks stop the process if an out-of-sequence drum is detected. Extensive use of closed circuit television is employed to allow the central control room-based operators to complete their tasks.

B-1.2 Macroencapsulation System

The macroencapsulation system provides for the application of surface coating materials to substantially reduce surface exposure to potential leaching media in the disposal environment. The process components are located in three areas: the grout preparation area, the puck drum grout filling station, and the drum cure area.

The grout preparation area supplies a cement-based grout to the grout filling station to encapsulate pucks or baskets of metal debris, which have been placed in a puck drum. The grout completely encapsulates the waste and is resistant to degradation by the waste, its contaminants, and substances that may contact the waste form after disposal.

The cement powders [ordinary Portland cement (OPC) and pulverized fuel ash (PFA)] are delivered to the receiving storage hoppers by bulk tankers and transferred into the respective weigh hoppers by the OPC/PFA transfer conveyors. The data management system maintains appropriate recipes for the production of the grout and calculates the correct volume of grout required for each puck drum based upon puck height. All grout preparations and grout filling activities are under programmable logic controller sequence control and are normally initiated from the central control room or from the local control area workstation. The quantity of each powder, which is dependant upon the formulation envelope, is screw-fed into the grout mixing vessel along with the required volume of water from the water feed vessel.

Prior to drum filling, clean puck drums are fed into the supercompaction cell from the clean drum feed route by a roller conveyor. The drum is identified by a barcode reader and transferred into the interfacing glovebox bagless transfer airlock by roller conveyor. A bagless transfer system is used to allow drum lid opening while maintaining glovebox ventilation conditions. Once the puck drum is within the airlock, an operator removes the bolt ring and outer lid via gloveports. The puck drum is then clamped centrally onto a drum positioning machine and raised into position at the bagless transfer mechanism. The bagless transfer port is opened with the inner drum lid attached (held in position by vacuum pump). The puck drum is pre-loaded with an insert and an anti-flotation device. The insert is used to prevent direct contact between the waste and the container, the anti-flotation device keeps pucks below the grout surface. Before pucks or baskets are loaded, the anti-flotation device is removed from the drum using the puck handler and parked nearby.

The data management system decides if a puck or metal debris basket can be loaded directly into the puck drum or if it requires placement into one of the five positions at the puck staging area. Pucks are loaded automatically into the puck drum using the puck handler. Recovery facilities are available within the postcompaction glovebox, along with hand operated tools, to deal with abnormal pucks that do not fit into the puck drum. Waste that escapes from pucks are manually collected through gloveports and placed into open mesh bags, which are inserted between pucks during puck filling and are encapsulated.

Baskets of non-compacted metal debris (requiring encapsulation) are loaded into an empty puck drum in a similar manner as the pucks. The baskets are transferred in open transfer drums through the compaction gloveboxes to the entrance of the postcompaction glovebox. At this point, the baskets are lifted out of the transfer drums using the puck handler and either placed into an empty puck drum or in one of the puck staging positions. The empty transfer drums are returned to the pretreatment lines.

After the puck drum is filled with pucks or a basket, the anti flotation device is fitted and locked into position using the puck handler. A funnel device is then placed over the puck drum opening to prevent loose debris or grout from splashing onto the drum seal or through the purge area. Prior to grouting, the grout pipe is rotated down towards the puck drum to ensure that the grout flows directly into the drum. A pinch valve is fully opened and grout is pumped into the drum until the waste is covered. Lasers are used to prevent overfilling during the grouting process. At a predetermined level monitored by a laser (approximately 1 in. above the waste), the grout pump is stopped and the pinch valve partially closed. A second laser device is used to prevent drum overfilling by completely stopping all grout flow when the overfill level is reached. A disposable pig is manually loaded into the grout line and compressed air is used to blow the pig and the last of the grout down the line to the pinch valve. A rodding drive that pushes the pig into the puck drum along with the last of the grout is manually inserted through the changeover valve.

Excess grout is emptied from the mixing vessel and transferred into the grout waste collection tank. Periodic wash down of the process equipment is required. Additives (e.g., Addmix) to the excess grout that inhibit the cement mixture from curing may be used to return grout washings to the grout-mixing vessel and minimize effluent discharges.

When the grouting sequence is complete, the grout pipe is rotated out of the way, the funnel protector retracted, and the bagless transfer port closed and locked to allow drum lidding. The filled and grouted puck drum is then lowered from the glovebox to the drum lidding area, and the bolt ring and outer lid are fitted by an operator through gloveports. The puck drum is transferred from the bagless transfer airlock to the swabbing station by a roller conveyor. The puck drum is rotated and manually swabbed to check that the exterior of the drum is clean and suitable for export. Externally clean puck drums (final waste form containers) are identified by a barcode reader and automatically transferred through an airlock to the drum cure area by a roller conveyor.

Within the drum cure area a drum transfer car moves the final waste form containers from an inlet conveyor to one of 28 staging bays (roller conveyor units), and the final waste form containers are allowed to cure for approximately 24 hours. After the final waste containers have cured they are transferred using the transfer car to the roller conveyor/forklift interface in the operating corridor, and then to the product certification area for external contamination monitoring and certification.

B-1.3 Special Case Waste Glovebox

The special case waste glovebox is provided for treatment of special case waste on a case-by-case basis. This glovebox is fitted to treat liquids recovered from the various liquid collection devices located throughout the pretreatment lines and the postcompaction glovebox, and elemental mercury. Other waste streams that may require processing in the special case waste glovebox on an irregular basis may include such items as hydraulic fluids, containers requiring venting, or wastes indicated as special case waste in Table C-1-1 of Book 1 of the AMWTP *Resource Conservation and Recovery Act* (RCRA) Permit Application.

Special case waste removed from waste containers in the pretreatment lines is placed into baskets in transfer containers and routed (via the central conveyor system) to the special case waste interface point. The transfer containers are then moved into the transfer airlock and identified by a barcode reader. With the special case waste transfer container in the airlock, the glovebox hatch is opened and an elevator lifts the transfer container up to the special case waste glovebox. At this point, a hoist is used to retrieve the basket from the transfer container, and then the waste containers are removed from the basket. Liquid waste effluents from the supercompactor, as well as the pretreatment lines, may also be manually transferred to the glovebox and imported via the bagless transfer purge port.

Within the special case waste glovebox, containers of liquid waste are examined for physical properties, including pH, viscosity phases, and conductivity. The containers are sampled and then placed into a staging rack until analytical results are available. Samples are analyzed for organics. Liquids are separated by a settling/decanting process, if required. If liquids are found to be acidic/basic, they are neutralized. Neutralized liquids are mixed with an appropriate absorbent, based on analytical results. Absorbed liquids may be combined, if analytical results show them to be compatible. Elemental mercury is amalgamated.

The following presents specific information on the three treatment processes conducted in the special case waste glovebox.

B-1.3.1 Neutralization. Neutralization is performed to obtain an optimum pH for subsequent treatment by absorption and then incineration. The optimum pH, which depends on the waste type and specific absorption agent(s) used, is established prior to conducting treatment. The following presents the treatment steps that are used in neutralizing a liquid waste:

- The weight or volume of the waste, as specified in the treatment procedure, is determined and recorded.
- A pH measurement is taken to verify the initial reading recorded in the treatment procedure.
- The appropriate types and amounts of neutralizing agents are weighed/measured out and added according to the treatment procedure. The primary acidic neutralizing agents include sulfuric acid or hydrochloric acid. The primary basic neutralizing agents include sodium hydroxide or various limes (such as calcium carbonate).
- The treatment agents and waste are mixed according to the method and duration specified in the treatment procedure.

- A pH measurement is taken to verify results against the pH end-point established in the treatment procedure and to confirm treatment effectiveness.

- If treatment is not effective, the neutralization process is repeated.
  Once neutralized, the liquid is mixed with appropriate absorbents as described below.

B-1.3.2 Absorption. Aqueous and/or organic liquid wastes, which have been neutralized as required, are separated (if two phases) and absorbed in order to meet downstream treatment requirements. The following are the general steps that are used during the absorption/treatment process:

- The volume of waste to be treated is measured and verified against the volume stated in the treatment procedure.

- The amount of appropriate absorbent is measured as specified in the treatment procedure.

- The absorbent is added to the liquid waste in accordance with the treatment procedure.

- The absorbent and waste are mixed according to the method and duration specified in the treatment procedure.

- Treated waste is visually inspected for signs of free liquids. If no free liquids are present, the treatment is considered successful. If liquids are present, additional absorbent material is added and the waste is remixed.

The types of absorbents used vary with the type of liquid waste and are selected based on (1) recommended usage and specifications provided by manufactures and (2) compatibility with the waste. Absorbents may include natural materials such as vermiculite, silicates, clays, or cellulose; or synthetic materials such as activated carbon, polypropylene, or other proprietary components.

Containers with absorbed liquids are placed into transfer containers and routed to the incinerator for thermal treatment.

B-1.3.3 Amalgamation. Any elemental mercury recovered is treated via amalgamation using reagents such as sulfur. The following are the treatment steps used in the amalgamation process:

- The mercury is weighed, and results recorded to verify against the weight of mercury stated in the treatment procedure.

- The required treatment reagents are measured as required by the treatment procedure.

- Treatment reagents are added to the mercury in the sequence established by the treatment procedure.

- The mercury and treatment reagents are mixed according to the method and time specified in the treatment procedure.

- The mercury amalgam is allowed to cure in accordance with the time specified in the treatment procedure.

- Following the allotted curing time, the amalgam is visually inspected to determine whether or not a semi-solid to solid waste form was produced. If treatment results in a semi-solid to solid waste form, amalgamation is deemed successful. If not, additional treatment reagents are added to the mercury waste form, and the mixture is remixed and allowed to cure a second time. The treatment process is repeated until desired results are obtained.

- Amalgamated metal is transferred out of the AMWTP facility.

B-2 Incinerators

The AMWTP facility incinerator is used to treat solid wastes containing HWMA- and TSCA-regulated constituents. Three main categories of waste are processed in the incinerator: organic homogeneous solids, inorganic homogeneous solids, and soils. The incinerator is used to destroy organic hazardous constituents in the solid wastes.

Operations Description. The incinerator unit consists of the incinerator and its ancillary equipment. The ancillary equipment includes the waste feed system, the air pollution control system, and the ash removal system. The following provides a brief description of the incineration system. A more detailed description can be found later in this section.

Incinerator. The incinerator, shown schematically on Figure B-2-1, is a dual-chamber auger hearth system. The operating characteristics of the incinerator when processing waste are summarized in Table B-2-1.

Air Pollution Control System. The incinerator air pollution control system, shown schematically in Figure B-2-2, is a combination dry filtration and wet scrubbing system. The system employs air injection and a liquid quencher for cooling, a packed bed absorber for acid gas scrubbing, and a high temperature filter and HEPA filters for particulate removal.

Table B-2-1. Incinerator operating conditions for LLMW.

Parameter	Operating Condition
Thermal capacity	3.0 MMBtu/h
Feed Capacity	Solid waste 650 lb/h
Types of Feed	Solid combustible mixed waste
Temperature	PCC - 1400 to 1800 °F Secondary chamber - 1800 to 2200 °F
Auxiliary Fuel	Propane
Waste Feed System	Solids – sized reduced and fed continuously through auger system
Gas Residence Time	Nominal 2 seconds in SCC when operating at thermal capacity of system

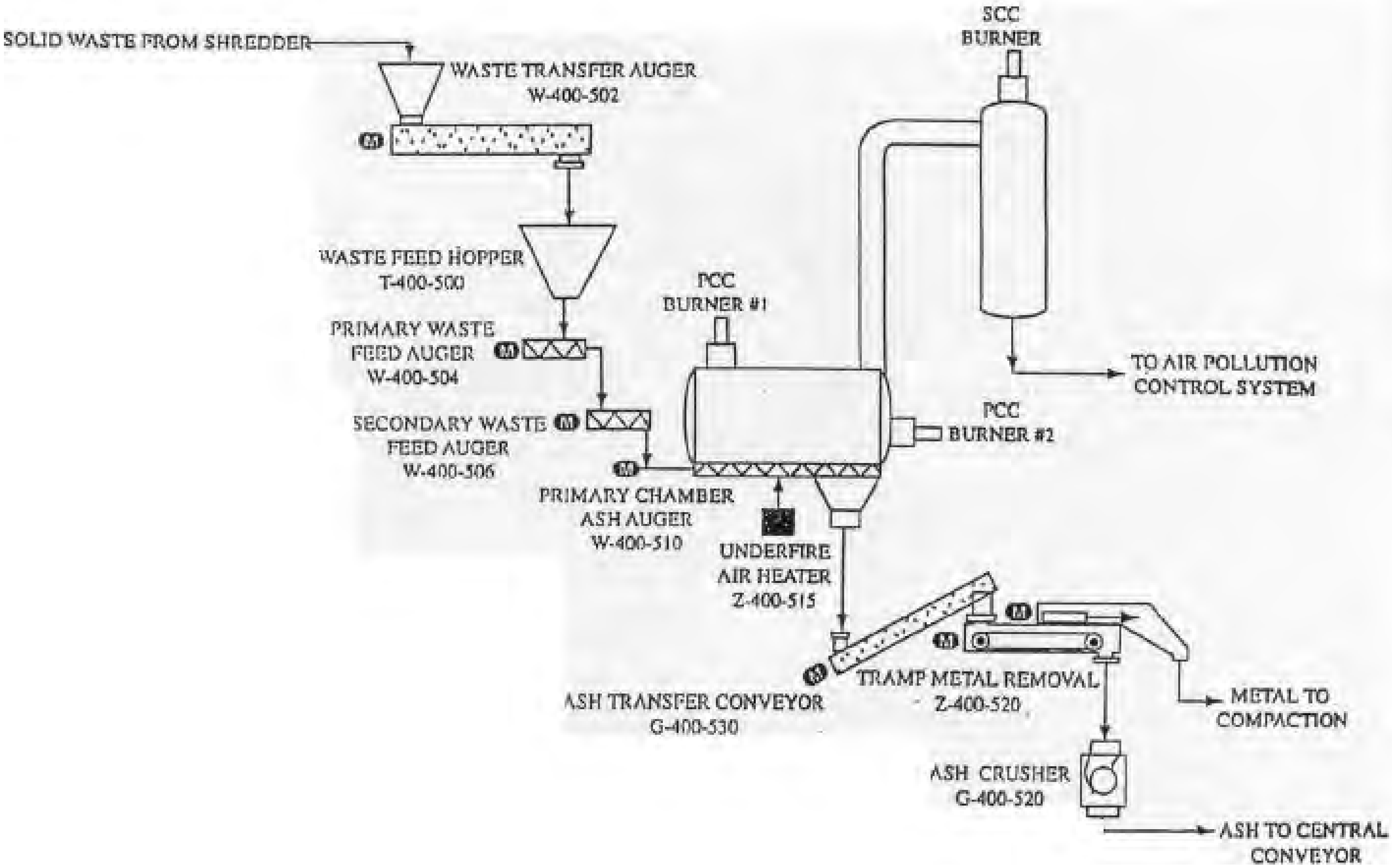

Figure B-2-1. AMWTP facility incinerator schematic.

Part of the offgas cooling is accomplished by mixing with ambient air. This is the initial operation conducted on the offgas stream. This reduces the gas temperature into the operating range of the high temperature filtration unit. The high temperature filtration unit is a mechanical filtration device that operates at high temperatures. The high temperature filter employs filtration elements to capture particulate entrained in the offgas. Offgas passes through the elements, and the particulate is trapped on the outer surface. Periodically, the elements are cleaned with a pulse of compressed air to drop the ash into a hopper for removal. High temperature filters are a very efficient means of particulate removal, collecting more than 99 percent of all particles greater than 0.5 microns in diameter.

After the high temperature filter is a full liquid quench of the offgas. The quencher injects an atomized liquid stream into the offgas stream for rapid cooling and saturation. The saturated and cooled gas is then treated in a packed bed absorber. The packed bed absorber is capable of removing over 99 percent of the acid gas from the offgas. A candle demister following the packed bed absorber separates entrained water droplets from the offgas stream.

Following the demister is a reheater. The reheater reduces the relative humidity of the gas stream to protect the HEPA filters from moisture. Two stages of HEPA filtration are used in series. HEPA filters are certified capable of removing 99.97 percent of all particulate in the range of 0.1 to 0.3 microns in diameter; the efficiency increases on all other particle diameters. The HEPA filters are also an effective means of toxic metals control.

Following the HEPA filters, a blower maintains a negative pressure within the incinerator and air pollution control system, ensuring confinement of particulate within the system and fugitive emissions control. The filtered exhaust exits the system through the facility stack.

Incinerator System Monitoring and Control. The AMWTP facility incinerator system has been designed to be remotely monitored and controlled. The system is continuously monitored and controlled by a programmable electronic system that has been programmed to receive signals from pressure, flow, temperature, level, and other transmitters located throughout the system. Further details of the monitoring and control devices located throughout the incinerator system are provided in the AMWTP RCRA Permit Application.

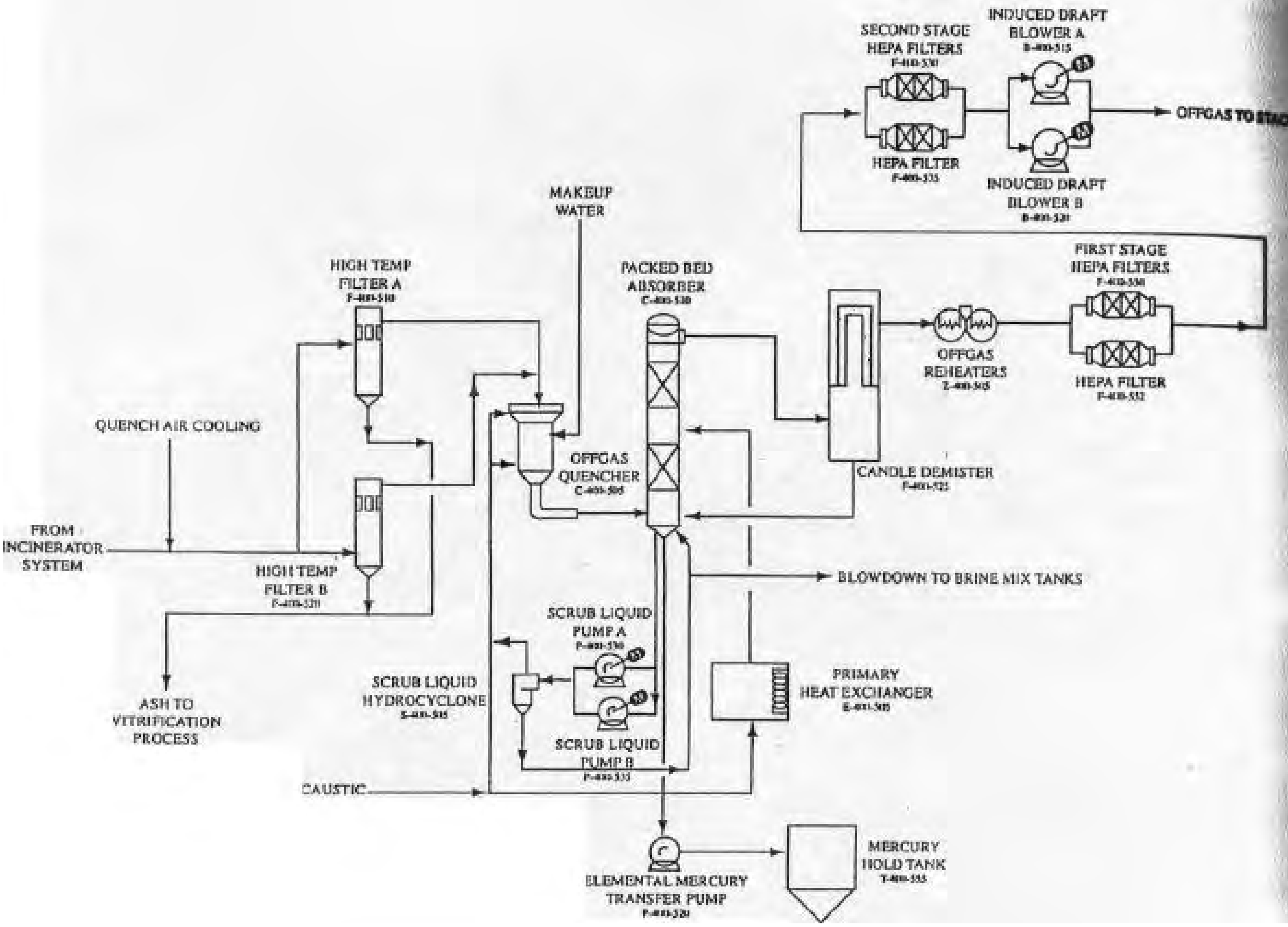

Figure B-2-2. AMWTP facility incinerator Air Pollution Control System.

B-2.1 Emissions/Compliance

B-2.1.1 Trial Burn. A trial burn is proposed for the AMWTP facility incinerator to demonstrate compliance with the performance standards of Idaho Administrative Procedures Act (IDAPA) 16.01.05.008 (40 CFR 264.343) and the current incinerator guidance documents. The trial burn will be conducted to obtain a HWMA operating permit using what is known as the "Universal Approach" to permitting. With this approach, a single set of operating conditions is sought for burning a relatively broad range of waste. To accomplish this, the trial burn is designed to represent the worst-case mix of wastes and operating conditions that the incinerator could encounter during operation. The trial burn is designed to accomplish the following primary goals:

- Demonstrate compliance with the current hazardous waste incinerator guidance *(Guidance on Setting Permit Conditions and Reporting Trial Burn Results*, EPA/625/6-89/019, January 1989) herein called the Incinerator Guidance

- Demonstrate the ability of the AMWTP facility incineration system to comply with the performance standards of IDAPA 16.01.05.008 (40 CFR 264 Subpart O).

- Provide emissions data for multipathway health risk assessment.

- Allow comparison of the AMWTP facility emissions to the proposed Hazardous Waste Combustion Maximum Allowable Control Technology (MACT) rule.

- Demonstrate the ability of the AMWTP facility incineration system to comply with the TSCA performance standards of 40 CFR 761.70.

The trial burn has been designed in accordance with the EPA's Incinerator Guidance series in pursuit of a certain set of desired operating conditions. The desired operating permit conditions, trial burn automatic waste feed cutoff set points, and the proposed means of demonstrating compliance are discussed in the AMWTP RCRA Permit Application, Book 4, Section D5-b.

B-2.1.2 New Incinerator Startup/Shakedown Conditions. Startup and testing of incinerator operations will occur for a period of several months with simulant chemicals and materials that are not regulated as hazardous wastes. This test period will be used to tune the controllers and test the incinerator, the feed system, the flame safety shutdown systems, the process interlocks, and the automatic waste feed cutoff system.

During the startup and testing period for the incinerator, a comprehensive set of procedures will be performed in order to bring the system online and ready for use. Activities to be performed during this testing period will include the following:

- The incinerator and the refractory material that lines its interior will be gradually brought up to operating temperature using auxiliary fuel.

- On-the-job training will be conducted for process operators, in addition to the formal training program.

- Operating data will be reviewed to evaluate the performance of the incinerator and its air pollution control system.

- The operators will be trained in the AMWTP facility incinerator system, the control system, the automatic waste feed cutoff system, and the Contingency Plan procedures.

After the initial systemization and startup testing, the shakedown period will begin for the trial burn. The initial shakedown will consist of a 720-hour operating period using actual waste feed material. While an extension is not anticipated to be required, an additional 720 hours may be requested, for a total of 1,440 operating hours, to conclude the shakedown operations. During shakedown, the incinerator will be operated at the operating conditions and waste feed rates anticipated during the trial burn.

B-2.2 Incinerator System

The AMWTP facility incinerator system consists of the following primary components: waste feed system, primary combustion chamber (PCC), secondary combustion chamber (SCC), and ash removal system.

B-2.2.1 Process Description. Waste acceptable to the incinerator is received from the sorting area via the central conveyor. The waste and liner are separated from the container and are passed through a shredder prior to being fed to the incinerator. Several types of waste are fed to the incinerator including organic homogeneous solids, inorganic homogenous solids, and soil.

The incinerator PCC has been designed to continuously process size-reduced waste. After analysis and assay, the waste is delivered to the incinerator area in containers, dumped into a shredder for size reduction and collected in a hopper underneath the shredder. The shredded waste is then transported to the incineration feed system hopper by a waste transfer auger. From the feed hopper, waste is continuously fed into the PCC using a dual screw, variable compression feeder designed to accommodate a wide variety of waste densities and compressibilities.

The refractory lined PCC typically operates between 1,400 to 1,800° F to dry, volatilize, and pyrolyze the wastes and has been designed with precise flow control and air injection locations to minimize particulate entrainment in the offgas. Ash is continuously transported down the length of the PCC by a screw auger and is collected in containers in the ash removal system. These ash containers are sampled, lidded and then sent for assay before transport to the vitrification system feed hopper.

The SCC completes the combustion process with the addition of excess air at temperatures of 1800 to 2200°F. Conventional auxiliary heat burners maintain temperatures in the PCC and SCC.

B-2.2.2 Type of Incinerator. The AMWTP facility incinerator is a dual-chamber, auger hearth system. The PCC consists of a refractory lined steel containment vessel sealed to the environment to prevent fugitive emissions. The base of the chamber contains an air-cooled ash auger for transporting the waste and ash through the PCC. Preheated underfire air is provided through tubes located in the auger trough to assist in volatilizing and combusting the waste organic matter. Flue gas from the PCC passes through an interconnecting duct to the refractory-lined SCC where combustion of the residual organic compounds is completed. The SCC has been sized to provide a nominal 2.0-second gas residence time for the combustion gases.

B-2.2.2.1 Linear Dimension of the Incinerator. The PCC has outer dimensions of approximately 25 ft long by 9 ft wide by 10 ft high. The internal volume of the PCC is approximately 240 ft^3. The SCC is cylindrical with an external diameter of 6 ft, an external length of 19 ft and an internal volume of approximately 220 ft^3. Additional details, including data sheet drawings of the PCC and SCC, may be found in the AMWTP RCRA Permit Application.

B-2.2.2.2 Description of the Auxiliary Fuel System. The auxiliary fuel for the AMWTP facility incinerator is propane. Propane burners are located in both the primary and secondary chambers. Two auxiliary burners are in the PCC; one located at the feed end and a second at the gas discharge end.

B-2.2.2.3 Combustion Burners. All three burners have a rich/lean mixture control capability for adjustment of stoichiometry. The ignition burner in the PCC produces a maximum flame length of approximately 3 ft. The pencil burner in the PCC produces a maximum flame length of approximately 7 ft and provides radiant heat to the waste being transferred down the length of the PCC by the auger.

All burners and flame safeguards systems have been designed to satisfy the most stringent and latest regulations specified by Factory Mutual, Underwriters Laboratory, and the National Fire Protection Association. All burners are equipped with ultra-violet flame detectors and are interlocked through the main programmable electronic system to ensure that all pre-ignition interlocks such as purging are satisfied before a burner can be ignited. When needed, the primary and secondary burners can be immediately brought on line without purging if the chamber temperature is above 1400°F (per National Fire Protection Association 86).

B-2.2.2.4 Underfire Air System. Combustion air is preheated prior to entering the underfire air manifolds. Four jet tubes in each of two manifolds direct the heated air at 1500°F to the trough containing the ash auger and waste. The trough consists of four zones in sequence: moisture removal, volatilization, ignition, and carbon burn out. Underfire airflow rates can be adjusted to each zone to meet process requirements. The air supply blower has an approximate capacity of 1900 acfm at the inlet and a differential pressure of 30 in. w.g. The blower is provided with an inlet silencer and HEPA grade filter and variable speed motor/drive capability.

B-2.2.2.5 Waste Feed System. The incinerator feed system continuously feeds shredded waste to the PCC. The feed system consists of the following major components: waste feed shredder, waste transfer auger, waste feed hopper, primary waste feed auger, secondary waste feed auger, and waste feed cutoff valve.

The waste feed shredder uses a dual auger/cutter within a sealed enclosure that size reduces the incinerator feed material to less than 2-in. pieces. The shredder is hydraulically controlled with automatic overload protection for auger/cutter reversal to free lodged waste material. Additional details of the shredder may be found in Appendix D-3 of the AMWTP RCRA Permit Application.

The waste transfer auger moves shredded waste from the shredder to the top of the waste feed hopper. The transfer auger is driven by a reversible, torque-sensing, variable speed electric motor to detect jamming by obstructions. The waste feed hopper assembly includes weight sensing devices for maintaining an appropriate waste level within the hopper. A nitrogen supply line to the waste feed hopper maintains the hopper and the waste feed glovebox at low oxygen conditions. A rotating agitator has been included with the hopper to prevent sludges from bridging or caking and thereby ensuring a constant supply of waste to the primary waste feed auger. The waste feed to the incinerator is measured in the waste feed hopper by load cells, which detect weight loss in the hopper over time.

Waste from the waste feed hopper falls by gravity into the primary waste feed auger and is then transferred to the secondary waste feed auger. The secondary waste feed auger includes a conical shaped tapered section near its exiting end that compresses the waste to approximately a 5-to-1 compression ratio, which provides a gas pressure seal between the incinerator and the feed system of approximately 2 psig.

The waste feed cutoff valve provides emergency waste feed cutoff during upset conditions or when critical monitoring devices fail or when it is necessary to isolate or remove the secondary waste feed auger from the PCC for feed system maintenance. The auger can be disassembled and moved back from the cutoff valve at its flange for repair or replacement while the PCC remains at operating temperature. The waste feed cutoff valve provides positive gas sealing, whenever compacted waste sealing is not available, as during startup conditions.

B-2.2.2.6 Ash Removal System. Ash discharged from the end of the PCC ash auger flows by gravity through two cooling chambers located in series. Ash in the upper chamber is cooled from approximately 1250 to 300°F via cooling air introduced through porous, non-clogging metal aerators. In the lower chamber, the ash is further cooled to less than 140° F by means of additional porous metal aerators, before being discharged to the ash transfer conveyer.

The ash transfer conveyor transfers the ash to a tramp metal removal and size-reduction station. Tramp metal is separated from the ash by a magnetic sorting device and the sorted metal is discharged into a container. Ash leaving the metals removal station proceeds to a conventional rotary jaw crusher for particle size reduction prior to being discharged into a container. The tramp metal removal and size-reduction station is shown on the piping and instrument design 1-05-55-510 found in Appendix D-3 of the AMWTP RCRA Permit Application.

B-2.2.2.7 Capacity of Prime Mover. AMWTP facility incinerator uses fully redundant induced draft fans with damper control to maintain negative pressure in the system and to draw flue gas through the PCC, SCC, and air pollution control system and deliver it to the stack. The exhaust blowers are constructed of alloy AL6XN or equivalent to prevent corrosion. Each fan has been designed to handle approximately 1500 standard cubic ft per minute when operating at a static pressure of approximately 36 in. w.g.

The AMWTP facility incinerator has been designed with the capability to be remotely monitored and controlled. Remote operation is performed from the central control room by experienced operators. The system is continuously monitored by a programmable electronic system that has been programmed to receive transmissions from pressure, flow, temperature, and performance transmitters located throughout the system. Based on preprogrammed information and system parameters, the programmable electronic system transmits signals to process control devices and to warning lights and alarms within the central control room, indicating a system malfunction.

B-2.3 Air Pollution Control System

The air pollution control system for the AMWTP facility incinerator consists of the following: quench air cooling, redundant high temperature filters, saturation quencher, packed bed absorber, candle demister, redundant first stage HEPA filtration, redundant second stage HEPA filtration, associated pumps and blowers, and an exhaust stack (see Figure B-2-2).

B-2.3.1 Process Description. Flue gas from the SCC is first cooled to approximately 1500°F before entering the high temperature filters. Cooling of the hot SCC exit gas is accomplished by mixing with ambient air supplied by redundant air supply blowers. The cooled gas from the SCC is directed into one of two parallel redundant high temperature filter vessels. Each filter vessel is refractory lined with a conical bottom for reliable discharge of solids by gravity. When the differential pressure across the filters reaches a preset value, the filters are cleaned in place by a jet-pulse blowback system using compressed air. Fly ash discharged from the filters is cooled in a holding volume prior to being discharged into a container. All fly ash collected in the high temperature filter is vitrified.

The gas exiting the high temperature filtration unit enters the quench tower where it is cooled and saturated by spraying the gas with brine. The cooled and saturated flue gas then passes through a wetted elbow at the base of the quench tower and discharges directly to the packed bed absorber below the packed bed column.

Upon entering the absorber tower, liquid droplets entrained in the offgas fall to the sump while the gas rises through the packing material. As the rising gas passes through the packed bed media, it comes into contact with the alkaline brine sprayed from the top of the packing. The brine absorbs the acidic gases to form salts. The brine solution falls from the packed bed and collects in the sump. From there it is pumped via redundant scrubber liquid pumps to the hydrocyclone.

Underflow from the hydrocyclone is continuously recirculated to the packed bed absorber sump. A slip stream is drawn off this line and sent to the scrubber brine mix tank to maintain brine density and to control the volume of liquid in the brine recirculation system. The overflow stream from the hydrocyclone is split with a portion being sent to the quench tower and the remainder being sent to a heat exchanger for cooling prior to being recirculated back to the packed bed absorber.

The rate of recirculation in the packed bed absorber is controlled to ensure an adequate liquid-to-gas ratio between the brine and flue gas at the expected maximum gas flow rate. Caustic is added to the brine to maintain a minimum pH, and makeup water is added to adjust the specific gravity and recirculating liquid volume.

Because mercury may be present in the waste streams treated by the AMWTP facility incinerator, the air pollution control system has been specifically designed to remove mercury from the offgas and scrubber brine. Mercury is maintained in its elemental state by maintaining the offgas exiting the SCC at high temperatures followed by rapid cooling of the offgas by quenching with subcooled brine. Since elemental mercury is more dense than brine, mercury collects in the bottom of the packed bed absorber sump. The mercury, along with sludge and brine is periodically pumped into the mercury hold tank. The elemental mercury is then tapped from the bottom of the mercury hold tank through a sight glass and double valves and then transferred to the special case waste glovebox for amalgamation.

Flue gas from the packed bed absorber tower enters the candle demister vessel and passes through the demister candles. The fiber mesh candles are periodically irrigated with a spray of fresh water to remove water-soluble constituents from the fiber media.

The saturated gas leaving the candle demister vessel passes through an in-line electrical resistance reheater that raises the temperature of the gas stream to approximately 50° F above the gas saturation temperature. Raising the temperature prevents moisture condensation in downstream process equipment, including the HEPA filters. The reheater housing contains two banks of redundant electrical resistance heaters in series. Only one bank of heaters is in service at any time as each heater bank is capable of raising the flue gas to the desired temperature.

Flue gas from the reheater passes through two sets of HEPA filter banks. The first stage contains redundant parallel modules, consisting of the following filters in series: a 65 percent roughing filter, a 90 percent roughing filter, and a glass matrix nuclear grade HEPA filter. The second stage contains redundant parallel modules and consists of the following filters in series: a 90 percent roughing filter and a nuclear grade stainless steel or higher alloy nuclear grade HEPA filter.

Following the second stage of HEPA filter modules, the flue gas passes to the exhaust blower where it is delivered to the stack. The exhaust blowers control the draft through the AMWTP facility incinerator and air pollution control system. A variable damper on the suction side of the blowers allows control of the draft to maintain negative pressure within the incinerator system and to sustain the movement of the flue gas through the air pollution control system. Only one exhaust blower is in service at any given time as each blower is capable of handling all flue gas flow rates from the incinerator system. The exhaust blower discharges the flue gas to the atmosphere via the stack.

B-2.3.2 Location and Descriptions of Temperature, Pressure, and Flow-Indicating and Control Devices for the Air Pollution Control System. A detailed discussion of the instruments that monitor proper performance of the air pollution control system is given in D-5b(2)(a) of the AMWTP RCRA Permit Application.

B-2.4 Automatic Waste Feed Cutoff System

The automatic waste feed cutoff system prevents the feeding of waste when key incineration conditions fall outside of the predetermined range. The system, as a minimum, automatically locks out operation of the solid feed system until proper operating conditions are restored. To enhance the reliability of the automatic waste feed cutoff system, each waste feed cutoff parameter has two completely redundant signals entering the programmable electronic system from redundant transmitters in the field. When one of the transmitters requires repair or replacement, the incinerator system is allowed to operate with only one transmitter for a period not to exceed six weeks.

When a waste feed cutoff condition occurs, the waste feed auger drive motors stop and the waste feed isolation valve closes. The valve provides positive gas sealing and thereby prevents PCC gases from flowing back through the feed system. A water cooled tube-flange extending from the valve body prevents overheating of the valve and premature combustion in the feed system prior to entering the PCC.

B-2.5 Programmable Electronic System

A programmable electronic system has been provided to control the thermal treatment process. The progammable electric system, at a minimum, meets the following hardware and software requirements:

- The system accurately collects, displays, stores and reports necessary process and safety parameters in real time.

- The system alarms and shuts down the process safely on electric or pneumatic control malfunction as well as on predetermined deviations from normal operation.

- The system provides a display console with a process alarm selection and detection display screen. This display screen provides an audible and visual alarm, calling attention to the display screen upon which the parameter has been programmed to appear.

- The system generates all required permanent and backup records which include magnetic media and hard copies when required.

- The system performs data reduction such as input averaging, parameter trend display, and data recording at the required logging rate.
- The system allows operation, startup, and shutdown of the system from the central control room.

- The system allows dial-in capability for remote monitoring of operating parameters by regulatory authorities.

- The system tracks and determines the status of all waste material processes through the facility.

Additional information on the control system and data management is provided in Section D of Book 1 of the AMWTP RCRA Permit Application.

Further details of the sampling and monitoring procedures for the trial burn are included in Appendix D-5 of the AMWTP RCRA Permit Application. Included are: the sampling methods and equipment, analytical procedures, sample frequency, description of the sample locations, and quality assurance/quality control measures for the trial burn.

B-2.6 Maximum Allowable Control Technology

On March 20, 1996, the EPA proposed new emission standards for hazardous waste incinerators, hazardous waste-burning cement kilns, and hazardous waste-burning lightweight aggregate kilns. This ruling, also known as Hazardous Waste Combustion Maximum Allowable Control Technology Rule (61 FR 17358), proposed new emission standards on chlorinated dioxins and furans, other toxic organic compounds, toxic metals, hydrochloric acid, chlorine gas, and particulate matter. The AMWTP facility sampling and analysis plan has been designed to provide the data necessary to demonstrate full compliance with this ruling. After the MACT rule is finalized (estimated at Fall 1998), the AMWTP facility trial burn plan will be revised as necessary to address MACT standards.

B-2.7 *Toxic Substances Control Act*

Because a TSCA permit will be required for the AMWTP facility incinerator, the sampling and analysis plan has included provisions to demonstrate a 99.9999 percent destruction and removal efficiency of all polychlorinated biphenyl (PCB) waste during the low temperature trial burn. Further details associated with the PCB sampling and analysis are included in Appendix D-5 of the AMWTP RCRA Permit Application. Included are calculations showing that the sampling times and methods are adequate to demonstrate the required destruction and removal efficiency.

B-2.8 Maintenance

The AMWTP facility incinerator has been designed to minimize the requirement of hands-on access to equipment. To the extent possible, replaceable or serviceable components will be readily accessible via manipulator, cranes, or glovebox access port. The incinerator process will reflect the following order of preference for performing maintenance:

- Adjust the item or unit in place.
- Repair item or unit by contact maintenance.
- Replace item or unit with spare unless it is more economical to perform remote maintenance or remove, decontaminate, repair, and return it to service.

Maintenance activities specifically associated with the trial burn will include calibration of regulated instruments and cleaning the high temperature filters and ash collection system. The high temperature filters will be cleaned by back-pulsing with compressed air to remove as much flyash from the bags as possible. All of the flyash will be transferred to the ash collection area and drummed out, leaving the high temperature filters and ash collection system as clean from ash as possible. Prior to the trial burn, all of the equipment described in the Trial Burn Plan will be operational. The trial burn is currently planned to be conducted with the high temperature filters, roughing filters, HEPA filters, and brine that are in place at the time of the trial burn (i.e., new brine and filters will not be used for the trial burn).

B-2.9 Fast Shutdown Procedures

The fast shutdown mode is activated when operation must be terminated as quickly as possible due to a likely threat to the health and safety of operating personnel or the environment. Fast shutdown mode can be initiated either manually by the operator pressing a button in the central control room, or automatically when one of the defined fast shutdown interlock limits has been reached. When activated, the fast shutdown mode automatically and immediately:

- Shuts off the waste feed
- Closes the waste feed cutoff valve
- Shuts off all burners
- Stops the air supply blowers
- Begins a maximum flow of tempering steam to the PCC.

B-2.10 Automatic Waste Feed Cutoff Pre-alarms

In order to minimize the occurrence of automatic waste feed cutoff events, pre-alarms are used to indicate that an automatic waste feed cutoff parameter is approaching its limit. All of the automatic waste feed cutoff parameters have a pre-alarm. In the event of an automatic waste feed cutoff pre-alarm, operating personnel will take corrective action to prevent the automatic waste feed cutoff from occurring. The pre-alarm setpoints were chosen to allow the operator sufficient time to take corrective action prior to an automatic waste feed cutoff event.

B-3 Vitrification

The melter is used to treat the ash from the incinerator unit, as well as collected cyclone and HEPA filter solids from the melter air pollution control system. Figures B-3-1 and B-3-2 provide simplified process flow diagrams of the melter and the melter air pollution control system, respectively.

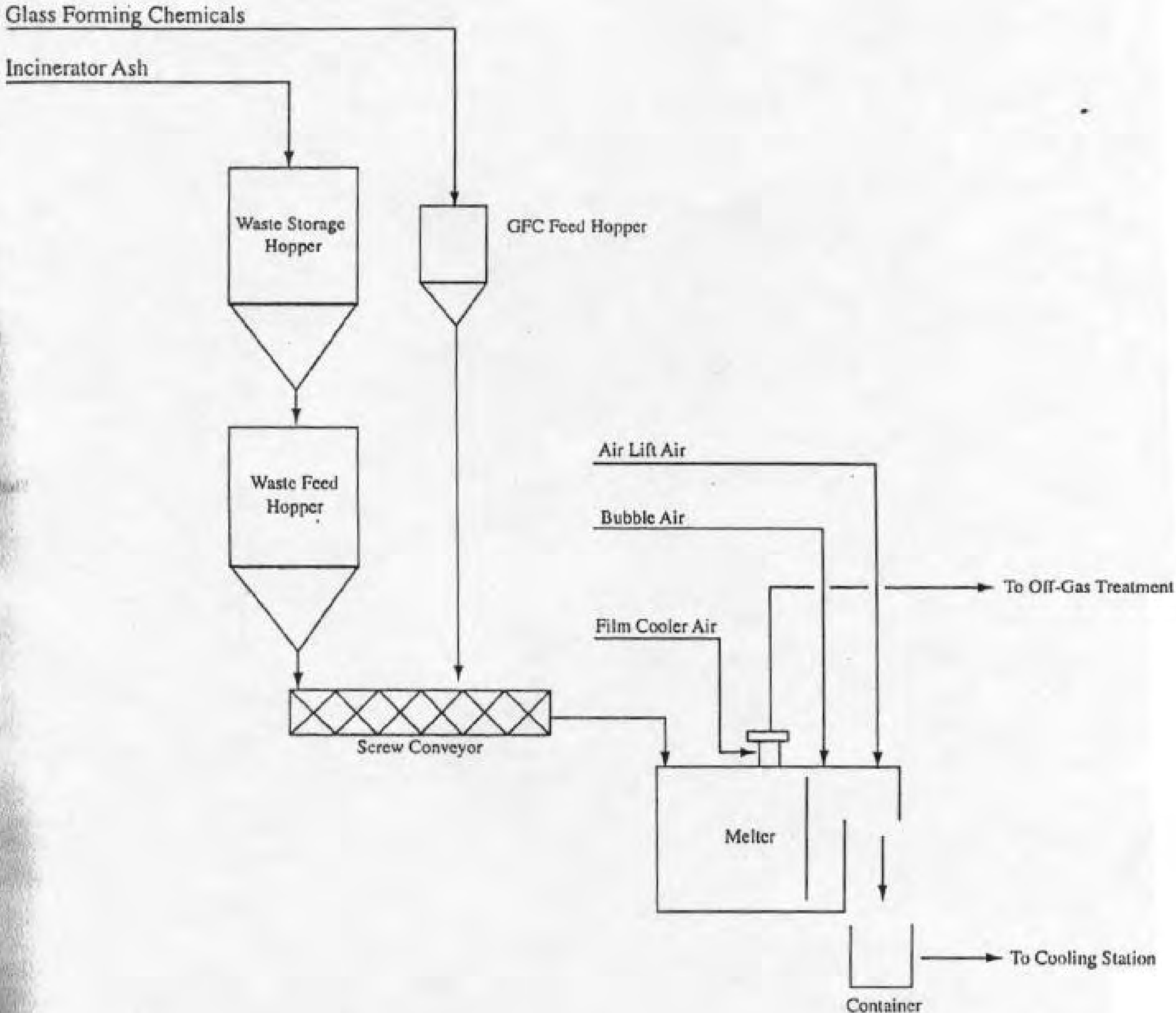

Figure B-3-1. Simplified process flow diagram of the melter.

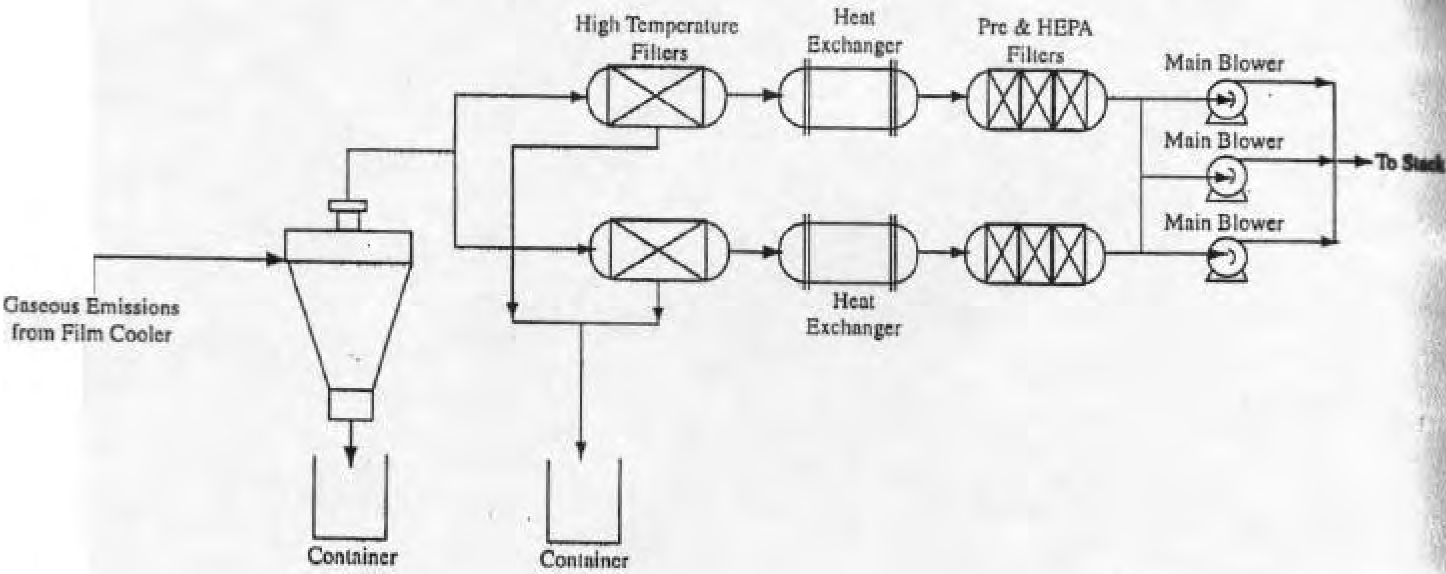

Figure B-3-2. Simplified process flow diagram of the melter Air Pollution Control System.

The following section describes: 1) the miscellaneous treatment unit, including its physical characteristics, operation, maintenance and monitoring procedures, inspection, closure, and operating standards, and 2) the environmental performance standards for this miscellaneous treatment unit, including waste types processed, containment systems, prevention of air emissions, and mitigative design and operating standards.

The treatment objective for the vitrification process is a glass waste form that will meet the Land Disposal Restriction standards based on the toxicity characteristic leaching procedure. The toxicity characteristic leaching procedure is used to determine the leach rates for HMWA metal constituents. A detailed performance test plan for the vitrification process is provided in the AMWTP RCRA Permit Application.

B-3.1 Description of Melter

The vitrification process deploys one melter which includes a feed system, a melter, glass waste form handling system, and an air pollution control system. The vitrification process is used to treat ash by-products from the incineration unit. The feed system handles ash material from the incinerator system as well as recycled solids from the vitrification cyclone and high temperature filters. The melter feed materials are dry solids. The waste solids are conveyed in lidded containers to the melter feed area by the plant central conveyor system. Once in the feed area, waste solids are conveyed by a roller conveyor to one of approximately 56 storage slots flanking the conveyor where they are temporarily staged until needed. When scheduled for processing, the waste drum is conveyed to a drum tipper which transfers the material into a waste storage hopper connected at the bottom to a waste feed hopper. The waste feed hopper delivers an operator-specified mass flow to a screw conveyor which conveys the material toward the melter. A separate entry port along this screw conveyor line delivers metered and operator-specified amounts of glass forming chemicals to the screw conveyor and the blended feed is then delivered into the melter.

The glass forming chemicals are stored and blended in an area external to the main building. They are mixed in defined batches and delivered to storage hoppers in the melter feed area. The glass forming chemicals storage hoppers deliver material through a specially-designed double dump valve to the glass forming chemicals feed hoppers which connect to the main screw conveyor as described above. The double dump valve arrangement is designed to isolate the non-contaminated glass forming chemicals line from the contaminated waste feed line.

The combined mixture of waste feed and glass forming chemicals feed, once in the main screw conveyor, is conveyed to its feed port where an auger feeder assists in delivering the solid material to the melt surface. The auger feeder incorporates an outer water-cooled jacket to thermally isolate the feed screw conveyor material from the melter plenum.

The design of the feed system is based on the assumption that glass forming chemicals will be delivered to the site in bulk by truck. The dry chemicals are pneumatically unloaded from the truck and conveyed into individual storage silos. Each silo provides a 30-day supply of material. The silos are located external to the main facility in order to provide easy truck access and minimize the inactive storage within the facility.

The target glass melting temperature is less than 2200 °F, which allows for Inconel electrode-based melter technology. The residence time for the AMWTP facility melter is at least 48 hours in order to allow for complete dissolution of the solid feed into the molten glass pool with agitation provided by compressed air bubblers. The melter plenum is maintained under constant negative air pressure via the offgas blower to minimize radioactive release into the surrounding melter cell's ventilation system. Oxygen or enriched air is introduced into the melter plenum to convert any residual carbon from the incinerator ash to carbon dioxide. The melter lid is configured to minimize uncontrolled air in-leakage and permit glovebox maintenance on replaceable components. The melter is fitted with a film cooler to minimize the deposition of material in the discharge port. A water-cooled jacket around the melter is incorporated into the design to reduce the heating load to the melter cell's ventilation system.

The solid waste, along with glass forming chemicals, is continuously fed to the melter and converted to a glass (vitrified waste), incorporating toxic metals. The glass is poured into a container forming a monolith, then overpacked into another container, and sent for product certification. Table B-3-1 summarizes vitrification process specifications including availability, feed rates, and waste loading.

B-3.1.1 Physical Characteristics. The following are physical characteristics.

Feed System. The feed system handles ash material from the incinerator as well as recycled solids from the vitrification cyclone and high temperature filters. The waste solids are conveyed in lidded containers to the melter feed area by the plant central conveyor system. Once in the feed area, the solids are conveyed by a roller conveyor to one of the storage slots where they are temporarily stored until needed. When scheduled for processing, the waste drum is conveyed to a drum tipper) which dumps the material into one of three waste storage hoppers. Each waste storage hopper is connected at the bottom to its waste feed hopper.

Table B-3-1. Summary of vitrification process specifications.

Specification item	Measurement
Project span	13 years
Working days	330 days/yr
Plant availability	65% (for 12 operating years)
Duration	2574 days
Waste loading (oxide basis)[a]	50%
Incinerator ash feed rate	289 lb/hr
Glass Forming Chemicals additives rate	284 lb/hr
Glass product rate	567 lb/hr 3.64 ft^3/hr 20 forty-gallon drums/day[b]
Number of melters	1
Melter size	6.8 tons of glass/day

a. Glass formers from incinerator ash versus glass formers from additives.
b. At 90 percent volume utilization.

The melter has three feed addition ports to provide for suitable dispersion of the feed material onto the molten glass pool. Each feed port has its own independent feed system consisting of a waste storage hopper connected to a waste feed hopper, a glass forming chemical storage hopper connected to a glass forming chemical feed hopper, a screw conveyor, and a melter feed auger. Waste material from the waste feed hoppers described above is metered onto the main screw conveyors at the desired operator-controlled mass flow rate. Once on the conveyor, the waste material is conveyed toward the melter. A second input port into the main screw conveyor delivers the desired operator-controlled amount of blended glass forming chemicals. The glass forming chemicals supply glass forming components otherwise deficient in the waste. glass forming chemicals are added to the feed stream based on physical and chemical characterization of the waste. The glass forming chemicals are blended and added in amounts required to efficiently produce a durable glass, thus becoming the principal means of process quality control. The glass forming chemicals will be stored and mixed in an area adjacent to the main plant building and pneumatically transferred into the plant. The glass forming chemical mixing and addition system is designed so that the glass composition can be maintained in the desired range by changing the relative amounts of the glass forming chemicals. In this way the glass forming chemical recipe can be changed as needed to maintain the melt chemistry of glass forming elements within the desired range. The large glass pool dampens fluctuations in the chemical composition of the melt resulting from variability in waste chemistry.

The transfer of glass forming chemical material from the glass forming chemical storage hopper to the glass forming chemical feed hopper uses a valve arrangement that acts to isolate the radiologically clean glass forming chemical transfer lines from the waste feed conveyor lines. The valve arrangement is designed so that air and material flow are balanced to prevent back contamination of the glass forming chemical transfer lines.

The combined mixture of waste and blended glass forming chemicals is conveyed along the main screw conveyor to the melt feed port. A vertical feed auger keeps the port from becoming clogged as the feed material comes off the screw conveyor. The auger is designed with a water-cooling jacket which serves the additional purpose of thermally isolating the feed material from the melter plenum. The feed auger tubes extend approximately 1 to 2 feet into the melter plenum to reduce the amount of carryover feed material into the offgas system.

Melter. Two discharge chambers are located side-by-side on the long wall of the melter. View ports to permit visual monitoring of the melter during operations are included. Access to and viewing of both discharge chambers are required on a regular basis during operations. The melter is mounted on a rail support system and positioned as close to the cell floor as practicable. The melter incorporates an integral cooling water jacket on all sides to help heat dissipation within the cell. The melter is a Durameltermanufactured by GTS Duratek.

Linear Dimensions of the Melter. The glass pool surface area is approximately 108 ft2, with internal dimensions of approximately 16 ft by 6.5 ft. The external dimensions of the melter, excluding the feed and air pollution control system, are approximately 21 ft long by 16 ft wide by 9 ft high. The melter weighs approximately 250 tons empty and 270 tons containing glass.

Electrode Configuration. The electrical configuration for the melter consists of three pairs of Inconel 690 plate electrodes mounted parallel to each other within the melter. Forced-air-cooled electrode buses penetrate the side of the melter below the glass level to minimize thermal expansion. Active cooling of the buses and the use of a water cooling jacket prevent the glass from migrating through the refractory package adjacent to the electrode penetrations.

Melter Temperature Control. The normal operating temperature of the melter glass pool is held constant at 2100 ^{o}F by controlling the electrical power into the melter. Three sets of electrodes located within the melter are independently governed by three silicon controlled rectifier silicon controller rectifier voltage controllers which are positioned outside the melter cell. The primary control loop is a temperature control loop that sets the secondary control loop silicon controlled rectifier voltage controller.

Temperature within the glass pool is measured by six Inconel sheathed thermocouple assemblies. There are two thermocouple assemblies placed equal distant between the electrodes for each set of electrodes. Each assembly contains 10 type “N” thermocouples within an MgO packing. Starting at the wetted end, the thermocouples are evenly placed within the wetted assembly length. This arrangement places seven thermocouples within the glass pool and three thermocouples within the melter offgas plenum. Three thermocouples within the glass pool are used for melter temperature control purposes. Thermocouple outputs are converted to 4 - 20 mA signals proportional to transmitters. Should a thermocouple fail, the output from the transmitter is higher than 20 mA and an alarm is logged.

For each assembly, the three temperature signals from the middle level of the glass pool are used to make a log average for use by the control system to set the electrode voltage. Should a thermocouple fail, the system transfers to power control and uses the last valid electrode power set point to safely control the melter temperature. The electrode power is held at a constant value and the current is regulated to deliver constant power.

Description of the Electrical Power System. Power to each pair of electrodes is via a single-phase, alternating current, dry-type power transformer. Transformers are located outside of the melter cell to facilitate maintenance. Remote bus connectors are located outside of the cell to facilitate melter change-out.

Each electrode pair is controlled by glass pool temperature feedback from thermocouples placed within the melter refractory package and directly in the glass pool.

Refractory Package. The melter refractory package consists of three layers: glass contact refractory, a backup refractory, and an electrical isolating barrier. This package, used in conjunction with active cooling provided by a water jacket, provides glass containment, thermal insulation, and electrical isolation. Glass migration through the refractory package is limited to within the glass contact refractory by establishing an isotherm that will freeze molten glass below 1250°F. The refractory package is designed to provide adequate containment if cooling is temporarily lost.

The first refractory layer, the glass contact refractory, consists of two Monofrax K3 (or equivalent) layers. The primary layer is approximately 12 in. thick and the secondary layer is approximately 5 in. thick. Below the glass level Monofrax K3 (or equivalent) is used, and above the glass Monofrax H (or equivalent) is used because it provides better thermal properties and higher corrosion resistance.

The second layer, the backup refractory, consists of two 3-in. layers of Zirmul (or equivalent). Around the electrodes Monofrax E (or equivalent) refractory is used. This second layer provides a highly corrosion resistant barrier in the event of glass migrating through the contact refractory.

The third layer, the electrical isolation barrier, consists of a 0.5 in. layer of mica (or other insulating material). This layer provides additional isolation between the glass pool and the outer shell of the melter.

Thermal expansion within the refractory package is controlled in two dimensions by an expandable water jacket. Refractory is allowed to expand away from the discharge chambers, and about the melter center line on the long axis. Expansion is controlled by guides and a series of springs and jackbolts located along the melter bottom and side edges. These springs and jackbolts allow the refractory to expand as it heats up, but also provide sufficient force to compress the bricks as the melter cools. Refractory expansion and contraction occurs during thermal cycling. The spring and jackbolt system acts to prevent excessive gaps from forming between the refractory bricks which could allow glass migration and accelerated brick erosion.

Lid Design. The lid design of the melter consists of a protective Inconel 690 ceiling plate, a layer of castable Zirmul (or equivalent), and a stainless steel outer shell/water jacket.

Glass Discharge Chamber. Glass discharge from the melter is via two discharge chambers, each capable of discharging 6.8 tons of glass per day. Discharge is achieved by transferring glass from the bottom of the melter pool into the discharge chamber and subsequently pouring it into a container.

Discharge by gas lift is achieved by bubbling gas via an Inconel tube into an Inconel-lined riser situated within the refractory package. The gas lift is designed to lift glass approximately 10 in. above the glass pool level during normal operations. The lifted glass flows into the discharge chamber via an Inconel discharge trough. During discharge, the discharge chamber is heated by lid-mounted heating elements to prevent the glass from cooling.

The discharge trough is fabricated from Inconel and lined with refractory fiberboard for thermal insulation. Glass entering the discharge chamber flows freely down the discharge trough and pours into a container positioned below at the canister filling station. The gas flow rate controls the rate of discharge. Gas bubbling is stopped at the end of the required discharge operation, and pouring is discontinued once the glass residue in the trough has discharged. The melter is never emptied once operations begin.

Discharge chambers are positioned adjacent to the electrodes to keep the discharge chambers and electrodes at the same electrical potential to avoid joule heating between the Inconel riser and refractory.

B-3.1.2 Glass Waste Form Handling and Processing. An empty 40-gallon drum is introduced to the drum handling system inside a 55-gallon drum overpack. Drums are sealed by a bagless transfer seal [See Section D-8a(6)c of the AMWTP RCRA Permit Application for a description of the bagless transfer system]. The drums are transferred to the lid removal station where the lid from the 55-gallon drum overpack is removed. A remotely-operated crane within the cell lifts the 40-gallon drum out of the larger drum and onto rollers for transport to the fill port and sampling station.

The operator samples melter glass at the fill station by inserting a sampling device into the molten glass stream. The sampling device is suitable for insertion into the x-ray fluorescence system. The glass sample is cooled and transferred out of the handling cell to the laboratory where sampling and analysis are performed. A detailed discussion of the sampling and analysis plan can be found in the AMWTP RCRA Permit Application.

The glass-filled drum is transported on rollers to a cooling station. The drum is cooled via a water or air cooling device for 1-2 hours so that it can be lifted by crane and placed back inside the 55-gallon drum overpack. The filled drum is smear tested for contamination. The drum is then transferred to the lid installation station where a 55-gallon lid is installed on the drum.

The glass discharge chamber contains a sealed glovebox with viewports and closed circuit television camera and access to aid the operator in viewing conditions inside the handler, such as glass level, commencement of discharging, discharging rate, and sampling and testing of the glass waste form as required. A stairway and platform with railings allows the operator access to the viewports and access areas.

B-3.1.3 Location and Description of Temperature, Pressure, and Flow-Indicating and Control Devices for the Melter. The melter is designed with the capability to be remotely monitored and controlled. Remote operations are performed from the central control room by trained operators. The system is continuously monitored by a programmable electronic system that is programmed to receive transmissions from pressure, flow, temperature, and performance transmitters located throughout the system and transmit those signals to control devices. Based on preprogrammed information and system parameters, the controller transmits signals to either process control devices or to warning lights within the central control room indicating a system malfunction.

The critical devices in the system that transmit signals to the central control room and programmable electronic system are listed in Table D-8-5 of the AMWTP RCRA Permit Application.

B-3.1.4 Air Pollution Control System. The melter is close coupled to a multistage air pollution control system that maintains the melter at a constant negative pressure, and contains and treats melter emissions. The melter exhaust consists of gases generated from the melting process. The melter exhaust is treated to reduce the airborne concentrations of gross particulate and toxic metals to meet the limits imposed for the facility.

Toxic metals partitioning to the offgas during the vitrification process are in the form of solid particulates; therefore their release to the environment can be controlled by HEPA filtration. Use of HEPA filters also ensures that the particulate loading of gas leaving the melter offgas train meets regulatory requirements.

The melter air pollution control system includes a film cooler, a cyclone separator, two parallel high temperature filters, two parallel shell and tube heat exchangers, two parallel conventional HEPA filters, and three parallel main blowers (see Figure B-3-2).

Components downstream of the cyclone are duplicated to reduce downtime and to allow maintenance without interrupting operation.

B-3.1.4.1 Film Cooler. The first stage of the air pollution control system for the melter consists of two components: an offgas port and a film cooler. Offgas exiting the melter carries solid particulates from the feed and vitrification process. High velocity air is injected into the offgas port to provide a cool film of air over the inside film cooler walls. The film effectively reduces particulate deposits by reducing their contact with the wall surfaces.

Due to the chemical composition variability of the AMWTP facility waste feed, the vitrification system is designed to handle a wide range of operating conditions. For example, the melter plenum temperatures range from 400 to 1750^{o}F, depending on the size of the “cold cap” on top of the molten glass pool. The melter plenum effluent is contacted with film cooler air prior to its introduction to the cyclone. However, to maintain particle removal efficiency in the cyclone, its input volumetric flow rate (which depends on its temperature) should ideally be held constant. Hence, to meet this requirement, the film cooler's air temperature and flow rate is adjustable over a wide range of operating conditions. This flexibility requirement is met by including electrical duct heaters able to heat the incoming film cooler air up to 850°F.

B-3.1.4.2 Cyclone. The fixed throat type cyclone dust collector operates with no moving parts, providing minimal operation and maintenance requirements. Gas with contaminated particulate from the melter enters the cylindrical/conical body of the cyclone tangentially at the top and then assumes a vortex pattern as it flows helically downward. Centrifugal force generated by the tangential air flow causes the heavier dust particles to move rapidly toward the cyclone wall. When the particles reach the wall, friction and gravity forces them to descend and discharge into a hopper. The cleaned gas spirals upward and exits at the top of the cyclone. Efficiency of the cyclone for the 10-micron diameter material is 80 to 85 percent and its operating temperature is between 750 and 930°F at approximately 6 in. w.g. average pressure drop.

B-3.1.4.3 High Temperature Filter. The high temperature filter incorporates a ceramic or metal gas filter. Particulate-laden gases enter the filter through the inlet pipe. Larger particulate matter tends to quickly fall into the discharge hopper. The gas with the remaining particles rises upward, passing through the modules.

The ceramic/metal gas module is a porous cordierite or sintered metal powder monolith which contains numerous parallel passageways extending from one end face to an opposing end face. During operation, the cyclone discharge gas flows through each passageway and particulate matter is collected on the inner surfaces. The filtered gas stream passes through the media and exits the filter by the downstream end face. As the differential pressure across the filters rises, the ceramic/metal gas filter is cleaned by a jet pulse compressed gas stream. The high temperature filter operates between 660 and 930°F.

B-3.1.4.4 Heat Exchanger. The filtered offgas is cooled by means of a water-jacketed shell and tube heat exchanger before entering the conventional HEPA filter units.

B-3.1.4.5 Conventional HEPA Filter Units. Two parallel HEPA filter banks are included for the melter offgas system to ensure that particulate loading to the stack meets regulatory requirements. Each filter housing includes two Nuclear grade HEPA filters in series, each with 99.97 percent efficiency for 0.3 micron particulate. Maximum design differential pressure across HEPA filters is 10 in. w.g. The maximum design temperature is 250°F. HEPA filters are di-octyl phthalate tested after each replacement.

B-3.1.4.6 Capacity of Offgas Main Blower. The main blower maintains steady negative pressure within the melter over a broad range of differential pressure fluctuations across the system. It draws the flue gas from the melter air pollution control system and delivers it to the stack. The main blower has a nominal capacity of 180 acfm at 130°F and a static pressure of negative 80 in. w.g.

B-3.1.5 Standby Offgas Train. The melter operates under negative pressure (relative to the process cell) to prevent the release of contaminated gas to the cell. The melter is designed with a standby offgas port to remove melter gaseous emissions during main offgas port (film cooler) maintenance.

This additional port through the melter lid permits bypassing of melter emissions from the melter plenum around the film cooler to the cyclone. During normal operations, this flow path is kept closed by valves. A small purge air stream is continuously injected into the port to the melter plenum to minimize potential blockage of this port by melter particulate emissions.

At upset conditions or during maintenance operations on the film cooler, the standby offgas port is opened when the melter plenum pressure reaches a predetermined threshold value. A pressure sensor is interlocked with a control valve which opens the melter plenum to the standby vent line when this threshold is reached. The waste feed to the melter is temporarily discontinued. Ambient air is introduced to the standby offgas port to maintain a constant flow rate to the cyclone. Note that this system utilizes the rest of the air pollution control system for gas cooling and particulate removal. When the upset condition or maintenance operation on the film cooler is completed, the small purge air stream into the standby port is resumed and the control valves to the standby vent line are closed. Normal waste feed to the melter can then be resumed.

B-3.1.6 Maintenance. The expected lifetime of a melter is approximately 6 years. The melter may be replaced twice during the lifetime of the facility. The melter is located on a set of tracks, or rails, which permits removal and replacement. The melter access ports are sealed and the unit externally decontaminated prior to removal.

Vitrification sub-systems (feed conveyors, filters, air pollution control system components, associated blowers and piping) are repaired or replaced in-place as required. In most cases, a temporary enclosure is used to isolate the work area prior to repair or replacement.

B-3.1.7 Monitoring Procedures. Central control room operators monitor operations of the melter through consoles and closed circuit television. The melter consoles display information from the programmable electronic system. The programmable electronic system provides operational data for analysis and records. Information obtained by the programmable electronic system is used to meet environmental monitoring and reporting requirements. In addition, the central control room operators are required to log events that occur during their shift.

B-3.1.8 Closure. Closure of the melter is addressed in the AMWTP RCRA Permit Application.

B-3.1.9 Mitigative Design and Operating Standards. The melter and ancillary equipment have been designed to operate in a manner to reduce the risk of waste constituents to the environment. The building protects the melter from precipitation, thereby precluding precipitation run-on and the potential for contaminated run-off. Specific design features and operating procedures that reduce the risk of waste exposure to personnel and the environment are explained below.

B-3.1.10 Melter Cells. Melter primary containment is provided by the outer melter box shell and prevents both gaseous releases and glass leakage to the cell. The outer shell is constructed of 304L stainless steel. Penetrations through the outer shell are sealed by appropriate gaskets and flanges that allow remote removal and replacement. The external shell is fabricated to permit ease of removal and to facilitate melter disconnection in a remote environment.

The melter is contained within a set of adjacent Zone 2 process cells. The first cell houses the melter and the rail mounted transporter. The second cell is situated above the first cell and provides access to the dry feed conveyors/mixers and the top of the melter.

B-3.1.11 Glass Waste Form Delivery System Cell and Glovebox. The melter unit has two discharge chambers each protruding through the common wall into separate gloveboxes. A seal is provided between the bottom of the discharge chamber and the inside of the glovebox. The inside of the melter and the inside of the glovebox is considered a single, continuous Zone 3 containment area. This Zone

3 area has a single common ventilation system which is maintained negative relative to the Zone 2 process cells within which it is contained.

A bagless transfer system is used as the system interface for drum access. An overpack drum containing a 40-gallon drum and an inner container lid is placed into the transfer system. A seal is provided between the top rim of the drum and the transfer system. An inner lid removal tool, positioned directly above the drum removes the inner drum lid. The underside of the lid removal tool is kept clean; hence, the top of the inner lid is also kept clean. Once open, the inside of the container becomes part of the contiguous Zone 3 area. An inner drum grappling device located inside the glovebox removes the inner 40-gallon drum and places it onto a conveyor. The conveyor positions the drum under the pour spout for glass waste delivery. Once full and cooled sufficiently for transfer, the 40-gallon drum is conveyed back to the inner drum grappling device for placement back into a container. The inner drum lid removal tool places the inner lid back onto the drum before the seal with the transfer system is broken. Operations personnel check the outside of the drum for contamination, and provide decontamination if needed, prior to placing the outer drum lid and locking ring onto the outer drum. The contamination survey and installation of the outer lid and locking ring are expected to occur within a glovebox. The drums are then transferred to the product certification area.

A system of monitors (e.g., closed circuit television cameras) and instrumentation (e.g., weigh scales or level controls) is provided to ensure maximum loading of each 40-gallon drum. A remote splatter removal tool is provided to clean spilled glass from the floor and walls of the glovebox.

B-3.1.12 Offgas Handling System Cell. The cells immediately adjacent to the melter and glass waste form delivery process cells contain the air pollution control system. This system consists of a cyclone, a pair of high temperature filters, gas cooling, and a pair of conventional HEPA filters.

Each of the high temperature filters and the cyclone incorporates an integrated hopper for recycle solids removal. The solids are dumped into containers for transport back into the melter feed system via the central conveyor system. The hoppers, drums, and conveyor are housed in a permanent glovebox with HEPA filtered exhaust.

B-3.1.13 Sample Removal. A process control sample is taken from the molten glass waste stream. A ladle is placed into the glass waste stream as it is being poured from the melter into a container. The ladle is removed from the stream and held over the drum to allow the glass to solidify. Once solidified, the sample is removed from the pour area into a container. The transfer drum is then removed through the bagless transfer system as described for final waste form removal. A process operator performs this operation using an extension tool or remote manipulator.

APPENDIX C
SETTLEMENT AGREEMENT

Public Service Co. of Colorado v. Batt and United States v. Batt

UNITED STATES COURTS
DISTRICT OF IDAHO

OCT 17 1995

8:34 A.M.	REC'D ______
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UNITED STATES COURTS

DISTRICT OF IDAHO

SETTLEMENT AGREEMENT

The State of Idaho, through the Attorney General and Governor Philip E. Batt in his official capacity; the Department of-Energy, through the General Counsel and Assistant Secretary for Environmental Management; and the Department of the Navy, through the General Counsel and Director, Naval Nuclear Propulsion Program, hereby agree on this 16th day of October, 1995, to the following terms and conditions to fully resolve all issues in the actions Public Service Co. of Colorado v. Batt, No. CV 91-0035-S-EJL (D. Id.) and United States v. Batt, No. CV-91-0054-S-EJL (D. Id.):

A. DEFINITIONS

For purposes of this Agreement, the following definitions shall apply:

1. The "State" shall mean the State of Idaho and shall include the Governor of the State of Idaho and the Idaho State Attorney General.

2. The "federal parties" means U.S. Department of Energy (DOE) and the U.S. Department of the Navy (the Navy), including any successor agencies.

3. "Treat" shall be defined, as applied to a waste or spent fuel, as any method, technique, or process designed change the physical or chemical character of the waste or fuel to render it less hazardous; safer to transport, store, dispose of; or reduce in volume.

4. "Transuranic waste" shall be defined as set forth in the EIS, Volume 2, Appendix E.

5. "One shipment of spent fuel" shall be defined as the transporting of a single shipping container of spent fuel.

6. "High-level waste" shall be defined as set forth in the EIS, Volume 2, Appendix E.

7. "DOE spent fuel" shall be defined as any spent fuel which DOE has the responsibility for managing with the exception of naval spent fuel and commercial spent fuel which DOE has accepted or will take title to pursuant to the Nuclear Waste Policy Act of 1982, 42 U.S.C. § 10101 et seq. or comparable statute.

8. "Naval spent fuel" shall be defined as any spent fuel removed from naval reactors as a result of refueling overhauls (refueling) or defueling inactivations (defueling).

9. "Metric ton of spent fuel" shall be defined as a metric ton of heavy metal of spent fuel.

10. "Naval reactors" shall be defined as nuclear reactors used aboard naval warships (submarines, aircraft carriers, or cruisers), naval research or training vessels, or at land-based naval prototype facilities operated by the Naval Nuclear Propulsion Program for the purposes of research, development, or training.

11. "Calendar year" shall be defined as the year beginning on January 1, and ending on December 31.

12. "Mixed Waste" shall be defined as set forth in the EIS, Volume 2, Appendix E.

13. "EIS" shall be defined as the Department of Energy Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Program Final Environmental Impact Statement issued April, 1995.

14. "ROD" shall be defined as the Record of Decision issued by DOE on June 1, 1995, concerning the EIS.

15. "INEL" shall be defined as the Idaho National Engineering Laboratory. .

16. "Running Average" shall mean the total number of shipments of naval spent fuel to INEL, or transuranic waste from INEL, over any period' of three years, divided by three.

17. "The Court" shall mean the United States District Court for the District of Idaho before which is pending <u>Public Service Company of Colorado v. Batt</u>, No. CV 91-0035-S-EJL and <u>United States v. Batt</u>, No. CV 91-0054-S-EJL, and any appellate court to which an appeal may be taken, or with which an application for a writ of certiorari may be filed, under applicable law.

B. TRANSURANIC WASTE SHIPMENTS LEAVING IDAHO

1. "DOE shall ship all transuranic waste now located at INEL, 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. DOE shall meet the following interim deadlines:

a. The first shipments of transuranic waste from INEL to WIPP or other such facility designated by DOE shall begin by April 30, 1999. ,

b. By December 31, 2002, no fewer than 3,100 cubic meters (15,000 drum-equivalents) of transuranic waste shall have been shipped out of the State of Idaho.

c. After January 1, 2003, a running average of no fewer than 2,000 cubic meters per year shall be shipped out of the State of Idaho.

2. The sole remedy for failure by DOE to meet any of these deadlines or requirements shall be the suspension of DOE spent fuel shipments to INEL as set forth in Section K.1.

C. SPENT FUEL & HIGH-LEVEL WASTE SHIPMENTS LEAVING IDAHO

1. DOE shall remove all spent fuel, including naval spent fuel and Three Mile Island spent fuel from Idaho by January 1, 2035. Spent fuel being maintained for purposes of testing shall be excepted from removal, subject to the limitations of Section F.1 of this Agreement.

2. Until all of the aluminum-clad spent fuel then stored at INEL has been shipped to the Savannah River Site, the cumulative number of shipments of spent fuel from the Savannah River Site to INEL under Section D as of the end of any calendar year shall not exceed the cumulative number of shipments of aluminum-clad spent fuel from INEL to the Savannah River Site for the same period.

3. DOE shall treat all high-level waste currently at INEL so that it is ready to be moved out of Idaho for disposal by a target date of 2035.

D. SHIPMENTS OF SPENT FUEL TO INEL

The federal parties may transport shipments of spent fuel to INEL only in accordance with the following terms and conditions.

1. Shipments of naval spent fuel to INEL shall take place as follows:

a. The Navy may make only those shipments of naval spent fuel to INEL that are necessary to meet national security requirements to defuel or refuel nuclear powered submarines, surface warships, or naval prototype or training reactors, or to ensure examination of naval spent fuel from these sources. The Secretary of Defense, upon notice to the Governor of the State of Idaho, shall certify the total number of such shipments of naval spent fuel required to be made through the year 2035.

b. The Navy shall not ship more than twenty four (24) shipments to INEL from the date of this Agreement through the end of 1995, no more than thirty six (36) shipments in 1996, and no more than twenty (20) shipments per year in calendar years 1997 through 2000. From calendar year 2001 through 2035, the Navy may ship a running average of no more than twenty (20) shipments per year to INEL. The total number of shipments of naval spent fuel to INEL through 2035 shall not exceed 575. Shipments of naval spent fuel to INEL through 2035 shall not exceed 55 metric tons of spent fuel.

c. Prior to January 1 of each calendar year through the year 2035, the Navy shall provide to Idaho an estimate of the number of shipments and the number of metric tons of naval spent fuel to be shipped during the following calendar year.

d. By January 31 of each calendar year, the Navy shall provide to Idaho the actual number of shipments and actual number of metric tons of naval spent fuel shipped during the preceding calendar year.

e. The naval spent fuel stored at INEL on the date of the opening of a permanent repository or interim storage facility shall be among the early shipments of spent fuel to the first permanent repository or interim storage facility.

f. The sole remedy for the Navy's failure to meet any of the deadlines or requirements set forth in this section shall be suspension of naval spent fuel shipments to INEL as set forth in Section K.1.

2. Shipments of DOE spent fuel to INEL shall take place-as follows:

a. If DOE and the U.S. Department of State adopt a policy to accept spent fuel from foreign research reactors into the United States, DOE may send to INEL a maximum of 61 shipments of spent fuel from foreign research reactors during the period beginning on the date such a policy is adopted and ending on December 31, 2000. The Secretary of Energy, upon notice to the Governor of the State of Idaho, must certify that these shipments are necessary to meet national security and nonproliferation requirements. Upon such certification, DOE may ship not more than 10 such shipments from the date such policy is adopted through December 31, 1996, not more than 20 such shipments from the date the policy is adopted through December 31, 1997, and not more than 40 such shipments from the date the policy is adopted through December 31, 1998.

b. Until such time as a permanent repository or interim storage facility for storage or disposal of spent fuel, located outside of Idaho, is operating and accepting shipments of spent fuel from INEL, DOE shall be limited to shipments of spent fuel to INEL as set forth in Sections D.2.a., c., d., e., and f. After a permanent repository or interim storage facility is operating and accepting shipments of spent fuel from INEL, the State of Idaho and DOE may negotiate and reach agreement concerning the timing and number of shipments of DOE spent fuel that may be sent to INEL, in addition to those otherwise permitted under this Section D.2., for preparation for storage or disposal outside the State of Idaho.

c. After December 31, 2000, DOE may transport shipments of spent fuel to INEL constituting a total of no more than 55 metric tons of DOE spent fuel (equivalent to approximately 497 truck shipments) and subject to the limitations set forth in Sections D.2.e., f., g., and h. below, except that the limitations of Section-D:2.a. above will not apply.

d. No shipments of spent fuel shall be made to INEL from Fort St. Vrain, unless a permanent repository or interim storage facility for spent fuel located outside of Idaho has opened and is accepting spent fuel from INEL, in which case such shipments may be made for the purpose of treating spent fuel to make it suitable for disposal or storage in such a repository or facility. Shipments of spent fuel from Fort St. Vrain shall remain at INEL only for a period of time sufficient to allow treatment for disposal or storage in such a repository or facility. The total number of Fort St. Vrain shipments shall not exceed 244, constituting no more than sixteen (16) metric tons of spent fuel, and shall be in addition to those allowed under Section D 2.c. above.

e. Except as set forth in Section D.2.d. above, DOE will make no shipments of spent fuel from commercial nuclear power plants to INEL.

f. After December 31, 2000, and until an interim storage facility or permanent repository is opened and accepting spent fuel from INERT, DOE shall not ship to INEL more than 20 truck shipments of spent fuel in any calendar year, except that:

(i) In one calendar year only, DOE may make not more than 83 truck shipments of spent fuel to INEL from the West Valley Demonstration Project;

(ii) DOE may not make more than 13 truck shipments in any of the nine calendar years succeeding the shipment of the West Valley Demonstration Project spent fuel to INEL; and

(iii) Shipments DOE is entitled to make to INEL in any calendar year, but has not made, may be shipped in any subsequent calendar year, notwithstanding the limitations in this Section D.2.f. on the number of shipments per year.

For purposes of this section and Section D.2.c., in determining the number of truck shipments, one rail shipment shall be deemed equivalent to 10 truck shipments, except that in the case of shipments from West Valley Demonstration Project, seven rail shipments shall be deemed to be equal to 83 truck shipments. DOE may elect to make rail shipments in lieu of truck shipments, in accordance with this conversion formula and subject to other limitations of this section.

g. Prior to January 1 of each calendar year through the year 2035, DOE shall provide to Idaho an estimate of the number of shipments and the number of metric tons of DOE spent fuel to be shipped during the following calendar year.

h. No later than January 31st of each calendar year, DOE shall provide to Idaho the actual number of shipments and actual number of metric tons of DOE spent fuel shipped during the preceding year.

i. The sole remedy for DOE's failure to meet any of the deadlines or requirements set forth in this section shall be the suspension of DOE spent fuel shipments to INEL as set-forth in Section K.1.

E. TREATMENT & TRANSFER OF EXISTING WASTES AT INEL

1. Treatment Commitment. DOE agrees to treat spent fuel, high-level waste, and transuranic wastes in Idaho requiring treatment so as to permit ultimate disposal outside the State of Idaho.

2. Mixed Waste Treatment Facility. DOE shall, as soon as practicable, commence the procurement of a treatment facility ("Facility") at INEL for the treatment of mixed waste, transuranic waste and alpha-emitting mixed low-level waste ("Treatable Waste"). DOE shall execute a procurement contract for the Facility by June 1, 1997, complete construction of the Facility by December 31, 2002, and commence operation of the Facility by March 31, 2003. Commencement of construction is contingent upon Idaho approving necessary permits.

a. Treatment of Non-INEL Wastes. Any and all Treatable Waste shipped into the State of Idaho for treatment at the Facility shall be treated within six months of receipt at the Facility, with the exception of two cubic meters of low-level mixed waste from the Mare Island Naval Shipyard which will complete base closure for nuclear work in 1996. DOE may request an exception to the six month time period on a case-by-case basis, considering factors at the shipping site such as health and safety concerns, insufficient permitted storage capacity, and base or site closures. Any transuranic waste received from another site for treatment at the INEL shall be shipped outside of Idaho for storage or disposal within six months following treatment. DOE shall continue to use the Federal Facility Compliance Act process, as facilitated by the National Governors' Association, to determine what locations are suitable for mixed low-level waste treatment and storage.

3. Operation of High-Level waste Evaporator. DOE shall commence operation of the high-level waste evaporator by October 31, 1996; and operate the evaporator in such a manner as to reduce the tank farm liquid waste volume by no fewer than 330,000 gallons by December 31, 1997. Efforts will continue to reduce the remaining volume of the tank farm liquid waste by operation of the high-level waste evaporator.

4. Calcination of Remaining Non-Sodium Bearing Liquid Wastes. DOE shall complete the process of calcining all the remaining non-sodium bearing liquid high-level wastes currently located at INEL by June 30, 1998.

5. Calcination of Sodium-Bearing Wastes. DOE shall commence calcination of sodium-bearing liquid high-level wastes by June 1, 2001. DOE shall complete calcination of sodium-bearing liquid high-level wastes by December 31, 2012.

6. Treatment of Calcined Wastes. DOE shall accelerate efforts to evaluate alternatives for the treatment of calcined waste so as to put it into a form suitable for transport to a permanent repository or interim storage facility outside Idaho. To support this effort, DOE shall solicit proposals for feasibility studies by July 1, 1997. By December 31, 1999, DOE shall commence negotiating a plan and schedule with the State of Idaho for calcined waste treatment. The plan and schedule shall provide for completion of the treatment of all calcined waste located at INEL by a date established by the Record of Decision for the Environmental Impact Statement that analyzes the alternatives for treatment of such waste. Such Record of Decision shall be issued not later than December 31, 2009. It is presently contemplated by DOE that the plan and schedule shall provide for the completion of the treatment of all calcined waste located at INEL by a target date of December 31, 2035. The State expressly reserves its right to seek appropriate relief from the Court in the event that the date established in the Record of Decision for the Environmental Impact Statement that analyzes the alternatives for treatment of such waste is significantly later than DOE's target date. In support of the effort to treat such waste, DOE shall submit to the State of Idaho its application for a RCRA (or statutory equivalent) Part B permit by December 1, 2012.

7. Transfer of Three Mile Island Fuel. DOE shall complete construction of the Three Mile Island dry storage facility by December 31, 1998. DOE shall commence moving fuel into the facility by March 31, 1999, and shall complete moving fuel into the facility by June 1, 2001.

8. Transfer out of Wet Storage. By December 31, 1999, DOE shall commence negotiating a schedule with the State of Idaho for the transfer of all spent fuel at INEL out of wet storage facilities. DOE shall complete the transfer of all spent fuel from wet storage facilities at INEL by December 31, 2023. If DOE determines that transfer to dry storage of any portion of such spent fuel is technically infeasible, or that transfer to such dry storage presents significantly greater safety or environmental risks than keeping the fuel in wet storage, DOE shall inform the State and propose a later date or alternative action. If the State does not agree to such later date or alternative action, DOE may apply to the Court for appropriate relief. DOE shall, after consultation with the State of Idaho, determine the location of the-dry storage facilities within INEL, which shall, to the extent technically feasible, be at a point removed from above the Snake River Plain Aquifer (“Aquifer”).

9. The sole remedy for DOE's failure to meet any of the deadlines or requirements set forth in this section shall be the suspension of DOE spent fuel shipment to INEL as set forth in Section K.1.

F. SPENT FUEL PROGRAM

1. Establishment of INEL as DOE Spent Fuel Lead Laboratory. DOE shall, within thirty days of entry of this Agreement as a court order, designate INEL as the Department's lead laboratory for spent fuel. DOE shall direct the research, development and testing of treatment, shipment and disposal technologies for all DOE spent fuel, and all such DOE activities shall be coordinated and integrated under the direction of the Manager, DOE-Idaho Operations Office. Such designation shall not permit the shipment to INEL of any spent fuel beyond that permitted by this Agreement with the exception that quantities of spent fuel brought to INEL for testing in excess of those permitted by this Agreement shall leave the State of Idaho within five years of the date of receipt at INEL.

2. Construction of Dry Storage. DOE shall include in its appropriation request for federal fiscal year 1998 to the Executive Office of the President funds necessary for DOE to initiate the procurement of dry storage at INEL to replace wet, below ground facilities. Spent fuel loading into dry storage shall commence by July 1, 2003.

3. Funding for Dry Cell Expansion Project. The Naval Nuclear Propulsion Program shall include in its appropriation request to the Executive Office of the President for federal fiscal year 1997 funds necessary for the Dry Cell Expansion Project (“Project”) at the Expended Core Facility at the Naval Reactors Facility to accommodate removal of excess material and examination of naval spent fuel in a dry condition. The Project shall commence as soon as Idaho issues the required permit under the Clean Air Act and funding is appropriated. Completion of this project shall result in the expenditure of approximately $26 million dollars over the next five years.

4. Multi-Purpose Canisters. DOE and the Navy shall employ Multi-Purpose Canisters (“MPCs”) or comparable systems to prepare spent fuel located at INEL for shipment and ultimate disposal of such fuel outside Idaho. Procurement shall be performed in accordance with the Federal Acquisition Regulation which ensures that companies in Idaho will have opportunity to bid on and obtain any competitive contracts for such work. The Record of Decision on the NEPA analysis shall be completed by April 30, 1999.

5. ECF Hot Cell Facility Upgrade. The Naval Nuclear Propulsion Program shall include in its appropriation request for federal fiscal year 1997 to the Executive Office of the President funds necessary to proceed with upgrades which shall require approximately $12 million of expenditures during the next three years.

6. ECF Dry Storage Container Loading Station. The Naval Nuclear Propulsion Program shall include in its appropriation request for federal fiscal year 1997 to the Executive Office of the President funds

necessary to proceed with design and construction of a dry storage container loading station at ECF. This project shall require no less than $20 million of expenditures during the next five years.

7. Funding for Discretionary Environmental Remediation Work at the Naval Reactors Facility. The Naval Nuclear Propulsion Program shall undertake environmental remediation efforts at the Naval Reactors Facility totaling approximately $45 million over the next five years.

8. Water Pool Reracking. DOE may proceed with installing new racks into the water pool in the building at the Idaho Chemical Processing Plant Facility currently holding naval spent fuel to provide enhanced capability for spent fuel storage in the existing water pool space until dry storage can be made available. Installation of the new racks may commence as soon as Idaho issues the necessary permit under the Clean Air Act. Idaho shall issue said permit within 180 days after DOE re-submits its application to Idaho.

G. INEL ENVIRONMENTAL RESTORATION PROGRAM

1. INEL Environmental Restoration Program to Continue. DOE shall continue to implement the INEL environmental restoration program in coordination with Idaho and EPA. Such implementation shall be consistent with the schedules contained in the Federal Facilities Agreement and Consent Order (FFA/CO) entered into with the State of Idaho, EPA and DOE, and it shall include schedule requirements developed pursuant to the completed and future Records of Decision under the FFA/CO. The sole remedies for failure to implement the environmental restoration activities specified in the FFA/CO shall be those specified in the FFA/CO.

H. OBTAINING TIMELY FEDERAL FUNDING FOR COMPLIANCE WITH THIS ORDER

1. Compliance Funding. DOE and the Naval Nuclear Propulsion Program shall share budget information concerning INEL with Idaho prior to submitting the budget request to the Executive Office of the President. Consultations with the State of Idaho shall continue throughout the budget process. The current DOE estimate for the costs of the activities and projects described in Sections A through G over the next five years is approximately $200 million above established budget targets.

I. FEDERAL FINDS FOR THIS SETTLEMENT AGREEMENT

1. DOE shall provide to the State of Idaho beginning in federal fiscal year 1996 and continuing through 1997-2000, a total amount of $30 million for community transition purposes and any other purposes that are mutually acceptable to the parties, such as the non-Federal development of Boron Neutron Capture Therapy and Radiological Toxicology technology in Idaho.

2. Acoustic Research Funding. The Navy shall include in its appropriation request to the Executive Office of the President for federal fiscal year 1997 no less than $7 million for the Navy to construct a Ships Model Engineering and Support Facility at the Naval Surface Warfare Center, Carderock Division, Acoustic Research Detachment at Bayview, Idaho.

J. GOOD FAITH COMPLIANCE & AFFIRMATIVE SUPPORT

1. The federal parties and Idaho agree that the activities to be performed under this Agreement and the subsequent Consent Order are in the public interest. The federal parties and Idaho acknowledge the complexity of this Agreement and have agreed to act in good faith to effectuate its fulfillment. The federal parties and Idaho shall affirmatively support this Agreement and its terms, conditions, rights and obligations in any administrative or judicial proceeding. The federal parties and Idaho intend to seek a sense of the Congress resolution expressing support for the terms, conditions, rights and obligations contained in this Agreement- and the subsequent Consent Order and recommending to future Congresses that funds requested by the President to carry out this Agreement be appropriated. In any administrative or judicial proceeding, Idaho shall support the adequacy of the EIS and ROD against any challenges by third parties. Idaho shall have the ability, in its sole discretion, to waive performance by the federal parties of any terms, conditions and obligations contained in this Agreement.

2. Idaho shall promptly issue, upon submission of legally sufficient applications, all permits, licenses or other approvals needed by the DOE, the Navy or the Naval Nuclear Propulsion Program for the performance of any of their respective obligations set forth in this Agreement.

3. No provision of this Agreement shall compel any party to act without due legal authority. Performance by every party under this Agreement shall be subject to and comply with all applicable federal statutes, regulations and orders, including the Anti-Deficiency Act. The inability of any party to comply with the provisions of this Agreement, or a delay in such compliance, as a result of any applicable federal statute, regulation or order shall not subject that party to judicial enforcement under Section K.2.a, but shall not preclude the application of Sections K.1.a. or K.1.b.

4. In the event any required NEPA analysis results in the selection after October 16, 1995, of an action which conflicts with any action identified in this Agreement, DOE or the Navy may request a modification of this Agreement to conform the action in the Agreement to that selected action. Approval of such modification shall not be unreasonably withheld. If the State refuses to accept the requested modification, DOE or the Navy may seek relief from the Court. On motion of any party, the Court may extend the time for W E or the Navy to perform until the Court has decided whether to grant relief. If the Court determines that the State has unreasonably withheld approval, the Agreement shall be conformed to the selected action. If the Court determines that the State has reasonably withheld approval, the time for DOE or the Navy to perform the action at issue shall be as set forth in this Agreement and subject to enforcement as set forth section in Section K.1.

5. Effect of Certain Court Orders.

a. Navy. In the event that a court order is entered in the case of Snake River Alliance Education Fund v. United States Department of Energy, No. CV-95-0331-S-EJL (D. Idaho), or in any other judicial proceeding, that prohibits in whole or in part any shipment of spent fuel to INEL by the Navy under section D, then all obligations, requirements and deadlines of the federal parties under this Agreement shall be suspended during the period of applicability of the order. Upon the vacating, dissolving or reversing of any such order, the obligations, deadlines and requirements provided for in this Agreement shall be extended by a period that corresponds to their period of suspension.

b. DOE. In the event that a court order is entered in the case of Snake River Alliance Education Fund v. United States Department of Energy, No. CV-95-0331-S-EJL (D. Idaho), or in any other judicial proceeding, that prohibits in whole or in part any shipment of spent fuel to INEL by DOE under section D, then the DOE has the option to suspend all DOE shipments to INEL and suspend all of DOE's obligations, requirements and deadlines under this Agreement during the period of applicability of the order. If DOE exercises this option, then upon the vacating, dissolving, or reversing of any such order, DOE's obligations, deadlines and requirements provided for in this Agreement shall be extended by a period that corresponds to their period of suspension.

K. ENFORCEMENT

1. Succession of Shipments.

a. DOE. If DOE fails to satisfy the substantive obligations or requirements it has agreed to in this Agreement or fails to meet deadlines for satisfying such substantive obligations or requirements, shipments of DOE spent fuel to INEL shall be suspended unless and until the parties agree or the Court determines that such substantive obligations or requirements have been satisfied. .

b. Navy. If the Navy or the Naval Nuclear Propulsion Program fails to satisfy the substantive obligations or requirements it has agreed to in this Agreement or fails to meet deadlines for satisfying such substantive obligations or requirements, shipments of Navy spent fuel to INEL shall be suspended unless and until the parties agree or the Court determines that such substantive obligations or requirements have been satisfied.

2. Other Enforcement

a. Judicial Enforcement. The Court may enforce the rights, obligations and requirements assigned by this Agreement, other than those exclusively enforceable under Section K.1., pursuant to all legal and equitable remedies available to the courts of the United States, including, but not limited to, use of the Court's contempt powers.

b. RCRA Enforcement. Nothing in this Agreement shall prohibit the State of Idaho from requiring necessary remedial actions as set forth in the Resource Conservation and Recovery Act, 42 U.S.C. section 6929 ("RCRA") (or statutory equivalent), including penalty and fine procedures, the sums of which shall be payable to the State of Idaho.

c. Payment Obligation. In the event that the federal parties do not carry out the requirement that all spent fuel located at INEL be removed from Idaho by January 1, 2035, then subject to the availability of the appropriations provided in advance for this purpose, the federal parties shall pay to the State of Idaho $60,000 for each day such requirement has not been met.

3. Prior Orders, Agreements end Decisions. The terms of this Agreement shall supersede all rights, duties and obligations set forth in any prior orders, agreements or decisions entered in this litigation, captioned <u>Public Service Company of Colorado v. Batt</u>, and <u>United States of America v. Batt</u>, Nos. CV 91-0035-S-EJL and CV 91-0054-S-EJL, except for the provisions of paragraph 4 of the December 22, 1993 Court Order.

4. Dispute Resolution. In the event that any party to this Agreement contends that any other party has violated any terms of the Agreement, the parties shall seek to resolve their differences informally before asking for resolution by the Court.

L. CONSENT ORDER

1. The parties agree they shall jointly present this Agreement to the U.S. District Court with a proposed Consent Order which will provide for the incorporation of this Agreement, continuing jurisdiction of the Court and the administrative termination of this action without prejudice to the right of the parties to reopen the proceedings for good cause shown. This Agreement and Consent Order shall not preclude any party from applying to the Court under Rule 60, of the Federal Rules of Civil Procedure, or the Court from granting relief thereunder.

2. If the Consent Order is not entered by the Court, in accordance with Section L.1 above, within 45 days of lodging with the Court, then either party to this Agreement may elect to terminate this Agreement, in which case this Agreement becomes null and void, and of no force or effect.

For the Federal Parties:

/s/

Robert R Nordhaus
General Counsel
Department of Energy

/s/

Thomas P. Grumbly
Assistant Secretary
for Environmental Management
Department of Energy

/s/

Steven S Honigman
General Counsel
Department of the Navy

/s/

Admiral Bruce DeMars
Director, Naval Nuclear
Propulsion Program

For the State of Idaho

/s/

Philip E Batt
Governor, State
State of Idaho

/s/

Alan G Lance
Attorney General,
State of Idaho

APPENDIX D
GLOSSARY

Terms in this glossary are defined based on the context in which they are used in this EIS.

100-year flood A flood event of such magnitude it occurs, on average, every 100 years (equates to a 1 percent probability of occurring in any given year).

500-year flood A flood event of such magnitude it occurs, on average, every 500 years (equates to a 0.2 percent probability of occurring in any given year).

abnormal condition Any deviation from normal conditions.

absorbed dose The energy imparted by ionizing radiation per unit mass of irradiated material. The unit of absorbed dose is the rad and the gray.

accelerator produced radioactive material Radioactive material that was produced in a charged particle accelerator.

acceptable ambient concentration for a carcinogen (AACC) Ambient air quality standards based on the probability of developing excess cancers over a 70-year lifetime exposure to one microgram per cubic meter ($1 \mu g/m^3$) of a given carcinogen and expressed in terms of a screening emission level or an acceptable ambient concentration for a carcinogenic toxic air pollutant.

acceptable ambient concentration for a noncarcinogen (AAC) Ambient air quality standards based on occupational exposure limits for airborne toxic chemicals expressed in terms of a screening emission level or an acceptable ambient concentration for a noncarcinogenic toxic air pollutant.

accident An unplanned sequence of events that results in undesirable consequences.

actinide Any of a series of chemically similar, mostly synthetic, radioactive elements with atomic numbers ranging from actinium-89 through lawrencium-103.

acute exposure The absorption of a relatively large amount of hazardous material (or intake of hazardous material) over a short period of time.

adsorption The attraction and adhesion of ions or molecules in a gaseous or aqueous state to a solid surface.

air pollutant Any substance including, but not limited to, dust, fumes, gas, mist, odor, smoke, vapor, pollen, soot, carbon, or particulate matter that is regulated.

air quality The general condition of the air resources, usually expressed in terms of attainment of ambient air quality standards.

air quality concentration The specific measurement (or estimate) in the ambient air of a particular air pollutant at any given time.

air quality criteria Regulatory limits of air pollutants in ambient air designated by the varying amounts of pollution and lengths of exposure designed to limit the potential for specific adverse effects to health and welfare (see air quality standard).

air quality standard The prescribed level of a pollutant in the outside air that cannot be exceeded during a specified time in a specified geographical area. Established by both Federal and State governments (see air quality criteria).

alluvium Sedimentary material deposited by flowing water, as in a river bed or delta.

alpha-emitter A radioactive substance that decays by releasing an alpha particle.

alpha low-level mixed waste (alpha LLMW) Waste that was previously classified as transuranic mixed waste but has a transuranic concentration lower than the currently established limit for transuranic waste. Alpha LLMW requires additional controls and special handling. This waste stream cannot be accepted for onsite disposal under the current waste acceptance criteria; therefore, it is special-case waste.

alpha-particle A positively charged particle ejected spontaneously from the nuclei of some radioactive elements. It is identical to a helium nucleus that has a mass number of 4 and an electrostatic charge of +2.

ambient air That portion of the atmosphere outside of buildings to which the general public has access.

applicable or relevant and appropriate requirements Requirements, including cleanup standards, standards of control, and other substantive environmental protection requirements and criteria for hazardous substances as specified under Federal and State law and regulations, that must be met when complying with the *Comprehensive Environmental Response, Compensation, and Liability Act* of 1980 (CERCLA).

aquifer A body of rock or sediment sufficiently permeable to conduct groundwater and to yield significant quantities of water to wells and springs.

as low as reasonably achievable (ALARA) A process by which a graded approach is applied to maintaining dose levels to workers and the public and releases of radioactive materials to the environment as low as reasonably achievable.

attainment area Any area which is designated, pursuant to 42 U.S.C. Section 7407(d) of the *Clean Air Act*, as having ambient concentrations equal to or less than national primary or secondary ambient air quality standards for a particular air pollutant or air pollutants.

atomic number The number of positively charged protons in the nucleus of an atom and the number of electrons on an electrically neutral atom.

background level The value assigned to the quantity of particulate or gaseous material in ambient air which originates from natural sources uninfluenced by the activity of man.

background radiation Radiation from cosmic sources, naturally occurring radioactive materials, including radon (except as a decay product of source or special nuclear material), and global fallout as it exists in the environment from the testing of nuclear explosive devices.

basalt A general term for dark-colored, fine-grained igneous rock. Commonly extrusive and composed primarily of calcic plagioclase and pyroxene minerals.

baseline A quantitative expression of conditions, costs, schedule, or technical progress to serve as a base or standard for measurement; the established plan against which the status of resources and the progress of a program can be measured.

below regulatory concern A definable amount of low-level waste that is sufficiently small that it can be deregulated with minimal risk to the public.

best available control technology (BACT) An emission standard (including fuel cleaning or treatment or innovative fuel combination techniques) for control of such contaminants. BACT shall be determined on a case-by-case basis, taking into account energy, environmental and economic impacts, and other costs, and shall be at least as stringent as any applicable Sections of 40 CFR Part 60 and 40 CFR Part 61. If an emissions standard is infeasible, a design, equipment, work practice, operational standard, or combination thereof, may be prescribed as BACT.

beta-emitter A radioactive substance that decays by releasing a beta particle.

beta-particle A charged particle emitted from a nucleus during radioactive decay, with a mass equal to 1/1837 that of a proton. A negatively charged beta particle is identical to an electron. A positively charged beta particle is called a positron.

beyond design basis accidents Accidents of the same type as a distinct design basis accident (fire, earthquake, and so forth) but defined by parameters that exceed in severity the parameters defined for the distinct design basis accident.

bound To estimate or describe an upper limit on a potential environmental consequence when uncertainty exists.

bounding That which represents the maximum reasonably foreseeable event or impact. All other reasonably foreseeable events or impacts would have fewer and/or less severe environmental consequences.

buffer zone An area designed to separate. Specifically, the portion of a disposal site that is controlled by the licensee and that lies under and between the disposal units and the boundary of the site.

by-product material (a) Any radioactive material (except special nuclear material) yielded in, or made radioactive by, exposure to the radiation incident to the process of producing or utilizing special nuclear material, and (b) the tailings or wastes produced by the extraction or concentration of uranium or thorium from any ore processed primarily for its source material content [*Atomic Energy Act* 11(e)]. By-product material is exempt from regulation under the *Resource Conservation and Recovery Act* (RCRA).

certification plan See waste certification plan.

certified waste Waste that has been confirmed to comply with the waste acceptance criteria of the treatment, storage, or disposal facility for which it is intended under an approved waste certification program.

certifying authority or official An organization or person outside the waste generator line organization who is responsible for certifying that the waste being sent to a treatment, storage, or disposal facility meets the requirements of the receiving facility's waste acceptance criteria.

characterization The determination of waste composition and properties, whether by review of process knowledge, nondestructive examination or assay, or sampling and analysis, generally done for the purpose of determining appropriate storage, treatment, handling, transportation, and disposal requirements.

chronic exposure The absorption of hazardous material (or intake of hazardous materials) over a long period of time (for example, over a lifetime).

Class I area Under the *Clean Air Act*, any Federal land that is classified or reclassified "Class I." The designation applies to pristine areas, such as national parks and wilderness areas, where substantial growth is effectively precluded in order to avoid any degradation of the air quality.

clean waste Waste products that are neither radioactive nor hazardous but require appropriate disposal in a solid waste landfill.

closure Deactivation, stabilization, and surveillance of a waste management unit, landfill, or other facility. Closure often refers to the process under RCRA involving the preparation and signing of a Closure Plan.

collective dose The sum of the individual doses received in a given period of time by a specified population from exposure to a specified source of radiation. The units of collective dose are person-rem.

collective effective dose equivalent The product of the effective dose equivalent (rem) to those exposed and the number of persons in the exposed population. The units are in person-rem.

co-located workers Workers in a fixed population outside the day-to-day process safety management controls of a given facility area. In practice, this fixed population is normally the workers at an independent facility area located some distance from the reference facility area.

commercial waste management facility A facility located off U.S. Department of Energy (DOE) controlled property that is not managed by DOE to which DOE sends waste for treatment, storage, and/or disposal.

committed dose equivalent (H_{50}) The dose equivalent to organs or tissues of reference that will be received from an intake of radioactive material by an individual during the 50-year period following the intake. The International Commission on Radiological Protection defines this as the committed equivalent dose.

committed effective dose See committed effective dose equivalent.

committed effective dose equivalent (CEDE) ($H_{E,50}$) The sum of the products of the weighting factors applicable to each of the body organs or tissues that are irradiated and the committed dose equivalent to these organs or tissues. The International Commission on Radiological Protection defines this as the committed effective dose.

***Comprehensive Environmental Response, Compensation, and Liability Act* of 1980 (CERCLA)** A Federal law (also known as "Superfund") that provides a comprehensive framework to deal with past or abandoned hazardous materials. CERCLA provides for liability, compensation, cleanup, and emergency response for hazardous substances released into the environment that could endanger public health, welfare, or the environment, as well as the cleanup of inactive hazardous waste disposal sites. CERCLA has jurisdiction over any release or threatened release of any "hazardous substance" to the environment. Under CERCLA, the definition of "hazardous" is much broader than under RCRA, and the hazardous substance need not be a waste. If a site meets the CERCLA requirements for designation, it is ranked along with other "Superfund" sites and listed on the National Priorities List. This ranking and listing is the Environmental Protection Agency's (EPA) way of determining which sites have the highest priority for cleanup.

committed equivalent dose See committed dose equivalent.

confinement General control of contaminants through engineering design, such as heating and ventilation systems that use high-efficiency particulate air filters to remove contaminants before discharge to the atmosphere. Such systems may break down or experience a loss of electric power that would "lose confinement" temporarily. This may require evacuation of the structure but would not lead to significant consequences to workers or a significant release.

contact-handled waste Packaged waste whose external surface dose rate does not exceed 200 millirem per hour.

containerization The process of placing radioactive or other hazardous material in a confining receptacle for storage or transport. For spent nuclear fuel, this is called canning.

containment The provision of a gastight shell or other enclosure around a reactor to confine fission products that otherwise might be released into the atmosphere in the event of an accident.

contamination The deposition of unwanted pollutants on the surfaces of structures, areas, objects, or personnel.

contingency plan A document setting out an organized, planned, and coordinated course of action to be followed in case of unanticipated events such as fire, explosion, or other events that may release toxic chemicals, hazardous wastes, or radioactive materials to threaten human health or the environment. The goal of the contingency plan is the containment or mitigation of the impacts resulting from the event.

continuity of operations Activities that include developing strategic and long-range waste management plans, surveillance and maintenance of facilities and equipment, waste certification, proper training programs for personnel, and record/information administration.

control equipment Any method, process or equipment which removes, reduces, or renders less noxious, pollutants discharged into the environment.

criteria air pollutant Under the *Clean Air Act*, and the State of Idaho air quality regulations, any air pollutant for which there is a State or national ambient air quality standard.

cumulative impact The impact on the environment which results from incremental impacts of an 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 impact can result from individually minor but collectively significant actions taking place over a period of time.

curie (Ci) The basic unit used to describe the intensity of radioactivity in a sample of material. The curie is equal to 37 billion disintegrations per second, which is approximately the rate of decay of 1 gram of radium. A curie is also a quantity of any radionuclide that decays at a rate of 37 billion disintegrations per second.

decay, radioactive The decrease in the amount of any radioactive material with the passage of time, due to the spontaneous emission from the atomic nuclei of either alpha or beta particles, often accompanied by gamma radiation (see half-life; radioactive).

decommissioning The process of removing a facility from operation, followed by decontamination, entombment, dismantlement, or conversion to another use.

decontamination The actions taken to reduce or remove substances that pose a substantial present or potential hazard to human health or the environment, such as radioactive contamination from facilities, soil, or equipment by washing, chemical action, mechanical cleaning, or other techniques.

deep dose equivalent Applies to the whole body exposure and is the dose equivalent at a depth of 1 cm (1000 mg/cm^2).

defense waste Radioactive waste from any activity performed in whole or in part in support of the DOE atomic energy defense activities; excludes waste from DOE nondefense activities or waste under the purview of the U.S. Nuclear Regulatory Commission or generated by the commercial nuclear power industry.

delta E A parameter used to define color shift in visual impact modeling. It is the primary basis for determining perceptibility of plume visual impact in screening analyses.

design basis accident Accidents that are postulated for the purpose of establishing functional requirements for safety significant structures, systems, components, and equipment.

diffusion The process by which a pollutant plume is diluted by turbulent eddies.

discharge Under principles of hydrogeology, the amount of water passing through (or leaving) a given cross-sectional area in a given period of time. Under the *Clean Water Act*, discharge of a pollutant, which includes any addition of any pollutant or combination of pollutants to waters of the United States from any point source. This definition includes additions of pollutants into waters of the United States from: surfaced runoff which is collected or channeled by man; discharges through pipes, sewers, or other conveyances owned by a State, municipality, or person which do not lead to a treatment works; and discharges through pipes, sewers, or other conveyances, leading into privately owned treatment works.

dispersion In air pollution, the process of transport and diffusion of airborne contaminants in the atmosphere.

disposal Emplacement of waste in a manner that ensures protection of human health and the environment within prescribed limits for the foreseeable future with no intent of retrieval and that requires deliberate action to regain access to the waste.

disposal facility A facility or part of a facility at which hazardous waste is intentionally placed into or on any land or water and at which waste will remain after closure.

dissolution The ability of water to take a substance into solution.

DOE orders Requirements internal to the DOE that establish DOE policy and procedures, including those for compliance with applicable laws.

DOE site boundary A geographic boundary within which public access is controlled and activities are governed by the DOE and its contractors, not by local authorities. Based on the definition of exclusion zone, a public road traversing a DOE site is considered to be within the DOE site boundary if DOE or the site contractor has the capability to control the road at any time necessary.

dose (or radiation dose) A generic term that means absorbed dose, dose equivalent, effective dose equivalent, committed dose equivalent, committed effective dose equivalent, or total effective dose equivalent, as defined elsewhere in this glossary.

dose conversion factor Any factor that is used to change an amount or concentration of radioactivity to dose in the units of concern. Frequently used as the factor that expresses the committed effective dose equivalent to a person from the intake (inhalation or ingestion) of a unit activity of a given radionuclide.

dose equivalent The product of the absorbed dose in tissue, quality factor, and all other necessary modifying factors at the location of interest. The unit of dose equivalent is the rem. The International Commission on Radiation Protection defines this as the equivalent dose.

dose rate The radiation dose delivered per unit of time; measured, for example, in rem per hour.

dry storage Storage of spent nuclear fuel in environments where the fuel is not immersed in liquid for purposes of cooling and/or shielding.

earthquake magnitude A measure of earthquake size, determined by taking the common logarithm (base 10) of the largest ground motion recorded during the arrival of a seismic wave type and applying a standard correction for distance to the epicenter. Three common types of magnitude are Richter (or local) (M_L), P body wave (m_b), and surface wave (M_s).

effective dose See effective dose equivalent.

effective dose equivalent (EDE) The sum of the products of the dose equivalent to the organ or tissue and the weighting factors applicable to each of the body organs or tissues that is irradiated. It includes the dose from radiation sources internal and/or external to the body and is expressed in units of rem. The International Commission on Radiation Protection defines this as the effective dose.

effluent The wastewater, treated or untreated, that flows out of a facility. Generally, effluent is discharged into surface waters.

emission (air) Any controlled or uncontrolled release or discharge into the outdoor atmosphere of any air pollutants or combination thereof. Emission also includes any release or discharge of any air pollutant from a stack, vent, or other means into the outdoor atmosphere that originates from an emission unit.

emission standard A permit or regulatory requirement established by the Idaho Department of Health and Welfare, or U.S. Environmental Protection Agency, which limits the quantity, rate, concentration of emissions, or impacts on a continuous basis, including any requirements which limit opacity, prescribe equipment, set fuel specifications, or prescribe operation or maintenance procedures to assure continuous emission control.

engineered barriers Manmade components of a waste management system or facility designed to prevent or impede the release of radionuclides or other waste material into the biosphere. This includes the waste form, radioactive waste containers, and other materials placed over and around such containers, and physical features of the system or facility.

environmental monitoring The process of sampling and analysis of environmental media in and around a facility being monitored for the purpose of (a) confirming compliance with performance objectives and (b) early detection of any contamination entering the environment to facilitate timely remedial action.

environmental restoration Cleanup and restoration of sites and decontamination and decommissioning of facilities contaminated with radioactive and/or hazardous substances during past production, accidental releases, or disposal activities.

environmental restoration program A DOE subprogram concerned with all aspects of assessment and cleanup of both contaminated facilities in use and of sites that are no longer a part of active operations. Remedial actions, most often concerned with contaminated soil and groundwater, and decontamination and decommissioning are responsibilities of this program.

eolian Applied (a) to deposits arranged by the wind, (b) to the erosive action of the wind, and (c) to deposits which are due to the transporting action of the wind.

equivalent dose See dose equivalent.

existing facilities Facilities that are projected to exist as of the Record of Decision for this EIS, scheduled for June 1995.

exposure Being exposed to ionizing radiation or to hazardous material. Alternatively, a measure of the ionization produced in air by X or gamma radiation; the unit of exposure in air is the roentgen.

external accident Accidents initiated by manmade energy sources not associated with operation of a given facility. Examples include airplane crashes, induced fires, transportation accidents adjacent to a facility, and so forth.

external dose That portion of the dose equivalent received from radiation sources outside the body.

facility (a) Any building, structure, installation, equipment, pipe or pipeline (including any pipe into a sewer or publicly owned treatment works), well, pit, pond, lagoon, impoundment, ditch, landfill, storage container, motor vehicle, rolling stock, or aircraft; or (b) any site or area where a hazardous substance has been deposited, stored, disposed of, placed, or otherwise come to be located.

facility area The area within the Idaho National Engineering and Environmental Laboratory (INEEL) boundary immediately surrounding a facility or group of facilities that functions under process safety management programs and a common emergency response plan. This definition covers any building within such an area regardless of whether it is dedicated to production, waste handling, or administrative issues; for example, an office building, a cafeteria, a production facility, a machine shop, and a waste handling facility all contained within a common boundary. If programs such as radiation protection, training, auditing, and evaluation are an integral part of safety management at each facility and emergency response plans cover the potential responses of individuals at all buildings, then the collection of buildings constitutes a facility area. All personnel in the area are facility workers, not co-located workers.

facility area boundary The geographic boundary of an area controlled on a daily basis by process safety management and a common emergency response plan.

facility security plan In the context of waste management, a security plan is one that provides the measures required by law, regulation, or good judgment for prevention of unknowing or unauthorized entry into a treatment, storage, or disposal facility; or operation of facility equipment and systems; or access to waste material or spent nuclear fuel.

facility worker Any worker whose day-to-day activities are controlled by process safety management programs and a common emergency response plan associated with a facility or facility area. This definition includes any individual within a facility/facility area or its 0.4-mile exclusion zone. This definition can also include those transient individuals or small populations outside the exclusion zone but inside the radius defined by the maximally exposed co-located worker if reasonable efforts to account for such people have been made in the facility or facility area emergency plan. For facility accident analyses, the facility worker is defined as an individual located 100 meters (328 feet) downwind of the facility location where an accidental release occurs.

feasibility study A step in the environmental restoration process specified by CERCLA. The objectives are to identify the alternatives for remediation and describe a remedial action that satisfies applicable or relevant appropriate requirements for mitigating confirmed environmental contamination. The feasibility study presents a series of specific engineering or construction alternatives for cleaning up a site; for each alternative presented, there will be a detailed analysis of the costs, effects, engineering feasibility, and environmental impacts. The feasibility study is based on information provided in the remedial investigation. Successful completion of a feasibility study should result in a decision (Record of Decision) selecting a remedial action alternative and the subsequent development of a remedial design for implementation of the selected remedial action.

***Federal Facility Compliance Act* (FFCAct)** Federal law signed in October 1992 amending RCRA. The objective of the FFCAct is to bring all Federal facilities into compliance with applicable Federal and State hazardous waste laws, to waive Federal sovereign immunity under those laws, and to allow the imposition of fines and penalties. The law also requires the U.S. Department of Energy to submit an inventory of all its mixed waste and to develop a treatment plan for mixed wastes.

Federal Facility Agreement and Consent Order A binding agreement, negotiated pursuant to Section 120 of CERCLA, signed by DOE, EPA Region X, and the State of Idaho, to coordinate cleanup activities at the INEEL. The Federal Facility Agreement and Consent Order and its Action Plan outline the remedial action process that will encompass all investigation of hazardous substance release sites. The Federal Facility Agreement and Consent Order superseded the Consent Order and Compliance Agreement.

Federal land manager The Secretary of the Federal department with authority over any Federal lands in the United States.

field offices An administrative division of the DOE that operates facilities that are in its jurisdiction.

fiscal year (FY) The time frame specified by any public or private entity to separate one year's financial (fiscal) activities from the next year's. The 1994 Federal Fiscal Year (FY 1994) began on October 1, 1993, and ended on September 31, 1994.

fissile material Although sometimes used as a synonym for fissionable material, this term has acquired a more restricted meaning; namely, any material fissionable by thermal (slow) neutrons. The three primarily fissile materials are uranium-233, uranium-235, and plutonium-239.

fission The splitting of a nucleus into at least two other nuclei and the release of a relatively large amount of energy. Two or three neutrons are usually released during this type of transformation.

fission products The nuclei (fission fragments) formed by the fission of heavy elements, plus the nuclides formed by the fission fragments' radioactive decay.

fissionable material Commonly used as a synonym for fissile material, the meaning of this term has been extended to include material that can be fissioned by fast neutrons, such as uranium-238.

fluorides Gaseous or solid compounds containing fluorine emitted into the air from a number of industrial processes.

free liquid Liquid that is not absorbed into host material such that it could readily separate from the solid portion of a waste under ambient temperature and pressure and spill or drain from its container.

fugitive dust Dust that is stirred up and released into the atmosphere during construction activities. Fugitive emissions composed of particulate matter.

fugitive emissions Those emissions which could not reasonably pass through a stack, chimney, vent, or other functionally equivalent opening.

gamma-emitter A radioactive substance that decays by releasing gamma radiation.

gamma ray (gamma radiation) High-energy, short wavelength electromagnetic radiation (a packet of energy) emitted from the nucleus. Gamma radiation frequently accompanies alpha and beta emissions and always accompanies fission. Gamma rays are very penetrating and are best stopped or shielded against by dense materials, such as lead or uranium. Gamma rays are similar to X-rays, but are usually more energetic.

generator (generation) Organizations of the DOE that produce waste.

geologic repository A system that is intended to be used for, or may be used for, the disposal of radioactive waste or spent nuclear fuel in excavated geologic media. A geologic repository includes (a) the geologic repository operations area, and (b) the portion of the geologic setting that provides isolation. A near-surface disposal area is not a geologic repository.

geothermal energy The energy available from natural sources of heat, such as hot springs and near-surface heat sources in volcanically active areas.

graded approach A process by which the level of analysis, documentation, and actions necessary to comply with a requirement are commensurate with (a) the relative importance to safety, safeguards, and security; (b) the magnitude of any hazard involved; (c) the life-cycle stage of a facility; (d) the programmatic mission of a facility; (e) the particular characteristics of a facility; and (f) any other relevant factor.

graphite fuel Fuel that consists of small pellets of highly enriched uranium (HEU)-carbide fuel surrounded by protective layers of other carbide compounds. These pellets are dispersed in much larger graphite structures for handling and neutron moderation.

greater-than-Class-C waste Low-level radioactive waste that exceeds U.S. Nuclear Regulatory Commission concentration limits specified in 10 CFR 61. The DOE is responsible for the disposal of greater-than-Class-C wastes from DOE nondefense programs.

groundwater Generally, all water contained in the ground. Water held below the water table available to freely enter wells.

grouting Grouting is the process of immobilizing or fixing solid forms of waste so they can be more safely stored or disposed.

half-life The time in which half the atoms of a particular radioactive substance disintegrate to another nuclear form. Measured half-lives vary from millionths of a second to billions of years. Also called physical half-life.

hazard classification A safety classification based on potential onsite consequences. Criteria for this classification are discussed in DOE Order 5480.23 (Nuclear Safety Analysis Reports).

hazard index An indicator of the potential toxicological hazard from exposure to a particular substance. The hazard index is equal to an individual's estimated exposure divided by EPA's substance-specific reference dose.

hazardous air pollutant Any air pollutant subject to a standard promulgated under 42 U.S.C. Section 7412 or other requirements established under 42 U.S.C. Section 7412 of *the Clean Air Act*, including 42 U.S.C. Section 7412(g), (j), and (r) of the *Clean Air Act*.

hazardous chemical A term defined under the *Occupational Safety and Health Act* and the *Emergency Planning and Community Right to Know Act* as any chemical that is a physical hazard or a health hazard.

hazardous material A substance or material, including a hazardous substance, which has been determined by the U.S. Secretary of Transportation to be capable of posing an unreasonable risk to health, safety, and property when transported in commerce.

hazardous substance Any substance that when released to the environment in an uncontrolled or unpermitted fashion becomes subject to the reporting and possible response provisions of the *Clean Water Act* and CERCLA.

hazardous waste Under RCRA, a solid waste, or combination of solid wastes, which because of its quantity, concentration, or physical, chemical, or infectious characteristics may (a) cause, or significantly contribute to, an increase in mortality or an increase in serious irreversible, or incapacitating reversible, illness; or (b) pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, or disposed of, or otherwise managed. Source, special nuclear material, and byproduct material, as defined by the *Atomic Energy Act*, are specifically excluded from the definition of solid waste.

hazardous waste landfill A disposal facility or part of a facility where hazardous waste is placed in or on land and which is not a pile, a land treatment facility, a surface impoundment, an underground injection well, a salt dome formation, a salt bed formation, an underground mine, or a cave.

heavy metals Metallic elements with high atomic weights (for example, mercury, chromium, cadmium, arsenic, and lead) that can damage living things at low concentrations and tend to accumulate in the food chain.

heterogeneous Pertaining to a substance having different characteristics in different locations. A synonym is nonuniform.

high-efficiency particulate air (HEPA) filter A filter with an efficiency of at least 99.95 percent used to separate particles from air exhaust streams prior to releasing that air to the atmosphere.

high-level waste The highly radioactive waste material that results from the reprocessing of spent nuclear fuel, including liquid waste produced directly from reprocessing and any solid waste derived from the liquid that contains a combination of transuranic and fission product nuclides in quantities that require permanent isolation. High-level waste may include other highly radioactive material that the U.S. Nuclear Regulatory Commission, consistent with existing law, determines by rule requires permanent isolation.

Holocene In the geological scale of time, the more recent of the two epochs of the Quaternary period (10,000 years ago to the present); that period of time since the last ice age.

hot cell/hot cell facility A heavily shielded enclosure for handling and processing (by remote means or automatically) or storing highly radioactive materials.

hydraulic conductivity Capacity of a porous media to transport water.

hydraulic gradient The slope of the water table per unit of distance, resulting in groundwater movement.

hydrogeochemistry The study of the chemical interactions between the earth's components, including rocks, minerals, and water.

hydrogeology The study of the geological factors relating to water.

hydrology The study of water, including groundwater, surface water, and rainfall.

infiltrate Water passing from the land surface through the vadose zone into the aquifer.

intermittent surface water A stream, creek, or river which does not contain water during part or all of the year.

inadvertent intrusion The inadvertent disturbance of a disposal facility or its immediate environment by a potential future occupant that could result in loss of containment of the waste or exposure of personnel. Inadvertent intrusion is a significant consideration that shall be included either in the design requirements or waste acceptance criteria of a waste disposal facility.

incineration The efficient burning of combustible solid and liquid wastes to destroy organic constituents and reduce the volume of the waste. Incineration of radioactive materials does not destroy the radionuclides but does significantly reduce the volume of these wastes.

industrial commercial waste Material that is not subject to RCRA Subtitle C or *Atomic Energy Act* regulation. It is generated by manufacturing or industrial processes. Industrial commercial waste is also known as solid waste and is regulated by RCRA, Subtitle D.

INEEL industrial waste Industrial commercial waste generated at the INEEL is categorized as INEEL industrial waste.

institutional control The control of waste management facilities by human institutions.

Interagency Agreement See Federal Facility Agreement and Consent Order.

interim status facility See RCRA interim status facility.

interim action (CERCLA) A remedial action undertaken to clean up or contain a potential threat to human health and the environment that can or should be addressed within a short timeframe. The study associated with an interim action may be completed within an "umbrella" remedial investigation/feasibility study. Interim actions are completed on an accelerated schedule and generally deal with well-defined contamination problems that present a significant, although not immediate, threat to human health and the environment.

interim action (NEPA) An action that may be undertaken while work on a required program EIS is in progress and the action is not covered by an existing program statement. An interim action may not be undertaken unless such action: (a) is justified independently of the program; (b) is itself accompanied by an adequate EIS or has undergone other NEPA review; and (c) will not prejudice the ultimate decision on the program. Interim action prejudices the ultimate decision on the program when it tends to determine subsequent development or limit alternatives.

internal accidents Accidents that are initiated by man-made energy sources associated with the operation of a given facility. Examples include process explosions, fires, spills, criticalities, and so forth.

inversion In the atmosphere, a condition in which air temperature warms with increasing altitude.

isotope One of two or more atoms with the same number of protons, but different numbers of neutrons, in their nuclei. Thus, carbon-12, carbon-13, and carbon-14 are isotopes of the element carbon, the numbers denoting the approximate atomic weights. Isotopes have very nearly the same chemical properties, but often different physical properties (for example, carbon-12 and -13 are stable, carbon-14 is radioactive) (see also radioisotope).

Kjeldahl nitrogen A method of nitrogen analysis designed to measure nitrogen present as part of organic compounds.

lacustrine Pertaining to, produced by, or formed in a lake or lakes; growing in or inhabiting lakes.

Land Disposal Restrictions (LDRs) A RCRA program that restricts land disposal of RCRA hazardous and RCRA mixed wastes and requires treatment to promulgated treatment standards. LDRs identify hazardous wastes that are restricted from land disposal and define those limited circumstances under which an otherwise prohibited waste may continue to be land disposed.

land-use planning A decisionmaking process to determine the future or end use of a parcel of land, considering such factors as current land use, public expectations, cultural considerations, local ecological factors, legal rights and obligations, technical capabilities, and costs.

lapse In the atmosphere, a condition in which air temperature cools with increasing altitude.

less-than-90-day storage The onsite accumulation and/or storage of hazardous waste for a period of less than 90 days by a generator subject to the requirements of 40 CFR 262.34(a).

life cycle The entire time period from generation to permanent disposal or elimination of waste.

liquid metal fast breeder reactor A reactor that operates using a type of fission known as fast fission where the neutrons that are used to split the atoms are not slowed down or moderated, as is usually the case with normal fission. It creates more fissionable material than it consumes and uses liquid metal as a coolant. Liquid sodium is a common metal used to cool this type of reactor.

listed waste Under RCRA, waste listed in 40 CFR 261, Subpart D, as hazardous. Listed hazardous wastes include wastes from specific sources, nonspecific sources, and discarded commercial chemical products. These wastes have not been subjected to the toxicity characterization leaching procedure because the dangers they present are considered self-evident.

loess A homogeneous deposit consisting predominantly of silt, with subordinate amounts of very fine sand and/or clay.

long-term storage The storage of hazardous waste (a) onsite (a generator site) for a period of 90 days or greater, other than in a satellite accumulation area, or (b) offsite in a properly managed treatment, storage, or disposal facility for any period of time.

low-level waste Waste that contains radioactivity and is not classified as high-level waste, transuranic waste, or spent nuclear fuel. Test specimens of fissionable material irradiated for research and development only, and not for the production of power or plutonium, may be classified as low-level waste, provided the concentration of transuranic elements is less than 100 nanocuries per gram of waste.

mafic Pertaining to or composed predominantly of the magnesian rock-forming silicates; said of some igneous rocks and their constituent minerals; synonymous with “dark minerals.”

major radionuclides The radioisotopes that together comprise 95 percent of the total curie content of a waste package by volume and have a half-life of at least 1 week. Radionuclides that are important to a facility's radiological performance assessment and/or a safety analysis and are listed in the facility's waste acceptance criteria are considered major radionuclides.

management (of spent nuclear fuel) Emplacing, operating, and administering facilities, transportation systems, and procedures to ensure safe and environmentally responsible handling and storage of spent nuclear fuel pending (and in anticipation of) a decision on ultimate disposition.

maximally exposed individual (MEI) A hypothetical individual defined to allow dose or dosage comparison with numerical criteria for the public. This individual is located at the point on the DOE site boundary nearest to the facility in question. Sometimes called maximally exposed offsite individual.

maximally exposed offsite individual A hypothetical individual defined to allow dose or dosage comparison with numerical criteria for the public. This individual is located at the point on the DOE site boundary nearest to the facility in question. Sometimes called the MEI.

maximum concentration level These are the maximum concentrations of radionuclides in water estimated to correspond to a lifetime cancer risk of 1/10,000, assuming a lifetime daily consumption of 2 liters of water. These concentrations assume radionuclides emit only one type of radiation. For nonradioactive, noncarcinogenic compounds, maximum concentration levels are based on no observable effect levels.

maximum contaminant level (MCL) Under the *Safe Drinking Water Act*, the maximum permissible concentrations of specific constituents in drinking water that are delivered to any user of a public water system that serves 15 or more connections and 25 or more people. The standards set as maximum contaminant levels take into account the feasibility and cost of attaining the standard.

meteorological classifications Categories defining various states of atmospheric turbulence (dispersion and dilution) that are used to estimate diffusion of radioactive material concentrations for accident scenarios. The criteria consider the relationship of wind speed, insolation (amount of incoming solar radiation), and cloudiness (see Brenk et al. 1983).

> **Average (50 percent) meteorology:** Average meteorological dispersion conditions; more favorable and less favorable to dispersion conditions will each occur 50 percent of the time.
>
> **Conservative (95 percent) meteorology:** Adverse meteorological dispersion conditions (unfavorable to dispersion) which will not occur more than 5 percent of the time.
>
> **Neutral meteorology:** Pasquill Stability Class D, conditions which neither enhance nor inhibit vertical diffusion in the atmosphere.
>
> **Stable meteorology:** Pasquill Stability Class F, moderately stable conditions; the atmospheric condition existing when the temperature of the air rises rather than falls with altitude. It allows for little or no vertical air movement.

millirem One thousandth of a rem (see rem).

mitigation Those actions that avoid impacts altogether, minimize impacts, rectify impacts, reduce or eliminate impacts, or compensate for the impact.

mixed waste Waste that contains both hazardous waste under RCRA and source, special nuclear, or by-product material subject to the *Atomic Energy Act* of 1954.

mixing depth The height to which pollutants can freely disperse, above which inversion conditions exist.

moment magnitude A measure of earthquake size. The rigidity of the rock times the area of faulting times the amount of slip.

M_s Surface wave magnitude; motion is restricted to near the ground surface. Such waves correspond to ripples of water that travel across a lake. Most of the wave motion is located at the outside surface itself; and, as the depth below this surface increases, wave displacements become less and less.

nanocurie One billionth of a curie (see curie).

***National Environmental Policy Act* of 1969 (NEPA)** A law that requires Federal agencies to include in their decisionmaking processes appropriate and careful consideration of all potential environmental effects of proposed actions, analyses of their alternatives, and measures to avoid or minimize adverse effects of a proposed action that have the potential for significantly affecting the environment. These analyses are presented in either an environmental assessment or in an environmental impact statement.

National Oceanic and Atmospheric Administration A Federal agency that collects and analyzes information on the weather. The National Oceanic and Atmospheric Administration has an office at INEEL for collecting weather information. The National Oceanic and Atmospheric Administration also is involved with the environmental monitoring programs at INEEL.

National Priorities List A formal listing of the nation's worst hazardous waste sites, as established by CERCLA that have been identified for remediation.

natural phenomena accidents Accidents that are initiated by phenomena such as earthquakes, tornadoes, floods, and so forth.

near-surface disposal Disposal in the uppermost portion of the earth, approximately 30 meters. Near-surface disposal includes disposal in engineered facilities that may be built totally or partially above-grade provided that such facilities have protective earthen covers. A near-surface disposal facility is not considered a geologic repository.

nearest public access For facility accident analyses, the location of the nearest public highway where members of the public could be present.

new facilities Any facility that is not an existing facility or an existing hazardous waste management facility.

nitrogen oxides (NO_x) Gases formed in great part from atmospheric nitrogen and oxygen when combustion takes place under conditions of high temperature and high pressure; a criteria air pollutant. Two major nitrogen oxides, nitric oxide (NO) and nitrogen dioxide (NO_2), are important airborne contaminants. Oxides of nitrogen are considered precursor to the formation of ozone (photochemical smog).

nonattainment area Any area which has been designated as not meeting (or contributes to ambient air quality in a nearby area that does not meet) the national primary or secondary ambient air quality standard for the pollutant.

noncertifiable waste Waste that is not able to meet the waste acceptance criteria for the intended treatment, storage, or disposal facility; transportation requirements; or waste that may be too difficult to characterize adequately to prove that it meets the applicable criteria.

nonreactor nuclear facility Those activities or operations that involve radioactive and/or fissionable materials in such form and quantity that a nuclear hazard potentially exists to the employees or to the general public. These activities or operations include producing, processing, or storing radioactive liquid or solid waste, fissionable materials, or tritium; conducting separation operations; conducting inspections of irradiated materials, fuel fabrication, decontamination, or recovery operations; conducting fuel enrichment operations; or performing environmental remediation or waste management activities involving radioactive materials.

nonhazardous Waste that does not pose risks to human health and the environment. Industrial/commercial waste is an example (see hazardous waste).

normal conditions All activities associated with a facility mission, whether operation, maintenance, storage, and so forth, which are carried out within a defined envelope. This envelope can be design process conditions, performance in accordance with procedure, and so forth.

normal operation All normal conditions and those abnormal conditions that frequency estimation techniques indicate occur with a frequency greater than 0.1 events per year.

NO_x A generic term used to describe the oxides of nitrogen (see nitrogen oxides).

nuclear criticality A self-sustaining chain reaction that releases neutrons and energy and generates radioactive by-product material.

nuclear fuel Materials that are fissionable and can be used in nuclear reactors to make energy.

nuclide A general term referring to all known isotopes, both stable (279) and unstable (about 5,000), of the chemical elements.

off-link doses Doses to members of the public within 800 meters (2,625 feet) of a road or railway.

offsite facility A facility located at a different site or location than the shipper.

offsite population For facility accident analyses, the collective sum of individuals located within an 80-kilometer (50-mile) radius of the INEEL facility and within the path of the plume with the wind blowing in the most populous direction. For routine radionuclide emissions, the collective population residing within an 80-kilometer radius for which an annual dose assessment is performed (includes all directions).

on-link doses Doses to members of the public sharing a road or railway.

onsite The same or geographically contiguous property that may be divided by public or private right-of-way, provided the entrance and exit between the properties is at a cross-roads intersection, and access is by crossing as opposed to going along the right-of-way. Non-contiguous properties owned by the same person but connected by a right-of-way that he/she controls and to which the public does not have access is also considered onsite property.

onsite facilities Buildings and other structures, their functional systems and equipment, and other fixed systems and equipment installed onsite.

operable unit A discrete portion of a Waste Area Group consisting of one or many release sites considered together for assessment and cleanup activities. The primary criteria for placement of release sites into an operable unit include geographic proximity, similarity of waste characteristics and site types, and the possibilities for economy of scale.

operator The organization that operates a facility.

organic compounds Chemicals containing mainly carbon, hydrogen, and oxygen. Petroleum products, petroleum-based solvents, and pesticides are examples of organic compounds. Exposure to some organic compounds can produce toxic effects on body tissues and processes.

orphan wastes Wastes in a classification that currently have no long-term disposal scheduled or anticipated. An example of an orphan waste is low-level mixed waste. Orphan waste is probably not radioactive enough to qualify for disposal at the Waste Isolation Pilot Plant and it cannot be disposed of onsite because it has hazardous components.

orthophosphate The phosphate ions including H_2O_4, HPO_4^{2-}, and PO_4^{3-}.

overpack A secondary container placed around a primary container to provide additional protection to or from the contents of a waste package or enclose a damaged primary container.

package The packaging plus its contents.

packaging A receptacle and any other components or materials necessary for the receptacle to perform its required containment function.

particulate matter Any material, except water in uncombined form, that exists as a liquid or a solid at standard conditions (see also PM-10).

passivation The process of making metals inactive or less chemically reactive. For example, to passivate the surface of steel by chemical treatment.

perched water A discontinuous saturated water body above the water table with unsaturated conditions existing both above and below.

perennial surface water A stream, creek, lake, pond, or river which contains water year round.

performance assessment A systematic analysis of the potential risks posed by waste management systems to the public and environment and a comparison of those risks to established performance objectives.

performance assessment limited waste Special-case waste comparable to greater-than-Class-C waste but generated by the government. This is a low-level waste but has unique characteristics that make it unsuitable for shallow land burial.

performance-assessment-limited alpha waste Any alpha-contaminated waste, not meeting the definition of transuranic waste, that cannot be disposed of by shallow land burial, based on a documented site-specific performance assessment approved by the DOE Operations Office and Headquarters.

performance objectives Parameters within which a facility must perform to be considered acceptable.

permeability The degree of ease with which water can pass through a rock or soil.

person-rem A unit of collective radiation dose applied to populations or groups of individuals (see collective dose).

playa The shallow central basin of a desert plain in which water gathers and then evaporates.

Pleistocene The older of the two epochs of the Quaternary period (2 million to 10,000 years ago).

plume The three-dimensional area containing measurable concentrations of a compound or element which has migrated from its source point.

PM-10 All particulate matter in the ambient air with an aerodynamic diameter less than or equal to a nominal ten (10) micrometers.

pollutant migration The movement of a contaminant away from its initial source.

pollution prevention The use of any process, practice, or product that reduces or eliminates the generation and release of pollutants, hazardous substances, contaminants, and wastes, including those that protect natural resources through conservation or more efficient utilization.

polychlorinated biphenyls (PCBs) A class of chemical substances formerly manufactured as an insulating fluid in electrical equipment that is highly toxic to aquatic life. In the environment, PCBs exhibit many of the characteristics of dichloro diphenyl trichloroethane (DDT); they persist in the environment for a long time and accumulate in animals.

population dose The collective dose to the offsite population (usually within 80 kilometers of the facility being assessed).

porosity (n) Porosity is an index of the relative pore volume. It is the total unit volume of the soil or rock divided into the void volume.

preferential pathways Preferred pathways for fluid flow. They are dependent upon the moisture content of the porous media.

pressurized water reactor A nuclear power reactor that uses water under pressure as a coolant. The water boiled to generate steam is in a separate system.

primary ambient air quality standard That air quality that, allowing an adequate margin of safety, is requisite to protect the public health. National primary ambient air quality standards have been established for criteria pollutants (particulate matter, carbon monoxide, sulfur dioxide, nitrogen dioxide, ozone, and lead).

probable maximum flood The largest flood for which there is any reasonable expectancy in a specific area. The probable maximum flood is normally several times larger than the largest flood of record.

process knowledge The set of information that is used by trained and qualified individuals who are cognizant of the origin, use, and location of waste-generating materials and processes in sufficient detail so as to certify the identity of the waste.

processing (of spent nuclear fuel) Applying a chemical or physical process designed to alter the characteristics of a spent nuclear fuel matrix.

public Anyone outside the DOE site boundary at the time of an accident or during normal operation. With respect to accidents analyzed in this EIS, anyone outside the DOE site boundary at the time of an accident.

quality assurance All those planned and systematic actions necessary to provide adequate confidence that a facility, structure, system, or components will perform satisfactorily and safely in service. Quality assurance includes quality control, which is all those actions necessary to control and verify the features and characteristics of a material, process, product, or service to specified requirements.

quality factor The modifying factor that is used to derive dose equivalent from absorbed dose.

Quaternary The younger of the two geologic periods in the Cenozoic Era (2 million years ago to the present). Quaternary is subdivided into the Pleistocene and Holocene epochs.

rad The special unit of absorbed dose. One rad is equal to an absorbed dose of 100 ergs/gram.

radiation (ionizing radiation) Alpha particles, beta particles, gamma rays, x-rays, neutrons, high-speed electrons, high-speed protons, and other particles capable of producing ions. Radiation, as it is used in this environmental impact statement, does not include nonionizing radiation, such as radio- or microwaves, or visible, infrared, or ultraviolet light.

radiation worker A worker who is occupationally exposed to ionizing radiation and receives specialized training and radiation monitoring devices to work in such circumstances.

radioactive waste Waste that is managed for its radioactive content.
radioactivity The property or characteristic of material to spontaneously "disintegrate" with the emission of energy in the form of radiation. The unit of radioactivity is the curie (or becquerel).

radioisotope An unstable isotope, of an element, that decays or disintegrates spontaneously, emitting radiation. Approximately 5,000 natural and artificial radioisotopes have been identified.

radiological survey The evaluation of the radiation hazards accompanying the production, use, or existence of radioactive materials under a specific set of conditions. Such evaluation customarily includes a physical survey of the disposition of materials and equipment, measurements or estimates of the levels of radiation that may be involved, and a sufficient knowledge of processes affecting these materials to predict hazards resulting from unexpected or possible changes in materials or equipment.

Radiological and Environmental Sciences Laboratory A facility involved in environmental monitoring of INEEL onsite and offsite radiation and research on its effects.

radionuclide See radioisotope.

RCRA See *Resource Conservation and Recovery Act*.

RCRA accumulation point There are two types of accumulation areas allowed under RCRA:

> **Satellite Accumulation:** Locations where hazardous waste generators are allowed to accumulate waste at or near the point of generation. Generators may accumulate up to 55 gallons of hazardous waste or one quart of acutely hazardous waste at or near the point of generation. Upon reaching 55 gallons, the generator has 72 hours to move the hazardous waste to either a temporary accumulation area or a permitted facility.
>
> **Temporary Accumulation Areas:** Under RCRA, the location where hazardous waste may be stored by a generator without a RCRA permit, temporary accumulation areas are limited by the amount of time they can store a hazardous waste. Generators may store hazardous wastes for up to 90 days without a permit if the generator complies with other safety and storage requirements, including a personnel training plan, a contingency plan, and an emergency preparedness and response plan.

RCRA interim status facility Hazardous waste management facilities (that is, treatment, storage, or disposal facilities) subject to RCRA requirements that were in existence on the effective date of regulations are considered to have been issued a permit on an interim basis as long as they have met notification and permit application submission requirements. Such facilities are required to meet interim status standards until they have been issued a final permit or until their interim status is withdrawn.

RCRA storage A facility used to store RCRA hazardous waste for greater than 90 days. To be in compliance with the regulatory requirements of RCRA, the facility must meet both documentation requirements (for example, contingency and waste analysis plans) and physical requirements (for example, specific aisle widths and separation of incompatible wastes).

reclassified low-level waste See alpha low-level waste.

Record of Decision (ROD) A public document that records the final decision(s) concerning a proposed action. The Record of Decision is based in whole or in part on information and technical analysis generated either during the CERCLA process or the NEPA process, both of which take into consideration public comments and community concerns.

recycling Recycling techniques are characterized as use, reuse, and reclamation techniques (resource recovery). Use or reuse involves the return of a potential waste material either to the originating process as a substitute for an input material or to another process as an input material. Reclamation is the recovery of a useful or valuable material from a waste stream. Recycling allows potential waste materials to be put to a beneficial use rather than going to treatment, storage, or disposal.

regulated substances A general term used to refer to materials other than radionuclides that are regulated by Federal, State, (or possibly local) requirements.

release site A location at which a hazardous, radioactive, or mixed waste release has occurred or is suspected to have occurred. It is usually associated with an area where these wastes, or substances contaminated with them, have been used, treated, stored, and/or disposed of.

rem The dosage of an ionizing radiation that will cause the same biological effect as one roentgen of X-ray or gamma-ray exposure.

remedial investigation The CERCLA process of determining the extent of hazardous substance contamination and, as appropriate, conducting treatability investigations. The remedial investigation provides the site-specific information for the feasibility study.

remediation Process of remedying a site where a hazardous substance release has occurred.

remote-handled waste Packaged waste whose external surface dose rate exceeds 200 millirem per hour.

remote handling The handling of wastes from a distance so as to protect human operators from unnecessary exposure.

repository A permanent deep geologic disposal facility for high-level or transuranic wastes and spent nuclear fuel.

representative sample A sample of a universe or whole (for example, waste pile, lagoon, groundwater) that can be expected to exhibit the average properties of the universe or whole.

reprocessing (of spent nuclear fuel) Processing of reactor irradiated nuclear material (primarily spent nuclear fuel) to recover fissile and fertile material, in order to recycle such materials primarily for defense programs. Historically, reprocessing has involved aqueous chemical separations of elements (typically uranium or plutonium) from undesired elements in the fuel.

research reactor A nuclear reactor used for research and development.

***Resource Conservation and Recovery Act* (RCRA)** A Federal law addressing the management of waste. Subtitle C of the law addresses hazardous waste under which a waste must either be “listed” on one of EPA’s hazardous waste lists or meet one of EPA’s four hazardous characteristics of ignitability, corrosivity, reactivity, or toxicity, as measured using the toxicity characterization leaching procedure. Cradle-to-grave management of wastes classified as RCRA hazardous wastes must meet stringent guidelines for environmental protection as required by the law. These guidelines include regulation of transportation, treatment, storage, and disposal of RCRA-defined hazardous waste. Subtitle D of the law addresses the management of nonhazardous, nonradioactive, solid waste, such as municipal wastes.

retrieval The process of recovering wastes that have been stored or disposed of onsite so they may be appropriately characterized, treated, and disposed of.

rhyolite A very acid volcanic rock that is the lava form of granite.

risk Quantitative expression of possible loss that considers both the probability that a hazard causes harm and the consequences of that event.

roentgen A unit of exposure to ionizing radiation. It is that amount of gamma or X-rays required to produce ions carrying one electrostatic unit of electrical charge in one cubic centimeter of dry air under standard conditions.

safe and secure Storage with design and operational features that maintain the integrity of the fuel cladding, prevent criticalities, preclude diversion, and so forth. Safe and secure storage would generally meet the intent of DOE Orders, but waivers may be required and granted for some requirements on a case-by-case basis where warranted.

safety analysis report A report, prepared in accordance with DOE Orders 5481.1B and 5480.23, that summarizes the hazards associated with the operation of a particular facility and defines minimum safety requirements.

safety class structures, systems, and components Those systems, structures, or components whose functioning is necessary to keep maximally exposed offsite individual exposure below a dose of 25 rem or an Emergency Response Planning Guideline-2 dosage for design basis accidents and evaluation basis accidents.

sanitary landfill A facility for the disposal of solid waste where there is no reasonable probability of adverse effects on health or the environment from disposal of the solid waste at the facility. This facility is not an open dump and is not for disposal of hazardous waste.

sanitary waste Liquid or solid wastes that are generated as a result of routine operations of a facility and are not considered hazardous or radioactive.

satellite accumulation See RCRA accumulation point.

saturated zone That part of the earth's crust in which all naturally occurring voids are filled with water.

scaling factor A multiplier that allows the inference of one radionuclide concentration from another that is more easily measured.

scientific notation A notation adopted by the scientific community to deal with very large and very small numbers. The notation calls for moving the decimal point to the right or left so that only one number above zero is to the left of the decimal point. Scientific notation uses a number times 10 and either a positive or negative exponent to show how many places to the left or right the decimal place has been moved. For example, in scientific notation, 120,000 would be written as 1.2×10^{5}, and 0.000012 would be written as 1.2×10^{-5}. In a variation of scientific notation often used in computer printouts, the multiplication sign and number 10 are replaced by the letter E. The above numbers would be written as 1.2E5 (or 1.2E+05) and 1.2E-5, respectively.

scrubber A device that uses a liquid spray to remove aerosol and gaseous pollutants from an airstream. The gases are removed either by absorption or chemical reaction. Solid and liquid particulates are removed through contact with the spray.

secondary ambient air quality standard That air quality which is requisite to protect the public welfare from any known or anticipated adverse effects associated with the presence of air pollutants in the ambient air.

secondary emissions Emissions which would occur as a result of the construction, modification, or operation of a stationary source or facility but do not come from the stationary source or facility itself.

sedimentary interbeds Rock layers composed of materials, such as sand or gravel, which are derived from the breakdown of various rocks that are layered between other rock types.

segregation The process of separating (or keeping separate) individual waste types and/or forms in order to facilitate their cost-effective treatment and storage or disposal.

seismicity The phenomenon of earth movements; seismic activity. Seismicity is related to the location, size, and rate of occurrence of earthquakes.

site inspection The CERCLA process to acquire the necessary data to confirm the existence of environmental contamination and to assess the associated potential risks to human health, welfare and the environment. The data collected must be sufficient to support the decision either for continuing with a remedial investigation/feasibility study or for removing the site from further investigation through a decision document.

site waste management organization The functional organization at a DOE site whose responsibility it is to manage waste generated by that site's operations.

sizing The process of reducing the size of various types of solid wastes by compaction, melting, or mechanical reduction.

small quantity generator A generator who generates less than 1,000 kilograms of hazardous waste in a calendar month.

sodium-bearing waste Liquid radioactive waste generated from decontamination of process equipment and other miscellaneous activities at the Idaho Chemical Processing Plant.

sole source aquifer A designation granted by the U.S. Environmental Protection Agency when groundwater from a specific aquifer supplies more than 50 percent of the drinking water for the area overlying the aquifer. Sole source aquifers have no alternative source or combination of sources which could physically, legally, and economically supply all those who obtain their drinking water from the aquifer. Sole source aquifers are protected from federally financially assisted activities determined to be potentially unhealthy for the aquifer.

solid waste Any garbage, refuse, or sludge from a waste treatment plant, water supply treatment plant, or air pollution control facility and other discarded material, including solid, liquid, semisolid, or contained gaseous material resulting from industrial, commercial, mining, and agricultural operations, and from community activities. It does not include solid or dissolved material in domestic sewage, or solid or dissolved materials in irrigation return flows or industrial discharges, which are point sources subject to permits under Section 402 of the *Federal Water Pollution Control Act*, as amended, or source, special nuclear, or by-product material as defined by the *Atomic Energy Act* of 1954, as amended [Public Law 94-580, 1004(27) RCRA].

solid waste management units Any site, excluding Land Disposal Units, that received or handled solid waste, whether or not hazardous constituents were involved.

solvents Liquid chemicals, usually organic compounds, that are capable of dissolving another substance. Exposure to some organic solvents can produce toxic effects on body tissues and processes.

source material (a) Uranium, thorium, or any other material that is determined by the Nuclear Regulatory Commission pursuant to the provisions of the *Atomic Energy Act* of 1954, Section 61, to be source material; or (b) ores containing one or more of the foregoing materials, in such concentration as the Nuclear Regulatory Commission may by regulation determine from time-to-time [*Atomic Energy Act* 11(z)]. Source material is exempt from regulation under RCRA.

source term The type and quantity of pollutants emitted to air or other media from a specific source or group of sources.

SO_x A generic term used to describe the oxides of sulfur. Air emission of oxides of sulfur contribute to sulfur dioxide concentrations, for which there is an ambient air quality standard; contributes to the formation of acidic precipitation (see sulfur oxides).

special case waste Special case waste is defined in this EIS as those wastes which are not suitable for direct treatment via the primary AMWTP facility supercompaction, macroencapsulation, incineration, and vitrification treatment processes. Special case waste includes wastes which may require additional characterization and/or pretreatment (e.g., neutralization and/or absorption) prior to processing via incineration/vitrification or final treatment (e.g., amalgamation to meet land disposal restrictions [LDR] treatment standards) prior to disposal. Some examples of special case waste are: Containers of liquids (i.e., containerized liquids) removed from the original waste containers, and Free liquids (i.e., non-containerized liquids) removed from the original waste containers and containerized prior to transfer to the special case waste glovebox.

spent nuclear fuel Fuel that has been withdrawn from a nuclear reactor following irradiation, the constituent elements of which have not been separated. For the purposes of this EIS, spent nuclear fuel also includes uranium/neptunium target materials, blanket subassemblies, pieces of fuel, and debris.

stabilized waste (stability) Treatment or packaging of a waste stream that is intended to ensure that the waste does not structurally degrade and affect overall stability of the disposal site through slumping, collapse, or other types of failures that will lead to water infiltration into the waste. Stabilization is also a factor in limiting exposure to an inadvertent intruder since it provides a recognizable and nondispersible waste.

stable (Atmospheric) low potential for vertical mixing. Also, nonradioactive.

stakeholder Any person or organization with an interest in or affected by DOE activities. Stakeholders may include representatives from Federal agencies, State agencies, Congress, Native American Tribes, unions, educational groups, industry, environmental groups, other groups, and members of the general public.

stationary source Any building, structure, emissions unit, or installation which emits or may emit any air pollutant.

storage The collection and containment of waste or spent nuclear fuel in such a manner as not to constitute disposal of the waste or spent nuclear fuel for the purposes of awaiting treatment or disposal capacity (that is, not short-term accumulation).

storativity Storativity of a saturated aquifer is defined as the volume of water that a unit volume of the aquifer releases from storage under a unit decline in hydraulic head.

sulfur oxides Pungent, colorless gases formed primarily by the combustion of fossil fuels; considered major air pollutants, sulfur oxides may damage the respiratory tract as well as vegetation (see SO_x).

subsurface The area below the land surface (including the vadose zone and aquifers).

superfund The common name used CERCLA and its amendments.

superfund site Any site that has been listed on the National Priority List because it has been identified by the EPA as having the potential to harm human health and the environment. Study and cleanup activities at these sites are regulated by the CERCLA. "Superfund" sites at Federal facilities must be cleaned up by the operating agency (lead agency) under the oversight of the EPA and other parties to a Federal Facility Agreement.

surface dose The radiological dose emanating from a container of material (waste), usually expressed as a measurement at contact and at one meter.

tank A stationary device designed to contain an accumulation of waste, which is constructed primarily of non-earthen materials (for example, wood, concrete, steel, plastic) which provide structural support.

technical safety requirement Those requirements that define the conditions, safe boundaries, and the management or administrative controls necessary to ensure the safe operation of a nuclear facility and reduce the potential risk to the public and co-located workers from uncontrolled release of radioactive materials, radiation exposure due to inadvertent criticality, or uncontrolled release of nonradiological material or energy hazards.

tectonics Geological structural features as a whole, or a branch of geology concerned with the structure of the crust of a planet and especially with the formation of folds and faults in it.

tephra Solid material ejected into the air during a volcanic eruption, including volcanic dust, ash, and cinders.

Tertiary The older of the two geologic periods in the Cenozoic Era (63 to 2 million years ago).

thermal treatment The treatment of hazardous waste in a device which uses elevated temperatures as the primary means to change the chemical, physical, or biological character or composition of the hazardous waste. Examples of thermal treatment processes are incineration, molten salt, pyrolysis, calcination, wet air oxidation, and microwave discharge.

total effective dose equivalent The sum of the external dose equivalent (for external exposures) and the committed effective dose equivalent (for internal exposures).

toxic air pollutant Under the Idaho Air Quality Control Regulations, any air pollutant that is determined by the Idaho Department of Health and Welfare to be, by its nature, toxic to human or animal life or vegetation.

toxic air pollutant reasonably available control technology An emission standard based on the lowest emission of toxic air pollutants that a particular source is capable of meeting by the application of control technology that is reasonably available, as determined by the Idaho Department of Health and Welfare, considering technological and economic feasibility.

toxicological hazard Any material defined in 40 CFR 355 Appendix A as an extremely hazardous substance.

transient A change in the reactor coolant system temperature and/or pressure. Transients can be caused by adding or removing neutron poisons, by increasing or decreasing the electrical load on the turbine generator, or by accident conditions.

transmissivity The rate at which water of a prevailing density and viscosity is transmitted through a unit width of an aquifer under a unit hydraulic gradient. It is a function of properties of the liquid, the porous media, and the thickness of the porous media.

transuranic waste Waste containing more than 100 nanocuries of alpha-emitting transuranic isotopes with half-lives greater than 20 years per gram of waste, except for (a) high-level radioactive waste; (b) waste that DOE has determined, with the concurrence of the EPA Administrator, does not need the degree of isolation required by 40 CFR 191; or (c) waste that the U.S. Nuclear Regulatory Commission has approved for disposal on a case-by-case basis in accordance with 10 CFR 61.

transuranium radionuclide Any radionuclide having an atomic number greater than 92.

treatment Any method, technique, or process, including neutralization, designed to change the physical, chemical, or biological character or composition of any hazardous waste so as to neutralize such waste, or so as to render such waste nonhazardous, safer for transport, amenable for recovery, amenable for storage, or reduced in volume. Such term includes any activity or processing designed to change the physical form or chemical composition of hazardous waste so as to render it nonhazardous.

treatment facility Land area, structures, and/or equipment used for the treatment of waste or spent nuclear fuel.

ultimate disposition The final step in which a material is either processed for some use or disposed of.

United States Geological Survey (USGS) A Federal agency that collects and analyzes information on geology and geological resources including groundwater and surface water.

vadose zone The zone between the land surface and the water table. Saturated bodies, such as perched groundwater, may exist in the vadose zone. Also called the zone of aeration and the unsaturated zone.

vapor vacuum extraction A technology that applies a vacuum to a well field to remove volatile organic contamination from soils and permeable rock layers in that well field.

vitrification The process of immobilizing waste material that results in a glass-like solid.

volatile organic compound (VOC) Chemical containing mainly carbon, hydrogen, and oxygen that readily evaporates at ambient temperature. Exposure to some organic compounds can produce toxic effects on body tissue and processes. VOCs are regulated as precursors to the criteria air pollutant ozone.

Volcanic Rift Zones (VRZs) Linear belts of basaltic vents marked by open fissures, monoclines, and small normal faults. Volcanic rift zones were produced during the propagation of vertical molten basaltic dikes that fed surface eruptions.

vulnerabilities Conditions or weaknesses that may lead to radiation exposure to the public, unnecessary or increased exposure to the workers, or release of radioactive materials to the environment. For example, some DOE facilities have had leakage from spent fuel storage pools, excessive corrosion of fuel causing increased radiation levels in the pool, or degradation of handling systems. Vulnerabilities are also caused by loss of institutional controls, such as cessation of facility funding or reductions in facility maintenance and control.

waste Any waste defined as solid waste by 40 CFR 261.2. Solid waste excluded from regulation by RCRA is still considered a waste. This includes wastes of all types (solid, liquid, gaseous, hazardous, radioactive, sanitary, and so forth).

waste acceptance criteria (WAC) The requirements specifying the characteristics of waste and waste packaging acceptable to a waste receiving facility; and, the documents and processes the generator needs to certify that waste meets applicable requirements.

waste acceptance specifications The functions to be performed and the technical requirements for a Waste Acceptance System for accepting spent nuclear fuel and high-level waste into the Civilian Radioactive Waste Management System according to the *Waste Acceptance System Requirements Document* (DOE/RW-0352P, January 1993, Office of Civilian Radioactive Waste Management).

waste analysis plan A plan that specifies the parameters for which each waste will be analyzed. These include a testing and sampling method(s), timing, and the rationale of the generator or the facility operator responsible for treatment, storage, or disposal. It ensures that accurate waste type and composition determinations are made as required by law, regulation, or good judgment.

waste area group Ten groupings of release sites under the INEL Federal Facility Agreement and Consent Order 5. Groupings are for efficiency in managing the assessment and cleanup process. Nine of these waste area groups are associated with specific facilities, and the tenth is associated with the remaining miscellaneous facilities. Each waste area group may be broken down into individual operable units.

waste certification A process by which a waste generator certifies that a given waste or waste stream meets the waste acceptance criteria of the facility to which the generator intends to transport waste for treatment, storage, or disposal. Certification is accomplished by a combination of waste characterization, documentation, quality assurance, and periodic audits of the certification program.

waste certification plan A plan or collection of plans used by a generator to specify the means by which waste is prepared and certified to meet applicable waste acceptance and safety criteria; hazardous and radiological waste handling, treatment, transportation, and packaging regulations; and other local or site requirements. Certification plans result in developing the information that the receiving facility needs to confirm the suitability of waste for acceptance.

waste certification program A systematic approach to ensure that waste characterization is conducted in a manner to provide reasonable assurance that the receiving facility's waste acceptance criteria are met. A waste certification program consists of all the functional elements, organizations, and activities necessary to provide reasonable assurance that waste characterization is done with sufficient accuracy to ensure proper handling. These functions can be performed by various organizations.

waste characterization See characterization.

waste container A receptacle for waste, including any liner or shielding material that is intended to accompany the waste in disposal.

waste generation Any waste (after being declared a waste, see "waste") produced during a particular calendar year. This does not include waste produced in previous years that is being repacked, treated, or disposed of in the current calendar year. It does include any secondary waste (for example, clothing, gloves, waste from maintenance operations, and so forth) generated by treatment, storage, or disposal activities of previously generated wastes.

waste generator organization Any organization that is responsible for the individual generators of waste.

Waste Isolation Pilot Plant (WIPP) A facility near Carlsbad, New Mexico, authorized to demonstrate safe disposal of defense-generated transuranic waste in a deep geologic medium.

waste management The planning, coordination, and direction of those functions related to generation, handling, treatment, storage, transportation, and disposal of waste, as well as associated surveillance and maintenance activities.

waste management facility All contiguous land, structures, other appurtenances, and improvements on the land, used for treating, storing, or disposing of waste or spent nuclear fuel. A facility may consist of several treatment, storage, or disposal operational units (for example, one or more landfills, surface impoundments, or combinations of them).

waste management program A systematic approach to organize, direct, document, and assess activities associated with waste generation, treatment, storage, or disposal. A waste management program consists of all the functional elements, organizations, and activities that comprise the system needed to properly manage waste. These functions and activities can be performed by various organizations.

waste management systems assessment A systems assessment of the entire low-level waste management (or all of waste management) structure/program at a given site that considers treatment, storage, and disposal, as well as onsite and offsite points of generation with an emphasis on optimization of all aspects of the operations, including, but not limited to, protection of human health and the environment, regulatory compliance, and cost effectiveness.

waste minimization An action that economically avoids or reduces the generation of waste by source reduction, reducing the toxicity of hazardous waste, improving energy usage, or recycling. These actions will be consistent with the general goal of minimizing present and future threats to human health, safety, and the environment.

waste receiving facility A facility that formally accepts waste from a waste generator organization for treatment, storage, or disposal.

waste segregation The process of separating (or keeping separate) individual waste types and/or forms in order to facilitate their cost-effective treatment and storage or disposal.

waste stream A waste or group of wastes with similar physical form, radiological properties, EPA waste codes, or associated land disposal restriction treatment standards. It may be the result of one or more processes or operations.

waste type The waste types discussed in this EIS are high-level waste, transuranic waste, mixed low-level waste, low-level waste, hazardous waste, or nonhazardous waste.

water table The surface below which is saturated with water (an aquifer) and above which is not saturated with water (the vadose zone).

weathering The process by which rocks are broken down and decomposed by the physical and chemical actions of wind, rain, temperature change, plant colonization, and bacterial activity.

weighting factor (W_T) For an organ or tissue, (W_T) is the proportion of the risk of health effects (cancer fatalities) resulting from irradiation of that organ or tissue to the total risk of health effects (cancer fatalities) when the whole body is irradiated uniformly.

wet storage Storage of spent nuclear fuel in a pool of water, generally for the purposes of cooling and/or shielding.

zone of aeration See vadose zone.

zone of saturation That part of the earth's crust in which all voids are filled with water.

APPENDIX E

TECHNICAL METHODOLOGIES AND KEY DATA

E-1 SOCIOECONOMICS

E-1.1 Methodology and Key Assumptions for Socioeconomics

The socioeconomic impact analysis evaluates both the impacts on regional economic activity, as measured by changes in employment and earnings, and the impacts on communities surrounding Idaho National Engineering and Environmental Laboratory (INEEL), as measured by changes in population and the demand for housing and public services. The study area comprises a seven-county Region of Influence (ROI) and socioeconomic impacts are estimated for each of the proposed Advanced Mixed Waste Treatment Project (AMWTP) alternatives. The methodology employed for the AMWTP Environmental Impact Statement (EIS) is similar to that used in the *Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Program Final Environmental Impact Statement* (DOE INEL EIS) (DOE 1995), but includes updated data and a revised version of the Regional Input-Output Modeling System (RIMS II).

Socioeconomic impacts are addressed in terms of both direct and indirect impacts. Direct impacts are changes in INEEL employment and earnings expected to take place under each alternative and include both construction and operations phase impacts. Indirect impacts are the effects on regional economic activity that result form changes in U.S. Department of Energy (DOE) purchases of goods and services within the region expected to occur under any of the alternatives. The total economic impact to the ROI is the sum of direct and indirect effects. Both the direct and indirect effects 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 INEEL workforce. 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 (BEA 1997). The construction activities were represented by the New Construction, Maintenance, and Repair Industry, while operations activities were represented by the Industrial Inorganic and Organic Chemicals Industry.

The significance 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, provides the framework for analyzing the significance 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 the year 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.

E-1.2 Population, Housing, and Community Services

Population changes associated with the projected baseline conditions and the proposed alternatives are an important determinant of other social economic and environmental impacts. These population changes have three key components: (1) baseline growth, (2) relocation of workers and their dependents, (3) natural increase of population over the long term.

Because of the small size of the workforce associated with each of the AMWTP alternatives, the socioeconomic impact analyses assumed that all jobs could be filled by available workers currently residing in the ROI. The assumption was based on the types and number of jobs that would be required to implement each of the proposed alternatives, the composition of the work force currently residing in the ROI, and projected unemployment rates. Even if a small proportion of the required workforce were to migrate in from other regions, the number would be to small to have an effect on demographics and the housing market. Similarly, there would be no perceptible increase in demand for public services.

E-1.3 Key Assumptions

- The baseline workforce is assumed to be non-construction related.
- Construction and operations employment were assumed to be newly created jobs for all the alternatives.
- Construction staffing was based on project descriptions. Impacts were assessed for the peak year of construction.
- Operations staffing was based on project descriptions and assumed to be per year for the life of the project.
- Operations and construction staffing requirements could be filled by available workforce currently residing in the ROI.
- Wages for operations workers were based on project descriptions. An average wage of $26,286 was assumed for construction employees (Census 1997).
- The projected population trends for the ROI assume continuation of current operations at INEEL. The forecasts assumed a stable workforce through the year 2025.

E-2 GEOLOGY AND WATER

This section describes the methodology used to support the conclusions regarding the geologic hazards at the INEEL and local and regional water resources impacts for the four alternatives evaluated in this environmental impact statement. These conclusions resulted from an extensive review of existing documentation characterizing the geologic and hydrological conditions at the INEEL and a compilation of this material into a concise description of the existing conditions and potential impacts. This portion of Appendix E directly supports the summaries presented in Sections 4.6 and 5.6 (Geology) and 4.8 and 5.8 (Water Resources.)

E-2.1 Geology

The evaluation of geology at the INEEL site focused on the geologic hazards that could potentially impact the Radioactive Waste Management Complex (RWMC) and AMWTP project site. The following section discusses the studies used to determine the magnitude and likelihood of the hazards associated with seismicity and volcanism at the AMWTP project site.

E-2.1.1 Seismicity

The INEEL is located on the eastern Snake River Plain. The Snake River Plain extends in a broad arc from the Idaho-Oregon border on the west to the Yellowstone Plateau on the east. The plain varies in width from about 50 to 60 miles and is over 370 miles long (Figure E-2.1.1-1).

The mountains surrounding the eastern Snake River Plain are composed mostly of much older rocks (100 million to 600 million years) that were folded by compression forces about 60 million years ago. Starting about 17 million years ago and continuing today, extensional forces on these same rocks caused faulting (Link et al. 1988 and Pierce and Morgan 1992). The failure produced long north-to northwest-trending mountain ranges that extend both north and south from the margins of the eastern Snake River Plain. Those that extend north (the Lost River, the Lemhi Range, and the Beaverhead Range) are each bounded along their western sides by large active faults that are capable of generating earthquakes of magnitude 7 or slightly greater. The south ends of these faults lie very close to the western and northern boundaries of the INEEL and are the major sources of seismic hazards for INEEL facilities.

The largest recorded earthquake in the vicinity of the INEEL was the 1983 Borah Peak earthquake. This 7.3 earthquake, occurred on the middle portion of the Lost River Fault near the towns of Mackay and Challis, about 50 miles from INEEL. Peak horizontal accelerations ranged from 0.022 to 0.078g at the INEEL site from the Borah Peak earthquake (Jackson 1985). Another large earthquake, the Hebgen Lake earthquake (magnitude 7.5), occurred in 1959 on the Yellowstone Plateau about 125 miles from INEEL. No damage to INEEL facilities resulted from either earthquake (Jackson & Boatwright 1987).

Both of these earthquakes occurred within a parabolic zone of historic recorded seismicity and young faults (Figure E-2.1.1-1). This zone passes through the Yellowstone Plateau and flanks the eastern Snake River Plain (Andres et al. 1989). However, the INEEL seismic network and other networks show that the eastern Snake River Plain and adjacent parts of nearby mountain ranges form a zone of seismic inactivity or relatively low seismic activity inside the seismically active parabolic zone. During the 25 or more years of earthquake monitoring by the INEEL seismic network, only a few microearthquakes (magnitude less than 1.5) have occurred on or near the INEEL site (Jackson et al. 1993). Studies of the southern ends of the lost River and Lemhi faults near the towns of Arco and Howe show that earthquakes as large as the Borah Peak earthquake occurred there most recently about 20,000 years age (Woodward-Clyde 1992b,1995)

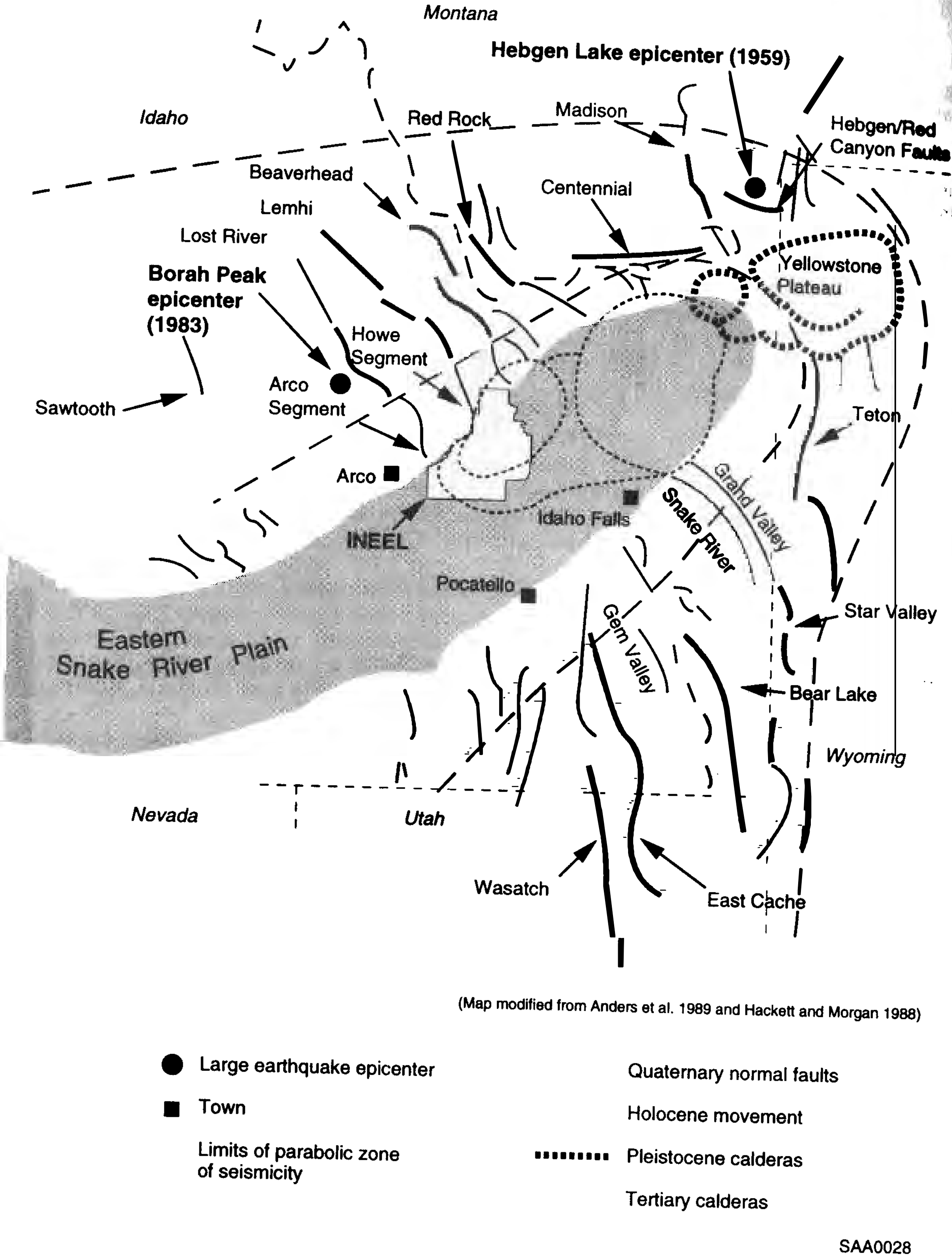

Figure E-2.1.1-1. Geologic features in the region of the INEEL.

For purposes of siting new facilities within the INEEL, a series of seismic hazard maps have been generated (Smith 1995). These maps show the levels of ground motion to be expected at various return periods using contour lines. The seismic hazard maps for return periods of 500 and 2000 years are shown in Figures E-2.1.1-2 and E-2.1.1-3, respectively. The contoured ground motions can be used for site selection purposes and as a general guide to the level of seismic hazard but not for design of facilities. The design of facilities must incorporate site-specific investigations.

A Site-Specific Probabilistic Seismic Hazard Analyses for the Idaho National Engineering Laboratory (INEL) (Woodward-Clyde 1996) was prepared using the results of the fault studies and other recent geologic and seismologic studies to determine the levels of ground motion to be expected at INEEL facilities (Woodward-Clyde 1996).

Figure E-2.1.1-4 shows the contribution of the three main source types to the mean hazard at the RWMC. The volcanic rift zones (VRZs) contribute very little to the total hazard compared to the regional source zones and the fault sources. The relative contributions of the fault sources increase as one considers longer period motions because of the increased effect of magnitudes on ground motion levels at longer periods, resulting in an increased domination of the hazard by larger magnitude events. The fault zones are expected to have higher frequency of large magnitude events and the largest maximum magnitudes compared to the nearby regional source zones.

Figure E-2.1.1-5 shows the relative contribution of the three fault sources at the RWMC. The Lost River fault contributes the most hazard because of its proximity and its relatively higher recurrence rates than the other two faults.

Figure E-2.1.1-6 shows the contribution to the mean hazard from the volcanic sources at the RWMC. The volcanic sources have minimal contribution to the RWMC site hazard because of their low activity rates and, in the case of the postulated Howe-East Butte zone, the low likelihood that it represents a distinct seismic source. The contribution to the seismic hazard from the various regional source zones at the RWMC is shown in Figure E-2.1.1-7. The northern Basin and Range source zone is the controlling regional source zone because of its proximity to the INEEL and its relatively high rate of seismicity compared to the eastern Snake River Plain. The eastern Snake River Plain source contributes to the hazard at very low probability levels

E-2.1.2 Volcanism

The most significant volcanic hazard to INEEL facilities is basaltic volcanism, since it has occurred more recently, has covered more area, and has the potential to occur nearer INEEL facilities. Geologically young volcanic activity in the INEEL area consists of eruption of basalt lava flows and the building of rhyolite domes (Kuntz et al. 1992). Basalts exposed at the surface of the INEEL range in age from over 1 million years to about 12,000 years. Basalts a few miles away from the INEEL at Hell's Half Acre lava field are about 5,000 years old. At Craters of the Moon National Monument a few miles to the west of the INEEL, the basalts are as young as 2,000 years. The vent areas for basaltic lava flows are not randomly distributed on the eastern Snake River Plain but are concentrated in elongate northwest-trending volcanic rift zones and along the Axial Volcanic Zone (Figure E-2.1.2-1). Rhyolite domes occur along the axis of the plain at the Big Southern Butte (30,000 years old), and East Butte (600,000 years old), and probably the Middle Butte (age unknown).

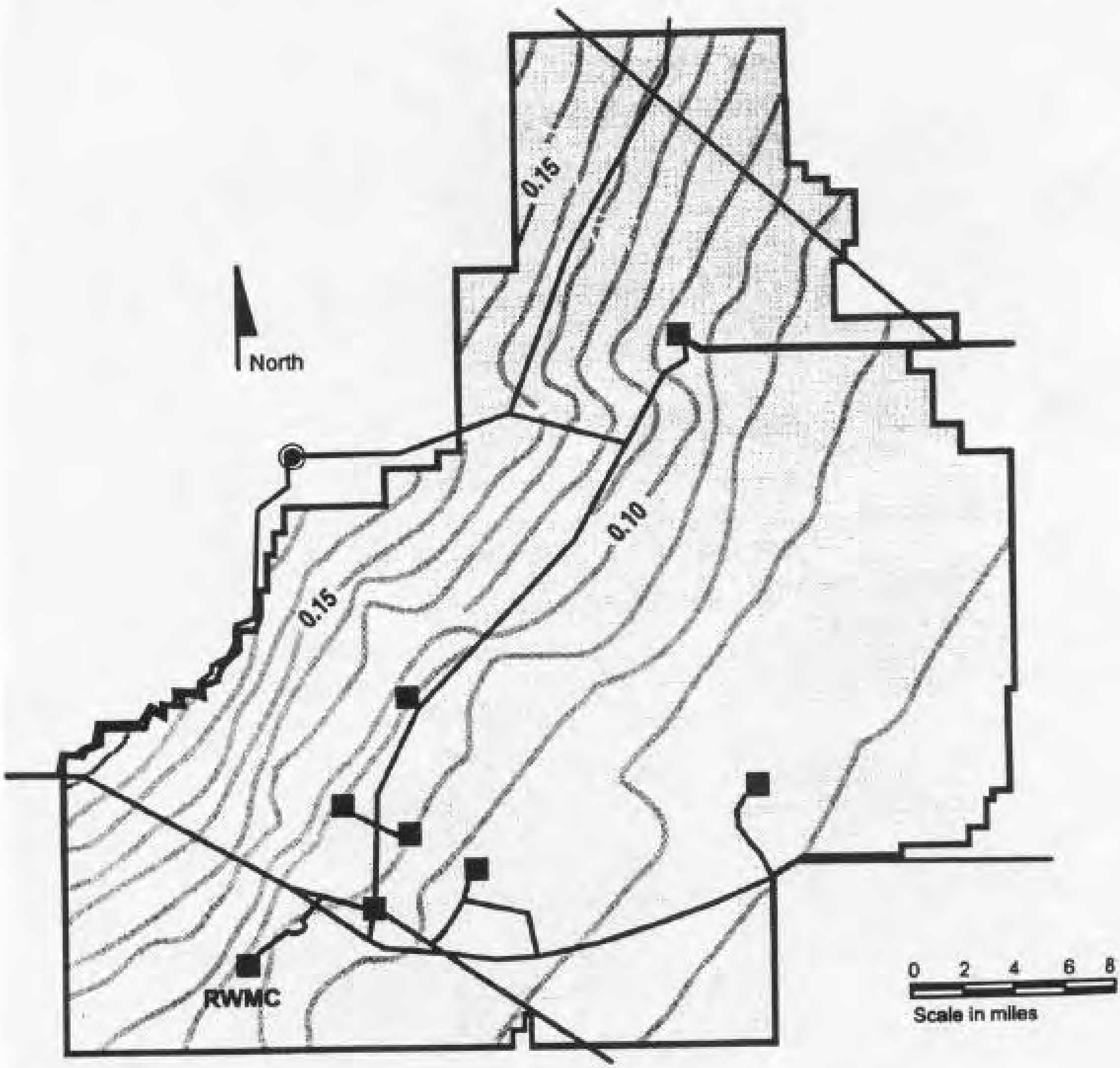

Figure E-2.1.1-2. Seismic hazard map for a return period of 500 years.

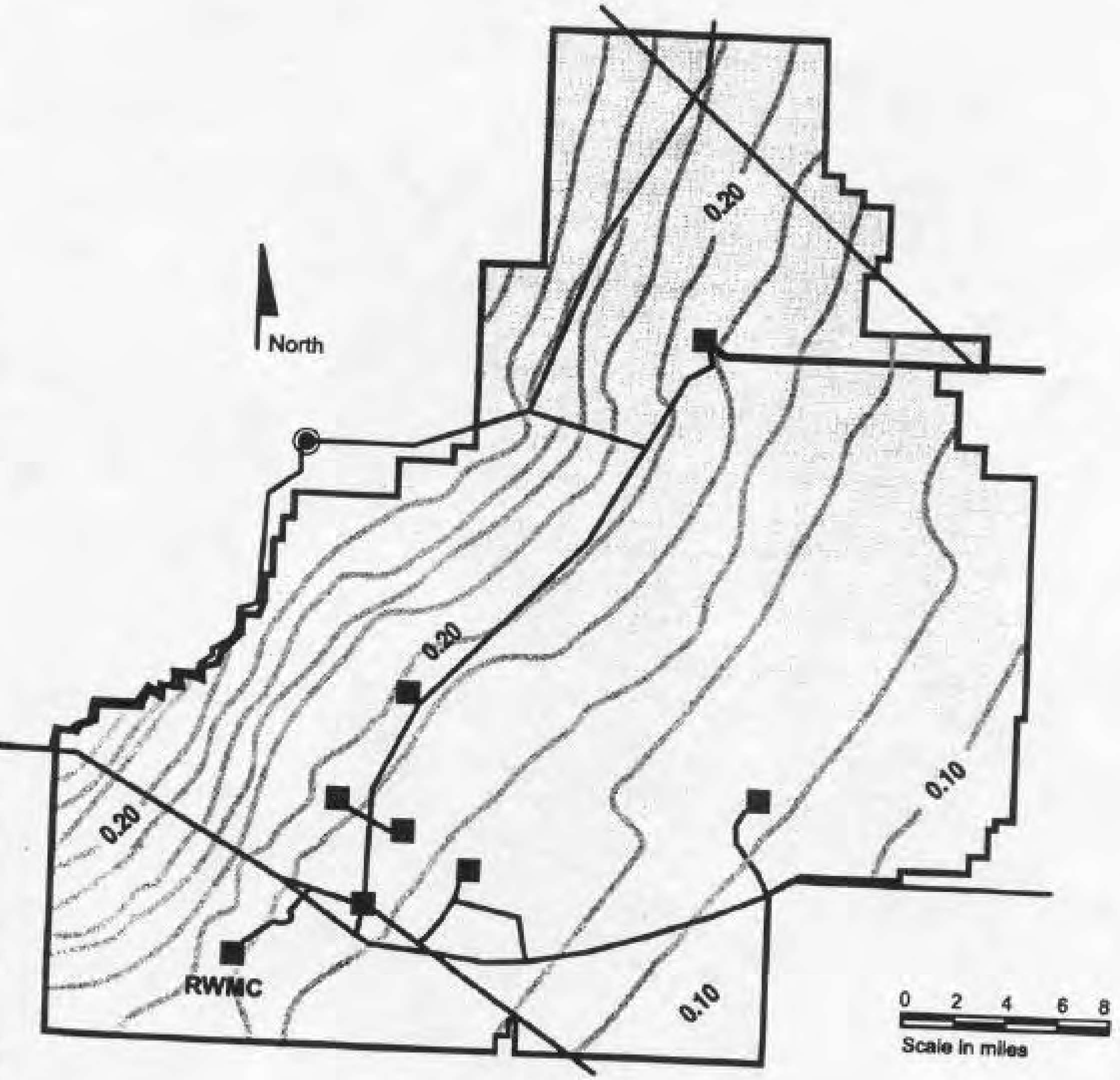

Figure E-2.1.1-3. Seismic hazard map for a return period of 2000 years.

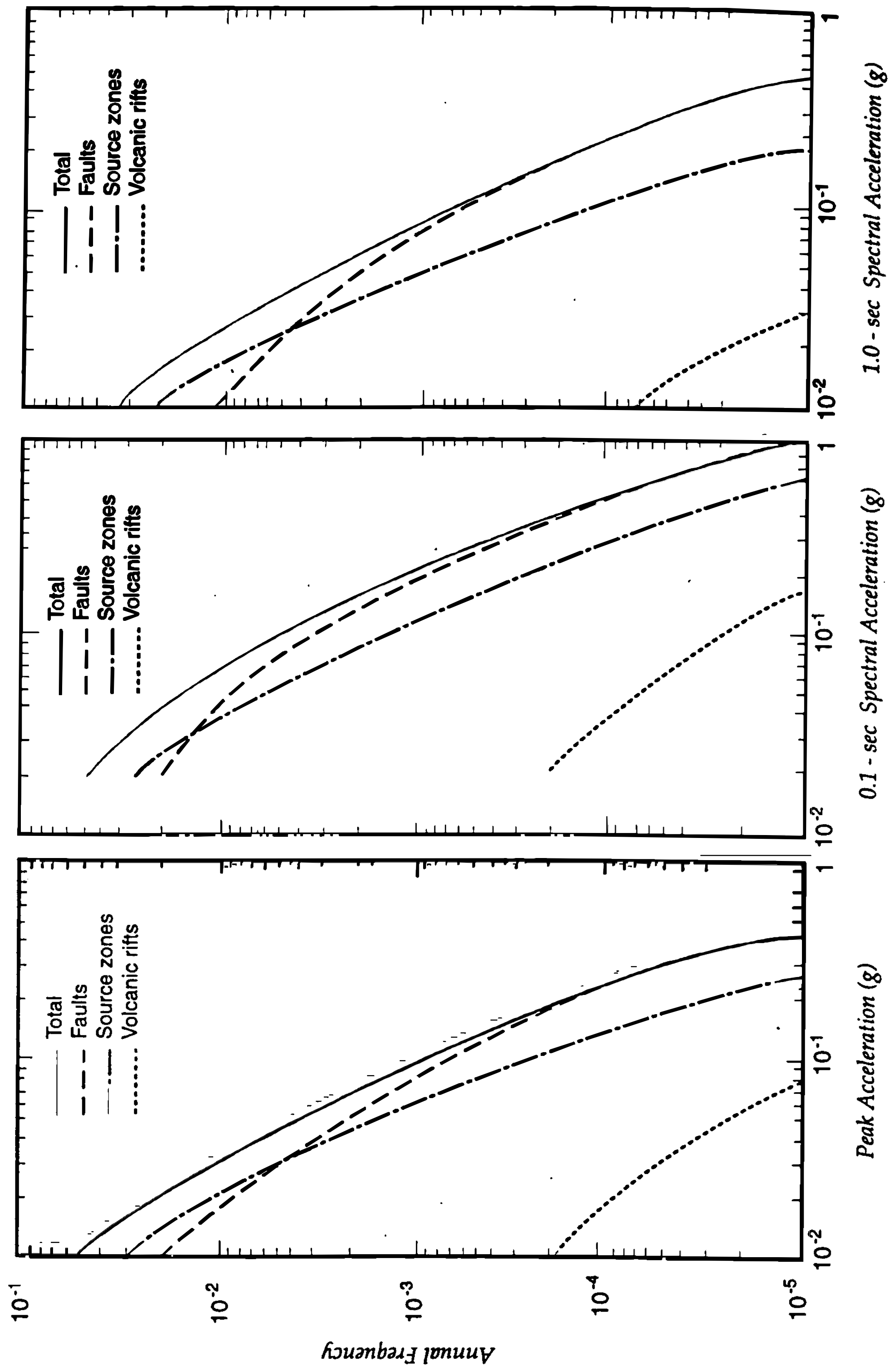

Figure E-2.1.1-4. Contributions of the seismic sources to the mean seismic hazard at RWMC.

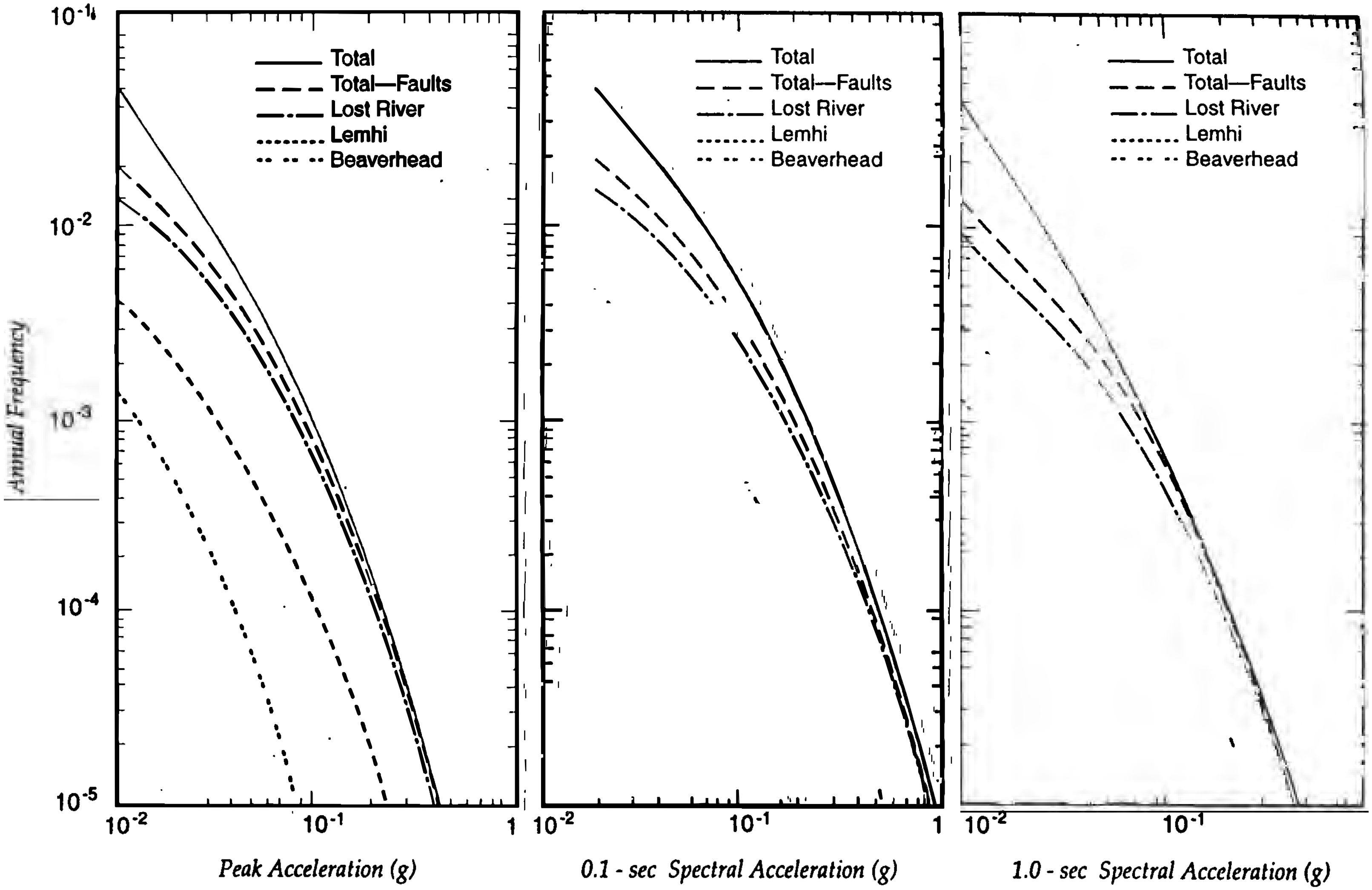

Figure E-2.1.1-5. Contributions of the fault sources to the mean seismic hazard at RWMC.

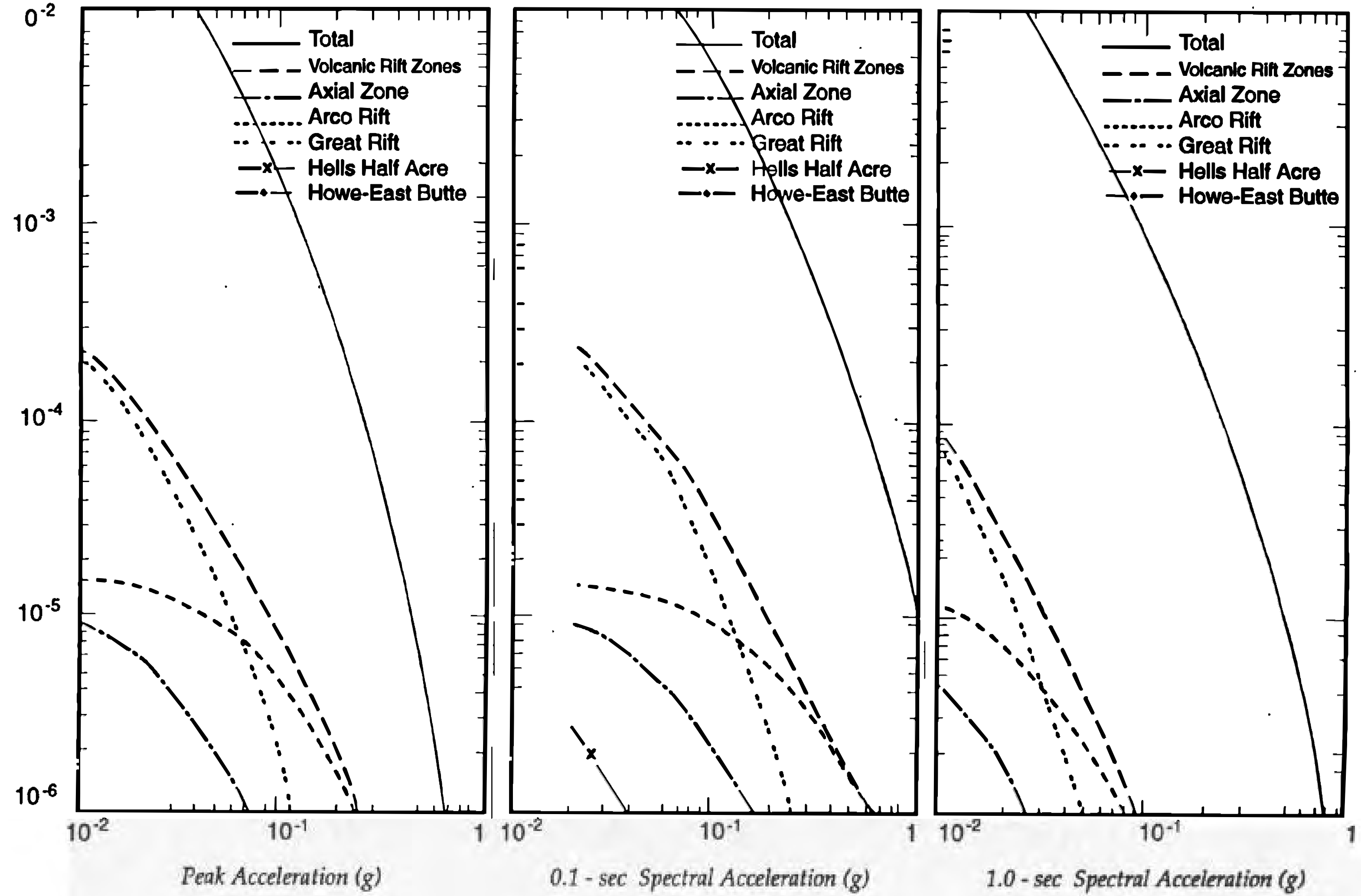

Figure E-2.1.1-6. Contributions of the volcanic sources to the mean seismic hazard at RWMC

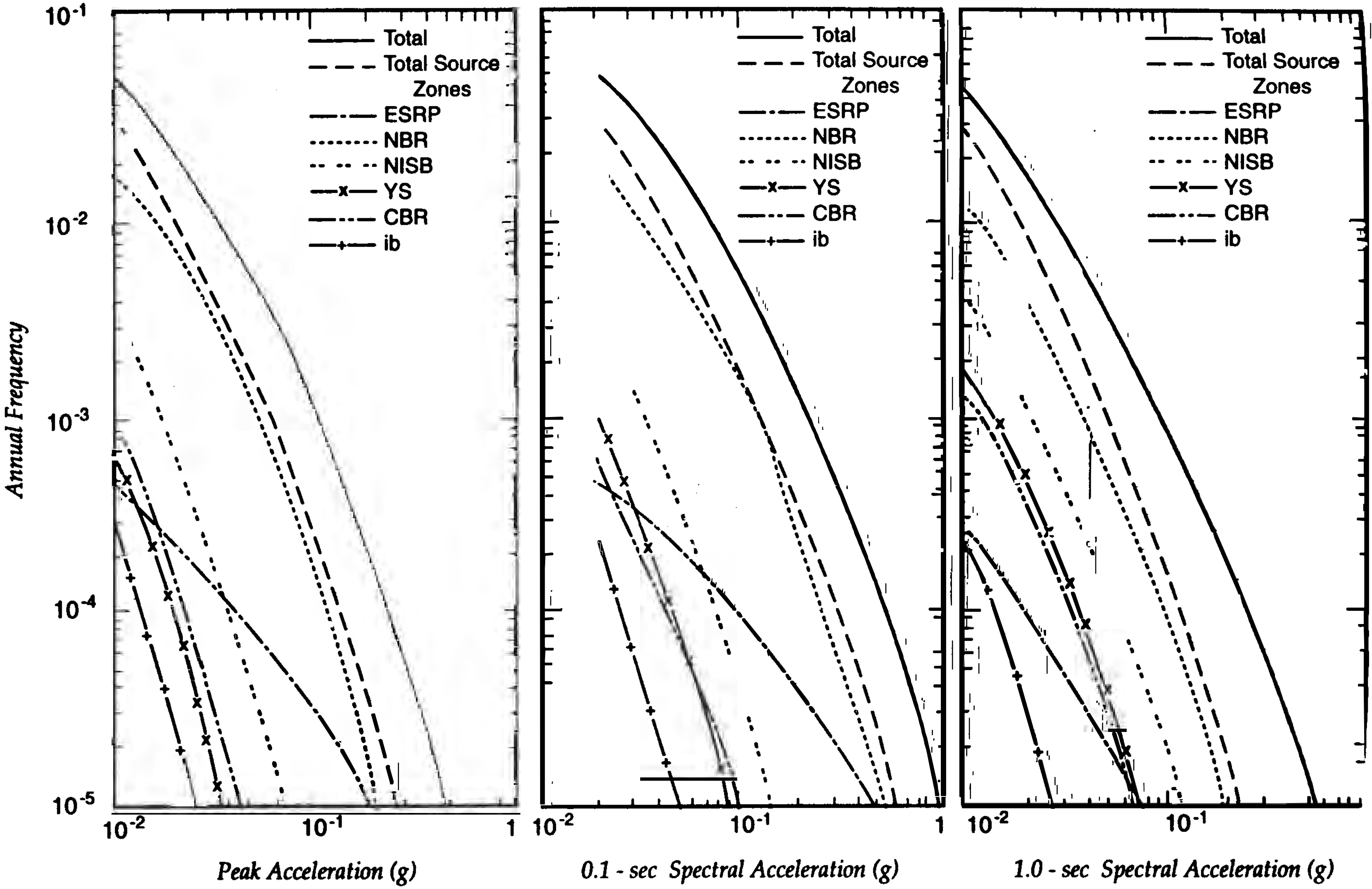

Figure E-2.1.1-7. Contributions of the regional source zones to the mean seismic hazard at RWMC.

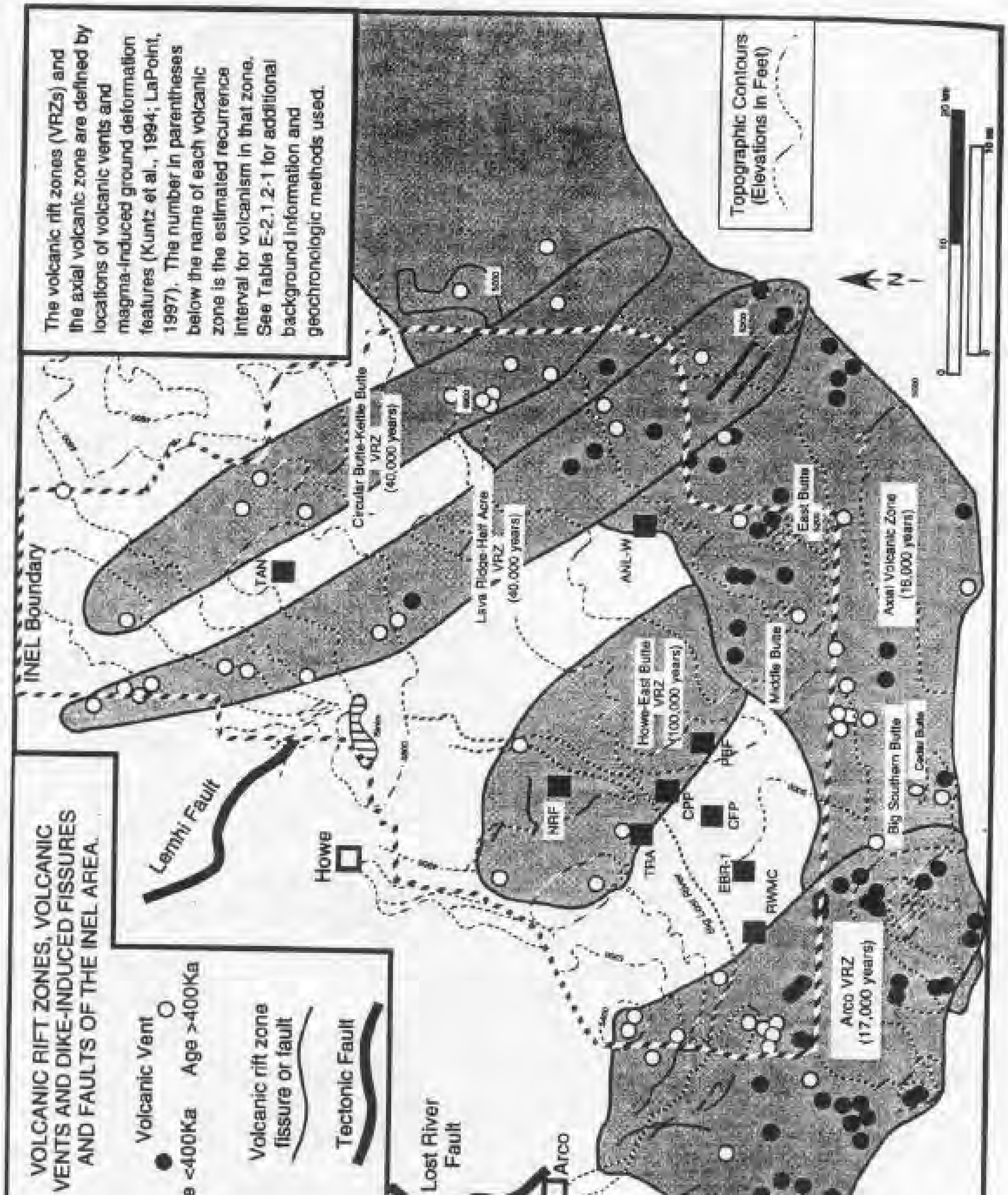

Figure E-2.1.2-1. Map showing volcanic vents and volcanic recurrence intervals for volcanic zone in the INEEL region.

Table E.2.1.2–1. Estimated volcanic-recurrence intervals and corresponding annual eruption probabilities (in parentheses) for volcanic zones and boreholes of the INEEL area.

Volcanic zone or borehole	Data sources	Time interval of volcanism	Number of vents fissures or flow groups	Comments	Estimated recurrence interval
Great Rift (25 km southwest of INEEL)	Kuntz et al., 1986, 1988	2,100 - 15,00 yrs (radiocarbon dating)	> 100 vents; 8 Holocene eruptive periods (each lasting a few decades or centuries, and each including multiple flows and cones)	No impact on INEEL; most recently and frequently active of all Eastern Snake River Plain rift zones; thus provides minimum recurrence for entire Eastern Snake River Plain; most probable area of future Eastern Snake River Plain volcanism	2,000 yrs ($5x10^{-4}$/yr)
Axial Volcanic Zone (southern INEEL)	Kuntz et al., 1986, 1994	5,000 - 730,000 yrs K-Ar dating; radiocarbon; paleomagnetic data)	73 vents & fissure sets; Holocene lava fields, 3 of them shared by VRZs. 45 cogenetic vent/fiss gps	Could affect much of southern INEEL; most recently and frequently active of all volcanic zones that could impact INEEL	16,000 yrs ($6.2x10^{-5}$ /yr)
Arco VRZ (southwestern INEEL)	Kuntz, 1978; Smith et al., 1989; Kuntz et al., 1994	10,000 - 600,000 yrs (radiocarbon, K-Ar and TL dating; paleomagnetic data)	83 vents & fissure sets; 2 Holocene lava fields. 35 cogenetic vent/fiss gps	Volcanism could affect southwestern INEEL	17,000 yrs ($5.9x10^{-5}$ /yr)
Lava Ridge-Hells Half Acre VRZ (Includes Circ Butte/kettle Butte volc rift zone) (north & eastern INEEL)	Kuntz et al., 1986, 1994	5,000 - 1,200,000 yrs (K-Ar dating; radiocarbon; paleomagnetic data)	48 vents & fissure sets; 1 Holocene lava field: Hells Half Acre. 30 cogenetic vent/fiss gps	Could affect northern & eastern INEEL; extremely long eruptive history; includes oldest and youngest basalts in the INEEL area	40,000 yrs ($2.5x10^{-5}$ /yr)
Howe-East Butte Volcanic Rift Zone (central INEEL)	Kuntz, 1978, 1992; Golder Associates, 1992	230,000 - 730,000 yrs (K-Ar dating; paleomagnetic data)	7 vents & fissure sets; no Holocene features. 5 cogenetic vent/fissure groups	Old, poorly exposed and sediment-covered; identified in part by subsurface geophysical anomalies	100,000 yrs ($1.0x10^{-5}$ /yr)
Borehole NPR SITE E (south-central INEEL)	Champion et al., 1988	230,000 - 640,000 yrs (K-Ar dating; paleomagnetic data)	9 lava-flow groups (each group contains multiple flows, erupted over a short time)	Dates from 600-foot interval of subsurface lavas give recurrence estimate consistent with surficial geology of the area	45,000 yrs ($2.2x10^{-5}$ /yr)
Borehole RWMC 77-1 (southwestern INEEL)	Kuntz, 1978; Anderson & Lewis, 1989	100,000 - 565,000 yrs (K-Ar and TL dating; palemagnetic data)	11 lava-flow groups (each group contains multiple flows, erupted over a short time)	Dates from 600-foot interval of subsurface lava give longer recurrence interval than nearby Arco & Axial zones, reflecting flow-group (sub-surface) vs. vent-counting (surface geology) approaches	45,000 yrs ($2.2x10^{-5}$ /yr)

Source: Woodward-Clyde 1996.

The Axial Volcanic Zone (16,000 year recurrence) provides a bounding value of eruption probability for the INEEL volcanic zones because it has erupted most frequently, and because the southern parts of the Arco-and Lava Ridge-Hell's Half Acre VRZ merge with it (Table E-2.1.2-1). Specific sites of future eruptions cannot be forecast, however, as estimate of the probability of future lava flows inundating a random site within a VRZ can be constructed. Hackett and Smith (1994) estimated the general probability for lava flow inundation within each of the INEEL volcanic zones. They assumed that every eruption would produce a lava flow of average dimensions, and terrain factors were ignored. The average INEEL lava flow of the past 40,000 years is 5 miles long and covers 18 square miles. The annual probability of a 18 mi^2 lava flow inundating a random site within the Axial Volcanic Zone (386 mi^2 area) is $2.9x10^{-6}$ per year. The Arco VRZ has erupted about as frequently as the Axial Volcanic Zone, and it covers about 115 square miles. The annual probability for the Arco Volcanic Zone is approximately $9.3x10^{-6}$ per year. For a random site within the Lava Ridge-Hell's Half Acre VRZ (193 mi^2 area), the probability is about $2.4x10^{-6}$ per year.

It is important to emphasize that these probabilities are not equivalent to site-specific risk assessments, because only source terms were considered within the context of several simplifying assumptions. Site-specific assessments must incorporate other factors including distance from the source zone(s), the influence of local terrain upon lava paths, the consequences of volcanic effects, and the potential success of mitigation measures (e.g., construction of barriers or removal of property).

Other hazardous phenomena (i.e., tephra fall, volcanic-gas emissions, and magma-induced ground deformation) are expected to accompany virtually all basaltic volcanic eruptions, however, the affected areas are assessed to be smaller than the areas inundated by lava flows (Hackett & Smith 1994).

E-2.2 Water Resources

The evaluation of potential consequences to water resources at the INEEL, particularly the RWMC, focused on flooding potential, water quality and water use. The following sections discuss the methods and references used to determine impacts resulting from the implementation of the waste management activities for the proposed alternatives.

DOE conducted an extensive review of the INEEL's potential environmental consequences to water resources for the alternatives (DOE INEL EIS Sections 4.8, 5.8 and Appendix F.2.2). In lieu of duplication of that discussion in this environmental impact statement (EIS), the applicable sections of the DOE INEL EIS Volume 2 (Appendix F.2.2) for surface and subsurface water, and water use are referenced, and new information and data applicable to water resources are provided.

E-2.2.1 Surface Water

Surface water studies and data were reviewed during a literature search performed for this EIS. This section presents the methodology used for the analyses of potential impacts of the AMWTP alternatives to natural and artificial (manmade) surface waters on and in the vicinity of the RWMC. These methods were used to determine existing surface water quality and flood potential.

The U.S. Geological Survey (USGS) has been compiling surface water quality data for many years at the INEEL. Many potential sources of surface water contamination are identified also in the Federal Facility Consent Order. All potential contamination sources were evaluated, including facility-specific activities, material inventory, past spills and leaks, nonpoint source water discharge, and existing storm water monitoring data (DOE INEL EIS, Appendix F.2.2.1.1).

Under the Clean Water Act, two National Pollutant Discharge Elimination System (NPDES) General Permits for Storm Water Discharges were issued for the INEEL; one for industrial activities and one for construction activities. The permit requirements for both of these activities specify the development of a Site-Wide Storm Water Pollution Prevention Plan. Any facility at the INEEL having the potential to discharge storm water to the Big Lost River System associated with industrial or construction activities is subject to the monitoring and reporting requirements of the INEEL.

Water samples are collected during each quarter when sufficient rain falls or snow melts to produce enough runoff from the Transuranic Storage Area (TSA) asphalt pads and in the Subsurface Disposal Area (SDA) gate ditch. One sample is collected from the outfall that drains off of the TSA asphalt pads. In addition, a sample is taken at the point of discharge from the SDA near the sump pump. A control sample is collected to determine background concentrations of the radionuclides of interest at a location unaffected by facility operations upgradient of the SDA (LMITCO 1996). Results of the sampling are discussed in Section 4.8, Water Resources.

In addition, several USGS and INEEL studies have been conducted concerning flood potential at the INEEL. The USGS estimated peak flow and flow volume from the Big Lost River for a 100-year flood event. The estimated peak flow was 7,260 cubic feet per second. The estimated volume of flow for a 60-day period from a flood event likely to occur once in 100 years (100-year flood event) was 390,000 acre-feet for the entire INEEL (DOE-ID 1997c) (Kjelstrom and Berenbrock 1996). Acre-feet is the unit of measure in which one foot of water would cover one acre.

Dames and Moore (1993) conducted a flood design evaluation for the RWMC. The scope of work included hydrologic analyses including the development of 100-, 500-, 1,000-, and 10,000-year storm event, 1/2 probable maximum flood, and probable maximum flood hydrographs for subbasins contributing surface runoff to the Main Channel Flow System and East Channel Flow System at the RWMC. The work also included preparation of 100-year flood and probable maximum flood inundation map, development of alternative 100-, 500-, and 1,000-year rain-on-snow scenarios, and computation of revised flood elevations, along with surface runoff hydrographs for two specific cases. The utilized methodology divided the RWMC watershed basin into 21 separate drainage catchments (subbasins) for purposes of hydrologic analysis. The analysis was based on the probable maximum precipitation for each of the storm events analyzed. Subbasins were determined by delineating natural watershed boundaries for each catchment that is a tributary to the RWMC. Estimation of precipitation losses, times of concentration, and lag times were defined using a minimum of four different methods, respectively. These methods were analyzed through the U.S. Army Corps of Engineers flood hydrograph package modeling programs, Hydrologic Engineering Center (HEC)-1 for peak discharges and HEC-2 for water surface profiles, for the Main and East Channel Flow Systems to Big Lost River (Dames and Moore 1993). Based on the current drainage engineered structures (culverts and ditches), the study indicates that no flooding would occur for the 100-, 500-, 1,000- and 10,000-year storm event for the RWMC, specifically within the SDA. For the 1/2 probable maximum flood and probable maximum flood, overtopping of the culvert on Adams Boulevard would occur for the box culvert. The 100-year flood inundation map is presented in the report (Dames and Moore 1993).

In addition to the Dames and Moore report, the USGS plans to determine the extent of the 100-year floodplain for the Big Lost River and Birch Creek at the INEEL. A simulated 100-year peak flow, using a computer model, will be routed downstream to spreading areas and playas on the INEEL (DOE-ID

1997c). This modeling effort methodology will be similar to the study conducted by Dames and Moore in 1993 (Dames and Moore 1993).

E-2.2.2 Subsurface Water

The Snake River Plain Aquifer arcs approximately 220 miles through eastern Idaho's subsurface and varies in width from 50 to 70 miles (Becker et al. 1996). Total area of the Snake River Plain Aquifer is estimated at 9,600 square miles. Depth to groundwater at the INEEL ranges from approximately 200 feet below land surface in the north to over 900 feet in the south (Becker et al. 1996). The Snake River Plain Aquifer has been estimated to hold $2.5x10^{12}$ cubic meters of water, which is approximately equivalent to the amount of water contained in Lake Erie, or enough water to cover the entire State of Idaho to a depth of 4 feet (Becker et al. 1996). Water is pumped from the aquifer primarily for human consumption and irrigation. The INEEL's use of the aquifer is minor (Becker et al. 1996).

Groundwater parameters reviewed for this EIS were aquifer permeability, recharge and discharge areas, groundwater flow, and groundwater quality and use.

Improvement in management practices since 1952 at the RWMC have resulted in differences in soil covers, thickness, land contours, vegetation types, and proximity of buried waste to roads and ditches. Each of these factors influences soil moisture dynamics in the protective soil caps. Since 1988, the Environmental Science and Research Foundation has measured soil moisture on eight study sites within the RWMC, mostly during the late winter, early summer, and fall. Throughout that period, precipitation during the non-growing season ranged from 46.6 to 135.5 percent of normal (DOE-ID 1997c). Soil moisture recharge was generally less than 16 inches deep for all areas and years except for 1989, 1993 and 1995. During those years maximum infiltration was recorded at depths of up to 4.5 feet (DOE-ID 1997c).

Infiltration rate studies have been conducted at the RWMC and ranged from 0.14 inches per year in undisturbed sediments to 6.9 feet per day inside the SDA (i.e., disturbed sediments) within the RWMC (Becker et al. 1996). The basalt takes from 0.016 feet per day under normal infiltration conditions (i.e., undisturbed basalt under natural flow conditions) to 16.9 feet per day through fractured basalt during the aquifer pumping and infiltration test (i.e., pumping from a well) near the RWMC (Becker et al. 1996).

The Snake River Plain Aquifer is primarily recharged by infiltration from rain and snowfall that occurs within the drainage basin surrounding the Eastern Snake River Plain and from deep percolation of irrigation water and stream flow from rivers that lose water along their flowpaths. All rivers contribute to recharging the Snake River Plain Aquifer (Becker et al. 1996). If streamflow exists on the INEEL, it is lost to the ground and eventually recharges the Snake River Plain Aquifier (Becker et al. 1996).

Aquifer permeability is controlled by the distribution of highly fractured basalt flow tops, interflow zones, lava tubes, fractures, vesicles, and intergranular pore spaces. The variety and degree of interconnected water-bearing zones complicates the direction of groundwater movement locally throughout the aquifer (Becker et al. 1996). The permeability of the aquifer varies considerably over short distances, but generally, a series of basalt flows will include several excellent water-bearing zones. Estimates of flow velocities within the Snake River Plain Aquifer range between 5 and 20 feet per day. Transmissivity values range from 1.1×10^0 to 1.2×10^7 square feet per day (Becker et al. 1996). Depth to groundwater near the RWMC is approximately 590 ft (Becker et al. 1996).

Discharge areas occur at springs and from pumping wells for water consumption. Major springs and see pages that flow from the aquifer on a regional scale are located near the American Falls Reservoir (southwest of Pocatello), the Thousand Springs area between Millner Dam and King Hill (near Twin Falls), and between Lorenzo and Lewisville, along the Snake River (DOE INEL EIS, Section 4.8.2.1).

Groundwater chemistry data were obtained by water sampling and chemical analysis. Sampled monitoring wells are purged until field parameters (pH, temperature, and specific conductivity) stabilize. This ensures that the sampled water is formation water and not residual water that has been chemically altered in the well. The USGS has been routinely monitoring wells at the INEEL since 1949 and uses these methods of sampling. Analytical techniques used to determine concentrations of solutes include liquid scintillation and alpha, beta, and gamma testing for radionuclides; atomic adsorption for metals and anions; and gas chromatography/mass spectrometry for volatile organic compounds. Recently, studies have used inductively coupled plasma-mass spectrometry for chemical analysis of cations, which offers lower detection limits and an expanded analyte list (DOE-ID 1997c). In 1996, the USGS routine groundwater surveillance program included collection of 374 samples for radionuclides and inorganic constituents including trace elements and 66 purgeable organic compounds on the INEEL.

Fate and transport modeling for the INEEL has been conducted previously and is discussed thoroughly in the DOE INEL EIS (Sections 5.8.1, 5.8.2.2, and Appendix F.2.2.2.3). Recent modeling activities include the fate and transport of volatile organic compounds for the SDA within the RWMC. The computer code used was PORFLOW™ and the analysis was conducted by Lockheed Idaho Technologies Company, Buried Waste and Landfill Department (Becker et al. 1996). This numerical simulation was conducted after installment of the vapor vacuum extraction wells. The wells were installed as part of a Record of Decision (ROD) between DOE, U.S. Environmental Protection Agency (EPA) and the State of Idaho to use the vapor vacuum extraction with treatment. Future modeling of the SDA for the proposed remedial investigation/feasibility study of Operable Unit 7-13/14 is planned for the future (Becker et al. 1996).

E-3 AIR RESOURCES

The characterization of air resources and assessment of impacts of alternative courses of action required (1) the performance of air dispersion modeling, and (2) the evaluation of results in terms of regulatory criteria developed to protect public health and welfare. Section E-3 presents background information related to these topics. The information presented herein supports the summary results presented in Sections 4.7 and 5.7 (Air Resources) and Sections 4.3 and 5.3 (Visual and Aesthetic Resources) of this EIS, which respectively describe the affected environment and consequences of alternatives on air quality.

The air resource assessments performed in support of this EIS utilized independent analyses performed by specialists from contractor organizations, as well as tiering from the DOE INEL EIS. Documents which are considered key references, their contents, and the manner in which they were used in the air resources assessments are summarized as follows:

- Application for a State of Idaho Permit to Construct (BNFL 1998c) and National Emission Standard for Hazardous Air Pollutants (NESHAP) (BNFL 1998a) analysis for radiological impacts. These documents provide data on facility location, design and projected emission rates.

- Material and energy balance calculations which were prepared to support permitting of the proposed AMWTP (BNFL 1998b). This document is also cited in the above-mentioned permit applications in support of emission calculations for criteria and selected toxic air pollutants.

- INEEL radiological NESHAP Reports for the calendar years 1995 and 1996 (DOE-ID 1996d, 1997b) were used to establish the existing radiological conditions in terms of airborne radionuclide emissions and highest dose to an offsite receptor.

- INEEL air emissions inventory for the years 1995 and 1996 (DOE-ID 1996b, 1997a) were used to update the criteria pollutant emission rates from existing INEEL facilities. These were compared with the emission rates which were used in the DOE INEL EIS to ensure that the current rates are within the bounds of those used in the DOE INEL EIS as a basis for characterizing existing conditions through atmospheric dispersion modeling.

Section E-3 attempts to integrate the descriptions of methods, assumptions, and other key information from the analyses cited above into a single source. The remainder of this section is organized as follows:

- Section E-3.1 presents background environmental information on the INEEL.

- Section E-3.2 contains a description of air quality standards and regulations, and a discussion of how they apply to sources at the INEEL. This section also details the controls incorporated into the proposed AMWTP to minimize air quality impacts and ensure regulatory compliance.

- Section E-3.3 provides supplemental information on the methods and assumptions used to estimate emissions and assess baseline conditions and impacts of releases of radiological and nonradiological pollutants.

E-3.1 The Idaho National Engineering and Environmental Laboratory Environment

This section describes background levels of radiation, airborne radioactivity, and nonradiological air quality in the environs of the INEEL.

E-3.1.1 Radiation and Airborne Radioactivity

The population of the Eastern Snake River Plain is exposed to environmental radiation from both natural and other sources of human origin. The predominant source of radiation in the region is the natural radiation background, a term that refers to natural sources of radiation to which humans are continuously exposed. 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). The dose from background radiation results from sources that can be either external (outside the body) or internal (within the body). External sources consist primarily of cosmic rays and radioactivity within soil and rocks. Internal sources include radioactivity naturally present within the human body and airborne radioactivity of natural origin that can deposit in the lungs when inhaled. 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 1997b).

In addition to natural background sources, residents of the Eastern Snake River Plain receive exposure from other sources of human origin, including medical X-rays, nuclear medicine diagnostic procedures, consumer products (such as televisions, smoke detectors, or self-luminous products), and radioactivity remaining in the environment as a result of worldwide atmospheric testing of nuclear weapons. Collectively, these result in an annual dose of about 68 millirem to the average U.S. population member, with most of this dose (about 54 millirem per year) resulting from the medical use of radiation (NCRP 1987). This dose does not include the contribution from radioactivity in tobacco products, which results in a substantial radiation dose (several rem per year) to the lungs of smokers. Additional information related to radiological conditions (including monitoring results and airborne radioactivity associated with existing INEEL facilities) is presented in the site environmental report (DOE-ID 1997c).

E-3.1.2 Background Nonradiological Air Quality

As used here, the term background air quality refers to the levels of nonradiological air pollutants in ambient air that are not attributable to INEEL activities. Regional ambient air monitoring data is sparse, however, it is recognized that air quality in the area is good. Some data have been collected by the National Park Service (NPS) at Craters of the Moon Wilderness Area. That monitoring program has shown no exceedances of the primary ozone standard, low levels of sulfur dioxide, although there was one exceedance for the 24-hour maximum standard in 1985, and total suspended particulate matter within the applicable standards.[1] The NPS has concluded that available data do not currently indicate a significant threat to Craters of the Moon Wilderness Area from gaseous pollutants (DOI 1994, Section IV.B.3.a.iii). More

[1] Standards for total suspended particulates have since been replaced with standards for respirable-sized particulate matter, usually referred to as PM-10.

recently the NPS has upgraded this program to include aerosols and fine particulates. The NPS also monitors parameters related to the estimation of background visual range, which they have estimated to be 144 miles annual average (Notar 1998a).

E-3.2 Air Quality and Environmental Protection Standards and Regulations

Air quality regulations have been established by Federal and State agencies to protect the public from potential harmful effects of air pollution. The Federal *Clean Air Act* (CAA) establishes the framework to protect the nation's air resources and public health and welfare.

EPA and the State of Idaho are jointly responsible for establishing and implementing programs that meet the requirements of the CAA. These regulations are based on an overall strategy that incorporates the following principal elements:

- Designation of acceptable levels of pollution in ambient air to protect public health and welfare;
- Implementation of a permitting program to regulate (control) emissions from stationary (nonvehicular) sources of air pollution; and
- Issuance of prohibitory rules, such as rules prohibiting open burning.

Facilities planned or currently operating at the INEEL are subject to air quality regulations and standards established under the CAA and by the Idaho Department of Health and Welfare (IDHW), Division of Environmental Quality, and to internal policies and requirements developed by DOE for the protection of the environment and health. At the INEEL, programs have been developed and implemented to ensure compliance with air quality regulations by (1) identifying sources of air pollutants and obtaining necessary State and Federal permits, (2) providing adequate control of emission of air pollutants, (3) monitoring emissions sources and ambient levels of air pollutants to ensure compliance with air quality standards, (4) operating within permit conditions, and (5) obeying prohibitory rules. Air quality standards and programs applicable to INEEL operations are summarized in Figure E-3-1 and are described in further detail below. This section also provides information on project design features to mitigate air quality impacts and operate within the bounds of regulatory requirements.

Clean Air Act

Federal Program

National Ambient Air Quality Standards (NAAQSs)
- Set limits on ambient air concentrations of sulfur dioxide, nitrogen dioxide, respirable particulate matter, carbon monoxide, lead, and ozone (criteria pollutants).
- Primary standards for protection of public health; secondary standards for protection of public welfare.

Prevention of Significant Deterioration (PSD)
- Limits deterioration of air quality and visibility in areas that are better than the NAAQSs.
- Requires Best Available Control Technology on major sources in attainment areas.

New Source Performance Standards
- Regulate emissions from specific types of industrial facilities (for example, fossil fuel-fired steam generators and incinerators).

National Emission Standards for Hazardous Air Pollutants (NESHAP)
- Control airborne emissions of specific substances harmful to human health.
- Specific provisions regulate hazardous air pollutants and limit radionuclide dose to a member of the public to 10 millirem/year.
- Proposed regulation will control emission of hazardous air pollutants from combustion of hazardous waste.

Clean Air Act (CAA) Amendments of 1990
- Sweeping changes to the CAA, primarily to address acid rain, nonattainment of NAAQSs, operating permits, hazardous air pollutants, potential catastrophic releases of acutely hazardous materials, and stratospheric ozone depletion.
- Specific rules and policies not yet fully developed and implemented in all areas (for example, hazardous air pollutants).

State of Idaho Administration Program

Rules for the Control of Air Pollution in Idaho
Current Regulations of the State of Idaho Department of Health and Welfare (IDHW 1997) include:

- **Idaho Ambient Air Quality Standards -** Similar to NAAQSs but also include standards for total fluorides.
- **New Source Program -** Permit to construct is required for essentially any construction or modification of a facility that emits an air pollutant; Major facilities require PSD analysis and permit to construct.
- **Carcinogenic and Noncarcinogenic Toxic Air Pollutant Increments -** Defines acceptable ambient concentrations for many specific toxic air pollutants associated with sources constructed or modified after May 1, 1994; Requires demonstration of preconstruction compliance with toxic air pollutant increments.
- **Operating Permits -** Required for nonexempt sources of air pollutants; Define operating conditions and emissions limitations, as well as monitoring and reporting requirements.

Rules and Standards for Hazardous Waste
- Includes standards for hazardous waste treatment facilities, including limits on emissions.
- Consistent with federal standards.

DOE Compliance Program

Policy to comply with applicable regulations and maintain emissions at levels as low as reasonably achievable.
Policy implemented through DOE orders.

- DOE (Headquarters) orders apply to all DOE and DOE-contractor operations.
- DOE-Idaho Operations Office (DOE-ID) supplemental directives provide direction and guidance specific to the INEEL.

The most relevant DOE orders and their DOE-ID supplemental directives are:

- **DOE Order 5400.1** establishes general environmental protection program requirements and assigns responsibilities for ensuring compliance with applicable laws, regulations, and DOE policy.
- **DOE Order 5400.5** provides guidelines and requirements for radiation protection of the public.
- **DOE Order 5480.1B** establishes the Environment, Safety, and Health (ES&H) Program for DOE operations (implemented via DOE-ID Supplemental Directive 5480.1).
- **DOE Order 5480.4** prescribes the application of mandatory ES&H standards that shall be used by all DOE and DOE-contractor operations (implemented via DOE-ID Supplemental Directive 5480.4).
- **DOE Order 5480.19** provides guidelines and requirements for plans and procedures in conducting operations at DOE facilities (implemented via DOE-ID Supplemental Directive 5480.19).

Figure E-3-1. Overview of Federal, State, and DOE programs for air quality management.

E-3.2.1 Ambient Air Quality Standards

The CAA establishes National Ambient Air Quality Standards (NAAQS) to protect public health and welfare. Primary standards define the ambient concentration of an air pollutant below which no adverse impact to human health is expected. A second category of standards (called secondary standards) has been established to prevent adverse impacts on public welfare, including aesthetics, property, and vegetation. Certain standards apply to long-term (annual average) conditions; others are short-term, applying to conditions that persist for periods ranging from one hour to three months, depending on the toxic properties of the pollutant in question. Ambient standards have been developed for only a few specific contaminants, namely respirable particulate matter (particles not larger than 10 micrometers in diameter, which tend to remain in the lung when inhaled), sulfur dioxide, nitrogen dioxide, carbon monoxide, lead, and ozone. In addition, the State of Idaho has also established an additional State ambient air quality standard for fluorides in vegetation.[1] Standards for these "criteria air pollutants" are used in Section 5.7, Air Resources, in the regulatory compliance evaluations of projected AMWTP emissions (see Table 5.7-4).

The EPA and the State of Idaho have monitored ambient air quality in an attempt to define areas as either attainment (that is, the standards are not exceeded), or nonattainment of the ambient air quality standard, although many areas are unclassified due to a lack of regional monitoring data. The attainment status is specific to each pollutant and averaging time. Designation as either attainment or nonattainment not only indicates the quality of the air resource but also dictates the elements that must be included in local air quality regulatory control programs. Unclassified areas are generally treated as being in attainment. The elements required in nonattainment areas are more comprehensive (or stricter) than in attainment areas. The region that encompasses the environs of the INEEL has been classified as attainment or unclassified for all NAAQS, meaning that air pollution levels are considered healthful. The nearest nonattainment area lies some 50 miles south of the INEEL in Power and Bannock Counties. This area has been designated as nonattainment for the standards related to respirable particulate matter.

E-3.2.2 Prevention of Deterioration

The CAA contains requirements to prevent the deterioration of air quality in areas designated as attainment of the ambient air quality standards. These requirements are contained in the Prevention of Significant Deterioration (PSD) amendments and are administered through a program that limits the increase in specific air pollutants above the levels that existed in what has been termed a baseline (or starting) year. The amendments specify maximum allowable ambient pollutant concentration increases, or increments. Increment limits for pollutant level increases are specified for the nation as a whole (designated as Class II areas), and more stringent increment limits (as well as ceilings) are prescribed for designated national resources, such as national forests, parks, and monuments (designated as Class I areas). In Southeastern Idaho, the Craters of the Moon Wilderness Area is the only Class I area. Increment values applicable to the INEEL are presented in Section 4.7.

The IDHW, Division of Environmental Quality, administers the PSD Program. Proposed new sources of emissions at the INEEL and modifications are evaluated to determine the expected level of emissions of all pollutants. The INEEL is considered a major source, since facility-wide emissions of some air contaminants exceed 250 tons per year. As such, a PSD analysis must be performed whenever any

[1] This standard however is less restrictive than more recently promulgated for toxic air pollutants.

modification would result in a significant net increase of any air pollutant. Levels of significance range from very small quantities (less than one pound) to over 100 tons per year, depending on the toxic nature of the substance. For radionuclides, significance levels range from any increase in emissions to that which would result in an offsite dose of 0.1 millirem per year or greater, depending on total facility emissions. If an INEEL facility requires a PSD permit, it must be demonstrated that the source:

- Will be constructed using best available control technology (a level of control which is technologically feasible and considered cost-effective) to reduce air emissions;
- Will operate in compliance with all prohibitory rules;
- Will not cause a detriment to ambient air quality at the nearby Craters of the Moon Wilderness Area, a PSD Class I area; and
- Will not result in an exceedance of an ambient air quality standard.

The evaluation also includes an assessment of potential growth and associated impacts to air quality-related values—visibility, vegetation, and soils. Generally, all PSD projects must go through a public comment period with an opportunity for public review. The INEEL has been granted more than 20 PSD permits by the Division of Environmental Quality.

E-3.2.3 National Emission Standards for Hazardous Air Pollutants

In addition to ambient air quality standards and PSD requirements, the CAA designates requirements for sources that emit substances designated as hazardous air pollutants. These requirements are specified in a program termed NESHAP. This program was substantially amended in 1990 and has yet to be fully implemented. However, one section of the NESHAP program that currently applies to INEEL operations is contained in Title 40 of the Code of Federal Regulations (CFR) Part 61, Subpart H, *National Emissions Standards for Radionuclides from Department of Energy Facilities*. This regulation establishes a limit to the dose that may be received by a member of the public due to operations at the INEEL. The annual dose limit (10 millirem) applies to the maximally exposed offsite individual and is designed to be protective of human health with an adequate margin of safety. The regulation also establishes requirements for monitoring emissions from facility operations and analysis and reporting of dose.

The INEEL complies with the requirements of the NESHAP through programs to monitor radionuclide emissions, evaluate dose to nearby residences, and report doses annually to the EPA. Proposed new sources of emissions at the INEEL and modifications are evaluated to identify the expected contribution to dose to nearby residents. If specified levels (fractions of the acceptable dose for combined site operations) are exceeded, a NESHAP permit application is prepared for submittal to the EPA. New sources are also evaluated to determine emissions monitoring requirements. The INEEL currently holds more than 25 NESHAP permits granted by the EPA.

In addition to radionuclides, emissions standards have been established under the NESHAP Program for several nonradiological hazardous air pollutants, including benzene, asbestos, and others. The INEEL complies with the requirements for evaluation, control, and permitting of nonradiological hazardous air pollutants through programs that are also administered by the EPA. In accordance with Title III of the 1990 Amendments to the CAA, maximum achievable control technology (MACT) will be specified by the

EPA for various source categories. The MACT will require a level of control at least as stringent as the best performing (i.e., best controlled) sources within each source category. Sources will be required to implement programs or controls to comply with the MACT by the scheduled implementation date. If the residual risk is above specified acceptable limits, additional controls will be required. Several maximum achievable control technology standards have been promulgated or proposed. Proposed MACT emission standards and work practice requirements associated with combustion of hazardous waste are expected be issued in final form prior to the operation of the proposed AMWTP. The proposed AMWTP, has, therefore, been designed to meet or exceed the proposed emissions standards, as well as limit residual risk to levels which will protect the public and occupational workers. Table E-3-1 contains proposed emission standards (expressed as stack concentrations) and a comparison to maximum projected AMWTP stack concentrations. The concentration estimated for mercury is higher than the MACT standard; however, this is due to the very conservative assumption that the waste to be incinerated contains 1 percent mercury. Preliminary waste characterization indicates 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. The MACT rule will also require a vigilant program of monitoring, recordkeeping, and periodic reporting to EPA and/or the State of Idaho to document and certify operational compliance.

It is also expected that additional INEEL air emissions sources will be assigned MACT requirements as standards are promulgated for additional source categories, including (but not limited to) waste treatment, storage and disposal facilities, research and development activities, industrial boilers, process heaters, stationary internal combustion engines, other hazardous waste incinerators, and site remediation activities.

E-3.2.4 State of Idaho Permit Programs

The Idaho Air Pollution Control Program, administered by the Division of Environmental Quality, requires that permits be obtained for potential sources of air pollutants. Unless the source is specifically exempt from permitting requirements, Permits to Construct and Operate must be obtained before a source can be constructed or operated. The permits specify source requirements, such as monitoring, reporting and recordkeeping, or limitations on operating conditions, such as emission limits. The list of equipment or operations which are exempt from permit requirements is very specific and limited; most new INEEL sources and modifications to existing sources are subject to permit requirements.

In addition to individual source permits, the INEEL is also required to obtain a Sitewide “Title V” Operating Permit, as stipulated under the 1990 CAA Amendments, which must be renewed periodically. The INEEL submitted an application for a Title V Operating Permit in July 1995. Permits are typically issued with specific emissions limits and conditions for operation. This formal permitting process allows the State to determine that emissions will be adequately controlled, the source will comply with all emission standards and regulations, and public health and safety will be adequately protected. Generally, Operating Permit reviews must go through a public review period with an opportunity for public comment. The MACT program (Title III of the 1990 CAA Amendments which is discussed above) will be administered under the Title V program and also allow for public review and comment.

Table E-3-1. Proposed MACT standards for combustion of hazardous waste and maximum estimated AMWTP stack concentrations.

Hazardous Air Pollutant or Surrogate	Proposed Standard[a]	Maximum Projected Stack Concentration[b]
Dioxins and Furans (nanograms per dry standard cubic meter, as 2,3,7,8-TCDD equivalent)	0.20	-[c]
Mercury (micrograms per dry standard cubic meter)	40	83[d]
Particulate Matter[e] (micrograms per dry standard cubic meter)	0.015	0.00014
Hydrogen Chloride and Chlorine (parts per million by volume as hydrogen chloride equivalents)	75	0.37
Semi-Volatile Metals (total lead and cadmium, micrograms per dry standard cubic meter)	100	0.00028
Low-Volatile Metals (total antimony, arsenic, beryllium and chromium, micrograms per dry standard cubic meter)	55	0.00042
Carbon Monoxide[f] (parts per million by volume)	100	0.95
Hydrocarbons[f] (parts per million by volume, as propane)	10	0.2

a. All MACT concentrations are based on dry, standard conditions corrected to 7 percent oxygen.

b. Concentration in main stack exhaust based on maximum hourly emission rates listed in Table E-3-3 and stack flow rate of 130,000 actual CFM and 14 percent oxygen (corrected to 7 percent for comparison to standard). Applies only to thermal treatment alternatives (Proposed Action or Treatment and Storage).

c. Dioxin and furans emission rates are not specifically estimated, but are assumed to be equal to the MACT limit; trial burns would be required to establish that the MACT-prescribed concentration will not be exceeded.

d. The mercury emission rate listed in Table E-3-3 is based on the conservative assumption that the waste feed contains 1 percent mercury. Preliminary waste characterization indicates the actual mercury content to be much less than 1 percent. Feed limits or other restrictions could be imposed to reduce the stack concentration to below the MACT standard.

e. Particulate matter is specified as a surrogate for control of non-mercury metals.

f. Pollutants are specified as surrogate indicators of good combustion control.

E-3.2.5 State of Idaho Rules for Toxic Air Pollutants

The Idaho Division of Environmental Quality has promulgated rules and methodologies to estimate and control the potential human health impacts of toxic air pollutants (pollutants which by their nature are toxic to human or animal life or vegetation) from new or modified sources.[1] These rules are contained in Title 1, Chapter 1, Sections 585 and 586 of the Rules for the Control of Air Pollution in Idaho (IDHW 1997) and are implemented through the air quality permit program described above. Emission levels of significance have been established for about 700 toxic air pollutants, based on the known or suspected toxicity of these substances. Expected (uncontrolled) emissions above administrative screening levels must be evaluated using standard air dispersion modeling techniques and risk assessment methodologies to assess potential impacts. The State has defined acceptable ambient concentration levels for many toxic air pollutants, including both carcinogenic and noncarcinogenic contaminants. These levels are increments over existing levels and apply only to sources that became operational after May 1, 1994.

For contaminants known or suspected to cause cancer in humans, this level has been defined as the acceptable ambient concentration for a carcinogen (AACC). The acceptable ambient concentration for a carcinogen is based on risk and corresponds to that concentration at which the probability of contracting cancer is one in a million, assuming continuous exposure over a 70-year lifetime.[2] The AACC differs for each carcinogenic substance due to its carcinogenic potency, as defined by the EPA. The State will grant a permit if the calculated incremental risk due to project emissions does not exceed the AACC (that is, does not result in an individual excess cancer risk greater than one in a million). If this level is expected to be exceeded, a permit may still be granted if (a) the calculated risk does not exceed ten in a million and (b) toxic reasonably achievable control technology (which is similar to best available control technology, or BACT) is employed to limit emissions of carcinogenic substances. A facility will not be granted a permit unless it can be shown that the emissions will comply with all applicable toxic air pollutant increments for carcinogenic (cancer-causing) and noncarcinogenic substances (IDHW 1997). As part of the permit evaluation process, requirements related to toxic air pollution control equipment, facility modifications, and materials substitutions may be specified to limit ambient levels of toxic air pollutants.

Many air contaminants do not cause cancer but may contribute to other health impacts, such as respiratory or eye irritants, or impacts to the cardiovascular, reproductive, central nervous or other body systems. Levels of significance for noncarcinogenic substances are called acceptable ambient concentrations (AAC). The AAC is based on acceptable exposure limits for occupational workers and other reference sources of information for the contaminant in question. For an added margin of safety, the State generally sets the AAC at one-hundredth of the acceptable occupational exposure level. Permits are granted if incremental emissions from the new or modified source are expected to result in annual average concentrations below the AAC. However, if the AAC is expected to be exceeded, a permit may still be granted based on consideration of other factors, such as the toxicity of the substance and anticipated level of exposure.

E-3.2.6 Standards for Hazardous Waste and Toxic Substance Control

In addition to regulations designed specifically for air resource protection, projects which include handling or treatment of hazardous substances are required to comply with various Federal and State environmental regulatory programs which incorporate certain requirements on releases to air. Among the

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[1] The method used to assess cancer health risk associated with air emissions form current INEEL facilities and proposed AMWTP alternatives is summarized in Appendix E-4, Health and Safety.

[2] This probability is often described as an “individual cancer risk.” Excess, in the sense used here, means above the normal cancer incidence rate, which is currently about one in three for the U.S. population. An individual excess cancer risk of one in a million or less is generally considered an acceptable level of risk.

most important of these are requirements for hazardous waste incineration are the standards for the destruction of organic hazardous constituents in solid wastes prescribed by EPA and IDAPA 16.01.05.008 (40 CFR 264 Subpart O). Polychlorinated biphenyls (PCB) incineration must achieve the minimum 99.9999 percent destruction and removal efficiency of the Toxic Substances Control Act (TSCA), while incineration of other difficult-to-destroy compounds, such as chlorobenzene and carbon tetrachloride, must achieve a minimum 99.99 percent destruction and removal efficiency. Resource Conservation and Recovery Act (RCRA) performance standards for hydrogen chloride emissions in IDAPA 16.01.05.008 require either 99 percent hydrogen chloride removal or less than 4 pounds per hour hydrogen chloride during the incineration of chlorinated wastes.

E-3.2.7 Department of Energy Orders and Guides

The DOE has developed and issued a series of orders and guides to ensure that all operations comply with applicable environmental, safety, and health regulations and DOE internal policies, including the concept of maintaining emissions and exposures to the public and workers at levels that are as low as reasonably achievable. The as-low-as-reasonably-achievable concept is employed in the design and operation of all facilities and applies to all types of air pollutants (for example, radionuclides, carcinogens, toxic and criteria air pollutants). Orders specifically designed for protection of environment, safety, and health are summarized in Section F-3.3.2 of the DOE INEL EIS.

E-3.2.8 Measures to Minimize Impacts

Specific features have been incorporated into the proposed AMWTP design, which, together with operational controls and practices, will reduce environmental impacts of releases of air contaminants. Many mitigation 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. Specific regulatory requirements will be incorporated into permit conditions related to proposed AMWTP construction and operation, and compliance with these requirements will be subject to regulatory oversight. Other mitigation features, while not specifically required by regulation, are necessary elements of the ALARA program to ensure protection of the public, workers and the environment.

Mitigation design features related to each of the processes which comprise the AMWTP alternatives (specifically, thermal and/or non-thermal treatment) are discussed below, including the separate air pollution containment and control systems which serve the pretreatment area, incinerator, vitrifier/melter, and evaporator.

E-3.2.8.1 Pretreatment Area (Zone 3 and Glovebox). Pre-treatment is an essential step in both the Proposed Action and Non-Thermal Treatment Alternatives. All uncontained waste will be located in Zone 3 areas—the interior of hot cells, process cells, glove boxes, or other containments for handling highly contaminated materials. A recirculatory self-cleaning reverse jet air filtration system will provide continuous air treatment and reduce dust loading in Zone 3 areas. Containment features will prevent the spread or release of contaminant materials both within the facility and to the environment. Air extracted from Zone 3 areas will 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 is also provided downstream from the first-stage HEPA filters to capture organic emissions. The system is shown schematically in Figure E-3-2.

E-3.2.8.2 Incinerator Design Requirements and Control Features. The proposed AMWTP incinerator has been designed to operate within the specifications of current and proposed regulations for combustion of hazardous waste. In particular, the following design and operational features will mitigate the production and release of air pollutants (BNFL 1998c):

- 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 (1,800 – 2,200°F), pressure, gas velocity, residence time (nominal 2-second), 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/melter and ancillary processes;
- Good Engineering Practice stack design to minimize concentrations of contaminants in the building cavity, and provide good dispersion of process 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 system has been designed to function in compliance with current hazardous waste incinerator guidance and performance standards for the destruction of organic hazardous constituents in solid wastes of EPA and IDAPA 16.01.05.008 (40 CFR 264 Subpart O). Since a TSCA permit for PCB incineration will be obtained, the project has been designed to meet the minimum combustion efficiency of TSCA. Trial burns will be conducted to ensure that a 99.9999 percent PCB destruction and removal efficiency is maintained. The facility is also designed to achieve a 99.99 percent destruction and removal efficiency for difficult-to-destroy compounds, such as chlorobenzene and carbon tetrachloride, which will also be confirmed during trial burns. The facility includes a scrubbing system for hydrochloric acid removal which will be operated to comply with the RCRA hydrogen chloride performance standard in IDAPA 16.01.05.008 which requires either 99 percent hydrogen chloride removal or less than 4 pounds per hour hydrogen chloride during the incineration of chlorinated wastes to be demonstrated during the trial burns.

The incinerator and offgas control system has also been designed to function within the framework of the recently proposed emission limits of the hazardous waste combustion MACT rule of Title III, Section 112 of the CAA. The proposed MACT contains emission limitations, which will control emissions to a level at least as stringent as the best performing (i.e., best controlled) hazardous waste combustion system, are provided in Table E-3-1.

In addition, public health and safety will be reevaluated in the project permitting phase through the use of health risk assessments to be conducted in accordance with IDAPA 585 and 586. The health risk assessment will incorporate emissions data collected during trial burns and must demonstrate that the Idaho Administrative Procedures Act (IDAPA) increments designed for protection of the public from

Figure E-3-2. Schematic of Zone 3 and glovebox exhaust system (BNFL 1998b).

releases of toxic air pollutants are not exceeded. If necessary, additional controls will be placed on the project if required to meet these standards for public health and safety.

E-3.2.8.3 Incinerator Air Pollution Control System. The incinerator air pollution control system includes a combination of dry filtration and wet scrubbing systems, with quench air cooling, a high-temperature filter, saturation quencher, packed-bed absorber for acid gas and mercury removal, a candle demister, three-stage HEPA filtration, associated pumps and blowers, and an exhaust stack. The system is shown schematically in Figure E-3-3.

Flue gas from the secondary combustion chamber is first cooled by mixing with ambient air through dedicated air supply blowers. It is then directed into one of two parallel redundant high-temperature filter vessels. The hot filters are designed for more than 99 percent removal of particles greater than 0.5 microns in diameter and are cleaned in place using a jet-pulse blowback system. The gas exiting the high-temperature filtration units enters the quench tower where it is cooled and saturated with quench brine spray. The gas discharges directly to the packed-bed absorber below the packed-bed column.

Alkaline clean liquor solution absorbs the acidic gases to form salts. The scrubber system is capable of removing over 99 percent of the acid gas from the offgas and has been specially designed to remove mercury from the offgas and scrubber brine. The mercury is gravity drained and manually tapped from the bottom of the holding tank for amalgamation. Clean liquor solution falls from the packed-bed and collects in the sump. From there it is pumped to the scrubber liquor hydrocyclone where large solids are removed from the liquid. Underflow from the hydrocyclone is continuously recirculated to the packed-bed absorber. The rate of recirculation is controlled with addition of caustic to maintain a minimum pH, and process water or separator condensate added to adjust the concentration.

Flue gas from the scrubber tower enters the candle demister vessel and passes through the mist eliminator candles. The candles are continuously irrigated with a spray of fresh water to remove water soluble constituents from the fiber media. The saturated gas leaving the candle demister vessel is ducted to an in-line resistance reheater that raises the temperature above the saturation temperature prior to passing through three sets of HEPA filter banks. The first stage contains redundant parallel modules, consisting of two filters in series (65 percent and 90 percent roughing filters), and a glass-matrix nuclear-grade HEPA filter. The second stage contains redundant parallel modules each consisting of a 90 percent roughing filter and a nuclear-grade stainless steel or higher alloy nuclear-grade HEPA filter in series. The third stage will include a nuclear-grade HEPA filter. HEPA filters are certified capable of removing 99.97 percent of all particulate in the range of 0.1 to 0.3 microns in diameter (which is the most difficult size range for particulate removal), with increased efficiency for all other particle diameters

Following the second stage of HEPA filter modules, the flue gas passes to the exhaust blower where it is delivered to the stack. A variable damper on the suction side of the blowers allows control of the draft to maintain negative pressure within the incinerator system and to sustain the movement of the flue gas through the air pollution control system.

E-3.2.8.4 Vitrification Offgas Treatment System. The vitrification process includes a feed system, a melter, the glass form handling system and an air pollution control system. Each vitrification unit has two discharge chambers each protruding into separate gloveboxes. The inside of the vitrification unit and its separate glovebox is a single continuous containment area with a single common ventilation system maintained at negative pressure with respect to the surrounding process cells. The system is shown schematically in Figure E-3-4.

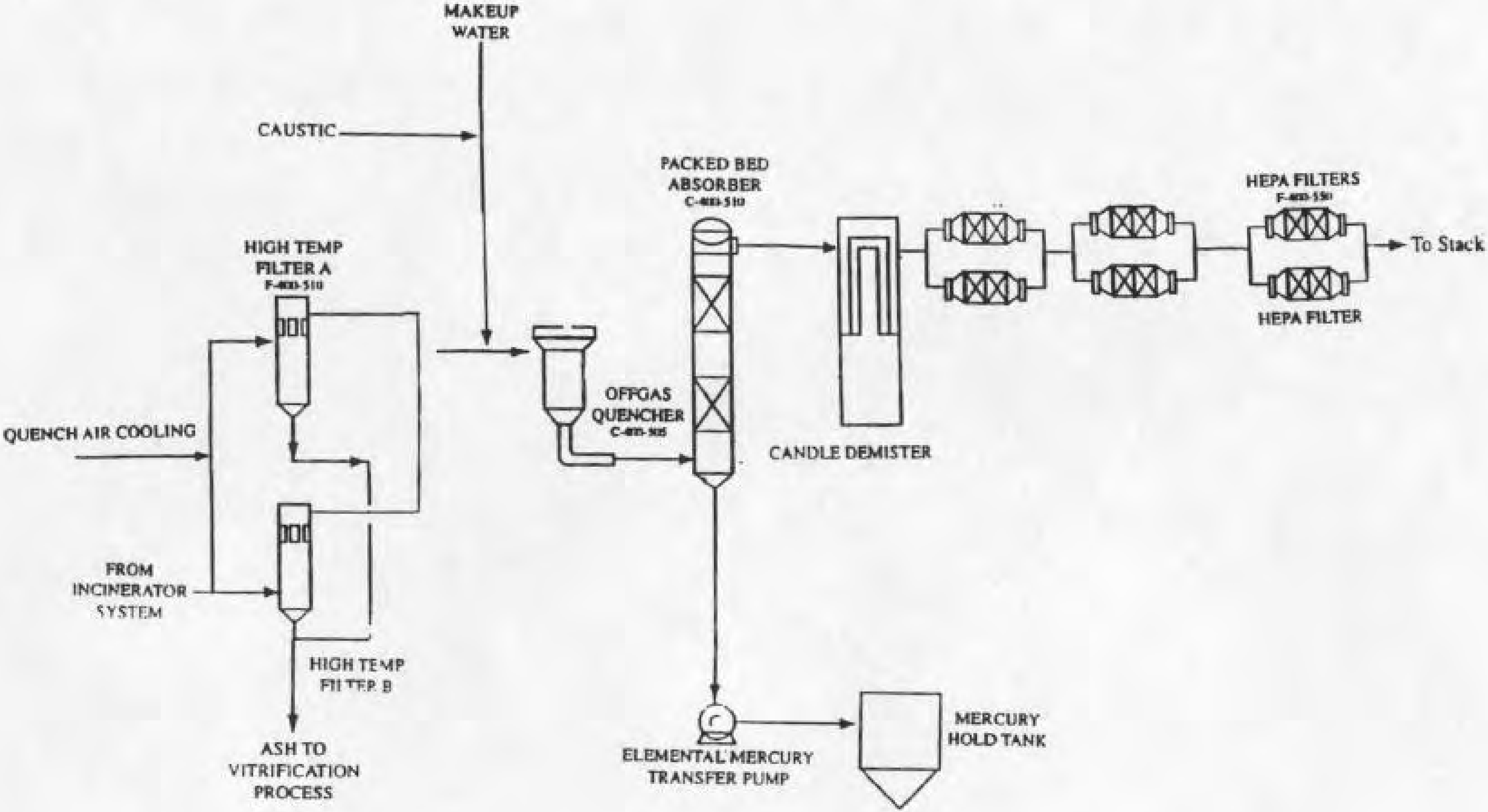
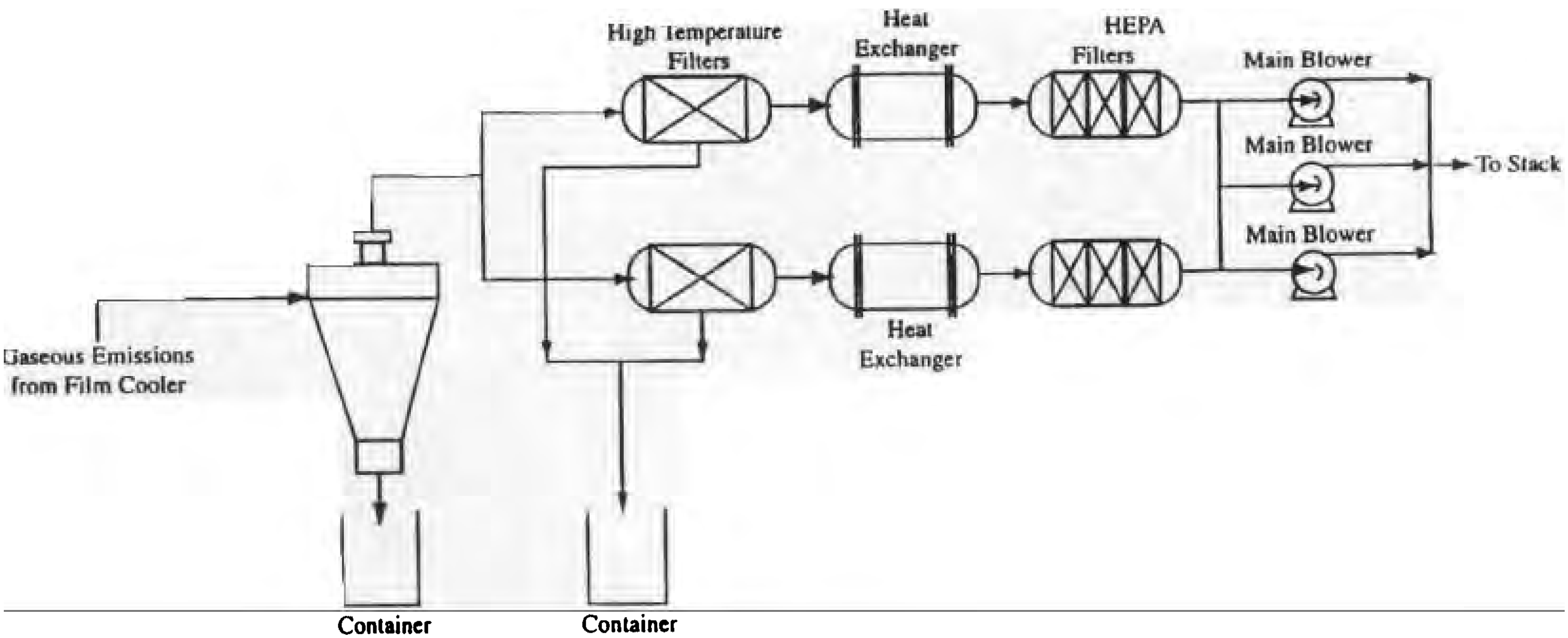


Figure E-3-3. Simplified schematic of the incinerator air pollution control system (BNFL 1998a).



igure E-3-4. Simplified schematic of the melter air pollution control system (BNFL 1998a).

The melter offgas treatment system includes a film cooler, cyclone separator, two parallel trains of high-temperature filters, heat exchangers, 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.

E-3.2.8.5 Evaporator Treatment System. The evaporator is used to dry the scrubber brine blowdown generated from the incinerator and process non-organic liquid wastes from other areas of the plant. Brine is pumped through a thin film evaporator which disperses the liquid along the inner surface of the vessel, creating a high liquid surface area for efficient drying. Vapors from the evaporator proceed through a mesh pad demister in the housing of the evaporator vessel to remove entrained salt in the vapor phase. The salt-free vapor then enters a condenser, where a portion of the vapors are condensed and returned to the plant makeup water tank. The remainder of the vapor is returned to the incinerator air pollution control system.

E-3.3 Air Quality Impact Assessment Methodology

Distinct types of assessments have been performed to assess air quality for existing conditions and future actions. These are:

- Radiological air quality assessments, which are performed for radionuclide emissions from stationary sources;
- Nonradiological air quality assessments, which are performed for criteria and toxic air pollutant emissions from stationary (stack and diffuse) operational sources and fugitive dust and combustion product emissions associated with construction equipment and some operational sources;
- Degradation of visibility assessments, which are performed for certain criteria emissions from stationary sources; and
- Assessments of criteria pollutant emissions from mobile sources.

This section describes the methodology used in each type of air quality assessment, including the general approach to source term estimation and atmospheric dispersion modeling, as well as specific information on related assumptions, methods, and data used in the analyses.

E-3.3.1 Source Term Estimation

The type and quantity of pollutants emitted to air from a specific source, or group of sources, is often referred to as the source term. The baseline source term was compiled from INEEL emissions inventory reports (DOE-ID 1996b, 1997a) and NESHAP reports (DOE-ID 1996d, 1997b), with projected increases as described in DOE INEL EIS (Section 5-7, and Appendix F-3). The source term for each of the proposed AMWTP alternatives was developed using conservative engineering calculations based on permit applications, and project engineering design documents and material flow balance calculations (BNFL 1998a, b, and c; MK 1997). The source term for auxiliary equipment (boilers and diesel generators) was estimated using equipment specifications and emission factors from authoritative reference sources, such as the *Compilation of Air Pollution Emission Factors Volume 1* (EPA 1997, Sections 1 and 3). Estimated radionuclide emission rates are presented in Table E-3-2 for each process having the potential for significant emissions. Table E-3-3 provides detailed non-radiological emission rate estimates for individual treatment processes as well as ancillary equipment.

E-3.3.2 Radiological Assessment Methodology

This section summarizes information on the data and methods used to assess radiological conditions and dose to individuals at onsite and offsite locations due to routine emissions of radionuclides from existing and proposed INEEL facilities.

E-3.3.2.1 Model Selection and Application. The computer program GENII (Napier et al. 1988) was used to calculate doses from all pathways and modes of exposure likely to contribute significantly to the total dose from airborne releases. These are:

- External radiation dose from radionuclides in air
- External dose from radionuclides deposited on ground surfaces
- Internal dose from inhalation of airborne radionuclides
- Internal dose from ingestion of contaminated food products.

GENII incorporates algorithms, data, and methods for calculating doses to various tissues and organs and for determination of effective dose equivalent, based on the recommendations of the International Commission on Radiological Protection (ICRP), as contained in Publications 26 and 30 (ICRP 1977, 1979). This model has several technical advantages over other available methods, including the ability to assess dose from many different release scenarios and exposure pathways. In addition, it conforms to the strict quality assurance requirements of NQA-1, Basic Requirement 3 (Design Control) and Supplementary Requirement 3S-1 (Supplementary Requirements of Design Control), which includes requirements for verification and validation of computer codes.

E-3.3.2.2 Release Modeling. Releases from stacks or vents may be modeled as either elevated or ground-level releases. For this EIS, the decision whether to model a given emission point as a stack or ground-level release was based on guidelines issued by the EPA (EPA 1995a) and the National Council on Radiation Protection and Measurements (NCRP 1986). In general, if the height of the release point is less than or equal to 2.5 times the height of attached or nearby buildings, turbulent (wake and downwash) effects are assumed to influence the release, effectively lowering the release height to ground level. In some cases, stacks at existing facilities were modeled as individual release points; in other cases, sources were grouped together and treated as a single release point. For example, elevated sources at the Power Burst Facility (the Waste Experimental Reduction Facility North and South Stacks, and the Power Burst Facility Stack) were modeled as individual elevated releases. Conversely, effluents from various vents at the Naval Reactors Facility were summed and treated as a single ground-level release.

Table E-3-2. Radionuclide emission rates for individual sources (curies per year).

	Non-thermal - Glovebox		Incinerator		Vitrification		Non-thermal Zone 3		Total (abated) emissions	
Radionuclide	Unabated RF[a]=0.001	Abated FF[b]=1E-6	Unabated RF=1.0	Abated FF=1E-7	Unabated PF[c,d]=0.1 Inc.	Abated FF=1E-06	Unabated PF=0.1 Inc.	Abated FF=1E-06	Proposed Action Alt.	Non-thermal. Treat. Alt.
Am-241	7.3E-02	7.3E-08	5.4E+03	5.4E-04	5.4E+02	5.4E-04	1.6E+01	1.6E-05	1.1E-03	1.6E-05
Pu-238	6.9E-02	6.9E-08	5.1E+03	5.1E-04	5.1E+02	5.1E-04	1.5E+01	1.5E-05	1.0E-03	1.5E-05
Pu-239	4.1E-02	4.1E-08	3.0E+03	3.0E-04	3.0E+02	3.0E-04	9.0E+00	9.0E-06	6.2E-04	9.0E-06
Pu-240	9.5E-03	9.5E-09	7.0E+02	7.0E-05	7.0E+01	7.0E-05	2.1E+00	2.1E-06	1.4E-04	2.1E-06
Pu-242	6.2E-07	6.2E-13	4.6E-02	4.6E-09	4.6E-03	4.6E-09	1.4E-04	1.4E-10	9.3E-09	1.4E-10
Pu-241	9.6E-02	9.6E-08	7.1E+03	7.1E-04	7.1E+02	7.1E-04	2.1E+01	2.1E-05	1.4E-03	2.1E-05
Ba-137m	1.3E-03	1.3E-09	1.0E+02	1.0E-05	1.0E+02	1.0E-04	2.9E-01	2.9E-07	1.1E-04	3.0E-07
Cs-137	1.4E-03	1.4E-09	1.0E+02	1.0E-05	1.0E+02	1.0E-04	3.0E-01	3.0E-07	1.1E-04	3.0E-07
Sr-90	1.2E-03	1.2E-09	8.9E+01	8.9E-06	8.9E+00	8.9E-06	2.6E-01	2.6E-07	1.8E-05	2.7E-07
Y-90	1.2E-03	1.2E-09	8.9E+01	8.9E-06	8.9E+00	8.9E-06	2.6E-01	2.6E-07	1.8E-05	2.7E-07
U-233	6.1E-04	6.1E-10	4.5E+01	4.5E-06	4.5E+00	4.5E-06	1.3E-01	1.3E-07	9.2E-06	1.3E-07
Cm-244	3.2E-04	3.2E-10	2.4E+01	2.4E-06	2.4E+00	2.4E-06	7.0E-02	7.0E-08	4.9E-06	7.1E-08
H-3	1.6E-04	1.6E-04	1.2E+01	1.2E+01	1.2E+00	1.2E+00	3.5E-02	3.5E-02	1.3E+01	3.5E-02
Cs-134	6.6E-05	6.6E-11	4.9E+00	4.9E-07	4.9E+00	4.9E-06	1.5E-02	1.5E-08	5.4E-06	1.5E-08
Co-60	6.0E-05	6.0E-11	4.4E+00	4.4E-07	4.4E-01	4.4E-07	1.3E-02	1.3E-08	9.0E-07	1.3E-08

Source: BNFL 1998a.

a. RF = Release fraction from 40 CFR 61, Appendix D.

b. FF = Filtration factor (Note: These factors do not apply to H-3)

c. PF = Partition factor.

d. Vitrification emissions are based on incinerator source term, with a PF of 0.1 (except for Cs-137/Ba-137m and Cs-134, for which PF = 1.0).

Table E-3-3. Projected nonradiological emission rates for the proposed AMWTP and support equipment.[a]

Substance	Non-thermal Treatment[b]		Thermal Treatment[e]		Boilers/Heaters[f,g]		Diesel Generators[h]		Total Alternative	
	Maximum Hourly[c] g/hr	Annual Average[d] kg/yr	Maximum Hourly g/hr	Annual Average kg/yr	Maximum Hourly g/hr	Annual Average kg/yr	Maximum Hourly g/hr	Annual Average kg/yr	Maximum Hourly g/hr	Annual Average kg/yr
Proposed Action										
Criteria Pollutants										
Carbon Monoxide	-[i]	-[i]	1.2E+02	9.1E+02	1.3E+02	1.0E+03	8.1E+03	4.2E+02	8.4E+03	2.3E+03
Oxides of Nitrogen	-[i]	-[i]	1.9E+03	1.4E+04	7.5E+02	5.9E+03	3.8E+04	2.0E+03	4.0E+04	2.2E+04
Sulfur Dioxide	-[i]	-[i]	2.8E+03	1.9E+04	5.9E+01	4.7E+02	2.5E+03	1.3E+02	5.4E+03	2.0E+04
Particulate Matter (PM-10)	1.6E-07	1.3E-06	1.5E-05	6.4E-05	2.4E+01	1.9E+02	2.7E+03	1.4E+02	2.7E+03	3.3E+02
Volatile Organic Compounds	6.4E+00	5.0E+01	1.5E+01	1.2E+02	2.0E+01	1.6E+02	3.0E+03	1.6E+02	3.0E+03	4.8E+02
Lead	2.4E-08	1.9E-07	4.9E-06	3.9E-05	-[i]	-[i]	-[i]	-[i]	4.9E-06	3.9E-05
Carcinogens										
Arsenic	1.5E-09	1.2E-08	2.6E-05	2.1E-04	-[i]	-[i]	-[i]	-[i]	2.6E-05	2.1E-04
Asbestos	5.0E-09	4.0E-08	-[j]	-[j]	-[i]	-[i]	-[i]	-[i]	5.0E-09	4.0E-08
Benzene	5.0E-02	4.0E-01	3.0E-01	2.3E+00	-[i]	-[i]	1.2E+02	6.2E+00	1.2E+02	9.0E+00
Beryllium	1.0E-09	7.9E-09	1.0E-05	8.2E-05	-[i]	-[i]	-[i]	-[i]	1.0E-05	8.2E-05
Cadmium	1.5E-09	1.2E-08	2.6E-05	2.1E-04	-[i]	-[i]	-[i]	-[i]	2.6E-05	2.1E-04
Carbon tetrachloride	1.7E-01	1.3E+00	3.0E+00	2.3E+01	-[i]	-[i]	-[i]	-[i]	3.1E+00	2.5E+01
Chloroform	6.4E-02	5.0E-01	3.0E-01	2.3E+00	-[i]	-[i]	-[i]	-[i]	3.6E-01	2.8E+00
Chromium (hexavalent)	7.5E-11	5.9E-10	1.0E-05	8.2E-05	-[i]	-[i]	-[i]	-[i]	1.0E-05	8.2E-05
1,2-Dichloroethane (Ethylene dichloride)	5.0E-02	4.0E-01	3.0E-01	2.3E+00	-[i]	-[i]	-[i]	-[i]	3.5E-01	2.7E+00
1,1-Dichloroethylene	6.4E-02	5.0E-01	3.0E-01	2.3E+00	-[i]	-[i]	-[i]	-[i]	3.6E-01	2.8E+00
Dioxin/furans (2,3,7,8 TCDD equivalent)	-[k]	-[k]	7.3E-07	5.8E-06	-[i]	-[i]	-[i]	-[i]	7.3E-07	5.8E-06
Formaldehyde	-[i]	-[i]	-[i]	-[i]	-[i]	-[i]	2.3E+02	1.2E+01	2.3E+02	1.2E+01
Methylene chloride	6.4E-02	5.0E-01	3.0E-01	2.3E+00	-[i]	-[i]	-[i]	-[i]	3.6E-01	2.8E+00
Nickel	4.5E-10	3.6E-09	1.0E-05	8.2E-05	-[i]	-[i]	-[i]	-[i]	1.0E-05	8.2E-05
Polychlorinated Biphenyls	2.9E-09	2.3E-08	8.9E-02	7.0E-10	-[i]	-[i]	-[i]	-[i]	8.9E-02	7.0E-01
Tetrachloroethylene	5.4E-01	4.3E+00	3.0E-01	2.3E+00	-[i]	-[i]	-[i]	-[i]	8.4E-01	6.7E+00
1,1,2-Trichloroethane	5.0E-02	4.0E-01	3.0E-01	2.3E+00	-[i]	-[i]	-[i]	-[i]	3.5E-01	2.7E+00
Trichloroethylene	5.4E-01	4.3E+00	3.0E-01	2.3E+00	-[i]	-[i]	-[i]	-[i]	8.4E-01	6.7E+00

Table E-3-3. Projected nonradiological emission rates for the proposed AMWTP and support equipment (continued).

Substance	Non-thermal Treatment[b]		Thermal Treatment[e]		Boilers/Heaters[f,g]		Diesel Generators[h]		Total Alternative	
	Maximum Hourly[c] g/hr	Annual Average[d] kg/yr	Maximum Hourly g/hr	Annual Average Kg/yr	Maximum Hourly g/hr	Annual Average kg/yr	Maximum Hourly g/hr	Annual Average kg/yr	Maximum Hourly g/hr	Annual Average kg/yr
Proposed Action (Continued)										
Noncarcinogens										
Acetone	6.4E-02	5.0E-01	3.0E-01	2.3E+00	-[i]	-[I]	-[i]	-[i]	3.6E-01	2.8E+00
Barium	1.5E-09	1.2E-08	1.0E-05	8.2E-05	-[i]	-[I]	-[i]	-[i]	1.0E-05	8.2E-05
Butyl alcohol	6.4E-02	5.0E-01	3.0E-01	2.3E+00	-[i]	-[I]	-[i]	-[i]	3.6E-01	2.8E+00
Chlorine	-[i]	-[i]	1.8E+01	1.5E+02	-[i]	-[I]	-[i]	-[i]	1.8E+01	1.5E+02
Chlorobenzene	5.0E-02	4.0E-01	3.0E-01	2.3E+00	-[i]	-[I]	-[i]	-[i]	3.5E-01	2.7E+00
Chromium (trivalent)	1.4E-09	1.1E-08	1.0E-05	8.2E-05	-[i]	-[I]	-[i]	-[i]	1.0E-05	8.2E-05
Cyanide	3.6E-10	2.9E-09	3.0E-01	2.3E+00	-[i]	-[I]	-[i]	-[i]	3.0E-01	2.3E+00
Cyclohexane	5.0E-02	4.0E-01	3.0E-01	2.3E+00	-[i]	-[I]	-[i]	-[i]	3.5E-01	2.7E+00
2-Ethoxyethanol	5.0E-02	4.0E-01	3.0E-01	2.3E+00	-[i]	-[I]	-[i]	-[i]	3.5E-01	2.7E+00
Ethyl benzene	5.0E-02	4.0E-01	3.0E-01	2.3E+00	-[i]	-[I]	-[i]	-[i]	3.5E-01	2.7E+00
Hydrogen chloride	-[i]	-[i]	2.5E+01	1.9E+02	-[i]	-[I]	-[i]	-[i]	2.5E+01	1.9E+02
Hydrogen fluoride	-[i]	-[i]	1.4E+02	1.1E+03	-[i]	-[I]	-[i]	-[i]	1.4E+02	1.1E+03
Mercury	1.6E-09	1.3E-08	9.2E+00	7.3E+01	-[i]	-[I]	-[i]	-[i]	9.2E+00	7.3E+01
Methanol	6.4E-02	5.0E-01	3.0E-01	2.3E+00	-[i]	-[I]	-[i]	-[i]	3.6E-01	2.8E+00
Methyl ethyl ketone	5.0E-02	4.0E-01	3.0E-01	2.3E+00	-[i]	-[I]	-[i]	-[i]	3.5E-01	2.7E+00
Nitrobenzene	1.5E-02	1.2E-01	3.0E-01	2.3E+00	-[i]	-[I]	-[i]	-[i]	3.1E-01	2.5E+00
Selenium	1.5E-09	1.2E-08	7.3E+01	5.8E+02	-[i]	-[I]	-[i]	-[i]	7.3E+01	5.8E+02
Silver	1.5E-09	1.2E-08	1.0E-05	8.2E-05	-[i]	-[I]	-[i]	-[i]	1.0E-05	8.2E-05
Toluene	5.4E-01	4.3E+00	3.0E-01	2.3E+00	-[i]	-[I]	-[i]	-[i]	8.4E-01	6.7E+00
1,1,1-Trichloroethane	4.0E-01	3.2E+00	8.9E+00	7.0E+01	-[i]	-[I]	-[i]	-[i]	9.3E+00	7.3E+01
Trichloroethylene	5.4E-01	4.3E+00	3.0E-01	2.3E+00	-[i]	-[I]	-[i]	-[i]	8.4E-01	6.7E+00
1,1,2-Trichloro-1,2,2-trifluoroethane	1.7E-01	1.3E+00	3.0E+00	2.3E+01	-[i]	-[I]	-[i]	-[i]	3.1E+00	2.5E+01
Xylene	5.4E-01	4.3E+00	3.0E-01	2.3E+00	-[i]	-[I]	-[i]	-[i]	8.4E-01	6.7E+00

Table E-3-3. Projected nonradiological emission rates for the proposed AMWTP and support equipment (continued).

Substance	Non-thermal Treatment[b]		Thermal Treatment[e]		Boilers/Heaters[f,g]		Diesel Generators[h]		Total Alternative	
	Maximum Hourly[c] g/hr	Annual Average[d] kg/yr	Maximum Hourly g/hr	Annual Average kg/yr	Maximum Hourly g/hr	Annual Average kg/yr	Maximum Hourly g/hr	Annual Average kg/yr	Maximum Hourly g/hr	Annual Average kg/yr
Non-thermal Treatment Alternative										
Criteria Pollutants										
Carbon Monoxide	-[i]	-[i]	-[l]	-[l]	3.6E+01	2.8E+02	4.1E+03	2.1E+02	4.1E+03	4.9E+02
Oxides of Nitrogen	-[i]	-[i]	-[l]	-[l]	2.1E+02	1.7E+03	1.9E+04	9.8E+02	1.9E+04	2.6E+03
Sulfur Dioxide	-[i]	-[i]	-[l]	-[l]	1.7E+01	1.3E+02	1.3E+03	6.5E+01	1.3E+03	2.0E+02
Particulate Matter (PM-10)	1.6E-07	1.3E-06	-[l]	-[l]	6.7E+00	5.3E+01	1.3E+03	7.0E+01	1.3E+03	1.2E+02
Volatile Organic Compounds	6.4E+00	5.0E+01	-[l]	-[l]	5.5E+00	4.4E+01	1.5E+03	7.8E+01	1.5E+03	1.7E+02
Lead	2.4E-08	1.9E-07	-[l]	-[l]	-[i]	-[I]	-[i]	-[i]	2.4E-08	1.9E-07
Carcinogens										
Arsenic	1.5E-09	1.2E-08	-[l]	-[l]	-[i]	-[I]	-[i]	-[i]	1.5E-09	1.2E-08
Asbestos	5.0E-09	4.0E-08	-[l]	-[l]	-[i]	-[I]	-[i]	-[i]	5.0E-09	4.0E-08
Benzene	5.0E-02	4.0E-01	-[l]	-[l]	-[i]	-[I]	6.0E+01	3.1E+00	6.0E+01	3.5E+00
Beryllium	1.0E-09	7.9E-09	-[l]	-[l]	-[i]	-[I]	-[i]	-[i]	1.0E-09	7.9E-09
Cadmium	1.5E-09	1.2E-08	-[l]	-[l]	-[i]	-[I]	-[i]	-[i]	1.5E-09	1.2E-08
Carbon tetrachloride	1.7E-01	1.3E+00	-[l]	-[l]	-[i]	-[I]	-[i]	-[i]	1.7E-01	1.3E+00
Chloroform	6.4E-02	5.0E-01	-[l]	-[l]	-[i]	-[I]	-[i]	-[i]	6.4E-02	5.0E-01
Chromium (hexavalent)	7.5E-11	5.9E-10	-[l]	-[l]	-[i]	-[I]	-[i]	-[i]	7.5E-11	5.9E-10
1,2-Dichloroethane (Ethylene dichloride)	5.0E-02	4.0E-01	-[l]	-[l]	-[i]	-[I]	-[i]	-[i]	5.0E-02	4.0E-01
1,1-Dichloroethylene	6.4E-02	5.0E-01	-[l]	-[l]	-[i]	-[I]	-[i]	-[i]	6.4E-02	5.0E-01
Dioxin/furans (2,3,7,8 TCDD equivalent)	-[i]	-[i]	-[l]	-[l]	-[i]	-[I]	-[i]	-[i]	-[i]	-[i]
Formaldehyde	-[i]	-[i]	-[l]	-[l]	-[i]	-[I]	1.2E+02	6.0E+00	1.2E+02	6.0E+00
Methylene chloride	6.4E-02	5.0E-01	-[l]	-[l]	-[i]	-[I]	-[i]	-[i]	6.4E-02	5.0E-01
Nickel	4.5E-10	3.6E-09	-[l]	-[l]	-[i]	-[I]	-[i]	-[i]	4.5E-10	3.6E-09
Polychlorinated Biphenyls	2.9E-09	2.3E-08	-[l]	-[l]	-[i]	-[I]	-[i]	-[i]	2.9E-09	2.3E-08
Tetrachloroethylene	5.4E-01	4.3E+00	-[l]	-[l]	-[i]	-[I]	-[i]	-[i]	5.4E-01	4.3E+00
1,1,2-Trichloroethane	5.0E-02	4.0E-01	-[l]	-[l]	-[i]	-[I]	-[i]	-[i]	5.0E-02	4.0E-01
Trichloroethylene	5.4E-01	4.3E+00	-[l]	-[l]	-[i]	-[I]	-[i]	-[i]	5.4E-01	4.3E+00

Table E-3-3. Projected nonradiological emission rates for the proposed AMWTP and support equipment (continued).

	Non-thermal Treatment[b]		Thermal Treatment[e]		Boilers/Heaters[f,g]		Diesel Generators[h]		Total Alternative	
Substance	Maximum Hourly[c] g/hr	Annual Average[d] kg/yr	Maximum Hourly g/hr	Annual Average kg/yr	Maximum Hourly g/hr	Annual Average kg/yr	Maximum Hourly g/hr	Annual Average kg/yr	Maximum Hourly g/hr	Annual Average kg/yr
Non-thermal Treatment Alternative (Continued)										
<u>Noncarcinogens</u>										
Acetone	6.4E-02	5.0E-01	-[i]	-[i]	-[i]	-[i]	-[i]	-[i]	6.4E-02	5.0E-01
Barium	1.5E-09	1.2E-08	-[i]	-[i]	-[i]	-[i]	-[i]	-[i]	1.5E-09	1.2E-08
Butyl alcohol	6.4E-02	5.0E-01	-[i]	-[i]	-[i]	-[i]	-[i]	-[i]	6.4E-02	5.0E-01
Chlorine	-[i]	-[i]	-[i]	-[i]	-[i]	-[i]	-[i]	-[i]	-[i]	-[i]
Chlorobenzene	5.0E-02	4.0E-01	-[i]	-[i]	-[i]	-[i]	-[i]	-[i]	5.0E-02	4.0E-01
Chromium (trivalent)	1.4E-09	1.1E-08	-[i]	-[i]	-[i]	-[i]	-[i]	-[i]	1.4E-09	1.1E-08
Cyanide	3.6E-10	2.9E-09	-[i]	-[i]	-[i]	-[i]	-[i]	-[i]	3.6E-10	2.9E-09
Cyclohexane	5.0E-02	4.0E-01	-[i]	-[i]	-[i]	-[i]	-[i]	-[i]	5.0E-02	4.0E-01
2-Ethoxyethanol	5.0E-02	4.0E-01	-[i]	-[i]	-[i]	-[i]	-[i]	-[i]	5.0E-02	4.0E-01
Ethyl benzene	5.0E-02	4.0E-01	-[i]	-[i]	-[i]	-[i]	-[i]	-[i]	5.0E-02	4.0E-01
Hydrogen chloride	-[i]	-[i]	-[i]	-[i]	-[i]	-[i]	-[i]	-[i]	-[i]	-[i]
Hydrogen fluoride	-[i]	-[i]	-[i]	-[i]	-[i]	-[i]	-[i]	-[i]	-[i]	-[i]
Mercury	1.6E-09	1.3E-08	-[i]	-[i]	-[i]	-[i]	-[i]	-[i]	1.6E-09	1.3E-08
Methanol	6.4E-02	5.0E-01	-[i]	-[i]	-[i]	-[i]	-[i]	-[i]	6.4E-02	5.0E-01
Methyl ethyl ketone	5.0E-02	4.0E-01	-[i]	-[i]	-[i]	-[i]	-[i]	-[i]	5.0E-02	4.0E-01
Nitrobenzene	1.5E-02	1.2E-01	-[i]	-[i]	-[i]	-[i]	-[i]	-[i]	1.5E-02	1.2E-01
Selenium	1.5E-09	1.2E-08	-[i]	-[i]	-[i]	-[i]	-[i]	-[i]	1.5E-09	1.2E-08
Silver	1.5E-09	1.2E-08	-[i]	-[i]	-[i]	-[i]	-[i]	-[i]	1.5E-09	1.2E-08
1,1,1-Trichloroethane	4.0E-01	3.2E+00	-[i]	-[i]	-[i]	-[i]	-[i]	-[i]	4.0E-01	3.2E+00
Trichloroethylene	5.4E-01	4.3E+00	-[i]	-[i]	-[i]	-[i]	-[i]	-[i]	5.4E-01	4.3E+00
1,1,2-Trichloro-1,2,2-trifluoroethane	1.7E-01	1.3E+00	-[i]	-[i]	-[i]	-[i]	-[i]	-[i]	1.7E-01	1.3E+00
Toluene	5.4E-01	4.3E+00	-[i]	-[i]	-[i]	-[i]	-[i]	-[i]	5.4E-01	4.3E+00
Xylene	5.4E-01	4.3E+00	-[i]	-[i]	-[i]	-[i]	-[i]	-[i]	5.4E-01	4.3E+00

Table E-3-3. Projected nonradiological emission rates for the proposed AMWTP and support equipment (continued).

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a. Based on BNFL 1998c.

b. Does not include fugitive emissions (2.4 g/hr and 19 kg/yr) resulting from grout preparation and glass former mixing.

c. Short-term impacts (e.g., noncarcinogenic toxic air pollutants, carbon monoxide, etc.) are evaluated using maximum hourly emission rates.

d. Long-term impacts (e.g., carcinogens and criteria pollutant annual average concentrations) are evaluated using the annual average emission rate which is based on an operating schedule of 330 days per year.

e. Thermal treatment assumes a feed rate of 650 lb/hr for the incinerator and 289 lb/hr for the vitrifier.

f. Boilers and hot water heater are assumed to operate 330 days per year. Under the Proposed Action or Treatment and Storage Alternative, there would be two steam boilers, two hot water boilers and one water heater operating concurrently.

g. Under the Non-thermal Treatment Alternative, two heating boilers (but no process boilers) and one hot water heater would operate concurrently.

h. Diesel generators are assumed to operate for 52 hours per year. Two generators would be used under the Proposed Action or Treatment and Storage Alternative, while only one would operate under the Non-thermal Treatment Alternative.

i. Substance is not emitted in significant amounts by this process or equipment.

j. Asbestos-containing waste would not be treated in the incinerator.

k. Dioxin and furans emissions are limited in accordance with the proposed MACT standard for combustion of hazardous waste, and have been set equal to that limit. They are expressed in terms of equivalency to the compound, 2,3,7,8 TCDD.

l. Thermal treatment is not part of this alternative.

The proposed AMWTP main stack is about 1.5 times the height of the building. While this does not strictly meet the general guideline of 2.5 times the building height to characterize the release as elevated, various additional factors were considered, which together indicated that the release is more appropriately characterized as elevated. The include: (1) the actual stack height of 90 feet is well above ground level, (2) the combined effects of discharge velocity (20 m/s) and thermal induced buoyancy of the offgas, which tend to increase the effective stack height, and (3) design analyses which resulted in an optimization of stack height based on good engineering practice to minimize building-induced cavity effects.

E-3.3.2.3 Meteorological Data. The atmospheric transport modeling performed as part of these radiological assessments was based on actual meteorological conditions measured at eight different locations at the INEEL. In particular, the data files prepared for these assessments were derived from observations at INEEL weather stations over the period 1987 through 1991. Radionuclide emissions from the proposed AMWTP main stack were modeled using meteorological data from the 200-foot level of the Grid III monitoring station, which is located about 8 miles northeast of the proposed AMWTP site.

E-3.3.2.4 Receptor Locations. Doses were assessed for individuals located at the onsite and offsite locations of highest predicted dose and for the surrounding population, as described below.

***Maximally Exposed Individual*.** The offsite individual whose assumed location and habits are likely to result in the highest dose is referred to as the maximally exposed individual (MEI). The location of the maximally exposed individual was identified on the basis of the source-receptor distance and direction combination that yielded the highest predicted offsite dose. In the DOE INEL EIS, radiation dose was calculated for the minimum distance from each of the major INEEL source areas to the site boundary for each of the 16 compass directions. Since this location was assessed separately for emissions from each of the INEEL areas, the maximally exposed individual receptor locations are merely points on the INEEL boundary and do not correspond to any actual residences or quarters. These maximum impacts were conservatively summed to derive cumulative impacts, although they occur at spatially distant locations. (The actual MEI locations for five of the major INEEL facilities are all located along a segment of the southern boundary, southwest of the facilities in question.) Although unrealistic, this cumulative MEI assessment process serves to establish the upper-bounding dose. Despite the inherent conservatism, the results obtained were low, and further resolution of the actual MEI location and dose was not necessary.

In this EIS, the dose to the MEI from existing facilities is taken from the annual NESHAP compliance evaluations (DOE-ID 1996d, 1997b). The highest of the most recent two years is used. The MEI dose estimated for the Preferred Alternative from the DOE INEL EIS is assumed to represent projected increases to the current dose. The MEI dose from proposed AMWTP emissions was modeled using GENII and then added to the baseline dose and projected increases to determine the cumulative offsite individual dose.

Population Dose. In the DOE INEL EIS, dose was assessed for the collective population residing in a circular area defined by a radius of 80 kilometers extending out from each major INEEL facility. Population data used were based on 1990 census data provided by the U.S. Census Bureau. For projects associated with DOE INEL EIS alternatives and for projects expected to become operational before June 1, 1995, growth projections for the counties surrounding INEEL were applied. These growth estimates are approximately 10 percent per decade. The period covered by the DOE INEL EIS analysis extends to the year 2005, and the population doses reported in Section 5.7, Air Resources, of Volume 2 of this EIS are the highest obtained for any year throughout this period.

For this EIS, the population dose assessment applies only to the population residing within 80 kilometers of the RWMC, which is the proposed AMWTP location. A maximum growth rate of 6 percent per annum has been assumed for the proposed AMWTP population dose assessment.

***INEEL Worker*.** INEEL workers may be exposed to radiation attributable to INEEL sources both as a direct result of job performance (such as work within a radiologically controlled area) and incidentally (such as from airborne releases from facilities within their work area, as well as more distant sources within the INEEL). Incidental exposure due to onsite concentrations of radionuclides were assessed in the DOE INEL EIS (for existing sources and future projects) and in this EIS (for the proposed AMWTP). (Direct, job-related occupational exposure is discussed in Sections 4.12 and 5.12, Health and Safety, of this EIS and Volume 2, Part A of the DOE INEL EIS.) An individual who would receive the highest dose due to incidental exposures is termed the maximally exposed worker. The dose to the maximally exposed worker was assessed using the general methodology described in previous sections. One major difference is the fact that the worker dose calculations did not include the food ingestion pathway, since workers do not consume food products grown onsite.

Although both EIS onsite dose assessments used the GENII code, the methodology used for this EIS differed somewhat from the DOE INEL EIS assessments. The proposed AMWTP dose assessment was performed by first generating an atmospheric dispersion factor using the Industrial Source Complex (ISC-3) code described in Section E-3.3.3.1 below. A finely spaced receptor grid (50-meter spacing) was used to identify the area of highest predicted onsite dose. The dispersion factor for that receptor location was manually entered as input to GENII, which was then executed to calculate dose. This level of refinement was not possible in the DOE INEL EIS, because of the large number of sources involved, the large areas over which the sources were distributed, and the lack of detailed facility descriptions for many of the future sources.

E-3.3.3 Nonradiological Assessment Methodology

Air pollutant levels have been estimated by application of air dispersion computer models that incorporate mathematical functions to simulate transport of pollutants in the atmosphere. The modeling methodology conforms to that recommended by the EPA (EPA 1995a) and the State of Idaho (IDHW 1997) for such applications. The models and application methodology are designed to be conservative; that is, they employ data and algorithms designed to prevent underestimating the pollutant concentrations that would actually exist. In general, the methods used to assess consequences of proposed actions were identical to those used in the baseline assessments. Minor exceptions (such as the use of refined versus screening-level modeling) will be noted where applicable. The primary objective of the assessments is to estimate nonradiological pollutant concentrations and other impacts in a manner that facilitates comparison between alternative courses of action, while also providing an indication of compliance with applicable standards or guidelines.

The types of pollutants assessed include the criteria pollutants and certain types of toxic air pollutants. Criteria pollutant concentrations were estimated for locations and over periods of time corresponding to State of Idaho and NAAQS. Since these standards apply only to ambient air (that is, locations to which the general public has access), criteria pollutant concentrations were assessed for offsite locations and public roads traversing the INEEL. The nonradiological assessment did not quantitatively assess impacts related to ozone formation because (1) volatile organic compound emission levels are below the significance level designated by the State of Idaho; (2) no simple, well-defined method exists to assess ozone formation potential (Wilson 1993); and (3) 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 confirmed by recent data collected by the NPS at Craters of the Moon Wilderness Area where no exceedances of the primary ozone standard have been reported (DOI 1994).

Offsite levels of carcinogenic and noncarcinogenic toxic air pollutants were evaluated on the basis of annual average emission rates and compared to annual average standards (increments) recently promulgated by the State of Idaho. Toxic air pollutants were also assessed for onsite locations because of potential exposure of workers to these hazardous substances. Onsite levels of specific toxins were calculated using maximum hourly emission rates and compared to occupational exposure limits set for these substances by either the Occupational Safety and Health Administration (OSHA) or the American Conference of Governmental Industrial Hygienists (ACGIH) (the lower of the two limits is used).

E-3.3.3.1 Model Description and Application. The EPA Industrial Source Complex-3 (ISC-3 short-term version) computer code (EPA 1995b) was used to evaluate AMWTP alternatives. The ISC-3 model incorporates site-specific data (such as meteorological observations from INEEL weather stations), and takes into account effects such as stack tip downwash and turbulence induced by the presence of nearby structures. In addition, the model accommodates multiple sources and calculates concentrations for user-specified receptor locations. Concentrations were calculated over a range of durations, from one-hour maximum values to annual averages. In summary, dispersion modeling using ISC-3 allows for a reasonable prediction of the impacts of proposed facilities and, therefore, is ideally suited for use in the EIS process.

The analyses performed for the DOE INEL EIS which served to establish the baseline used for this AMWTP EIS made use of some additional models as described in Appendix F-3 of the DOE INEL EIS. These models are comprised of the earlier version of ISC (ISC-2). SCREEN, a screening-level model was used in many cases where a source's contribution to toxic air pollutant concentrations was expected to be minimal (that is, well below acceptable standards). The EPA-recommended Fugitive Dust Model (Winges 1991) was used to assess fugitive dust impacts. SCREEN and the Fugitive Dust Model are not used in this EIS.

E-3.3.3.2 Emission Parameters. The use of air dispersion models requires emission parameters, such as stack height and diameter and exhaust gas temperature and flow rate; size of area (for example, disturbed areas related to construction sources); and pollutant emission rates. The DOE INEL EIS analysis obtained emission parameter data from the INEEL air emissions inventories discussed above, as well as from project design documents.

The principal source of emissions at the proposed AMWTP will 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, vitrifier/melter, glovebox and containment areas, and process area heating, ventilation and air conditioning (HVAC) systems each 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 (90-foot) main stack (MK 1997). A diagram of the main stack showing these emission points is presented in Figure E-3-5. In addition to the main stack, for the Proposed Action and Treatment and Re-Storage Alternatives, nonradiological pollutants will be emitted from six propane-fueled water boilers (four of which could operate at any one time), one hot water heater, and two diesel-fueled emergency generators. With the Non-Thermal Treatment Alternative, nonradiological pollutants will be emitted from three propane-fueled water boilers (only two would operate at any one time), one hot water heater, and one diesel-fueled emergency generator. The boiler and heater stacks would be located at a utility building situated about 70 feet south of the proposed AMWTP main building. The generators will be located near the southeast and southwest corners of the main building. The parameter values used for the proposed AMWTP stacks are provided in Table E-3-4.

E-3.3.3.3 Meteorological Data. Emissions from the proposed AMWTP main stack were modeled using meteorological data from the 200-foot level of the Grid III monitoring station, which is located about 8 miles northeast of the proposed AMWTP site. Emissions from the diesel generators and boilers were modeled using data from the 33-foot level of the Grid III monitoring station. The meteorological data used contained hourly observations of wind speed, direction, temperature, and stability class for the years 1991 and 1992.

Data required for the calculation of mixing height are currently being collected at the INEEL but are not available for these periods. Therefore, default mixing heights were used. For short-term assessments, a value of 150 meters, which represents the lowest value measured at the INEEL, was used. For annual average evaluations, 800 meters was used. This value has been calculated by the National Oceanic and Atmospheric Administration and is recommended for use in dispersion modeling assessments (Sagendorf 1991). Each case was assessed separately using data from these years, and the highest of the predicted concentrations was selected.

E-3.3.3.4 Receptor Locations. The ISC-3 Model is capable of determining air quality impacts at receptor locations using either a grid layout pattern or user-specified receptor points. Based on modeling efforts performed previously, maximum impacts at ambient receptor locations are expected to occur either (1) along public roads that traverse the INEEL or (2) along the INEEL boundary. No points of maximum impact are expected to occur at locations beyond the INEEL boundary. Thus, only discrete receptors at those locations (as opposed to a gridded array) have been used for regulatory air assessments at those locations and at Craters of the Moon Wilderness Area. (Gridded arrays were used, however, in modeling performed to identify the areas where fine spacing of discrete receptors points is necessary.)

The receptor locations for the AMWTP dispersion modeling were based on the receptor array developed for the DOE INEL EIS (described in Appendix F-3 of that document). This array was modified to include additional receptor locations and eliminate those receptor locations that are clearly beyond the range of maximum impact. Also, the elevation of each receptor location was added.

AAC were calculated for each location specified in the receptor array; however, the regulatory compliance evaluations for carcinogenic toxic air pollutants were performed only for site boundary locations (and not transportation corridors), as provided by IDAPA 210.036 (IDHW 1997). Criteria and noncarcinogenic toxic air pollutants were assessed at all ambient air locations. PSD increment consumption was also assessed for the INEEL area and Craters of the Moon Wilderness Area, the Class I area nearest the INEEL. Class I area increments were assessed at discrete receptor locations along the eastern and northern boundaries at intervals of 1,640 feet.

Concentrations of toxic air pollutants for which occupational exposure standards exist were assessed at locations within the RWMC to characterize potential levels to which workers may be subjected. For these assessments, a grid centered on the proposed AMWTP main stack and extending to the boundary of the RWMC area was developed. This grid uses 164.5-foot spacing in order to identify the onsite location of highest impact.

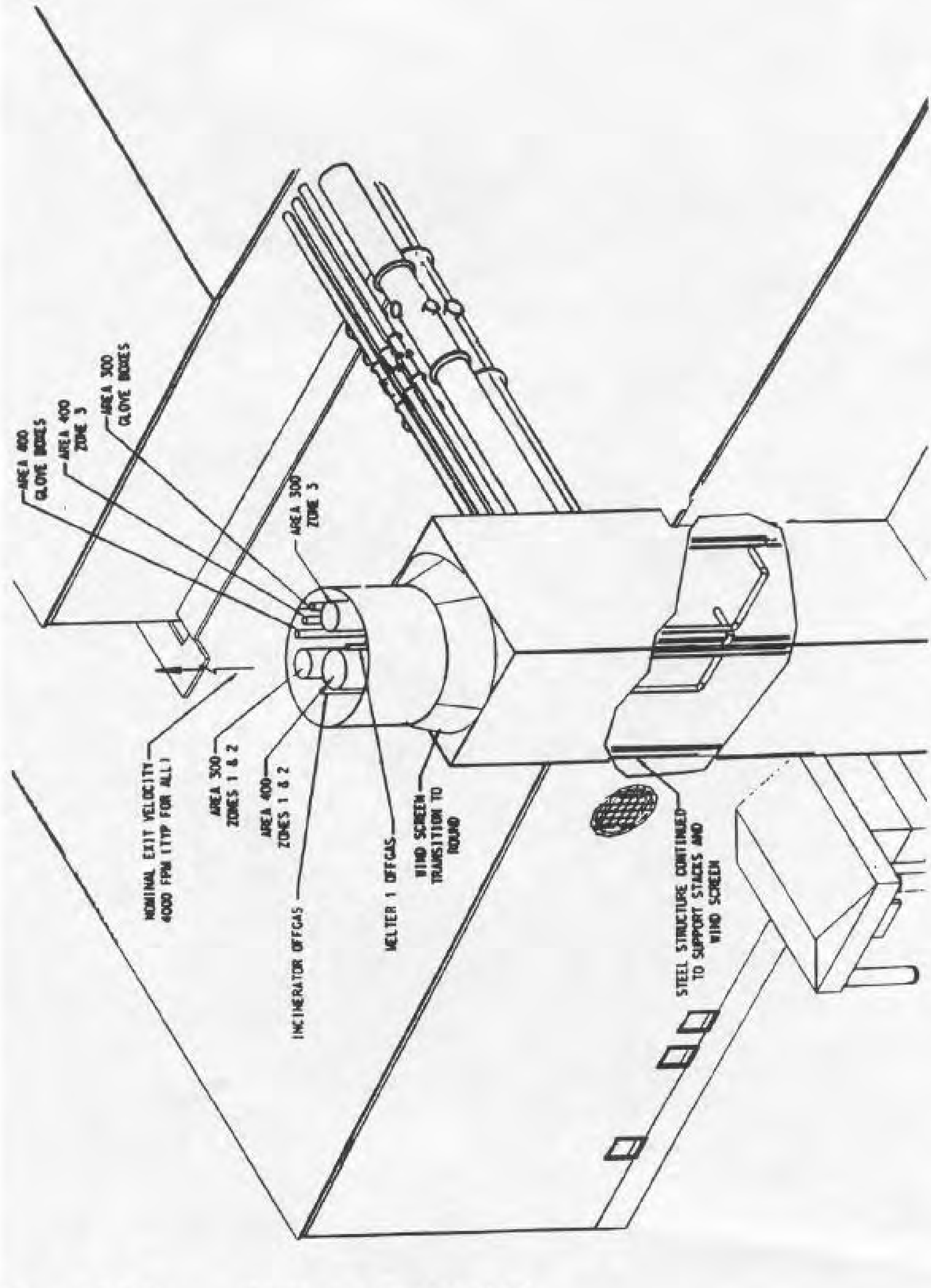

Figure E-3-5 Diagram of main stack flues (MK 1997).

Table E-3-4. AMWTP Stack Exit Parameters.

Stack name	Stack Exit Conditions Height (ft)	Velocity (ft/min)	Diameter (inches)	Temp. (°F)	Flowrate (ACFM)	Emission sources
Melter	90	4,000	2.5	120	136	Melter
Incineration	90	4,000	9.9	187	2,140	Incinerator
Non-thermal Zone 1&2 Extract	90	4,000	38.0	86	31,500	None
Non-thermal Zone 3 Extract	90	4,000	37.1	86	30,000	Non-thermal handling other than glovebox
Non-thermal Glovebox Extract	90	4,000	9.6	86	2,000	Analytical lab and sample extraction gloveboxes
Thermal Zone 1&2 Extract	90	4,000	52.4	86	60,000	None
Thermal Zone 3 Extract	90	4,000	9.6	86	2,000	None
Thermal Glovebox Extract	90	4,000	9.6	86	2,000	None
Steam Boiler Exhaust (1)	68	1,914	22.0	450	5,050	Steam Boiler
Steam Boiler Exhaust (2)	68	1,914	22.0	450	5,050	Steam Boiler
HVAC Boiler Exhaust (1)	68	1,722	16.0	450	2,400	HVAC Boiler
HVAC Boiler Exhaust (2)	68	1,722	16.0	450	2,400	HVAC Boiler
Potable Hot Water Heater Exhaust	68	582	12.0	400	460	Potable Hot Water Heater
Diesel Generator (1)	16	6,888	6.0	934	1,352	Diesel engine
Diesel Generator (2)	16	6,888	6.0	934	1,352	Diesel engine

Sources: MK 1997; BNFL 1998c.

E-3.3.3.5 Impacts on Visibility. Atmospheric visibility has been specifically designated as an air quality-related value under the 1977 PSD Amendments to the CAA. Therefore, in the assessment of proposed projects that invoke PSD review (see Section F-3.1.1.2), potential impacts to visibility must be evaluated and shown to be acceptable in designated Class I areas and associated integral vistas. Craters of the Moon Wilderness Area, located approximately 12 miles southwest of the INEEL, is the only Class I area in the Eastern Snake River Plain. However, recognizing the importance of the scenic views in and around the Fort Hall Indian Reservation, additional analyses were performed for this location.

The EPA has designed methodologies and developed computer codes to estimate potential visual impacts due to emissions of proposed sources. The methodologies include three levels of sophistication. Level-1 is designed to be very conservative; it uses assumptions and simplifying methodologies that will predict plume visual impacts larger than those calculated with more realistic input and modeling assumptions. This conservatism is achieved by the use of worst-case meteorological conditions, including extremely stable (Class F) conditions coupled with a very low wind speed (3 feet per second) persisting for 12 hours, with a wind direction that would transport the plume directly adjacent to a hypothetical observer in the Class I or scenic area. The Level-1 analysis is implemented using the computer code VISCREEN to calculate the potential visual impact of a plume of specified emissions for specific transport and dispersion conditions. If screening calculations using VISCREEN demonstrate that during worst-case meteorological conditions a plume is either imperceptible or, if perceptible, is not likely to be considered objectionable, further analysis of plume visual impact would not be required (EPA 1992). Level-2 visual impact modeling employs more site-specific information than that of Level-1. It is still conservative and designed to overestimate potential visibility deterioration. Level-3 visual impact modeling is more intensive in scope and designed to provide a more realistic treatment of plume visual impacts. In both the DOE INEL EIS and this EIS, the Level-1 VISCREEN analyses were performed to ensure conservatism.

Because within a range of wavelengths, a measure of contrast must recognize both intensity, and perceived color, the VISCREEN model determines whether a plume is visible by calculating contrast (brightness) and color contrast. Contrast is calculated at three visual wavelengths to characterize blue, green, and red regions of the visual spectrum to determine if a plume will be brighter, darker, or discolored compared to its viewing background. If plume contrast is positive, the plume is brighter than its viewing background; if negative, the plume is darker. To address the dimension of color as well as brightness, the color contrast parameter, termed "delta E", is used as the primary basis for determining the perceptibility of plume visual impacts in screening analyses. Delta E provides a single measure of the difference between two arbitrary colors as perceived by humans. If contrasts are different at different wavelengths, the plume is discolored. If contrasts are all zero, the plume is indistinguishable from its background.

In order to determine whether a plume has the potential to be perceptible to observers under reasonable worst-case conditions, the VISCREEN model calculates both delta E and contrast for two assumed plume-viewing backgrounds: the horizon sky and a dark terrain object. Results are provided for two assumed worst-case sun angles (to simulate forward and backward scattering of light), with the sun in front and behind the observer, respectively. If either of two screening criteria is exceeded, more comprehensive and realistic analyses should be carried out. The first criterion is a delta E value of 2.0; the second is a green contrast value of 0.05. Regional haze, which is caused by multiple sources throughout a region, is not calculated or estimated with the VISCREEN model.

The VISCREEN model was used to evaluate the potential visual impact of the proposed AMWTP and cumulative emissions of proposed sources at the INEEL on Craters of the Moon Wilderness Area and the Fort Hall Indian Reservation, in recognition of the importance of scenic views in and around each of these areas. For this assessment, the potential impact of incremental emissions of particulate matter and oxides of nitrogen associated with AMWTP alternatives was evaluated using maximum short-term (hourly) emission rates of particulates and nitrogen oxides and minimum and maximum distances from the source to the Class I area and Reservation. Cumulative impacts were estimated by adding impacts for each alternative to those of proposed projects associated with the baseline of the DOE INEL EIS (excluding IWPF). Current operations were considered in the baseline [that is, the impact of current emission levels is monitored at Craters of the Moon Wilderness Area, resulting in a 144-mile value for annual average visual range]. All emission sources were included except construction emissions and emergency diesel generators, which are not evaluated in a PSD assessment.

The EPA recommends default values for various model parameters. In this analysis, default values were used for all parameters with the exception of background ozone concentration. A value of 0.051 parts per million was assigned as a representative regional value (DOI 1994, Notar 1998b). A site-specific annual average background visual range, estimated to be 144 miles based on monitoring programs conducted by the NPS at Craters of the Moon Wilderness Area (Notar 1998a), was also used.

E–4 OCCUPATIONAL AND PUBLIC HEALTH AND SAFETY

This appendix describes the method used and presents the key data required for evaluating the health effects reported in this EIS. The methods presented here are organized under two broad categories: (1) health impacts from effluent releases and (2) normal workplace hazards. The first category includes effluent releases of radioactivity to air and water and addresses health effects to both the public and workers. Sufficient detail on health effects of carcinogenic and toxic chemicals is provided in Section 5.12, Occupational and Public Health and Safety, and additional detail is not provided in this appendix. The second category includes radiological and nonradiological hazards to workers at the AMWTP facility in the normal conduct of their jobs.

E–4.1 Radiological Health and Safety

Estimated health effects from radionuclides are based on the 1990 recommendations of the ICRP (ICRP 1991). These risk factors are presented in Table E-4.1-1.

In the interest of clear and consistent presentation and to allow ready comparison with health impacts from other sources, such as chemical carcinogens, the measure of impact used for evaluation of potential radiation exposures in this EIS is risk of fatal cancer. Population effects are reported as collective radiation dose (in person-rem) and the estimated number of fatal cancer in the affected population. The maximum individual effects are reported as individual radiation dose (in rem) and the estimated lifetime probability of fatal cancer. Other effects, such as nonfatal cancer and genetic effects, are presented in Table E-4.1-1 for informational purposes.

Table E-4.1-1. Risk of fatal cancer and other health effects from exposure to radiation.[a]

Receptor	Fatal cancer	Nonfatal cancer	Genetic effects	Total detriment
Worker	4.0E-04	8.0E-05	8.0E-05	5.6E-04
General public	5.0E-04	1.0E-04	1.3E-04	7.3E-04

a. Units when applied to an individual are “lifetime probability of cancer per rem of radiation dose.” Units when applied to a population of individuals are “excess number of cancer per person-rem of radiation dose.” Genetic effects apply to population, not individuals.

Human health effects associated with radionuclide emissions from the AMWTP have been calculated for (1) a worker at the location of highest predicted radioactivity level, (2) the MEI at an offsite location, and (3) the entire population (adjusted for future growth) within an 80-kilometer radius of each source of emission within the INEEL. Doses and associated human health effects are assessed for AMWTP emissions under each proposed alternative and are added to current (baseline) doses and human health impacts and projected increases as a result of other future INEEL facilities to determine cumulative radiological impacts. Projected increases are assumed to be represented by dose and human health impact estimates for the DOE INEL EIS (DOE 1995) Preferred Alternative. However, some modification to the baseline and foreseeable dose and human health impacts were necessary (see Appendix E-3, Air Resources) to remove contributions from facilities that would not operate under the proposed alternatives. Tables E-4.1-2 and E-4.1-3 present these annual and operating lifetime doses and associated human health impacts, respectively.

The principal pathway by which the public may be exposed to radioactivity is through releases to the atmosphere. Radiation doses to members of the public from airborne releases at INEEL are calculated annually using information from the Radioactive Waste Management Information System

ID 1996d, 1997c). Table E-4.1-4 presents data for 1995 and 1996. As Table E-4.1-4 indicates, the offsite radiation dose to any member of the public from normal operations is substantially less than 1 millirem per year for both periods. Current regulations limit releases of airborne radioactivity from DOE facilities to no more than 10 millirem per year to any member of the public.

Table E-4.1-2. Summary of radiation dose and human health impacts associated with airborne emissions from the AMWTP.

Receptor	Baseline		Projected		AMWTP		Cumulative	
	Dose millirem	Risk [a] (fatality)	Dose millirem	Risk [a] (fatality)	Dose millirem	Risk [a] (fatality)	Dose millirem	Risk [a] (fatality)
No Action Alternative								
MEI Onsite	0.21	8.40E-08	0.023	9.20E-09	0.0	-	0.23	9.20E-08
MEI Offsite	0.031	1.55E-08	0.11	5.50E-08	0.0	-	0.14	7.00E-08
Population [b]	0.085	4.25E-05	0.41	2.05E-04	0.0	-	0.50	2.50E-04
Proposed Action Alternative								
MEI Onsite	0.21	8.40E-08	0.023	9.20E-09	0.73	2.92E-07	0.96	3.84E-07
MEI Offsite	0.031	1.55E-08	0.11	5.50E-08	0.11	5.50E-08	0.25	1.25E-04
Population [b]	0.085	4.25E-05	0.41	2.05E-04	0.056	2.80E-05	0.55	2.75E-04
Non-Thermal Treatment Alternative								
MEI Onsite	0.21	8.40E-08	0.023	9.20E-09	0.003	1.20E-09	0.24	9.60E-08
MEI Offsite	0.031	1.55E-08	0.11	5.50E-08	0.0017	8.50E-10	0.14	7.00E-08
Population [b]	0.085	4.25E-05	0.41	2.05E-04	0.00037	1.85E-07	0.50	2.50E-04

a. The risk fatality for MEI is based on annual dose and one individual, the population risk is based on annual dose and total population of 82,000 within 80 kilometer of the site.
b. The population dose is in person-rem per year.

Table E-4.1-3. Summary of radiation dose and human health impacts associated with airborne emissions over the projected operating lifetime of the AMWTP.[a]

Receptor	13-year facility lifetime		30-year facility lifetime	
	Dose	Risk (fatality)	Dose	Risk (fatality)
Proposed Action				
MEI Onsite	9.5 millirem	3.80E-06	22 millirem	8.80E-06
MEI Offsite	1.5 millirem	7.50E-07	3.4 millirem	1.70E-06
Population	0.65 person-rem [b]	3.25E-04	1.6 person-rem [c]	8.00E-04
Non-Thermal Treatment Alternative				
MEI Onsite	0.039 millirem	1.56E-08	[d]	[d]
MEI Offsite	0.023 millirem	1.15E-08	[d]	[d]
Population	0.0043 person-rem [b]	2.15E-06	[d]	[d]
Treatment and Storage Alternative				
MEI Onsite	9.5 millirem	3.80E-06	22 millirem	8.80E-06
MEI Offsite	1.5 millirem	7.50E-07	3.4 millirem	1.70E-06
Population	0.65 person-rem [b]	3.25E-04	1.6 person-rem [c]	8.00E-04

a. Data for dose and lifetime from Table 5.7-4 of Section 5.7, Air.
b. The population dose and risk is based on total population of 82,000.
c. The population dose and risk is based on total population of 89,000.
d. AMWTP would not operate beyond 13 years under this alternative.

Table E-4.1-4. Estimated doses to members of the public from INEEL airborne releases for years 1995 and 1996.

Year	Maximally exposed individual (millirem)	Population dose (person-rem)[a]
1995	0.018	0.3
1996	0.031	NA[b]

a. Population dose from DOE 1995.
b. NA = Not available.

Based on the nature of the work at the INEEL, occupational radiation exposure for some workers will inevitably be above background levels. Natural background radiation dose in the vicinity of INEEL site, Snake River Plain (DOE-ID 1991a), are presented in Table E-4.1-5. More recent background radiation levels of approximately 360 mrem/year have been reported (see Section 4.7, Air Resources). The radiation protection program required by regulation and DOE orders is designed to ensure that no worker receives doses larger than the applicable limits and that worker doses are kept as low as reasonably achievable.

Workers at the RWMC may be exposed either internally or externally to radiation. Internal exposure occurs when radioactive materials are deposited in the body through inhalation, ingestion, or absorption through intact skin or wounds in the skin. External exposures in the workplace are those received from radiation-emitting sources outside the body. Table E-4.1-6 presents the collective total effective dose equivalent (which includes both internal and external doses) for individual workers with measurable dose for the DOE complex, including contractor and government workers, the INEEL, and the RWMC. The statistics for the DOE complex and INEEL are from the DOE Occupational Radiation Exposure report (DOE 1996b). The 1995 information regarding the RWMC is from Parrish (1998).

Table E-4.1-5. Estimated natural background radiation dose for the Snake River Plain.

Source	Annual effective dose equivalent (millirem)
	External
Terrestrial	75
Cosmic	39
Subtotal	114
	Internal
K-40 and others	40
Inhaled nuclides [a]	200
Subtotal	240
TOTAL	354

Source: DOE-ID 1991a.

a. The dose from inhaled radionuclides is due primarily to short-lived decay products from radon and varies widely with geographic location. The value represents the United States population average.

Table E-4.1-6. Collective total effective dose equivalent (TEDE) of individuals with measurable dose for the DOE Complex, INEEL, and RWMC.

Year	Site	Total workers, DOE and contractors	Total monitored workers	Total monitored with measurable dose	Collective dose (person-rem)	Average measurable dose (rem)
1991	DOE	183,546	119,770	31,326	2,574	0.082
	INEEL	-[a]	-	-	162	-
	RWMC	-	-	-	-	-
1992	DOE	191,036	123,711	29,414	2,295	0.078
	INEEL	-	-	1,004	87	0.082
	RWMC	-	-	15	0.87	0.058
1993	DOE	194,547	127,042	25,095	1,644	0.066
	INEEL	-	-	1,175	235.5	0.200
	RWMC	-	-	33	2.03	0.062
1994	DOE	184,073	116,511	25,390	1,643	0.065
	INEEL	-	-	1,659	236.8	0.143
	RWMC	-	-	56	7.1	0.127
	DOE	172,178	127,276	23,613	1,840	0.078

1995	INEEL	-	-	1,501	284	0.189
	RWMC	-	-	51	6.4	0.125

[a] "- " represents no data available.

Reported doses resulting from normal operations for a recent four-year (1992-1995) period averaged to 72, 154, and 93 millirem for the DOE complex, INEEL, and RWMC, respectively. The average doses for RWMC change to 81 millirem when years 1996 and 1997 get included in the statistic. Table E-4.1-7 presents the total measured dose and the number of radiation workers.

Table E-4.1-7. RWMC total measured dose.[a]

Year	Number of radiation workers	Total dose (rem)	Average dose (rem)
1992[b]	15	0.874	0.058
1993[b]	33	2.030	0.062
1994[b]	56	7.135	0.127
1995	51	6.353	0.125
1996	78	4.439	0.057
1997	66	3.777	0.057

a. Data from INEEL radiation dosimetry system area radiation dose report.
b. For all years, the total dose includes all Environmental Restoration and Waste Management facilities, which are RWMC, Waste Experimental Reduction Facility (WERF), and Waste Reduction Operation Complex.

E-4.2 Nonradiological Hazards

The primary source of information on nonradiological hazards to the workers at the INEEL are reports of occupational injuries. Statistics regarding the injury, illness, and fatality rates for the entire DOE complex, INEEL, and RWMC are presented in Table E-4.2-1. The information for the DOE complex and INEEL are from the DOE Office of Environmental Safety and Health, Technical Information System web site [http://tis.eh.doe.gov/docs/oipds/oipds964/]. Statistics for the RWMC were obtained from an INEEL occupational health representative (Kavaran 1998). These data include construction workers in addition to operation and maintenance workers.

The calculated rates from Table E-4.2-1 are used to estimate the annual average injury/illness and fatalities based on the annual average number workers assuming 200,000 hours worked. The rate calculation is based on the approach used in DOE reports. The complete methodology can be found at the following web site [http://tis.eh.doe.gov/systems/doe_injury/rates.html]. The equations for calculating the incidence and fatality rates are as follows:

Incidence Rate per 200,000 hours = (Number of Injuries and Illnesses x 200,000 hours)/(Employee Hours Worked)

Fatality Rate per 200,000 hours = (Number of Fatalities x 200,000 hours)/(Total Hours Worked).

Table E-4.2-1. DOE Complex, INEEL, and RWMC injury, illness, and fatality statistics.

Year	Site	Total employees	Total work hours	Recordable cases	Recordable case rate	Total fatalities	Lost workday cases	Lost workday case rate[a]	Lost workdays	Lost workday rate[a]
1992	DOE	190,748	3.63E+08	6,858	3.8	10	3,209	1.8	97,827	54.0
	INEEL	9,544	1.76E+07	324	3.7	0	156	1.8	3,090	35.2
	RWMC	-[b]	-	1	-	0	-	-	1	-
1993	DOE	192,528	3.66E+08	6,737	3.7	3	2,999	1.6	90,453	49.5
	INEEL	9,042	1.72E+07	281	3.3	0	139	1.6	2.820	32.8
	RWMC	-	-	0	-	0	-	-	0	-
1994	DOE	183,574	3.49E+08	6.282	3.6	12	3,008	1.7	88,111	50.5
	INEEL	8,384	1.59E+07	250	3.1	0	110	1.4	1,823	22.9

	RWMC	-	-	4	-	0	-	-	19	-
1995	DOE	169,679	3.22E+08	5,714	3.5	3	2,784	1.7	80,191	49.7
	INEEL	7,094	1.35E+07	237	3.5	0	114	1.7	1,620	24.0
	RWMC	-	-	15	-	0	-	-	22	-
1996	DOE	157,003	2.98E+08	5,195	3.5	2	2,371	1.6	61,568	41.3
	INEEL	6,645	1.26E+07	192	3.0	1	78	1.2	1,100	17.4
	RWMC	-	-	13	-	1	-	-	8	-

[a] Rates are per 200,000 hours worked (based on the format of available data).
[b] "-" represents no data available.

E-5 FACILITY ACCIDENTS

E-5.1 Introduction

Section E-5 provides background information for Section 5.14, Facility Accidents. A facility accident is an unplanned sequence of events that results in undesirable consequences. This section describes the process used to identify accident scenarios, the basis for evaluating selected scenarios, and the modeling methods and assumptions used to estimate health effects consequences. The analysis of accidents is intended to be conservative in the sense that where uncertainties exist, assumptions that bound the potential for credible consequences are used.

E-5.2 Methodology

E-5.2.1 Selection of Accident Scenarios

Hazard identification and evaluation was performed for the AMWTP to derive the bounding accidents for the facility. The analysis provides a thorough, predominately qualitative, evaluation of the spectrum of risks to the public, workers, and environment. The hazard evaluation ranking qualitatively evaluates the frequency and consequence of an accident using four frequency bins and four consequence bins as described in Table E-5.2-1. The risk associated with each accident is the product of frequency and consequence.

The selection of the risk dominant accident scenarios relies on previous safety analysis reports for the RWMC (EG&G 1986, INEEL 1997) and on the draft preliminary safety analysis report for the AMWTP (BNFL 1998d). In general, the approach is to select the scenarios with the highest consequence within each frequency category. One first examines the scenarios that have a frequency category of anticipated. All of the scenarios in this category have a low consequence with the exception of one scenario which has a moderate consequence. Because of its high frequency, the scenario is a significant contributor to risk even though there are higher consequence events that have lower frequencies. The next step is to examine the scenarios that have a frequency category of unlikely. Four scenarios were identified with a moderate to high consequence within this frequency category. The final step is to examine the extremely unlikely frequency category for scenarios that could have a consequence higher than the consequences of the four unlikely scenarios already selected. Two scenarios were identified that could have higher consequences. The list of potentially risk-dominant design basis accident scenarios for the AMWTP is presented in Table E-5.2-2. The following subsections describe the design basis accident scenarios in more detail.

E-5.2.1.1 Fire Involving Waste in the Box/Drum Line. Transuranic (TRU) waste is removed from containers and sorted for further treatment in the AMWTP facility box and drum lines. It is postulated that a fire could be initiated in uncontained waste within the box or drum line confinement cell. A fire could be initiated by sparking from remote power tools used in the cell to open containers, or from within the waste itself via spontaneous combustion or undetected pyrophoric constituents. The fire then spreads to involve half of the uncontained waste within the cell before the fire is suppressed by fire protection systems. Waste in any unopened containers within the cell is not involved.

Table E-5.2-1. Frequencies and consequences of hazards evaluated.

Frequency	Description	Consequence	Description
Anticipated (>1.0E-02/yr)	Incidents that may occur several times during the lifetime of the facility	None	Negligible onsite and offsite impacts on people or the environment
Unlikely (1.0E-04/yr to 1.0E-02/yr)	Accidents not anticipated to occur during the lifetime of the facility	Low	Minor onsite and negligible offsite impacts on people or the environment
Extremely unlikely (1.0E-6/yr to 1.0E-02/yr)	Accidents that probably do not occur during the life cycle of the facility.	Moderate	Considerable onsite impact on people or the environment: only minor offsite impact
Beyond extremely unlikely (<1.0E-06/yr)	All other accidents	High	Considerable onsite and offsite impacts on people or the environment.

Source: INEEL 1997.

The box and drum lines are Zone 3 confinement cells with ventilation that is part of the AMWTP facility cascade system. The fire is postulated to increase the temperature in the cell and cause increased particulate loading on the ventilation system HEPA filters. The pressure in the cell increases, resulting in a release of radioactivity to Zone 2 areas. Radiation alarm systems and fire suppression systems function as designed, and workers evacuate the building within 5 minutes. No release outside the facility occurs.

Table E-5.2-2. Design basis accident scenarios for the AMWTP.

Accident description	Frequency	Consequence
Fire involving uncontained waste in the proposed AMWTP box and drum line confinement cell	A	L
Loss of pressure differential between confinement zones due to loss of electrical power and backup diesel generator failure	A	L
Waste box dropped outdoors and breaks open during transfer between facilities within the TSA	A	M
Fire involving TRU waste containers within the TSA Retrieval Enclosure	U	M
Incinerator explosion and confinement cell breach caused by a flameout, buildup of excess volatiles and or propane, and subsequent ignition and explosion	U	H
Wind-borne missile breach of building structure which causes a waste box to break open	U	M
Fire involving waste transfer vehicle during transfer between facilities within the TSA	U	H
Vitrifier explosion and confinement cell breach due to severe water incursion and subsequent steam explosion	E	H
Fire in Type II storage module caused by either a range fire, a propane delivery truck accident, or an internal fire that is not detected or suppressed	E	H

Source: BNFL 1998d.

E-5.2.1.2 Loss of All AC Power. It is postulated that a loss of electrical power occurs and the backup diesel generator fails to start or fails to run. Initial efforts to start the emergency generator fail resulting in a complete loss of AC for 10 minutes. During this time the pressure differential between the various confinement zones is not maintained, resulting in the spread of contamination.

Interruptions of offsite power occur up to several times per year at the RWMC, but the duration is usually less than a few minutes. Based on industry statistics for backup diesel generators, the combined likelihood of failure to start, pick up the electrical load, and continue to run is about 0.01 failures per demand. Given several demands per year, the frequency of the postulated accident is in the low end of the anticipated category.

E-5.2.1.3 Dropped Waste Box Outdoors During Transfer. TRU waste in waste boxes is transferred by flatbed truck within the TSA. For each box retrieved from the TSA Retrieval Enclosure (TSA RE), transfers between facilities occur as follows:

1. From TSA RE to Type I module
2. From Type I module to Type II module
3. From Type II module to proposed AMWTP facility.

Each transfer includes loading/unloading, some of which occurs outdoors. It is postulated that a waste box could either be dropped during loading/unloading or fall off a truck during transfer. The dropped waste box breaks open, releasing radioactive and toxic materials to the atmosphere.

E-5.2.1.4 Fire in TRU Waste in the TSA RE. Since 1970, TRU waste has been stored in containers on ground-level asphalt pads within the RWMC TSA. Waste containers were stacked and covered with plywood cover, fabric, and 3 to 4 feet of soil (TSA RE pad is covered with fabric only). It is expected that some containers have deteriorated during storage, and that waste will occasionally be exposed during retrieval operations. It is postulated that exposed waste could be ignited by chemical reaction, electrical discharge, spontaneous combustion, or ignition of pyrophoric materials. Spread of the fire would be limited by container integrity and lack of combustible fuel. A worst-case material at risk is estimated to be five boxes (one container in which the fire is initiated, and four adjacent containers beside and above it).

E-5.2.1.5 Incinerator Explosion. Feed to the incineration process is inorganic homogenous debris, organic homogenous debris, and soil. The postulated accident involves a flameout in the incinerator, buildup of excess volatiles and/or propane in the system, and subsequent ignition and explosion.

The explosion causes breach of the incinerator, the Zone 2 confinement cell, and the roof and/or adjacent maintenance dock access door. The material at risk involves the contents of the incinerator.

E-5.2.1.6 Wind-Borne Missile Breach of Building Structure. TRU waste in drums and waste boxes is received and staged for treatment in the southwest corner of the proposed AMWTP facility. It is postulated that a missile such as a pipe or piece of lumber driven by high wind penetrates the wall of the AMWTP facility and breaks open a waste box.

E-5.2.1.7 Fire Involving Waste Transfer Vehicle. TRU waste is transferred by flatbed semi-truck trailer within the TSA. For each box retrieved from the TSA RE, transfers between facilities occur as follows:

1. From TSA RE to Type I module
2. From Type I module to Type II module
3. From Type II module to proposed AMWTP facility.

The trailers are 40 feet long and can transport a maximum of ten 4 x 4 x 7 foot waste boxes. During a waste transfer, a vehicle accident is postulated to occur due to mechanical failure or human error. The accident initiates a fire that spreads to involve the waste contents of the truck. Fire protection programs and equipment at the AMWTP are assumed to function as planned.

E-5.2.1.8 Vitrifier Explosion. Feed to the vitrification process is ash material from the incinerator system, particulate from the atmospheric protection system, and certain secondary waste. Glass forming additives are continuously fed with the waste to enhance the glass quality of the final waste product drums. Waste and glass feed to the vitrifier is not flammable or explosive. The postulated accident involves a significant water incursion to the vitrifier and subsequent steam explosion. Water incursion could occur due to a severe breach of the vitrifier cooling water jacket, or by initiation of the fire suppression system and accidental flow down a feed, offgas, or bubbler path into the vitrifier chamber.

The explosion causes breach of the vitrifier, the Zone 2 confinement cell, and the roof and/or adjacent building doors. The material at risk involves the glass and “cold cap” in the vitrifier.

E-5.2.1.9 Type II Storage Module Fire. TRU waste is stored in boxes and drums in the seven Type II modules. It is postulated that a worst-case fire could involve a significant fraction of the contents of one Type II module. A worst-case fire could be initiated by a range fire for which control efforts are unsuccessful, and that spreads into the TSA. Other potential initiators are an accident involving a propane delivery truck near a Type II module, or an internal fire that is not detected or suppressed by the fire protection systems.

E-5.2.2 Computer Modeling to Estimate Radiation Doses

Radiological consequences to downwind receptors (collocated workers and public) were estimated using the Radiological Safety Analysis Computer Program (RSAC-5) (Wenzel 1993). The RSAC-5 computer program was developed for the DOE Idaho Operations Office by Westinghouse Idaho Nuclear Co., Inc. and is in the public domain.

RSAC-5 simulates potential radiation doses to maximally exposed individuals or population groups from accidental airborne releases of radionuclides to the environment. From a specified source term, users can calculate the environmental transfer, uptake, and human exposure. Individual doses are determined at specific distances onsite, at the site boundaries, and away from the site via airborne plume immersion, ground surface contamination, inhalation, and ingestion. The ingestion pathway applies only where food is raised locally and potentially consumed there.

The RSAC-5 program uses a two-dimensional Gaussian atmospheric-dispersion model to estimate the dispersion of the radioactive-material plume at various distances downwind from the point of release. INEEL-specific values of these dispersion coefficients are built into RSAC-5 for calculation of dispersion factors (÷/Qs). The meteorological capabilities of RSAC-5 include Pasquill-Gifford, Hilsmeier-Gifford, and Markee models for Gaussian plume diffusion.

RSAC-5 uses weighting factors for various body organs to calculate a committed effective dose equivalent (CEDE) from radioactivity deposited inside the body by inhalation or ingestion. RSAC-5 calculates an effective dose equivalent (EDE) for the external exposure pathways (immersion in plume, exposure from ground surface contamination) and a 50-year CEDE for the internal exposure pathways (inhalation, ingestion). The sum of the EDE from external pathways and the CEDE from internal pathways is called the total effective dose equivalent (TEDE).

E-5.2.3 Modeling for Hazardous Chemical Releases

The determination of hazardous chemical exposures for various accident scenarios uses the same release times and dispersion coefficients (÷/Qs) as those used for the radiological consequences. The toxicological evaluation guidelines are in terms of air concentration in units of mg/m^3. Because Emergency Response Planning Guidelines do not exist for the hazardous chemical constituents of the retrievable stored waste at RWMC to be processed at the AMWTP, the most restrictive criterion is used based on the following:

- For TOX-1,
  - Permissible exposure limit-time-weighted average (PEL-TWA)
  - Threshold limit value-time-weighted average (TLV-TWA).

- For TOX-2,
  - Emergency exposure guidance level (EEGL) (60 min)
  - 10 percent of immediately dangerous to life or health (IDLH).

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 extremely unlikely events.

Table E-5.2-3 shows the basic toxicological criteria used in the derivation of the toxicological evaluation guidelines. The TLVs have been defined to include various levels of exposure to worker populations. TLVs are published by the ACGIH. The population that comprises the general public differs from the population defined for TLVs in that the general public includes additional groups such as children, elderly persons, and hospitalized patients. The two thresholds used here are:

- TLV-TWA: The threshold limit value-time-weighted average for a specific substance defines the limit of acceptable concentration to which most workers can be exposed for up to a normal 8-hr day and a 40-hr week without adverse effect.

- TLV-STEL: The threshold limit value-short term exposure limit is a TWA concentration to which workers should not be exposed for longer than 15 minutes and which should not be repeated more than four times per day, with at least 60 minutes between successive exposures. Whereas the TLV-TWA is useful for chronic exposure effects, the TLV-STEL addresses acute effects of short-term, high-level exposures.

The PELs have been developed by the OSHA as a measure for safe and healthful working conditions for men and women employed in any business engaged in commerce in the United States. As with other exposure limits developed for industrial applications, limitations exist with respect to applicability to the general population.

The IDLH levels have been developed to define concentrations of materials from which workers should evacuate within 30 minutes without escape-impairing symptoms or any irreversible health effect. As IDLH values were developed by the National Institute for Occupational Safety and Health for industrial application, their usefulness for application to the general population is limited.

An EEGL is a concentration of a substance in air judged by the Department of Defense to be acceptable for the performance of specific tasks by military personnel during emergency conditions lasting 1 to 24 hours. EEGL dosages may produce transient central nervous system effects and eye or respiratory irritation, but none serious enough to prevent response to emergency conditions.

Table E-5.2-3. Basic toxicological criteria for derivation of TOX-1 and TOX-2.

	ACGIH TLVs		OSHA PELs			
Substance	TWA (mg/m^3)	STEL/C (mg/m^3)	TWA (mg/m^3)	STEL/C (mg/m^3)	IDLH (mg/m^3)	EEGL (mg/m^3)
Solids						
Asbestos[a]	2 f/cc	—	0.1 f/cc	1 f/cc (30 min)	—	—
Beryllium	0.002	0.006[b]	0.002	C0.005	4	—
Cadmium	0.002	0.006[b]	0.005	—	9	—
Lead	0.15	0.45[b]	0.05	—	100	—
Lithium chromate[c]	0.05	0.15	—	C0.1	15	15
Nitrates[d]	—	—	—	—	—	—
Liquids						
n-Butyl alcohol	—	C152	300	—	4,236	—
Carbon tetrachloride	31	63	63	C158	1,258	—
Mercury	0.05	0.15[b]	0.05	C0.1	10	0.2 (24 hr)
Methyl alcohol	262	328	260	310	7,861	262
Methylene chloride	174	522[b]	1,740	C3,480	7,970	—
Nitric acid	5.2	10	5	10	64	—
Polychlorinated byphenyls	0.5	1.5[b]	0.5	—	5	—
Perchloroethylene	170	678	685	C1,370	1,015	—
1,1,1-trichloroethane	1,910	2,460	1,900	2,450	3,811	—
1,1,2-trichloro-1,2,2-trifluoroethane	7,670	9,590	7,600	9,500	15,298	11,505
Trichloroethylene	269	537	540	C1,080	5,363	—
Xylene	434	651	435	655	3,901	868

Source: INEEL 1997.

[a] The density of chrysotile is 1.55 gm/cc (1.55E+09 mg/m^3). Fibers of respirable size would be approximately 10 microns long and 3.3 microns in diameter with a mass of 1.3E-07 mg per fiber. Using the concentration is mg/m^3 at each receptor and converting to fibers/cc allows a comparison of the asbestos released to the appropriate TLV or PEL.

[b] No STEL/C is established for these substances. Values listed are 3× the specific TWA values, as specified by DOE Standard 3005.

[c] For purposes of establishing toxicological limits, chromium is used.

[d] Nitrates are primarily sodium or potassium nitrates. There are no toxicological limits for these compounds.

E-5.3 Inventory of Radioactive and Hazardous Materials

The retrievably stored TRU waste at the RWMC is in the TSA. The source of information for the inventories in this area is the Radioactive Waste Management Information System. It is the official INEEL record for stored solid radioactive waste (TRU and mixed waste), disposed low-level waste , and processed waste (TRU, low-level waste, and mixed). The inventory in the TSA is what the AMWTP facility will treat prior to offsite shipment and disposal.

The TSA was established in November 1970 as a storage area for retrievable waste contaminated with greater than 10 nCi/g of TRU activity. The definition of TRU waste was finalized in 1982 to read "greater than 100 nCi/g," in accordance with DOE Order 5820.2. Contact-handled (CH) TRU waste is stored aboveground on asphalt pads designated TSA-1, -2, -3, and -R. The waste currently stored on these pads is being transferred to RCRA-approved temporary storage in the Waste Storage Facilities (WSFs) Type I and Type II storage modules. Remote-handled (RH) TRU waste is stored in the Intermediate-Level Transuranic Storage Facility (ILTSF), established in 1976. This waste is stored above grade and is designated as retrievably stored. The ILTSF comprises two pads containing storage vaults.

The volume and curie inventory are presented in Table E-5.3-1. CH TRU waste is the major inventory class of radionuclides within the TSA. The volume of CH TRU waste is approximately 65,000 cubic meters. This volume of waste is stored in approximately 140,000 waste containers. The volume of RH TRU waste stored at the ILTSF is approximately 77 m^3. The ILTSF waste is contained in approximately 619 waste containers. The ILTSF waste is also contaminated with TRU nuclides. However, the ILTSF waste is primarily composed of beta/gamma-emitters. The decay-corrected activity of the ILTSF waste is approximately 11.0 Ci/m^3. The dominant radionuclides found in the TSA waste are Pu-241, Pu-238, Pu-239, and Am-241. The average decay-corrected activity of TSA waste is approximately 5.65 Ci/m^3. The concentration of radionuclides typically present in TSA waste is presented in Table E-5.3-2. Table E-5.3-3 is the inventory of radionuclides in the 65,000m^3 of TSA waste (including a correction to account for the additional 20,000m^3 to be treated at the AMWTP facility) and the calculated partitioning of radionuclides between the two primary waste streams, non-debris and debris. The breakdown of the various container types for waste stored at the TSA is presented in Table E-5.3-4.

The hazardous chemicals inventory found in the retrievably stored waste at the TSA is provided in Table E-5.3-5. These hazardous chemical quantities are derived primarily from the waste generator and process knowledge of the incoming waste. The hazardous source term was developed with a conservative philosophy. Therefore, the weight fractions of hazardous substances actually present in the stored waste are judged to be lower than estimated. The release of hazardous substances, regulated pollutants, or oil not permitted by Federal regulations requires that the occurrence be reported. Reportable quantities are listed in 40 CFR Part 302, Table 302.4. Hazardous substances and materials released in quantities greater than the reportable quantities are subject to reporting to the National Response Center as required by DOE Order 232.1-1. Sodium chromate, hydrochloric acid, nitrobenzene, and ether appear in the source documents of incoming wastes, and, if present at all, they are present in only trace amounts.

Table E-5.3-1. Volume and decayed activity in waste stored at the TSA.

Location[a]	Volume (m^3)	2/17/93 Activity[b] (Ci)
TSA		
TRU		200,500
Non-TRU		
Total	64,691.2	
ILTSF		
TRU		100.3
Non-TRU		8,388
Total	77.2	8,489

Source: INEEL 1997.
a. In this table, the designation TSA means all of the Transuranic Storage Area except the ILTSF.
b. The activities are rounded off to four significant digits.

Table E-5.3-2. General concentration distribution of waste in the TSA.

	Concentration	
Radionuclide distribution	(Ci/m^3)	(Ci/ft^3)
44.3% Pu-241	2.5E+00	7.1E-02
24.3% Am-241	1.4E+00	3.9E-02
16.8% Pu-238	9.7E-01	2.7E-02
11.3% Pu-239	6.3E-01	1.8E-02
2.7% Pu-240	1.5E-01	4.3E-03
0.2% U-233	1.4E-02	3.9E-04
0.2% Cm-244	0.8E-02	2.4E-04

Source: INEEL 1997.

Table E-5.3-3. Radionuclide Inventory for TSA Waste and Scaled for the AMWTP facility.

Radionuclide[a]	Best Estimate Activity[b] (Ci)	Scaled Best Estimate Activity[c] (Ci)	Scaled Activity Non-Debris[d] (Ci)	Scaled Activity Debris[e] (Ci)	Activity Concentra'n Non-Debris[f] (Ci/kg)	Activity Concentra'n Debris[g] (Ci/kg)
Am-241	1.22E+05	1.60E+05	7.02E+04	8.93E+04	4.40E-03	4.49E-03
Pu-238	1.16E+05	1.52E+05	6.67E+04	8.49E+04	4.19E-03	4.27E-03
Pu-239	6.87E+04	8.98E+04	3.95E+04	5.03E+04	2.48E-03	2.53E-03
Pu-240	1.59E+04	2.08E+04	9.15E+03	1.16E+04	5.74E-04	5.86E-04
Pu-242	1.04E+00	1.36E+00	5.98E-01	7.62E-01	3.75E-08	3.83E-08
Pu-241	1.61E+05	2.11E+05	9.26E+04	1.18E+05	5.81E-03	5.93E-03
Ba-137m	2.25E+03	2.94E+03	1.29E+03	1.65E+03	8.12E-05	8.29E-05
Cs-137	2.26E+03	2.96E+03	1.30E+03	1.66E+03	8.16E-05	8.33E-05
Sr-90	2.02E+03	2.64E+03	1.16E+03	1.48E+03	7.29E-05	7.44E-05
Y-90	2.02E+03	2.64E+03	1.16E+03	1.48E+03	7.29E-05	7.44E-05
U-233	1.02E+03	1.33E+03	5.87E+02	7.47E+02	3.68E-05	3.76E-05
Cm-244	5.39E+02	7.05E+02	3.10E+02	3.95E+02	1.95E-05	1.99E-05
H-3	2.64E+02	3.45E+02	1.52E+02	1.93E+02	9.53E-06	9.72E-06
Cs-134	1.11E+02	1.45E+02	6.39E+01	8.13E+01	4.01E-06	4.09E-06
Co-60	1.00E+02	1.31E+02	5.75E+01	7.32E+01	3.61E-06	3.68E-06
Total (primary)	4.94E+05	6.46E+05				
Minor Radionuclides (present in TSA waste at between 1 and 100 Ci)						
Bi-212	2.66E+01	3.48E+01	1.53E+01	1.95E+01	9.60E-07	9.80E-07
C-14	2.38E+00	3.11E+00	1.37E+00	1.74E+00	8.59E-08	8.77E-08
Ce-144	2.71E+01	3.54E+01	1.56E+01	1.98E+01	9.78E-07	9.98E-07
Fe-55	1.13E+00	1.48E+00	6.50E-01	8.28E-01	4.08E-08	4.16E-08
Kr-85	6.86E+00	8.97E+00	3.95E+00	5.02E+00	2.48E-07	2.53E-07
Ni-63	3.57E+00	4.67E+00	2.05E+00	2.61E+00	1.29E-07	1.32E-07
Pb-212	2.66E+01	3.48E+01	1.53E+01	1.95E+01	9.60E-07	9.80E-07
Pm-147	2.73E+01	3.57E+01	1.57E+01	2.00E+01	9.86E-07	1.01E-06
Po-212	1.70E+01	2.22E+01	9.78E+00	1.24E+01	6.14E-07	6.26E-07
Po-216	2.66E+01	3.48E+01	1.53E+01	1.95E+01	9.60E-07	9.80E-07
Pr-144	2.72E+01	3.56E+01	1.57E+01	1.99E+01	9.82E-07	1.00E-06
Ra-224	2.66E+01	3.48E+01	1.53E+01	1.95E+01	9.60E-07	9.80E-07
Sb-125	1.65E+00	2.16E+00	9.49E-01	1.21E+00	5.96E-08	6.08E-08
Th-228	2.66E+01	3.48E+01	1.53E+01	1.95E+01	9.60E-07	9.80E-07
Th-232	7.31E+00	9.56E+00	4.21E+00	5.35E+00	2.64E-07	2.69E-07
Tl-208	9.54E+00	1.25E+01	5.49E+00	6.99E+00	3.44E-07	3.51E-07
U-232	2.60E+01	3.40E+01	1.50E+01	1.90E+01	9.39E-07	9.58E-07
U-234	5.78E+00	7.56E+00	3.33E+00	4.23E+00	2.09E-07	2.13E-07
Total (minor)	2.96E+02	3.87E+02				

a. Radionuclides from Table 4-1 INEL-95/0412, Radon (Rn-220) not included per 40 CFR 61, Subpart H.
b. Best estimate activities from Table 4-1 INEL-95/0412.
c. Scaling factor is 85,000 m3 / 65,000 m^3.
d. Non-Debris mass is 44.49% (44%) of total waste mass.
e. Debris mass is 55.51% (56%) of total waste mass.
f. Based on Total Non-Debris Mass of 15,936,396 kg (Process flow sheet node 23).
g. Based on Total Debris Mass of 19,879,854 kg (Process flow sheet nodes 24, 25, 26 and 4D).

Table E-5.3-4. Breakdown of TSA waste by container type.

Container type	Number
Bin	550
BLM[a]	127,690
BXC[b]	1
BXW[c]	8,800
BXM[d]	2,356
O[e]	27
Total Container	139,424

Source: INEEL 1997.
a. BLM: Metal barrel (drum).
b. BXC: Cardboard box.
c. BXW: Wooden box (fiberglass reinforced polyester and plywood).
d. BXM: Metal box.
e. O: Other

It is possible that because of previous use, mixing, contamination, and long-term radioactive effects, certain radioactive mixed waste may become more hazardous. Furthermore, other hazardous substances could conceivably be created by the addition of thermal energy and chemical recombinations. The number of substances created and the extent to which they are created are a function of numerous variables (e.g., oxygen availability, temperature, composition of the involved wastes).

Several articles have appeared in technical journals regarding the products from thermal stressing of chlorinated organics. These articles support the fact that halogenated hydrocarbons in the TSA wastes can form dangerous decomposition products such as phosgene ($COCl_2$), chlorine gas (Cl_2), hydrochloric acid (HCl), carbon dioxide (CO_2), and carbon monoxide (CO). However, the formation of these products requires high temperatures not normally present. Under oxygen-rich conditions, essentially all chlorinated organics from elemental Cl_2, with no HCl or phosgene production. Conversely, for oxygen-lean reactions, HCl is the favored product with possibly a small amount of phosgene. Under no conditions is phosgene a favored end product. It only occurs as a trace material under oxygen-lean conditions. As temperatures are increased, phosgene decomposes to HCl or Cl_2. At very high temperatures (e.g., >1900°C), all the chlorine compounds begin to decompose and form ionized species such as Cl^- and/or H^+.

Table E-5.3-5. Hazardous chemical inventory for waste stored at the TSA.

Chemical	Average weight fraction of stored waste	Maximum weight fraction of any waste container	Estimated stored waste quantity (kg)	Reportable quantity (kg)
Asbestos	2.74E-03	4.5E-01	71,328	0.454
Barium[a]	0.0	0.0	0.0	None
Beryllium	2.1E-04	9.5E-01	5392	4.54
Cadmium	3.0E-06	1.0E-05	78	4.54
Carbon tetrachloride	6.27E-03	5.0E-02	163,255	4.54
Chromium[a]	0.0	0.0	0.0	2270
n-Butyl alcohol	3.0E-06	1.0E-05	81	2270
Ether[a]	0.0	0.0	0.0	—
Lead	8.26E-03	6.0E-01	215,180	0.454
Hydrochloric acid[a]	0.0	0.0	0.0	2270
Lithium chromate	1.77E-03	2.0E-01	46,032	4.54
Mercury	3.54E-03	2.0E-01	92,211	0.454
Methyl alcohol	8.0E-06	2.5E-05	200	2270
Methylene chloride	4.0E-04	1.0E-03	10,298	454
Nitric acid	1.9E-03	5.05E-01	49,502	454
Nitrates[b]	3.7E-03	9.0E-01	9,655	(c)
Nitrobenzene[a]	0.0	0.0	0.0	454
PCB	8.54E-03	5.56E-01	222,472	0.454
Selenium[a]	0.0	0.0	0.0	45.4
Silver[a]	0.0	0.0	0.0	454
Perchloroethylene	6.2E-04	5.0E-02	16,275	45.4
Sodium chromate[a]	0.0	0.0	0.0	4.54
1,1,1-trichloroethane	5.81E-03	1.5E-01	151,434	454
Trichloroethylene	3.92E-03	1.5E-01	102,097	45.4
1,1,2-trichloro-1,2,2-trifluoroethane	3.71E-03	5.0E-02	96,677	—
Xylene	2.0E-05	5.0E-05	399	454

Source: INEEL 1997.
a. Any 0.0 entry indicates that trace quantities may exist.
b. Nitrates are classified as evaporator salts comprised of sodium nitrate and potassium nitrate.

Analysis of the reactions necessary to produce phosgene from PCBs reveals that such production is extremely unlikely because of the stable nature of the PCB benzene ring and the sequential steps necessary. Production of free chlorine is also unlikely. Likewise, production of phosgene from freons is extremely unlikely because of the strength of the carbon-fluorine bond and the sequential steps necessary. An unlikely end product would be carbonyl fluoride which immediately hydrolyses in the presence of moisture to form carbon dioxide and hydrofluoric acid.

The substance of greatest concern is methylene chloride. Radiolytic action in methylene chloride can produce phosgene by sequential steps. This reaction can occur at quite low energy levels and can be caused by drums heating in sunlight, as well as by ultraviolet radiation from the sun. In the presence of moisture, however, the phosgene hydrolyses over time to form hydrochloric acid and carbon dioxide. Radiolytic action can occur only where relatively high specific radioactivity exists.

Based on the absence of high processing temperatures and the stable nature of the waste materials, it is considered unlikely that sufficient hazardous substances could be created through chemical recombinations to cause injury to the worker or the public.

During accident scenarios involving fires and explosions, phosgene and hydrochloric acid are potential combustion products of chlorinated hydrocarbons and therefore they are accounted for in the accident source terms.

E-5.4 Accident Consequence Assessment

E-5.4.1 Source Terms

To calculate the downwind consequences, a source term (ST) was determined. The ST is the amount of radioactive material released during a specific accident scenario. The STs for each accident scenario are determined using the following equation:

$$BST = MAR \times DR \times ARF \times RF \times LPF$$

where

ST	=	source term (g)
MAR	=	material at risk (g)
DR	=	damage ratio
ARF	=	airborne release fraction
RF	=	respirable fraction
LPF	=	leak path fraction.

Material at Risk. The material at risk (MAR) is the total waste inventory impacted for a given accident scenario and is expressed in terms of total mass at risk (g).

Damage Ratio. The DR represents the fraction of the MAR that could be affected by the postulated accident and is a function of the accident initiator and the operational event being evaluated. The DRs are presented in two ways: a percentage of the total inventory or a finite portion of the total inventory. Percentage of the total inventory is used for accident scenarios such as earthquakes or fires. A finite portion of the total inventory is used for operational accidents in which the actual number of drums or boxes is known.

Airborne Release Fraction. The ARF is that fraction of total radioactive or hazardous chemical material used in a process or contained in storage that is assumed released from its primary confinement in a dispersible form by a postulated accident.

Leak Path Fraction. The LPF is that fraction of total radioactive or hazardous chemical material released from its primary confinement that is assumed released from its secondary confinement in a dispersible form by a postulated accident.

Respirable Fraction. The RF represents the fraction of the material with an aerodynamic equivalent diameter less than 10 μm. RF on particles made airborne under accident conditions are correlated to the stresses induced. Estimates for RF for mechanical releases range from 1.0 to 1.0E-03 based on the amount, type, and dispersability of the powder present.

E-5.4.1.1 Fire Involving Waste in the Box/Drum Line. The inventory of uncontained waste is limited by the mass of fissile material. A maximum of 450 grams of Pu-239 equivalent may be uncontained and in process within the cell at any time. The MAR is shown in Table E-5-8. The MAR assumes 450 g Pu-239 equivalent, and that all transuranic nuclides are present at the ratio of the average concentration in TRU waste at the TSA. Non-TRU nuclides are assumed to be present in the waste at a proportional quantity. The toxic chemical MAR is assumed to be the equivalent of two boxes of TRU waste.

It is assumed that uncontained waste would be located in various areas within the process cell, and some waste would be in export drums on the first floor and less available to the fire. Also, spread of the fire would be controlled by fire protection systems. The damage ratio is estimated to be 0.5.

TRU waste is assumed to be 35 percent combustible and 65 percent noncombustible. The ARF for a fire in combustible uncontained, surface-contaminated waste is 0.01 per DOE-HDBK-3010-94, Section 5.2.1.4. The ARF for a fire in noncombustible surface contaminated waste is 6.0E-3 per DOE-HDBK-3010-94, Section 5.3.1. The ARF for toxic chemicals is 0.01 for solids, 0.1 for semivolatile liquids, and 1.0 for volatile liquids.

When exposed to heat and flame, all halogenated compounds can be broken down to produce halogenated acids and small quantities of phosgene-type compounds. It is assumed that 89 percent of chlorinated hydrocarbons are volatilized, 10 percent decomposes to hydrochloric acid, and 1 percent are converted to phosgene gas. The phosgene molecular conversion ratio for chlorinated hydrocarbons is approximately 1.19. Therefore, the airborne release fraction for phosgene is 0.0119.

The RF for a fire in combustible uncontained, surface-contaminated waste is 1.0 per DOE-HDBK-3010-94, Section 5.2.1.4. The RF for a fire in noncombustible surface-contaminated waste is 0.01 per DOE-HDBK-3010-94, Section 5.3.1. The RF for toxic chemicals is 1.0.

The combined radionuclide ARF and RF for the accident includes the combustible and noncombustible fractions as follows:

$$ARF \times RF = 0.35\ (0.01 \times 1) + 0.65\ (6.0E\text{-}03 \times 0.01) = 3.54E\text{-}03.$$

The fire is assumed to heat up the atmosphere in the cell by 100^{o}F, consequently increasing the volume of the air in the cell by 20 percent. The 20 percent of the cell volume is released to an occupied Zone 2 area over a 1-hour period. The initial concentration in the Zone 2 area is 0, and a worker evacuates in 5 minutes. The effective leak path factor is 8.33E-03. The source terms for Zone 2 are presented in Table E-5.4-1.

Table E-5.4-1. Source term for fire involving waste in the box/drum line.

Nuclide/chemical	MAR (g)	DR	ARF x RF	LPF	Source (g)
Pu-241	1.30E+00	0.5	3.54E-03	8.33E-03	1.91E-05
Am-241	2.46E-01	0.5	3.54E-03	8.33E-03	3.63E-06
Pu-238	2.82E-01	0.5	3.54E-03	8.33E-03	4.16E-06
Pu-239	4.09E+02	0.5	3.54E-03	8.33E-03	6.02E-03
Pu-240	5.82E-01	0.5	3.54E-03	8.33E-03	8.57E-06
U-233	3.90E+01	0.5	3.54E-03	8.33E-03	5.75E-04
Cm-244	2.21E-04	0.5	3.54E-03	8.33E-03	3.26E-09
Cs-134	3.17E-05	0.5	3.54E-03	8.33E-03	4.67E-10
Cs-137	9.59E-03	0.5	3.54E-03	8.33E-03	1.41E-07
Ba-137m	1.57E-09	0.5	3.54E-03	8.33E-03	2.31E-14
Sr-90	5.45E-03	0.5	3.54E-03	8.33E-03	8.03E-08
Y-90	1.38E-06	0.5	3.54E-03	8.33E-03	2.04E-11
Co-60	3.22E-05	0.5	3.54E-03	8.33E-03	4.74E-10
H-3	4.19E-07	0.5	3.54E-03	8.33E-03	6.18E-12
Asbestos	7.03E+03	0.5	3.50E-03	8.33E-03	1.03E-01
Beryllium	5.32E+02	0.5	3.50E-03	8.33E-03	7.75E-02
Cadmium	7.69E+00	0.5	3.50E-03	8.33E-03	1.12E-04
Carbon tetrachloride	1.61E+04	0.5	3.50E-01	8.33E-03	2.35E+01
n-Butyl alcohol	7.99E+00	0.5	3.50E-01	8.33E-03	1.16E-02
Lead	2.12E+04	0.5	3.50E-03	8.33E-03	3.09E-01
Lithium chromate	4.54E+03	0.5	3.50E-03	8.33E-03	6.62E-02
Mercury	4.04E+02	0.5	3.50E-01	8.33E-03	5.89E-01
Methyl alcohol	1.97E+01	0.5	3.50E-01	8.33E-03	2.87E-02
Methylene chloride	1.02E+03	0.5	3.50E-01	8.33E-03	1.48E+00
Nitric acid	4.88E+03	0.5	3.50E-02	8.33E-03	7.11E-01
Nitrates	9.52E+02	0.5	3.50E-02	8.33E-03	1.39E-01
PCB	9.70E+02	0.04	3.50E-02	8.33E-03	1.13E-02
Perchloroethylene	1.60E+03	0.5	3.50E-01	8.33E-03	2.34E+00
1,1,1-trichloroethane	1.49E+04	0.5	3.12E-01	8.33E-03	1.94E+01
Trichloroethylene	1.01E+04	0.5	3.12E-01	8.33E-03	1.31E+01
1,1,2-trichloro-1,2,2-trifluoroethane	9.53E+03	0.5	3.12E-01	8.33E-03	1.24E+01
Xylene	3.93E+01	0.5	3.50E-01	8.33E-03	5.73E-02
Phosgene[a]	3.45E+04	0.5	4.17E-03	8.33E-03	5.99E-01
Hydrochloric acid[a]	3.45E+04	0.5	3.50E-02	8.33E-03	5.03E+00

Source: BNFL 1998d.
a. Phosgene and hydrochloric acid are not in the waste inventory, but are a potential combustion product of chlorinated hydrocarbons.

E-5.4.1.2 Loss of All AC Power. The MAR is the airborne contamination throughout the AMWTP facility. The highest concentrations of airborne contaminants are assumed to be in the following Zone 3 areas:

- Box line
- Drum line
- Incinerator hoppers and shredder
- Vitrifier hoppers
- Supercompactor glovebox.

It is assumed that each area has the airborne equivalent of one waste box being dumped out. The total MAR is therefore the nuclide-specific concentration in average TRU waste, times the volume of a waste box, times an airborne release fraction of 1.0E-03 per DOE-HDBK-3010-94 Section 5.3.3.2.2, times five areas. The ARF for viscous liquids is 2.0E-05 per DOE-HDBK-3010-94, Section 3.2.3.1.

All contaminants are assumed to be free to migrate following a total loss of electrical power. Therefore, the DR is 1.0. The ARF and RF of the airborne contaminants are also assumed to be 1.0.

Because the AMWTP facility cascade ventilation systems are inoperable, contamination migrates through natural convection. In many areas, migration is prevented or impeded by airlocks at zone boundaries. The extent of the time-dependent migration is indeterminate. For purposes of this assessment, the following assumptions are made to bound the release from the AMWTP facility:

- Ten percent of the Zone 3 contaminants are transferred to Zone 2 upon loss of power.
- Ten percent of the new Zone 2 contaminants are transferred to Zone 1 upon loss of power.
- Ten percent of the new Zone 1 contaminants are released from the building.

The LPF for release from the AMWTP facility is 1.0E-03. The LPF is 0.1 for workers in Zone 2 areas and 0.01 for workers in Zone 1 areas. A worker is exposed for 5 minutes before evacuating. The source terms for the release from the AMWTP facility are presented in Table E-5.4-2.

E-5.4.1.3 Dropped Waste Box Outdoors During Transfer. The volume of waste within a waste box is 3.2 cubic meters. It is assumed that all radionuclides and toxic constituents are present at the average concentration in TRU waste at the TSA.

It is assumed that the box breaks open and all waste is available to be released. Therefore, a DR of 1.0 is assumed. The ARF for a free-fall spill and impact stress of surface-contaminated waste is 1.0E-03 per DOE-HDBK-3010-94, Section 5.3.3.2.2. The ARF for viscous liquids (mercury and PCB) is 2.0E-05 per DOE-HDBK-3010-94, Section 3.2.3.1. The bounding RF for a free-fall spill and impact stress of surface-contaminated waste is 1.0 per DOE-HDBK-3010-94, Section 5.3.3.2.2. The accident is assumed to occur outdoors with no confinement. Therefore, the LPF is 1.0. Using these factors, the source term to the environment can be determined as shown in Table E-5.4-3.

Table E-5.4-2. Source Term for Loss of All AC Power.

Nuclide/Chemical	MAR, g	DR	ARF x RF	LPF	Source, g
Pu-241	3.85E-04	1.0	1.00E+00	1.00E-03	3.85E-07
Am-241	8.76E-03	1.0	1.00E+00	1.00E-03	8.76E-06
Pu-238	1.67E-03	1.0	1.00E+00	1.00E-03	1.67E-06
Pu-239	2.73E-01	1.0	1.00E+00	1.00E-03	2.73E-04
Pu-240	1.73E-02	1.0	1.00E+00	1.00E-03	1.73E-05
U-233	2.61E-02	1.0	1.00E+00	1.00E-03	2.61E-05
Cm-244	1.64E-06	1.0	1.00E+00	1.00E-03	1.64E-09
Cs-134	2.11E-08	1.0	1.00E+00	1.00E-03	2.11E-11
Cs-137	6.39E-06	1.0	1.00E+00	1.00E-03	6.39E-09
Ba-137m	1.04E-12	1.0	1.00E+00	1.00E-03	1.04E-15
Sr-90	3.63E-06	1.0	1.00E+00	1.00E-03	3.63E-09
Y-90	9.22E-10	1.0	1.00E+00	1.00E-03	9.22E-13
Co-60	2.18E-08	1.0	1.00E+00	1.00E-03	2.18E-11
H-3	6.70E-09	1.0	1.00E+00	1.00E-03	6.70E-12
Asbestos	1.76E+01	1.0	1.00E+00	1.00E-03	1.76E-02
Beryllium	1.33E+00	1.0	1.00E+00	1.00E-03	1.33E-03
Cadmium	1.92E-02	1.0	1.00E+00	1.00E-03	1.92E-05
Carbon tetrachloride	4.02E+01	1.0	1.00E+00	1.00E-03	4.02E-02
n-Butyl alcohol	2.00E-02	1.0	1.00E+00	1.00E-03	2.00E-05
Lead	5.30E+01	1.0	1.00E+00	1.00E-03	5.30E-02
Lithium chromate	1.13E+01	1.0	1.00E+00	1.00E-03	1.13E-02
Mercury	2.02E-02	1.0	1.00E+00	1.00E-03	2.02E-05
Methyl alcohol	4.93E-02	1.0	1.00E+00	1.00E-03	4.93E-05
Methylene chloride	2.54E+00	1.0	1.00E+00	1.00E-03	2.54E-03
Nitric acid	1.22E+01	1.0	1.00E+00	1.00E-03	1.22E-02
Nitrates	2.38E+00	1.0	1.00E+00	1.00E-03	2.38E-03
PCB	4.85E-02	1.0	1.00E+00	1.00E-03	4.85E-05
Perchloroethylene	4.01E+00	1.0	1.00E+00	1.00E-03	4.01E-03
1,1,1-trichloroethane	3.73E+01	1.0	1.00E+00	1.00E-03	3.73E-02
Trichloroethylene	2.52E+01	1.0	1.00E+00	1.00E-03	2.52E-02
1,1,2-trichloro-1,2,2-trifluoroethane	2.38E+01	1.0	1.00E+00	1.00E-03	2.38E-02
Xylene	9.83E-02	1.0	1.00E+00	1.00E-03	9.83E-05

Source: BNFL 1998d.

E-5.4.1.4 Fire in TRU Waste in the TSA RE. The MAR is the inventory of waste within each of the five waste boxes. It is assumed that all radionuclides are present at the average concentration in TRU waste at the TSA. The MAR is presented in Table E-5.4-4.

Even in this worst-case fire scenario, it is unreasonable to postulate that all exposed containers would be involved in a fire. Results of severe fire tests documented in DOE-HDBK-3010-94, Section 7.3.9.2, indicate that only a fraction of containers would be totally breached, some would be only partially breached (lid seal failure), and some would remain intact. Fire suppression activities would also limit spread of the fire. From this information, a bounding DR of 0.25 is estimated.

TRU waste is assumed to be 35 percent combustible and 65 percent noncombustible. The ARF for a fire in combustible contained, surface-contaminated waste is 5.0E-04 per DOE-HDBK-3010-94, Section 5.2.1.1. The ARF for a fire in noncombustible surface contaminated waste is 6.0E-3 per DOE-HDBK-3010-94, Section 5.3.1. The ARF for toxic chemicals is 0.01 for solids, 0.1 for semivolatile liquids, and 1.0 for volatile liquids.

When exposed to heat and flame, all halogenated compounds can be broken down to produce halogenated acids and small quantities of phosgene-type compounds. It is assumed that 89 percent of chlorinated hydrocarbons are volatilized, 10 percent decomposes to hydrochloric acid, and 1 percent are converted to phosgene gas. The phosgene molecular conversion ratio for chlorinated hydrocarbons is approximately 1.19. Therefore, the airborne release fraction for phosgene is 0.0119.

E-5.4.1.5 Incinerator Explosion. The MAR includes waste in the feed auger, primary chamber, and ash collection drum. Based on preliminary incinerator design, it is estimated that there could be 6 cubic meters of waste in the incinerator system at the time of the explosion. It is assumed that all radionuclides are present at the average concentration of TRU waste at the TSA. Other MAR that could be released in the explosion, such as loading on incinerator offgas system filters, is considered insignificant compared to the incinerator. It is assumed that incomplete combustion has taken place in the waste in the incinerator, and that toxic compounds are present at the average concentration in TRU waste. The MAR is presented in Table E-5.4-5.

An explosion DR of 0.1 is estimated for the material in the incinerator. The ARF for ash is 6.0E-03 and the RF is 0.01 per DOE-HDBK-3010-94, Section 4.4.1.1. The explosion is assumed to cause failure of the incinerator cell and the roof above the incinerator cell and/or the adjacent maintenance door. A LPF of 1.0 is conservatively assumed. Using the above factors, the source term to the environment can be determined as presented in Table E-5.4-5.

E-5.4.1.6 Wind-Borne Missile Breach of Building Structure. The volume of waste within a waste box is 3.2 m^3. It is assumed that all radionuclides and toxic constituents are present at the average concentration in TRU waste at the TSA.

It is assumed that the box breaks open and all waste is available to be released. Therefore, a DR of 1.0 is assumed. The ARF for a free-fall spill and impact stress of surface-contaminated waste is 1.0E-03 per DOE-HDBK-3010-94, Section 5.3.3.2.2. The ARF for viscous liquids (mercury and PCB) is 2.0E-05 per DOE-HDBK-3010-94, Section 3.2.3.1. The bounding RF for a free-fall spill and impact stress of surface-contaminated waste is 1.0 per DOE-HDBK-3010-94, Section 5.3.3.2.2. The accident occurs within the breached confinement. Cascade ventilation is assumed to continue functioning during the accident, although extreme winds could also disrupt offsite power and require starting of backup systems. Ventilation is made less efficient by the breached room and the wind. It is estimated that a maximum of 10 percent of the material made airborne due to the impact of the missile could be released to the environment. Using these factors, the source term to the environment can be determined as shown in Table E-5.4-6.

Table E-5.4-3. Source Term for Dropped Waste Box Outdoor During Transfer.

Nuclide/Chemical	MAR, g	DR	ARF x RF	LPF	Source, g
Pu-241	7.71E-02	1.0	1.00E-03	1.0	7.71E-05
Am-241	1.75E+00	1.0	1.00E-03	1.0	1.75E-03
Pu-238	3.34E-01	1.0	1.00E-03	1.0	3.34E-04
Pu-239	5.46E+01	1.0	1.00E-03	1.0	5.46E-02
Pu-240	3.46E+00	1.0	1.00E-03	1.0	3.46E-03
U-233	5.22E+00	1.0	1.00E-03	1.0	5.22E-03
Cm-244	3.28E-04	1.0	1.00E-03	1.0	3.28E-07
Cs-134	4.22E-06	1.0	1.00E-03	1.0	4.22E-09
Cs-137	1.28E-03	1.0	1.00E-03	1.0	1.28E-06
Ba-137m	2.09E-10	1.0	1.00E-03	1.0	2.09E-13
Sr-90	7.26E-04	1.0	1.00E-03	1.0	7.26E-07
Y-90	1.84E-07	1.0	1.00E-03	1.0	1.84E-10
Co-60	4.29E-06	1.0	1.00E-03	1.0	4.29E-09
H-3	1.34E-06	1.0	1.00E-03	1.0	1.34E-09
Asbestos	3.52E+03	1.0	1.00E-03	1.0	3.52E+00
Beryllium	2.66E+02	1.0	1.00E-03	1.0	2.66E-01
Cadmium	3.84E+00	1.0	1.00E-03	1.0	3.84E-03
Carbon tetrachloride	8.05E+03	1.0	1.00E-03	1.0	8.05E+00
n-Butyl alcohol	3.99E+00	1.0	1.00E-03	1.0	3.99E-03
Lead	1.06E+04	1.0	1.00E-03	1.0	1.06E+01
Lithium chromate	2.27E+03	1.0	1.00E-03	1.0	2.27E+00
Mercury	2.02E+02	1.0	2.00E-05	1.0	4.04E-03
Methyl alcohol	9.86E+00	1.0	1.00E-03	1.0	9.86E-03
Methylene chloride	5.08E+02	1.0	1.00E-03	1.0	5.08E-01
Nitric acid	2.44E+03	1.0	1.00E-03	1.0	2.44E+00
Nitrates	4.76E+02	1.0	1.00E-03	1.0	4.76E-01
PCB	4.85E+02	0.08	2.00E-05	1.0	7.76E-04
Perchloroethylene	8.02E+02	1.0	1.00E-03	1.0	8.02E-01
1,1,1-trichloroethane	7.46E+03	1.0	1.00E-03	1.0	7.46E+00
Trichloroethylene	5.03E+03	1.0	1.00E-03	1.0	5.03E+00
1,1,2-trichloro-1,2,2-trifluoroethane	4.77E+03	1.0	1.00E-03	1.0	4.77E+00
Xylene	1.97E+01	1.0	1.00E-03	1.0	1.97E-02

Source: BNFL 1998d.

Table E-5.4-4. Source Term for Fire in TRU Waste in the TSA RE.

Nuclide/Chemical	MAR, g	DR	ARF x RF	LPF	Source, g
Pu-241	3.85E-01	0.25	2.14E-04	0.0095	1.96E-07
Am-241	8.76E+00	0.25	2.14E-04	0.0095	4.46E-06
Pu-238	1.67E+00	0.25	2.14E-04	0.0095	8.49E-07
Pu-239	2.73E+02	0.25	2.14E-04	0.0095	1.39E-04
Pu-240	1.73E+01	0.25	2.14E-04	0.0095	8.78E-06
U-233	2.61E+01	0.25	2.14E-04	0.0095	1.33E-05
Cm-244	1.64E-03	0.25	2.14E-04	0.0095	8.34E-10
Cs-134	2.11E-05	0.25	2.14E-04	0.0095	1.07E-11
Cs-137	6.39E-03	0.25	2.14E-04	0.0095	3.25E-09
Ba-137m	1.04E-09	0.25	2.14E-04	0.0095	5.31E-16
Sr-90	3.63E-03	0.25	2.14E-04	0.0095	1.85E-09
Y-90	9.22E-07	0.25	2.14E-04	0.0095	4.68E-13
Co-60	2.18E-05	0.25	2.14E-04	0.0095	1.11E-11
H-3	6.70E-06	0.25	1.00E+00	0.0095	1.59E-08
Asbestos	1.76E+04	0.25	3.50E-03	0.0095	1.46E-01
Beryllium	1.33E+03	0.25	3.50E-03	0.0095	1.10E-02
Cadmium	1.92E+01	0.25	3.50E-03	0.0095	1.60E-04
Carbon tetrachloride	4.02E+04	0.25	3.50E-01	0.0095	3.34E+01
n-Butyl alcohol	2.00E+01	0.25	3.50E-01	0.0095	1.66E-02
Lead	5.30E+04	0.25	3.50E-03	0.0095	4.41E-01
Lithium chromate	1.13E+04	0.25	3.50E-03	0.0095	9.43E-02
Mercury	1.01E+03	0.25	3.50E-01	0.0095	8.40E-01
Methyl alcohol	4.93E+01	0.25	3.50E-01	0.0095	4.10E-02
Methylene chloride	2.54E+03	0.25	3.50E-01	0.0095	2.11E+00
Nitric acid	1.22E+04	0.25	3.50E-02	0.0095	1.01E+00
Nitrates	2.38E+03	0.25	3.50E-02	0.0095	1.98E-01
PCB	2.43E+03	0.25	3.50E-02	0.0095	1.61E-02
Perchloroethylene	4.01E+03	0.25	3.50E-01	0.0095	3.33E+00
1,1,1-trichloroethane	3.73E+04	0.25	3.12E-01	0.0095	2.76E+01
Trichloroethylene	2.52E+04	0.25	3.12E-01	0.0095	1.86E+01
1,1,2-trichloro-1,2,2-trifluoroethane	2.38E+04	0.25	3.12E-01	0.0095	1.76E+01
Xylene	9.83E+01	0.25	3.50E-01	0.0095	8.17E-02
Phosgene[a]	8.63E+04	0.25	4.17E-03	0.0095	8.54E-01
Hydrochloric acid[a]	8.63E+04	0.25	3.50E-02	0.0095	7.17E+00

Source: BNFL 1998d.
[a.] Phosgene and hydrochloric acid are not in the waste inventory, but are a potential combustion product of chlorinated hydrocarbons.

The RF for a fire in combustible contained, surface-contaminated waste is 1.0 per DOE-HDBK-3010-94, Section 5.2.1.1. The RF for a fire in noncombustible surface-contaminated waste is 0.01 per DOE-HDBK-3010-94, Section 5.3.1. The RF for toxic chemicals is 1.0.

The combined radionuclide ARF and RF for the accident includes the combustible and noncombustible fractions as follows:

ARF x RF = 0.35 (5.0E-04 x 1) + 0.65 (6.0E-03 x 0.01) = 2.14E-04

The accident occurs inside of the TSA-RE. No breach of the enclosure is postulated, and the ventilation, fire detection, and fire suppression systems are assumed to function as designed. It is assumed that 95 percent of particulates from the fire are filtered through HEPA filters with an efficiency of at least 99 percent resulting in a stack release with a LPF of 0.95 x 0.01 = 0.0095. The remaining 5 percent of airborne emissions are assumed to be released unfiltered through doorways and other building penetrations at ground level, resulting in a leak path factor of 0.05 x 1.0 = 0.05. Using the above factors, the source term to the environment can be determined as shown in Table E-5.4-6.

E-5.4.1.7 Fire Involving Waste Transfer Vehicle. The MAR consists of 10 waste boxes each with a volume of 3.2 m^3. It is assumed that all radionuclides and toxic constituents are present at the average concentration in TRU waste at the TSA. The MAR is presented in Table E-5.4-7.

Even in a worst-case fire scenario, it is not reasonable to postulate that all containers on the truck would be involved in a fire. Results of severe fire tests documented in DOE-HDBK-3010-94, Section 7.3.9.2, indicate that only a fraction of containers would be totally breached, some would be only partially breached (lid seal failure), and some would remain intact. Fire suppression activities would also limit spread of the fire. From this information, a bounding DR of 0.25 is estimated.

TRU waste is assumed to be 35 percent combustible and 65 percent noncombustible. The ARF for a fire in combustible contained, surface-contaminated waste is 5.0E-04 per DOE-HDBK-3010-94, Section 5.2.1.1. The ARF for a fire in noncombustible surface contaminated waste is 6.0E-3 per DOE-HDBK-3010-94, Section 5.3.1. The ARF for toxic chemicals is 0.01 for solids, 0.1 for semivolatile liquids, and 1.0 for volatile liquids.

When exposed to heat and flame, all halogenated compounds can be broken down to produce halogenated acids and small quantities of phosgene-type compounds. It is assumed that 89 percent of chlorinated hydrocarbons are volatilized, 10 percent decomposes to hydrochloric acid, and 1 percent are converted to phosgene gas. The phosgene molecular conversion ratio for chlorinated hydrocarbons is approximately 1.19. Therefore, the airborne release fraction for phosgene is 0.0119.

The RF for a fire in combustible contained, surface-contaminated waste is 1.0 per DOE-HDBK-3010-94, Section 5.2.1.1. The RF for a fire in noncombustible surface-contaminated waste is 0.01 per DOE-HDBK-3010-94, Section 5.3.1. The RF for toxic chemicals is 1.0.

The combined radionuclide ARF and RF for the accident includes the combustible and noncombustible fractions as follows:

ARF x RF = 0.35 (5.0E-04 x 1) + 0.65 (6.0E-03 x 0.01) = 2.14E-04.

The accident is assumed to occur outdoors with no confinement. Therefore, the LPF is 1.0. Using the above factors, the source term to the environment can be determined as presented in Table E-5.4-7.

Table E-5.4-5. Source Term for Incinerator Explosion.

Nuclide/Chemical	MAR, g	DR	ARF x RF	LPF	Source, g
Pu-241	1.45E-01	0.1	6.00E-05	1.0	8.67E-07
Am-241	3.29E+00	0.1	6.00E-05	1.0	1.97E-05
Pu-238	6.26E-01	0.1	6.00E-05	1.0	3.76E-06
Pu-239	1.02E+02	0.1	6.00E-05	1.0	6.15E-04
Pu-240	6.48E+00	0.1	6.00E-05	1.0	3.89E-05
U-233	9.78E+00	0.1	6.00E-05	1.0	5.87E-05
Cm-244	6.16E-04	0.1	6.00E-05	1.0	3.69E-09
Cs-134	7.92E-06	0.1	6.00E-05	1.0	4.75E-11
Cs-137	2.40E-03	0.1	6.00E-05	1.0	1.44E-08
Ba-137m	3.92E-10	0.1	6.00E-05	1.0	2.35E-15
Sr-90	1.36E-03	0.1	6.00E-05	1.0	8.17E-09
Y-90	3.46E-07	0.1	6.00E-05	1.0	2.07E-12
Co-60	8.18E-06	0.1	6.00E-05	1.0	4.91E-11
H-3	2.51E-06	0.1	6.00E-05	1.0	1.51E-11
Asbestos	6.59E+03	0.1	6.00E-05	1.0	3.96E-02
Beryllium	4.98E+02	0.1	6.00E-05	1.0	2.99E-03
Cadmium	7.21E+00	0.1	6.00E-05	1.0	4.33E-05
Carbon tetrachloride	1.51E+04	0.1	6.00E-05	1.0	9.05E-02
n-Butyl alcohol	7.49E+00	0.1	6.00E-05	1.0	4.49E-05
Lead	1.99E+04	0.1	6.00E-05	1.0	1.19E-01
Lithium chromate	4.25E+03	0.1	6.00E-05	1.0	2.55E-02
Mercury	3.79E+02	0.1	6.00E-05	1.0	2.27E-03
Methyl alcohol	1.85E+01	0.1	6.00E-05	1.0	1.11E-04
Methylene chloride	9.52E+02	0.1	6.00E-05	1.0	5.71E-03
Nitric acid	4.58E+03	0.1	6.00E-05	1.0	2.75E-02
Nitrates	8.92E+02	0.1	6.00E-05	1.0	5.35E-03
PCB	9.10E+02	0.1	6.00E-05	1.0	5.46E-03
Perchloroethylene	1.50E+03	0.1	6.00E-05	1.0	9.03E-03
1,1,1-trichloroethane	1.40E+04	0.1	6.00E-05	1.0	8.40E-02
Trichloroethylene	9.44E+03	0.1	6.00E-05	1.0	5.66E-02
1,1,2-trichloro-1,2,2-trifluoroethane	8.94E+03	0.1	6.00E-05	1.0	5.36E-02
Xylene	3.69E+01	0.1	6.00E-05	1.0	2.21E-04

Source: BNFL 1998d.

Table E-5.4-6. Source Term for Wind-Borne Missile Breach of Building Structure.

Nuclide/Chemical	MAR, g	DR	ARF x RF	LPF	Source, g
Pu-241	7.71E-02	1.0	1.00E-03	0.1	7.71E-06
Am-241	1.75E+00	1.0	1.00E-03	0.1	1.75E-04
Pu-238	3.34E-01	1.0	1.00E-03	0.1	3.34E-05
Pu-239	5.46E+01	1.0	1.00E-03	0.1	5.46E-03
Pu-240	3.46E+00	1.0	1.00E-03	0.1	3.46E-04
U-233	5.22E+00	1.0	1.00E-03	0.1	5.22E-04
Cm-244	3.28E-04	1.0	1.00E-03	0.1	3.28E-08
Cs-134	4.22E-06	1.0	1.00E-03	0.1	4.22E-10
Cs-137	1.28E-03	1.0	1.00E-03	0.1	1.28E-07
Ba-137m	2.09E-10	1.0	1.00E-03	0.1	2.09E-14
Sr-90	7.26E-04	1.0	1.00E-03	0.1	7.26E-08
Y-90	1.84E-07	1.0	1.00E-03	0.1	1.84E-11
Co-60	4.29E-06	1.0	1.00E-03	0.1	4.29E-10
H-3	1.34E-06	1.0	1.00E-03	0.1	1.34E-10
Asbestos	3.52E+03	1.0	1.00E-03	0.1	3.52E-01
Beryllium	2.66E+02	1.0	1.00E-03	0.1	2.66E-02
Cadmium	3.84E+00	1.0	1.00E-03	0.1	3.84E-04
Carbon tetrachloride	8.05E+03	1.0	1.00E-03	0.1	8.05E-01
n-Butyl alcohol	3.99E+00	1.0	1.00E-03	0.1	3.99E-04
Lead	1.06E+04	1.0	1.00E-03	0.1	1.06E+00
Lithium chromate	2.27E+03	1.0	1.00E-03	0.1	2.27E-01
Mercury	2.02E+02	1.0	2.00E-05	0.1	4.04E-04
Methyl alcohol	9.86E+00	1.0	1.00E-03	0.1	9.86E-04
Methylene chloride	5.08E+02	1.0	1.00E-03	0.1	5.08E-02
Nitric acid	2.44E+03	1.0	1.00E-03	0.1	2.44E-01
Nitrates	4.76E+02	1.0	1.00E-03	0.1	4.76E-02
PCB	4.86E+02	0.08	2.00E-05	0.1	7.78E-04
Perchloroethylene	8.02E+02	1.0	1.00E-03	0.1	8.02E-02
1,1,1-trichloroethane	7.46E+03	1.0	1.00E-03	0.1	7.46E-01
Trichloroethylene	5.03E+03	1.0	1.00E-03	0.1	5.03E-01
1,1,2-trichloro-1,2,2-trifluoroethane	4.77E+03	1.0	1.00E-03	0.1	4.77E-01
Xylene	1.97E+01	1.0	1.00E-03	0.1	1.97E-03

Source: BNFL 1998d.

Table E-5.4-7. Source Term for Fire Involving Waste Transfer Vehicle.

Nuclide/Chemical	MAR, g	DR	ARF x RF	LPF	Source, g
Pu-241	7.71E-01	0.25	2.14E-04	1.0	4.12E-05
Am-241	1.75E+01	0.25	2.14E-04	1.0	9.37E-04
Pu-238	3.34E+00	0.25	2.14E-04	1.0	1.79E-04
Pu-239	5.46E+02	0.25	2.14E-04	1.0	2.92E-02
Pu-240	3.46E+01	0.25	2.14E-04	1.0	1.85E-03
U-233	5.22E+01	0.25	2.14E-04	1.0	2.79E-03
Cm-244	3.28E-03	0.25	2.14E-04	1.0	1.76E-07
Cs-134	4.22E-05	0.25	2.14E-04	1.0	2.26E-09
Cs-137	1.28E-02	0.25	2.14E-04	1.0	6.84E-07
Ba-137m	2.09E-09	0.25	2.14E-04	1.0	1.12E-13
Sr-90	7.26E-03	0.25	2.14E-04	1.0	3.89E-07
Y-90	1.84E-06	0.25	2.14E-04	1.0	9.86E-11
Co-60	4.36E-05	0.25	2.14E-04	1.0	2.33E-09
H-3	1.34E-05	0.25	2.14E-04	1.0	7.17E-10
Asbestos	3.52E+04	0.25	3.50E-03	1.0	3.08E+01
Beryllium	2.66E+03	0.25	3.50E-03	1.0	2.33E+00
Cadmium	3.84E+01	0.25	3.50E-03	1.0	3.36E-02
Carbon tetrachloride	8.05E+04	0.25	3.50E-01	1.0	7.04E+03
n-Butyl alcohol	3.99E+01	0.25	3.50E-01	1.0	3.49E+00
Lead	1.06E+05	0.25	3.50E-03	1.0	9.28E+01
Lithium chromate	2.27E+04	0.25	3.50E-03	1.0	1.99E+01
Mercury	2.02E+03	0.25	3.50E-01	1.0	1.77E+02
Methyl alcohol	9.86E+01	0.25	3.50E-01	1.0	8.63E+00
Methylene chloride	5.08E+03	0.25	3.50E-01	1.0	4.44E+02
Nitric acid	2.44E+04	0.25	3.50E-02	1.0	2.14E+02
Nitrates	4.76E+03	0.25	3.50E-02	1.0	4.16E+01
PCB	4.85E+03	0.25	3.50E-02	1.0	3.40E+00
Perchloroethylene	8.02E+03	0.25	3.50E-01	1.0	7.02E+02
1,1,1-trichloroethane	7.46E+04	0.25	3.12E-01	1.0	5.81E+03
Trichloroethylene	5.03E+04	0.25	3.12E-01	1.0	3.92E+03
1,1,2-trichloro-1,2,2-trifluoroethane	4.77E+04	0.25	3.12E-01	1.0	3.71E+03
Xylene	1.97E+02	0.25	3.50E-01	1.0	1.72E+01
Phosgene[a]	1.73E+05	0.25	4.17E-03	1.0	1.80E+02
Hydrochloric acid[a]	1.73E+05	0.25	3.50E-02	1.0	1.51E+03

Source: BNFL 1998d.
a. Phosgene and hydrochloric acid are not in the waste inventory, but are a potential combustion product of chlorinated hydrocarbons.

E-5.4.1.8 Vitrifier Explosion. The radionuclide content in the vitrifier is limited by criticality considerations. The MAR assumes that there is one kilogram of Pu-239 equivalent in the 18,000 kg of material in the vitrifier at the time of the explosion. It is assumed that all radionuclides are present at the average concentration in TRU waste at the TSA. Other MAR that could be released in the explosion (loading on vitrifier offgas system filters, feed auger) is considered insignificant compared to the vitrifier. It is also assumed that the majority of significant toxic compounds will have been removed from the MAR in the incineration process preceding vitrification. The MAR is presented in Table E-5.4-8.

An explosion DR of 0.1 is estimated for the material in the vitrifier. The ARF for molten glass is 6.0E-03 per DOE-HDBK-3010-94, Section 4.2.1.2.2. The ARF for any “cold cap” ash is also 6.0E-03 per DOE-HDBK-3010-94, Section 4.4.1.1. The RF is 1.0 based on DOE-HDBK-3010-94, Section 4.2.1.2.2.

Table E-5.4-8. Source Term for Vitrifier Explosion.

Nuclide/Chemical	MAR, g	DR	ARF x RF	LPF	Source, g
Pu-241	2.88E+00	0.1	6.00E-03	1.0	1.73E-03
Am-241	5.48E-01	0.1	6.00E-03	1.0	3.29E-04
Pu-238	6.27E-01	0.1	6.00E-03	1.0	3.76E-04
Pu-239	9.08E+02	0.1	6.00E-03	1.0	5.45E-01
Pu-240	1.29E+00	0.1	6.00E-03	1.0	7.75E-04
U-233	8.67E+01	0.1	6.00E-03	1.0	5.20E-02
Cm-244	4.91E-04	0.1	6.00E-03	1.0	2.95E-07
Cs-134	6.33E-05	0.1	6.00E-03	1.0	3.80E-08
Cs-137	1.92E-02	0.1	6.00E-03	1.0	1.15E-05
Ba-137m	3.13E-09	0.1	6.00E-03	1.0	1.88E-12
Sr-90	1.09E-02	0.1	6.00E-03	1.0	6.54E-06
Y-90	2.76E-06	0.1	6.00E-03	1.0	1.66E-09
Co-60	6.54E-05	0.1	6.00E-03	1.0	3.93E-08
H-3	2.01E-05	0.1	6.00E-03	1.0	1.21E-08

Source: BNFL 1998d.

The explosion is assumed to cause failure of the vitrifier cell and the roof above the vitrifier cell and/or the adjacent building doors. Therefore, a LPF of 1.0 is conservatively assumed. Using the above factors, the source term to the environment can be determined as shown in Table E-5.4-8.

E-5.4.1.9 Type II Storage Module Fire. The maximum transuranic waste storage capacity of one Type II module is 19,320 drums or 2,640 boxes. However, the normal storage configuration in each Type II module includes a combination of drums and boxes. An inventory of approximately 90 percent drums (11,040) and 10 percent boxes (1056) is used based on the average distribution of TRU waste container types and the Type II module storage configuration. The total MAR is 5698 cubic meters. It is assumed that all radionuclides and toxic constituents are present at the average concentration in TRU waste at the TSA. The MAR is presented in Table E-5.4-9.

Combustible materials within the facility are kept at a minimum, and all waste is in containers. Even in a worst-case fire scenario, it is not reasonable to postulate that all containers on the truck would be involved in a fire. Results of severe fire tests documented in DOE-HDBK-3010-94, Section 7.3.9.2, indicate that only a fraction of containers would be totally breached, some would be only partially breached (lid seal failure), and some would remain intact. Fire suppression activities would also limit spread of the fire. From this information, a bounding DR of 0.25 is estimated.

TRU waste is assumed to be 35 percent combustible and 65 percent noncombustible. The ARF for a fire in combustible contained, surface-contaminated waste is 5.0E-04 per DOE-HDBK-3010-94, Section 5.2.1.1. The ARF for a fire in noncombustible surface contaminated waste is 6.0E-3 per DOE-HDBK-3010-94, Section 5.3.1. The ARF for toxic chemicals is 0.01 for solids, 0.1 for semivolatile liquids, and 1.0 for volatile liquids.

When exposed to heat and flame, all halogenated compounds can be broken down to produce halogenated acids and small quantities of phosgene-type compounds. It is assumed that 89 percent of chlorinated hydrocarbons are volatilized, 10 percent decomposes to hydrochloric acid, and 1 percent are converted to phosgene gas. The phosgene molecular conversion ratio for chlorinated hydrocarbons is approximately 1.19. Therefore, the airborne release fraction for phosgene is 0.0119.

The RF for a fire in combustible contained, surface-contaminated waste is 1.0 per DOE-HDBK-3010-94, Section 5.2.1.1. The RF for a fire in noncombustible surface-contaminated waste is 0.01 per DOE-HDBK-3010-94, Section 5.3.1. The RF for toxic chemicals is 1.0.

The combined radionuclide ARF and RF for the accident includes the combustible and noncombustible fractions as follows:

ARF x RF = 0.35 (5.0E-04 x 1) + 0.65 (6.0E-03 x 0.01) = 2.14E-04.

Major failure of the building structure is assumed to occur. Therefore, the LPF is 1.0. Using the above factors, the source term to the environment can be determined as presented in Table E-5.4-9.

Table E-5.4-9. Source Term for Type II Storage Module Fire.

Nuclide/Chemical	MAR, g	DR	ARF x RF	LPF	Source, g
Am-241	3.12E+03	0.25	2.14E-04	1.0	1.67E-01
Ba-137m	3.72E-07	0.25	2.14E-04	1.0	1.99E-11
Cm-244	5.85E-01	0.25	2.14E-04	1.0	3.13E-05
Co-60	7.77E-03	0.25	2.14E-04	1.0	4.16E-07
Cs-134	7.52E-03	0.25	2.14E-04	1.0	4.02E-07
Cs-137	2.28E+00	0.25	2.14E-04	1.0	1.22E-04
H-3	2.39E-03	0.25	2.14E-04	1.0	1.28E-07
Pu-238	5.95E+02	0.25	2.14E-04	1.0	3.18E-02
Pu-239	9.73E+04	0.25	2.14E-04	1.0	5.20E+00
Pu-240	6.15E+03	0.25	2.14E-04	1.0	3.29E-01
Pu-241	1.37E+02	0.25	2.14E-04	1.0	7.34E-03
Sr-90	1.29E+00	0.25	2.14E-04	1.0	6.92E-05
U-233	9.29E+03	0.25	2.14E-04	1.0	4.97E-01
Y-90	3.28E-04	0.25	2.14E-04	1.0	1.76E-08
Asbestos	6.26E+06	0.25	3.50E-03	1.0	5.48E+03
Barium	0.00E+00	0.25	1.00E-02	1.0	0.00E+00
Beryllium	4.73E+05	0.25	3.50E-03	1.0	4.14E+02
Cadmium	6.85E+03	0.25	3.50E-03	1.0	5.99E+02
Carbon tetrachloride	1.43E+07	0.25	3.50E-01	1.0	1.25E+06
Chromium	0.00E+00	0.25	1.00E-02	1.0	0.00E+00
n-Butyl alcohol	7.11E+03	0.25	3.50E-01	1.0	6.22E+02
Ether	0.00E+00	0.25	1.00E+00	1.0	0.00E+04
Lead	1.89E+07	0.25	3.50E-03	1.0	1.65E+04
Hydrochloric acid	0.00E+00	0.25	1.00E-01	1.0	0.00E+00
Lithium chromate	4.04E+06	0.25	3.50E-03	1.0	3.54E+03
Mercury	3.60E+05	0.25	3.50E-01	1.0	3.15E+04
Methyl alcohol	1.76E+04	0.25	3.50E-01	1.0	1.54E+03
Methylene chloride	9.04E+05	0.25	3.50E-01	1.0	7.91E+04
Nitric acid	4.34E+06	0.25	3.50E-02	1.0	3.80E+04
Nitrates	8.47E+05	0.25	3.50E-02	1.0	7.41E+03
Nitrobenzene	0.00E+00	0.25	1.00E-01	1.0	0.00E+00
PCB	8.64E+05	0.02	3.50E-02	1.0	6.05E+02
Perchloroethylene	1.43E+06	0.25	3.50E-01	1.0	1.25E+05
Selenium	0.00E+00	0.25	1.00E-02	1.0	0.00E+00
Silver	0.00E+00	0.25	1.00E-02	1.0	0.00E+00
Sodium Chromate	0.00E+00	0.25	1.00E-01	1.0	0.00E+00
1,1,1-trichloroethane	1.33E+07	0.25	3.12E-01	1.0	1.04E+06
Trichloroethylene	8.96E+06	0.25	3.12E-01	1.0	6.98E+05
1,1,2-trichloro-1,2,2-trifluoroethane	8.49E+06	0.25	3.12E-01	1.0	6.61E+05
Xylene	3.50E+04	0.25	3.50E-01	1.0	3.06E+03
Phosgene[a]	3.07E+07	0.25	4.17E-03	1.0	3.20E+04
Hydrochloric acid[a]	3.07E+07	0.25	3.50E-02	1.0	2.69E+05

Source: BNFL 1998d.

a. Phosgene and hydrochloric acid are not in the waste inventory, but are a potential combustion product of chlorinated hydrocarbons.

E-5.4.2 Meteorological Parameters

Meteorological conditions assumed at the time of release impact the calculation by RSAC-5 of diffusion, dispersion, and depletion factors. Except for releases through operable discharge systems such as offgas filtration and ventilation systems, most releases are assumed to be at ground level. The ground-level release assumption is conservative because the slower dispersion compared to elevated releases results in higher ground-level concentrations and, in the case of radiological releases, higher estimates of radiation exposures near the point of release.

The F stability class was selected since it is the conservative stability class which minimizes dispersion, thereby maximizing downwind concentrations. Similarly, a low windspeed of 1.0 m/s is used for the same reasons. The RSAC-5 program has three different models for diffusion coefficients. For short duration releases (20 minutes or less), the Hilsmeier-Gifford model is used to determine diffusion coefficients as a function of downwind distance. For long duration releases (one hour or longer), the Markee model is used.

Downwind chemical concentrations and radiation exposures are determined at distances of 100 meters, 3,000 meters, and 6,000 meters. The receptor at 100 meters represents a co-located facility worker within the RWMC area. The 3,000 meters receptor represents the distance to the Experimental Breeder Reactor (EBR-I) National Historical Site where members of the public may be present. The receptor at 6,000 meters represents the distance to the nearest site boundary south of the RWMC.

APPENDIX F

PROJECT HISTORY

Waste History/Description

From 1970 through the early 1980's the Idaho National Engineering and Environmental Laboratory (INEEL) accepted over 65,000 cubic meters of transuranic (TRU) and alpha-contaminated waste from other U.S. Department of Energy (DOE) sites. These wastes were placed in above ground storage at the Radioactive Waste Management Complex (RWMC) on the INEEL. The wastes are primarily laboratory and processing wastes of various solid materials, including paper, cloth, plastics, rubber, glass, graphite, bricks, concrete, metals, nitrate salts, and absorbed liquids. Over 95 percent of the waste was generated at DOE's Rocky Flats Plant in Colorado and transported to the INEEL by rail in bins, boxes, and drums. All 65,000 cubic meters was considered to be TRU waste when it was first stored at the INEEL. The amount of this waste stored at the INEEL is over half of the retrievably stored TRU waste in the DOE Complex, all of which was to be eventually permanently disposed of at Waste Isolation Pilot Plant (WIPP). A detailed description of these wastes follows this section (Table F-1-9).

The waste was placed on an asphalt pad at the RWMC in its original shipping containers and covered with plywood, sheets of plastic, and soil. This storage location is an earthen covered berm. Eighty percent (or 52,000 cubic meters) of the waste is located in the earthen covered berm while 20 percent was placed in an Air Support Building and since moved to near-by permitted storage buildings.

The waste has been in the berm since the early 1970's. At the time of initial storage, the design life for the containers was 20 years. Some degradation and deterioration of drums and boxes is expected, with associated soil contamination. If the wastes are not removed from the berm, the soil and possibly the surrounding area could become contaminated.

Over 95 percent of the waste has hazardous constituents and is therefore considered to be mixed waste. Mixed waste is regulated under the *Resource Conservation and Recovery Act* (RCRA). The waste also contains materials such as polychlorinated biphenyls (PCB's) which is regulated under the *Toxic Substance and Control Act* (TSCA).

In 1984, DOE Order 5820.2 finalized the definition of TRU. The new definition excluded alpha emitting waste less than 100 nCi/g at the time of assay. The INEEL estimated that between 25,000 and 27,000 cubic meters of the stored waste would not meet the revised definition of TRU, would have to be managed as low-level mixed waste (LLMW), and could not be disposed of at WIPP. Since all of the waste was initially considered to be TRU, the alpha wastes were co-mingled in the same containers when placed in the earthen covered berm. To separate the wastes, each container would have to be opened and the material sorted and assayed to segregate the alpha from the TRU waste.

In planning a path forward for this waste in the early 1990's, DOE had two environment, safety, and health and regulatory considerations. The first was the potential for further breaching of containers in the berm and subsequent migration of contaminants into the surrounding soil and groundwater. The second was that the interim storage of the waste in the earthen covered berm and temporary buildings did not meet RCRA requirements. The waste in interim storage in the temporary buildings was the subject of an U.S. Environmental Protection Agency (EPA) Notice of Noncompliance in 1990. The RCRA Hazardous and Solid Waste amendments require that all hazardous waste be treated to EPA standards before being placed "in or on the land" [1] for disposal. In addition, the only permissible reason to store untreated waste is to accumulate sufficient quantities of hazardous waste as necessary to facilitate proper recovery, treatment, or disposal.[2] This is referred to as the Land Disposal Restriction (LDR) storage prohibition. The INEEL's interim storage of mixed waste did not meet these requirements.

Project Evolution

This section describes the planning and evaluation of options available to DOE in dealing with the stored waste. The initial plans for dealing with these wastes were developed by the INEEL Management and Operating (M&O) Contractor in the early 1990's. The plans components included the following:

- Retrieve the wastes from the earthen covered berm, and identify and segregate the alpha waste from the TRU waste;
- Build and operate a two-phase treatment facility. This facility was referred to as the Idaho Waste Processing Facility (IWPF). Phase 1 would treat the alpha mixed waste to allow disposal under RCRA LDR requirements, and Phase 2 would repackage the TRU waste into appropriate containers for shipment to WIPP, and thermally treat approximately 25 percent of the waste to meet WIPP waste acceptance criteria (WAC);
- Build a new waste characterization facility to characterize 10 percent of the TRU waste destined for WIPP to assure the WIPP WAC was met;
- Build 11 additional RCRA storage modules for the retrieved and/or treated waste. Seven RCRA storage modules were near completion at the time.

Initial cost estimates for the IWPF exceeded $620M. DOE and the M&O contractor were concerned about the high cost estimate and began exploring options. In 1992 the M&O performed a Systems Design Study to examine the potential for private sector treatment of alpha mixed waste and in 1993, Dames and Moore was commissioned to prepare studies to examine the subject. These studies (which are part of the administrative record for this EIS, as are the other studies referenced in this Appendix) concluded that at least $200M in savings could be achieved and the schedule could be shortened by seven years if the treatment were privatized. At the same time, private industry approached DOE and claimed that commercial LDR treatment of the alpha waste would be more cost effective than if performed by the DOE M&O contractor. Even with the two studies in hand, DOE–Idaho Operations Office (DOE-ID) recognized that current knowledge and funding were insufficient to directly pursue private services for the required treatment.

In December 1993, DOE-ID issued a Scope of Work for a "Feasibility Study of Treatment Services for Alpha-Contaminated Low-Level Mixed Waste." The Scope of Work announced DOE's intent to procure feasibility studies of private sector solutions for the treatment of alpha

[1] 40 CFR 268
[2] 40 CFR 268.50; RCRA Section 3004(j)

LLMW. The Scope of Work encouraged innovative approaches for providing all aspects of treatment services and was the first in a series of steps anticipated to lead to an eventual procurement for production level treatment services.

DOE's expressed intention in the feasibility study Scope of Work was to obtain industry's "best thinking" for a private sector approach to cost effective waste treatment. The Scope of Work indicated that teaming arrangements for preparation of the studies were preferred; that partners should have experience in design, construction, and operation of actual waste treatment facilities; and would need to demonstrate the ability to finance such a project.

Assumptions/direction provided in the Scope of Work indicated that the private sector should assume:

- They would own and operate the facility, would be responsible for all licensing and permitting, and would operate within applicable Federal and State rules and regulations. DOE orders were not invoked; rather, the private sector was asked to identify whether they would rather be DOE regulated, or U.S. Nuclear Regulatory Commission (NRC) licensed.

- They would assume risk and liability.

- They could consider using existing facilities on the INEEL or off-site, within Idaho, or in another part of the U.S. (the key was cost effectiveness).

- They needed to provide information on options considered, why options were rejected, and the rationale for their recommended approach.

- They could treat non-INEEL waste (including commercial waste) but residuals would have to be returned to the generator for disposal.

Study deliverables included a Business Plan, with financial approaches, recommendations on the type of contract and contract terms and conditions, cost estimates, pricing to DOE, a schedule for treatment services; Technology Plan; Licensing and Regulatory Plan; Transportation and Waste Transfer Plan; and a Public Acceptance Plan.

Three private sector teams ultimately provided feasibility studies for DOE-ID consideration. The private sector teams (in alphabetical order) were: Lockheed Environmental Systems and Technologies Company (LESAT) (now Lockheed Martin Advanced Environmental Systems); Rust Federal Services, Incorporated; and the Scientific Ecology Group (SEG).

The LESAT team included Mountain States Energy, Incorporated. The Rust Federal Services study team included Science Applications International Corporation (SAIC), Martin Marietta Aerospace and Naval Systems, and Consoer, Townsend and Associates. The SEG study team included British Nuclear Fuels Limited (BNFL), Raytheon Corporation, and Morrison-Knudsen Corporation.

The focus of the feasibility studies was alpha LLMW stored at the Transuranic Storage Area (TSA) at the RWMC. Optionally it was suggested that treatment of TRU waste stored at the TSA, similar environmental restoration buried wastes at the SDA, and similar wastes from other

DOE sites might be considered as expanded waste treatment markets depending upon technologies/services available at the prospective treatment facility.

The Scope of Work for the feasibility studies, and attendant reference reports (EGG-RWMC-11189 and 11190 March 1994), (part of the Administrative for this Environmental Impact Statement [EIS]) provided a detailed description of the stored wastes (both alpha LLMW and TRU) at the RWMC TSA. The Scope of Work also described the envisioned treated product waste acceptance criteria in functional performance terms, but did not require a specific type of product. As a minimum the treated product waste materials had to satisfy the requirements for RCRA and TSCA long term storage and disposal, and provide suitable performance properties for passing a DOE radiological disposal site performance assessment. Additional detailed specifications on desired waste form performance properties were supplied in the Scope of Work as a guide, but were not required. The selection of treatment technologies, and resulting products (final waste forms) was left up to those preparing the feasibility studies.

The feasibility studies all centered on primary treatment using forms of thermal processing. Each of the three identified primary treatment technologies appeared to be viable to the DOE evaluation team. The identified plasma technologies were less widely used and potentially require more development prior to full-scale deployment for mixed waste. Recovery of reduced metals (the Rust and SEG study team alternate, molten metal) as a separate stream was viewed as economically advantageous because of cost avoidance associated with storage, certification and transportation to WIPP.

DOE's feasibility study evaluation team recognized the public's concern about, and acceptance of, thermal technologies involving incinerators. The team recognized the importance of monitoring developments in non-thermal treatments as alternatives. The definition of non-thermal treatment is somewhat subjective. This is because some argue that a technology is not thermal or at the very least is not incineration, despite operation at elevated temperatures and off-gas streams consisting of products of combustion. There are a variety of non-thermal treatments in various stages of development, including molten metal, steam reforming, Delphi catalyzed wet oxidation, hydrothermal oxidation (a.k.a. supercritical water oxidation), molten salt, etc. In general these technologies require feed material to be liquid or ground to a fine particle size. They also may require follow-on processes to stabilize residues for disposal. Due to these limitations, these technologies were considered by the DOE review team to be applicable to a narrower range of DOE wastes than the thermal technologies identified in the feasibility studies. The SEG study team did identify alternate technologies advertised as “non-thermal” (molten metal and steam reforming). The disadvantages of pursuing non-thermal options are that less volume reduction would be realized and a greater fraction of the waste would not be treated.

All of the feasibility study suppliers planned to thermally treat from 60 to 90 percent of the waste.

Project Definition Process

As a part of its process in evaluating the feasibility studies to determine a path forward, DOE used interdisciplinary and systems approaches. A team of systems engineers, technical, regulatory, and business subject matter experts was assembled to conduct the evaluation process. The team's goal was: “Dispose of INEEL mixed waste in a safe and permanent manner.” Three objectives to support the goal were defined:

1. Demonstrate progress to the State of Idaho on treatment and disposal of alpha LLMW;

2. Minimize cost with respect to risk sensitivities; and

3. Accomplish the goal in a safe, ethical and legal manner.

The objectives were used in the strategic and tactical phases to evaluate candidate alternatives and subsequent options. The steps that were followed are described below. [1]

Step 1: Strategic Phase – Formulate Feasible Alternatives

The team developed two sets of alternatives, non-treatment and treatment. Candidate alternatives are briefly described in Table F-1-1. Note that for this stage, the team took a much broader view of potential actions. Due to actual and anticipated DOE budget cuts, the team wanted to evaluate "no action" types of alternatives to see if there would be cost savings, without increased risk to the environment.

Table F-1-1. Summary of Non-Treatment and Treatment Alternatives.

A.	**Non-Treatment Alternatives:**		
		Alternative	Description
	A.1	No Action	Leave waste in the earthen covered berm
	A.2	Barrier Enhancement	Construct a protective cap over the bermed waste to prevent infiltration and subsequent waste migration
	A.3	Retrieval Enclosure Building	Enclose the earthen covered berm in a protective building for indefinite storage
	A.4	Retrieval Enclosure Building and Barrier Enhancement	A combination of alternatives A.2 and A.3 above
	A.5	Retrieval and Indefinite RCRA Compliant Storage	Retrieve all drums and boxes of alpha LLMW and mixed TRU waste, repackage as necessary, and store in Type II storage buildings for 55 years
B.	**Treatment Alternatives:**		
		Alternative	Description
	B.1	IWPF Concept	Retrieve all waste, sort, treat alpha LLMW to Land Disposal Restrictions, land dispose of alpha LLMW, treat TRU to WIPP WAC, ship TRU to WIPP
	B.2	Private Sector Concept	Retrieve all waste, treat alpha LLMW and TRU together to LDRs, and ship resulting TRU waste to WIPP

To identify feasible alternatives, candidate treatment and non-treatment alternatives were evaluated against the objectives. Non-treatment alternatives A.1, A.2, A.3, and A.4 were rejected by the team due to the lack of demonstrable progress to the State and on legal and ethical grounds. From an ethics perspective, the team agreed that continued storage of earthen covered bermed waste could result in further deterioration in the waste containers which would increase the

[1] This material was taken from the DOE-ID Evaluation of Feasibility Studies for Private Sector Treatment of Alpha and TRU Mixed Waste (DOE/ID-10512, May 1995).

potential for contaminant migration into the Snake River Plain Aquifer and potential adverse consequences for future generations. Costs associated with the barrier enhancement alternatives (A.2) were not estimated, but construction costs would probably range from $10 million - $20 million with additional costs for continuous monitoring. Costs for construction of the Retrieval/Enclosure Building (Alternative A.3) over the earthen covered bermed waste, personnel costs, and monitoring for 55 years was estimated to be $1.1 billion.

Alternative A.5 (Retrieval of all mixed waste and Indefinite RCRA Compliant Storage) was also rejected. Although Alternative A.5 would remove the waste from the earthen covered berm and would thereby demonstrate progress to the State, the risk of migration and exposure was not significantly reduced, i.e., potential for migration and exposure via natural disasters over the 55 year time frame. Furthermore, the estimated cost to DOE for this alternative was $1.4 billion over 55 years (RWMC storage costs, personnel, monitoring, etc.).

Next, the two candidate treatment alternatives were evaluated. The first alternative was the baseline INEEL M&O planned IWPF. This concept involves M&O retrieval of all earthen covered bermed waste over a period of 5 years, segregating the waste (alpha and TRU) based on radiological assay, treating alpha LLMW to LDRs, treating TRU to WIPP WAC, and shipping all TRU to WIPP. The first alternative of treating alpha and TRU separately was comprised of two variations: 1) M&O retrieval and M&O treatment of alpha LLMW to LDRs; or 2) M&O retrieval and private sector treatment to LDRs. The second alternative was a concept recommended in all three private sector feasibility studies, i.e., treat all waste together to LDRs (treatment renders all waste to TRU) and ship TRU to WIPP. This alternative was also comprised of two variations: 1) M&O retrieval and private sector treatment or 2) private sector retrieval and treatment. Again, these steps are similar with or without private sector involvement.

Step 2 – Evaluate Feasible Alternatives with Respect to Objectives

The following discussion highlights and qualifies the comparison of alternatives relative to each objective. Table F-1-2 summarizes treatment alternatives with respect to the stated objectives. Life-cycle costs (retrieval, storage, assay, characterization, treatment, and transportation to WIPP) are used.

Objective 1: Demonstrate Progress to State

All four alternatives above demonstrate DOE commitment to retrieving, treating, and disposing of mixed waste. The primary discriminators are: 1) time required to complete retrieval, treatment, and disposal, and 2) the final location for disposition of LDRs treated alpha LLMW.

> **M&O IWPF Concept** – For the baseline alternative, where all work was to be performed by the M&O, it was estimated that all TRU waste would be shipped to WIPP by 2021 (assuming IWPF began treatment by 2010). If there was any remaining alpha low level (waste that does not include a hazardous waste constituent), it could be land disposed (shallow burial) at INEEL or another location to be determined. For the private sector treatment alternative, shipment of TRU waste to WIPP was to be completed by 2016. Similarly, remaining alpha low level waste was to be land disposed. It was estimated that use of private sector treatment services would reduce the baseline IWPF schedule by four to seven years.

Table F-1-2. Treatment Alternatives with Respect to Objectives.

Treatment Alternative	Demonstrate Progress to State	Minimize Cost w/ Respect to Risk[a]	Safe, Legal, and Ethical Conduct
M&O IWPF Concept (M&O retrieval & treat alpha & TRU separately)	TRU to WIPP by 2021[b] Alpha disposal site to be determined	$1.6 billion	
Private Sector (treat alpha only) Concept (M&O retrieval & treat alpha & TRU separately)	TRU to WIPP by 2016	$1.2 billion	
Private Sector Treat-all Concept (treat alpha & TRU together to LDRs) w/ M&O Retrieval	Alpha & TRU waste to WIPP by 2016 Most waste out of Idaho	$1.2 billion	- Reduced handling and exposure for workers - Increased criticality concerns
Private Sector Treat-all Concept (treat alpha & TRU together to LDRs) w/ Private Sector Retrieval	Alpha & TRU waste to WIPP by 2013 Most waste out of Idaho	$827 million	- Reduced handling and exposure for workers - Increased criticality concerns

a. Total DOE/INEEL life-cycle costs.

b. Based on operations beginning in 2010; this did not support the 1994 WIPP closing date of 2018.

Private Sector Concept – Treating alpha and TRU waste streams together would create significant process efficiencies in sorting, assaying, and characterization. However, many of these efficiencies would be lost due to the M&O's planned retrieval rate that is lower than the private sector's projected treatment capacity; this translates into increased time and costs for the private sector and DOE. Under this scenario, waste shipments to WIPP would be completed by 2016. This alternative removes nearly all TRU contaminated waste from the State of Idaho since all treated alpha becomes TRU waste and is transported to WIPP. Private sector treatment of alpha and TRU waste streams together, combined with private sector retrieval, would allow the private sector to shorten the retrieval period, thereby increasing system efficiency. For this alternative, it is estimated that most mixed TRU and alpha waste would be removed from Idaho and transported to WIPP by 2013. It was estimated that a private sector "turn-key" operation would reduce the baseline IWPF schedule by seven to eight years.

Objective 2: Minimize Cost with Respect to Risk Sensitivities

There was a wide range of costs between treatment alternatives. Total DOE/INEL life-cycle costs are presented in Table 4-1. Looking strictly at costs, the difference between the M&O IWPF concept of treating waste streams separately and the private sector concept of treating alpha and TRU together, was approximately $800 million ($1.6 billion and $827 million, respectively). However, in addition to bottom line costs, treating all waste together generates other risk reduction benefits for DOE.

1. The amount of assay and characterization required and associated cost is greatly reduced when all waste is treated to LDRs. In order to segregate alpha and TRU waste, assay

capabilities must be precise, particularly for waste readings approaching the classification limits. This degree of assay precision is time and work intensive. In contrast, treating alpha and TRU waste together requires only a safety assay to maintain criticality control. Similarly, the amount of characterization required for treated alpha and TRU differs markedly in that much less characterization is required for a homogenous treated product.

2. The utility of a consistent and stable final waste form improves system efficiency and safety in transportation, handling, and storage.

3. Volume reduction from treating all waste is significant, lowers transportation costs, simplifies transportation safety-related issues, and may reduce WIPP operational costs (not calculated)

4. All waste is treated, volume reduced, and becomes TRU, eliminating the need for separate land disposal of alpha low level waste.

The team concluded that treating alpha and TRU wastes together should result in significant cost savings, as well as lessen some of the fundamental risks and uncertainties facing DOE in dealing with mixed waste.

Objective 3: Accomplish the Goal in a Safe, Ethical, and Legal Manner

The primary discriminators in the comparison of the two base alternatives (treating alpha and TRU separately or together) involved worker safety and criticality control issues. The team believed that treating all waste streams together with private sector assay and waste characterization would greatly decrease worker exposure to radiation and the hazardous components of the mixed waste. On the other hand, the team felt treating all wastes together would increase criticality concerns. However, the team’s radiation experts believed these concerns could be adequately addressed through treatment process controls. Regulatory experts indicated that obtaining a RCRA Part B permit would be similar under either alternative, although it was recognized that the “Treat-all” concept would entail significantly more thermal treatment which is a sensitive public issue. Some of the benefits of treating TRU and alpha LLMW together are significantly fewer shipments to WIPP, a more stable and known waste form, and enhanced public safety. In summary, treating all wastes to LDRs should decrease risks to workers and the public assuming adequate worker protection standards and criticality controls are maintained.

Strategic Decision: Evaluation of the two alternatives, treating waste streams separately versus treating waste streams together, revealed clear advantages (cost, safety, and final disposition) to DOE-ID in treating alpha and TRU mixed wastes with the same treatment process.

Tactical Phase

Once the decision was made to recommend treating alpha and TRU wastes together, the next level of decision making focused on tactical issues, i.e., how the decision should be implemented. This phase of the decision making process involved formulating feasible options and evaluating these options with respect to the objectives. Options evaluated were primarily derived from the private sector feasibility studies.

Step 1 – Formulate Options

A. Private Sector Treatment

1. Sole Source
2. Off-site Location for Treatment Facility
3. M&O Retrieval
4. Private Sector Turn-key (i.e. all work performed by private sector.

B. M&O Treat-all to LDRs

Two potential options, sole source treatment services and siting the private sector treatment facility off the INEL, were determined to be infeasible.

Sole Source – This option was rejected due to the requirements of the *Competition in Contracting Act* and implementing regulations. The team determined that procurement of waste treatment services does not meet the criteria for a sole source contract, i.e., national emergency, national security, or unique capability. Furthermore, the consensus opinion was that competition would reduce the total cost of the project.

Off-site Treatment Facility Location – This option was rejected due to an evaluation of the advantages and disadvantages of an off-site location. One of the feasibility studies suggested an off-site location for the treatment facility while two of the studies did not consider locations outside the INEEL boundaries.

The one contractor that advocated an off-site location stated that “the conceptual design is totally adaptable to either a privately leased site within the INEEL complex or an off-site location,” and listed numerous advantages and disadvantages of siting the treatment facility at the INEEL. Advantages cited include: close proximity to waste, existing site infrastructure, functional facilities (fire department and site security), similar waste management activities and absence of community and state fees. Disadvantages cited include: precedent in siting a private fixed price facility on Federal land, perceived delays with licensing and permitting, uncertainty of *National Environmental Policy Act* (NEPA) requirements, and the burden of DOE orders and oversight.

These concerns were discussed at length by the team members and their opinion was that the disadvantages were more perceived than real. For example, there is a precedent of siting a private facility on Federal land (U.S. Ecology Facility at Hanford). The team felt that all these issues could be adequately addressed but was unsure of the extent that DOE would have to be involved in licensing and permitting an off-site waste treatment facility. Some level of responsibility was assumed because the facility would presumably not be built but for DOE's waste. NEPA requirements are addressed 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 [DOE 1995]) and DOE would assume the burden of any supplemental NEPA requirements. Finally, the team determined that a set of “necessary and sufficient” requirements from DOE orders, i.e., Environment Safety & Health (ES&H) requirements, should be identified. In summary, private sector concerns regarding problems associated with siting a facility at the INEEL were not well substantiated and insignificant relative to the advantages (cost and safety) of siting the treatment facility near the RWMC.

The SEG study team off-site feasibility study option was based on the premise that the scope of treatment services was restricted to alpha waste only. Although not verified, the evaluation team assumed that had the contractor been requested to treat all alpha and TRU waste types, the logistics of transporting large quantities of TRU waste in addition to alpha waste would have eliminated the option of siting the facility off the INEEL.

Once the team decided to recommend all mixed waste be treated to LDRs, an off-site location was determined to be infeasible for the following reasons:

1. Transport and Handling of TRU Wastes – approximately 60 percent of the waste is stored in boxes; these boxes would need to be repackaged prior to transport off-site because there is no approved TRU box transport system. This would require a characterization facility and a repackaging facility with an estimated life-cycle cost of $800 million. Furthermore, transportation of treated TRU waste would have required Transuranic Pact Transporter (TRUPACT) containers. An independent estimate procured by DOE estimated that constructing a private road from the RWMC to a private off-site treatment facility with restricted access would cost $10 million.

2. Site infrastructure and emergency services could be utilized at an on-site location. Impacts to existing site operations was projected to be minimal.

3. Discussions with NRC regarding licensing indicated that their lack of experience in licensing this type of facility would delay the project.

Eliminating the Sole Source and Off-site options resulted in the formulation of three remaining options: (1) Private Sector Turn-key, (2) M&O Retrieval and Private Sector Treatment, and (3) M&O Treat-all to LDRs. The next stage of the decision making process involved evaluating these remaining options against the objectives.

Step 2 – Evaluate Remaining Options with Respect to Objectives

The following discussion highlights and compares the remaining options relative to each objective. Table F-1-3 summarizes treatment options with respect to the stated objectives. (Note: For the M&O IWPF Option, the facility was assumed to be operational by 2010 with a 20-year operating life. All cost estimates were based on a 2010 starting date).

Objective 1: Demonstrate Progress to State

M&O IWPF Treat-all to LDRs – This option scored the lowest with respect to this objective. Waste treatment and disposal at WIPP would not be completed until 2030.

M&O Retrieval and Private Sector Treatment – This option scored high relative to this objective since treatment was projected to begin in 1998-2001, with all waste shipped to WIPP by 2016, 14 years sooner than the M&O option.

Private Sector Turn-key – This option scored highest relative to this objective since treatment could begin in 1998-2001, with all waste shipped to WIPP by 2013. An accelerated retrieval schedule matched to the capacity of the treatment facility would result in a three year savings over M&O Retrieval with Private Sector Treatment option, and a 17 year savings over the full M&O option.

Table F-1-3. Evaluation of Feasible Options with Respect to the Objectives.

Treatment Alternative	Demonstrate Progress to State	Minimize Cost w/ Respect to Risk[a]	Safe, Legal, and Ethical Conduct[b]
M&O IWPF (retrieve and treat-all waste together to LDRs)	TRU to WIPP by 2030	$2.0 billion	See footnote[b]
M&O Retrieval & Private Sector Treatment	TRU to WIPP by 2016	$1.2 billion	Reduced DOE flexibility with private sector involvement
Private Sector Turn-key	All waste to WIPP by 2013. Most waste out of Idaho.	$827 million	Reduced DOE flexibility with private sector involvement

[a] Total DOE/INEEL costs.

[b] The consensus opinion of the team was that there is no differences in safety, ultimate DOE liability, and real level of DOE control between options.

Objective 2: Minimize Cost with Respect to Risk

M&O IWPF treat-all to LDRs – This option, estimated at approximately $2 billion, is significantly higher than the two competing options. It is more than twice the estimated cost of the Private Sector Turn-key option. The $2B estimate was provided by the LITCO cost-estimating group (this cost estimate is part of the administrative record for this EIS). DOE-ID believes it is probably high. It is reasonable to assume that the M&O IWPF alternative to treat all waste to LDRs standards should be slightly less than the $1.6B estimate for the baseline case. Under this option all financial risks would be borne by DOE; DOE would provide funding for all capitalization, contract modifications, claims, etc. Budget vulnerabilities increase as a function of time, and this option extends over the longest time period. On the other hand, the relationship between DOE and the M&O may be less adversarial due to traditional performance incentives. Costs of extended WIPP operations are not included in the overall cost estimate.

M&O Retrieval and Private Sector Treatment – It is estimated that this option would cost DOE substantially less than the M&O option but approximately $400 million more than the Private Sector Turn-key option. Financial risk is shared by DOE and the private sector, with the private sector providing capitalization for facilities associated with treatment. The private sector would also provide insurance/surety. Associated WIPP costs may be reduced due to the earlier completion date. Budget uncertainties are somewhat reduced due to the project's lower cost and shorter duration. A major disadvantage of this option is the potential for DOE to incur significant delay and/or disruption claims from the private sector contractor. This would be due to changes in conditions if the M&O fails to provide the private sector contractor retrieved waste in the contractually specified condition and at the specified rate. Also, DOE would be responsible for interim storage of the treated waste.

Private Sector Turn-key – This is the lowest cost option. It avoids the potential problems associated with an interface point between contractors thereby eliminating DOE's responsibility for interim storage. Retrieval can be performed just-in-time to minimize handling and storage. Similarly to the M&O Retrieval and Private Sector Treatment option, financial risk is shared by DOE and the private sector, with the private sector providing capitalization for facilities associated with treatment. The private sector would also provide insurance/surety. Associated WIPP costs may be reduced due to the earlier completion date. Budget uncertainties are further reduced due to even lower cost and shorter duration that under the other two options.

Objective 3: Accomplish the Goal in a Safe, Ethical, and Legal Manner

This objective was the most difficult to quantify. The team discussed safety, ethical, and legal issues at great detail. Ethical DOE conduct involves accomplishing the mission at the lowest cost to the taxpayers, while maintaining safety standards and complying with applicable law. Thus, given the large disparity in cost and schedule between the private sector options and the M&O option, the team was forced to address the following questions:

1. What is DOE gaining from private sector involvement?

versus

2. What is DOE giving up with private sector involvement?

What is DOE gaining? Assuming the private sector can perform the work at the estimated cost within in the estimated time frames, DOE gains tremendous cost savings. In addition, most waste is removed from Idaho up to 17 years sooner than with the M&O option.

What is DOE giving up? DOE traditionally strives to operate in a near risk-free environment, as a result, DOE has an impressive record of safety. Conversely, a near risk-free culture comes at a high price. Privatization and the call for “DOE to function more like a business” essentially entails accepting slightly more risk in anticipation of large cost savings. It was the consensus opinion of the team that DOE would not compromise safety or environmental quality by utilizing private sector services for treatment of mixed waste. Furthermore, use of private sector treatment services would not increase nor limit the risk to DOE of catastrophic liability any more than with the M&O-operated, DOE-owned IWPF. On the other hand, the team recognized the loss of DOE flexibility (not control) in utilizing the private sector under a fixed price contractual arrangement. In the event of budget perturbations or “change conditions,” DOE has much less latitude and ability to redirect a fixed-price contractor (without incurring substantial costs) versus the M&O under a cost-plus arrangement. In addition, project budget uncertainty may be reduced since it may be more difficult to remove funding from a fixed-price private sector contract than an M&O. In summary, the consensus opinion of the team was that, given the tremendous potential cost savings, DOE should afford to surrender some flexibility within an acceptable level of environmental, health and safety risk.

Tactical Decision: After careful evaluation of the three options (M&O IWPF Treat-all, M&O Retrieval and Private Sector Treatment, and Private Sector Turn-key), the team recommended that DOE pursue procurement of treatment, assay and characterization services for alpha and TRU mixed waste from the private sector. The contract may include a priced option for private sector retrieval and storage.

<u>DOE Make or Buy Decision</u>

The evaluation team's recommendations were presented to Jill Lytle, DOE Environmental Management (EM) Deputy Assistant Secretary for Waste Management, and Thomas Grumbly, Assistant DOE Secretary for EM. The evaluation team recommended that plans for the M&O constructed and operated IWPF concept be terminated in favor of privatizing the treatment of TRU and alpha LLMW to LDRs because of cost effectiveness. In May 1995, Assistant Secretary Grumbly gave oral direction to proceed with a procurement action for privatization.

Link to NEPA Activities

As the feasibility studies were being completed in 1994, information from them was being provided for analysis in the DOE INEL EIS, then in preparation. The information summarized from the DOE INEL EIS with regard to private sector treatment of alpha and TRU mixed waste is described in the Table F-1-4.

Table F-1-4. Summary of private sector treatment of alpha LLMW and TRU mixed waste.

Area	Description
Private Sector Alpha LLMW Treatment	Alpha-contaminated, possibly TRU, and small amounts of low-level waste and LLMW and environmental restoration wastes. Treat alpha to LDRs, treatment of TRU sufficient to allow disposal at WIPP. Facility throughput 2,000 cubic meters of alpha and 4,000 cubic meters of TRU. Sort, segregate containers, vent, open, and dump contents for further sorting and processing; physical and chemical processing; thermal treatments (oxidation/combustion and stabilization). Analyses include transportation to off-site commercial facility for treatment: 1,022 offsite truck trips per year. Chapter 5 of the EIS, Alt. B, 10 year plan, and D, Maximum Treatment, Storage and Disposal.
RWMC Modifications to Support Private Sector Treatment of Alpha LLMW	Needed to support transport of alpha LLMW and TRU to a privately owned and operated treatment facility. Additional waste retrieval, venting, and examination facilities would be required to be operational by 10/2000 to support the transport of waste offsite for treatment, and receiving it back onsite after treatment -new examination and assay facilities to supplement the Stored Waste Examination Pilot Plan -transportation facilities to stage drums and boxes for transport to the private facility and receive returning drums of treated waste; capacity is 680 drum equivalents per day.
Shipping/Transfer Station	Built to deal with number of off-site shipments required to send waste elsewhere for treatment.

The Record of Decision (ROD) from the DOE INEL EIS (3.2.2.2 TRU Waste) states that the INEEL would construct treatment facilities necessary to comply with the *Federal Facility Compliance Act* (FFCAct). Treatment of TRU waste at a minimum will be for the purpose of meeting waste acceptance criteria for disposal at WIPP and will occur on a schedule to be negotiated with the State of Idaho. The decision also indicates that projects for retrieving, characterizing, and treating TRU waste will prepare the waste for transportation and disposal in a repository or on site. The ROD indicates that decisions regarding the projects shown above (Private Sector alpha LLMW Treatment, and RWMC Modifications to Support Private Sector Treatment of Alpha Contaminated LLMW, as well as IWPF), will be made in the future pending further project definition, funding priorities, or appropriate review under NEPA.

Current Regulatory Situation

Under RCRA, the FFCAct of 1992 required DOE to prepare a plan for developing treatment capacities and technologies for each facility at which DOE generates or stores mixed wastes. The Idaho Department of Health and Welfare (IDHW), Division of Environmental Quality, upon consultation with EPA, issued an order to DOE requiring compliance with the approved plan. This plan, referred to as the Site Treatment Plan (STP) and Consent Order fulfill the requirements contained in the FFCAct, applicable RCRA sections, and the Idaho *Hazardous Waste Management Act*. Storage of waste, covered under the STP and consent order, at the INEEL, pending development of treatment capacities and technologies and completion of LDR requirements pursuant to the STP, are considered to be in compliance.

The STP, originally signed in October 1995, indicates that alpha LLMW is managed along with mixed TRU waste (sections 4.2 and 5.4 of the plan). The plan indicates that DOE has decided to fully pursue private sector treatment of the transuranic-contaminated stored waste at the INEEL. The STP states that private sector treatment of the TRU contaminated stored wastes is planned, along with limited amounts of LLMW from the INEEL and offsite which may be treated at the same facility. It indicates that for a majority of the TRU contaminated waste at the INEEL, DOE-ID plans to achieve compliance with the requirements of the FFCAct by implementing full treatment and then disposing of the treated waste at WIPP (page 5-16). Specific milestones/planning dates in the STP for mixed alpha and TRU wastes are as follows: place contract (complete); initiate construction fourth quarter of FY-99; commence system testing fourth quarter FY-02; commence operations, second quarter of FY-03; and, submit schedule for backlog, fourth quarter of FY-03.

In addition to the STP, DOE is under a Federal court-ordered 1995 DOE and Navy Settlement Agreement with the State of Idaho to ship all TRU waste from the INEEL. The target date for all waste to leave the State is December 31, 2015, and no later than December 31, 2018. After January 1, 2003, a running average of no fewer than 2,000 cubic meters per year of this waste must be shipped out of the State of Idaho. If DOE fails to meet specified deadlines or requirements, the State will suspend all DOE spent fuel shipments to the INEEL. The agreement states that DOE may treat non-INEEL waste. The waste must be treated within six months of receipt at the facility. Any TRU waste received from another site for treatment at the INEEL must be shipped out of Idaho for storage or disposal within six months following treatment.

Advanced Mixed Waste Treatment Project (AMWTP) Procurement

A draft Request for Proposal for the treatment of TRU and alpha LLMW was issued for industry comment in July 1995. A final RFP was issued in January 1996. DOE requested that retrieval and other support activities to treatment be priced separately, since a decision to buy treatment with all services had not yet been made. Additionally, DOE did not mandate the facility location, but was open to on-site or off-site facilities.

The overall vision expressed in the Request for Proposal (RFP) was for the project to treat waste for final disposal by a process that provided the greatest value to the Government. This was envisioned to be accomplished through a private sector treatment facility that had the capability to treat INEEL waste streams with the flexibility to treat other INEEL and DOE regional and national waste streams. The services were to: (1) treat waste to meet the most current WIPP WAC, RCRA

LDRs, and TSCA standards; (2) reduce waste volume and life-cycle cost to DOE, and (3) be performed in a safe and environmentally compliant manner.

Bids were received from four teams; three teams were in the competitive range. The teams were Foster Wheeler and the SEG, Lockheed Martin Advanced Environmental Systems, and BNFL who teamed with Morrison Knudsen, SAIC, Duratek, and BEL. All proposed on-site facilities and DOE regulation.

BNFL was selected in December 1996.

AMWTP Contract

The contract includes treatment and supporting services of retrieval, sorting, characterization, storage, and certifying, packaging, and loading the final waste product for disposal for 65,000 cubic meters of waste.

The contract contains performance specifications that include: a schedule that conforms to the Settlement Agreement; the final waste form must meet RCRA LDRs treatment standards and the WIPP WAC Rev. 5; the waste must contain greater than 100 nCi/g TRU, or the contractor receives a payment penalty; and the contractor must also achieve 65 percent volume reduction or receive a payment penalty.

A specific final waste form (such as glass or concrete), or specific technology to be used to treat the waste, was not included in the performance specifications of the contract.

The contract has three phases and two options. Phase I is permitting, submission of data for DOE's NEPA analysis, and an ES&H Authorization Process. Phase II is construction and operational testing; Phase III is operations, RCRA closure and Decontamination and Decommission (D&D). There is a go/no go between Phase I and Phase II. Before the contractor can proceed to Phase II, Phase I must be completed and DOE must complete its NEPA review. If the decision under NEPA is unfavorable to moving forward with Phases II and III of the project, then the contact will be terminated for the convenience of the government. The contact has an option to treat an additional 120,000 cubic meters of waste in 20,000 cubic meters increments. The contract specifies that only DOE waste can be treated at the facility.

For Phase I of the project, BNFL will be paid a total of $16.3M. Payments are made only for specific deliverables accepted by DOE. For Phase II, the construction and operational testing phase, no payments will be made. This is entirely financed by BNFL. Once treatment begins in 2003, BNFL will be paid per cubic meter of waste treated and accepted by DOE. BNFL will amortize the cost of the facility over the first 25,000 cubic meters of waste treated. For treatment of the 65,000 cubic meters of waste plus RCRA closure of the facility, BNFL will be paid $859.8M. The price of the contract for all three phases and all services for the treatment of 65,000 cubic meters is $876M.

AMWTP Cost Savings/Cost Avoidance over M&O Plans

In looking at potential cost savings based on the feasibility studies, DOE estimated an average of $820M could be saved by privatizing treatment and all supporting services. After the contract was awarded, cost savings estimates were recalculated using the contract price plus DOE and M&O contractor supporting services.

For the recalculation, dollars were adjusted from FY-1994 to FY-1996 using DOE guidance from the Office of Management and Budget, construction dollars spent in 1995 and 1996 were treated as sunk costs, remaining costs and facility start-ups from the M&O baseline plan were delayed two years, and transportation costs were reduced to eliminate the operating cost of the TRU transporters for comparability with the awarded contract, which excluded transportation. Information is summarized in the Table F-1-5.

Table F-1-5. Summary of adjusted transportation costs to 1996 dollars.

1994 M&O Alternative	1994 Estimate ($FY-94)	Escalated to 1996 ($FY-96)	M&O Adusted 1996 ($FY-96)
Baseline Plan[a]	$1,647	$1,763	$1,679
Treat All to LDRs	$2,000	$2,141	$2,067
Treat All to WIPP WAC [b]	$1,595	$1,707	$1,611
	BNFL Contract plus DOE/M&O Support Costs	M&O Baseline Plan Adjusted 1996 ($FY-96)	Savings/Cost Avoidance
Total Costs ($'96)	$1,009	$1,679	$670
Total Escalated Cost @ 2.7 percent in EM 2006 Plan	$1,173	$2,524	$1,351

a. Baseline plan was treat TRU to WIPP WAC and treat alpha to RCRA LDRs.
b. This alternative would require a change to the *Land Withdrawal Act* to accept alpha mixed waste.

When the contract price of $827M is added to the DOE and M&O supporting costs, the cost is $1.009B. As reflected in the table, this saves or avoids costs of $670M in 1996 constant dollars over the M&O baseline plan described in the feasibility study evaluation.

<u>Treatment Drivers</u>

During the feasibility study stage, treatment needs for the waste were discussed extensively. Treatment of the alpha mixed waste to meet RCRA LDRs was never debated. The level of TRU waste treatment was examined from a technical and cost perspective. The feasibility studies bore out that treating both waste streams together resulted in substantial cost savings over dealing with them separately. In addition, volume reduction lowered INEEL storage costs. The feasibility studies indicated that volume reduction would also lead to further savings in transportation of the waste to WIPP. However, further examination after contract award has shown that due to weight loading limits of the TRUPACT II container, these cost savings would be minimal. They were eliminated from the cost savings calculations; the cost savings of $670M does not include transportation costs.

Since the feasibility studies and the award of the contract, the issue of treatment vs. no treatment is still a topic of interest to some stakeholders. For that reason, the following information is provided in this section.

Treatment as defined in RCRA 40 CFR Part 260, Subpart B, 260.10, "means any method, technique, or process, including neutralization, designed to change the physical, chemical, or biological character or composition of any hazardous waste so as to neutralize such waste, or so as to recover energy or material resources from the waste, or so as to render such waste non-hazardous, or less hazardous; safer to transport, store, or dispose of; or amenable for recovery, amenable for storage, or reduce in volume." Using this definition, the INEEL has viewed that repackaging boxed waste so that it can legally be transported, and sizing, and compaction of waste for volume reduction meets the definition of treatment.

Some stakeholders do not understand that while waste being disposed of at WIPP is exempted from RCRA LDRs, there are still strict characterization, transportation, and disposal requirements, which are part of the WIPP WAC.

- WIPP and its regulatory agencies require that waste be characterized sufficient to meet its waste acceptance criteria;

- The only approved transport system approved for moving TRU waste to WIPP is the TRUPACT II's. The TRUPACT II has restrictions on types of containers that can be placed in it, the weight of individual containers and total load weight, hydrogen generation within containers, and liquids volume within the containers.

- Not all categories of hazardous and toxic wastes can be disposed of at WIPP, and;

- WIPP's ability to handle various containers types and sizes for disposal is limited.

Table F-1-6 illustrates some of these points.

Table F-1-6. Summary of WIPP WAC characterization, transportation, and disposal requirements.

WIPP Requirements	INEEL Wastes	INEEL Action to Meet WIPP WAC
Only standard waste boxes or Type A 55 gallon drums can be shipped in the TRUPACT II and disposed of at WIPP	38,000 cubic meters (60 percent) of the INEEL stored waste is in nonstandard waste boxes; 24,000 cubic meters, or 6,600 boxes, of this waste is TRU waste	Repackage all of the boxes into drums and/or standard waste boxes
Waste with radionuclides below 100nCi/g cannot be disposed at WIPP	25,000 cubic meters of waste is expected to be below 100 nCi/g	Treat waste through thermal and mechanical processes to maximize that $\geq$ 100 nCi/g and can be disposed of at WIPP
WIPP will not accept wastes with PCB's above 50 ppm	1,560 cubic meters of waste has been identified as potentially having PCB's above the limit; 12,662 cubic meters is suspect for PCB's	Thermal treatment of PCB's is Best Demonstrated Available Technology for this TSCA regulated waste
No liquids over 1 percent volume	8,450 cubic meters of waste with excess liquids	Excess liquids will be absorbed or incinerated
No ignitable wastes	3,900 cubic meters exhibit the ignitable characteristic	Ignitable waste will be incinerated

Considering all of the above categories, a total of 90 percent of the INEEL stored waste requires repackaging or other treatment to meet all regulatory requirements for transportation and disposal.

In response to comments received from the public at RCRA pre-application meetings and NEPA EIS scoping meetings, BNFL made changes to their treatment process flow sheets to minimize the amount of thermal treatment to be performed. They originally proposed thermal treatment for more than 50 percent of the waste. This change appears to have gained the approval of a number of members of the public as reasonable and environmentally more acceptable.

The purpose of this WAC document is to 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 Technical Proposal. Wastes which do not meet the criteria stated herein may be accepted for treatment, but only following a detailed case-by-case evaluation of the specific waste characteristics, and special authorization from the AMWTP General Manager.

Table F-1-7 presents a summary of the AMWTP WAC for INEEL wastes required to be treated in the AMWTP.

Table F-1-8 presents a summary of the AMWTP WAC for non-INEEL wastes which could be received for treatment in the AMWTP.

Please note that the AMWTP WAC proposed in this section are for receipt of wastes for treatment, and not for outgoing, treated wastes. Treated wastes will meet the WAC for the respective disposal site. Also note that the AMWTP WAC presented in this section is subject to change as more is learned about the specific physical, chemical, and radiological characteristics of the INEEL stored wastes, and the needs of other potential INEEL and non-INEEL customers.

Table F-1-7. Summary of AMWTP WAC for INEEL Wastes.

Criteria	Requirement
General	• Waste must be characterized for identity and quantity of radionuclides, organic and inorganic constituents, and metals • Waste must not contain classified materials
Container and Physical Properties	
Size	• Waste must be packaged in a; 1. 55 gallon drum, or 2. Over pack drum no larger than 83 gallons, or 3. Standard Waste Box, or 4. Overpacked Standard Waste Box, or 5. 4'x4'x7' box • Other sized boxes may be considered on a case-by-case basis, and are limited only by the physical dimensions of the receipt, opening and content removal capacity of the AMWTP
Containment	• Waste must be confined in at lease two levels of containment • All containers must be vented (filtered vent) • Containers must not contain shielded radioactive material (case-by-case evaluation)
Marking/Labeling	• Containers must be uniquely numbered or coded for tracking purposes
Package Weight	• Drum gross weight must not exceed 1,000 lb • Box gross weight must not exceed 8,000 lb
Free Liquids	• Quantity and composition of free liquids must be identified in the characterization information
Particulates	No restrictions
Chemical Properties	
Metals	• Separable or contained beryllium metals, mercury and lead must be identified in the characterization information • Beryllium-contaminated waste from foundries, extraction plants, ceramic plants and propellant plants are prohibited • Mercury-contaminated waste must not exceed 1,000 ppm
Corrosives	• Waste must not contain corrosive materials (<2 or >12.5 pH)
Explosives, Pyrophorics, Reactives, and Compressed Gases	• Waste must not contain explosive or pyrophoric material, except for pyrophoric forms of radionuclides • Waste must contain DOT Class 1 explosives • Waste must not contain reactive metals or forbidden materials per 49 CFR 173.21. • Waste must not contain compressed gases. Pressurized containers must be vented and drained
Mixed/TSCA Waste	• Mixed waste is acceptable except as restricted in other parts of this WAC (see general topic above) • Liquid PCB waste must not exceed 50 ppm
Other	• Pathological or etiologic agents must be identified in characterization information

Table F-1-7. Summary of AMWTP WAC for INEEL Wastes (continued).

Criteria	Requirements
Nuclear Properties	
Fissile Mass	• Drums must not contain more that 200 grams of Pu-239 fissile-gram equivalent (FGE) • Boxes must not contain more than 325 grams (FGE) • Waste containers with more than 15 grams of non-TRU fissile material (e.g. U-235) must be reviewed and approved on a case-by-case basis
Pu-239 Equivalent Activity (PE-Ci)	• Waste containers must not contain more than 1,000 PE-Ci
Non-Fissile Radionuclides	• Waste containers must not contain more than 1 Ci of non-TRU betagamma emitting radionuclides
Dose Rate	• Contact dose rate (beta + gamma + neutron) at any point on the surface of a container must not exceed 200 mRem/hr • Dose rate (gamma + neutron) at two meters from the surface of a container must not exceed 10 mRem/hr • Neutron contributions (at contact) greater than 20 mRem/hr must be documented in the characterization information
Surface Contamination	• Removable contamination shat not exceed 200 dpm/100cm^2 beta gamma activity, or 20 dpm/100 cm^2 of alpha activity
Thermal Power	• Containers with thermal power greater than 0.1 watt/ft^2 must be identified and quantified in the characterization information

Table F-1-8. Summary of WAC for wastes received from non-INEEL sites

Criteria	Requirement
General	• Generators must receive approval from the BNFL Team prior to shipping waste to the AMWTP Facility • Waste must be characterized for identity and quantity of radionuclides, organic and inorganic constituents, and metals • Waste must not contain classified materials Each waste container must be accompanied by a data package
Container and Physical Properties	
Size	• Waste must be packaged in one of the following DOT-approved containers; 1. 55 gallon drum, or 2. Overpack drum no larger than 83 gallons, or 3. Standard Waste Box, or 4. Overpacked Standard Waste Box, or 5. 4'x4'x7' box 6. Other sized boxes may be considered on a case-by-case basis, and are limited only by the physical dimensions of the receipt, opening and content removal capacity of the AMWTP
Containment	• Waste must be confined in at lease two levels of containment • All containers must be vented (filtered vent) • Containers must not contain shielded radioactive material (case-by-case evaluation)
Marking/Labeling	• Containers must be uniquely numbered or coded for tracking purposes • Waste packages must have DOT labels, RCRA labels, container number, gross weight, and other appropriate DOE markings and labels.
Package Weight	• Drum gross weight must not exceed 1,000 lb • Box gross weight must not exceed 8,000 lb
Free Liquids	• Quantity and composition of free liquids must be identified in the characterization information
Particulates	No restrictions
Chemical Properties	
Metals	• Separable or contained beryllium metals, mercury and lead must be identified in the characterization information • Beryllium-contaminated waste from foundries, extraction plants, ceramic plants and propellant plants are prohibited • Mercury-contaminated waste must not exceed 1,000 ppm
Elemental Content Limits	• Chlorine is limited 3 wt% • Sulfur is limited to 1 wt% • Fluorine is limited to 15 wt% • Phosphorus is limited to 5 wt% • Barium is limited to 5 wt% • Chromium is limited to 2 wt% • Chromium is limited to 2 wt% • Nickel is limited to 12 wt% • Silver is limited to 10 wt% • Cadmium is limited to 5 wt% • Thallium is limited to 1 wt%

Table F-1-8. Summary of WAC for wastes received from non-INEEL sites (continued).

Criteria	Requirements
Elemental Content Limits (continued	• Arsenic is limited to 2 wt% • Antimony is limited to 2 wt% • Selenium is limited to 2 wt% • Other elements are limited to 30 wt% except Si, Al, B, alkalis, alkaline earths, C, H, N, and O when calculated as the corresponding oxide
Corrosives	• Waste must not contain corrosive materials (<2 or >12.5 pH)
Explosives, Pyrophorics, Reactives, and Compressed Gases	• Waste must not contain explosive or pyrophoric material, except for pyrophoric forms of radionuclides • Waste must not contain DOT Class 1 explosives • Waste must not contain reactive metals or forbidden materials per 49 CFR 173.21. • Waste must not contain compressed gases. Pressurized containers must be vented and drained
Mixed/TSCA Waste	• Mixed wastes which have as their Best Demonstrated Available Technology: AMLGM, CMBST, DEACT (for ignitable waste only), IMERC, and STABL will be accepted for treatment • Mixed waste with a technology-based treatment standard other than those listed above will be accepted on a case-by-case basis only • Liquid PCB waste must not exceed 50 ppm
Other	• Pathological or etiologic agents must be identified in characterization information • Waste must not contain incompatible material
Nuclear Properties	
Fissile Mass	• Drums must not contain more than 200 grams of Pu-239 fissile-gram equivalent (FGE) • Boxes must not contain more than 325 grams (FGE) • Waste containers with more than 15 grams of non-TRU fissile material (e.g. U-235) must be reviewed and approved on a case-by-case basis
Pu-239 Equivalent Activity (PE-Ci)	• Waste containers must not contain more than 1,000 PE-Ci
Non-Fissile Radionuclides	• Waste containers must not contain more than 1 Ci of non-TRU beta-gamma emitting radionuclides
Dose Rate	• Contact dose rate (beta + gamma + neutron) at any point on the surface of a container must not exceed 200 mRem/hr • Dose rate (gamma + neutron) at one meters from the surface of a container must not exceed 10 mRem/hr • Neutron contributions (at contact) greater than 20 mRem/hr must be documented in the characterization information
Surface Contamination	• Removable contamination shall not exceed 200 dpm/100 cm^2 beta-gamma activity, or 20 dpm/100 cm^2 of alpha activity
Thermal Power	• Containers with thermal power greater than 0.1 watt/ft^3 must be identified and quantified in the characterization information
Data	
Data Package	• Shipments of mixed waste must have an accompanying Hazardous Waste Manifest • The data package must contain the following information: 1. Package (container) identification number

	Package assembly identification number (if applicable)

Table F-1-8. Summary of WAC for wastes received from non-INEEL sites (continued).

Criteria	Requirements
	2. Date of waste package certification 3. Waste generation site (certification site) 4. Date of packaging (closure date) 5. Maximum surface dose rate in mRem/hr and specific neutron dose rate if greater than 20 mRem/hr 6. Weight Container type
Data Package (continued)	7. Physical description of waste form, content codes(s), weight percent of organic material, and estimated weight or mass of organic material 8. Assay information, including PE-Ci, alpha Curies, and Pu-239 fissile gram equivalent content 9. Fissile mass plus two times the error 10. Radionuclide information including radionuclide symbol and quantity and: a. Characterization data should include all radionuclides that contribute >1% (by Curies) of the total activity of the waste matrix and any of the following radionuclides even if they contribute <1% of the total activity: H-3, C-14, Co-60, Ni-59, Ni-63, Se-79, Sr-90 Nb-94 Tc-99, I-129, Pu-241, Cm-242, Cs-137 and alpha-emitting nuclides with half-lives >5 years b. Reporting of the radionuclides must include any parent-daughter radionuclide pairs that meet the above criteria (e.g., Ba-137 must be reported with Cs-137, Y-90 must be reported with Sr-90) c. Data must be reported in either grams or Curies 13. Mixed wastes must have LDR materials characterized 14. Organics and inorganics must be characterized in terms of type and concentrations 15. Measured or calculated thermal power (if greater than 0.1 watt/cubic foot); report this data in terms of decay heat plus error limits 16. Shipment number 17. Data of shipment 18. Vehicle type 19. Headspace VOC in ppm 20. Aspiration time determined and recorded in data package (or hydrogen gas concentration 21. Name of certifying official who certified the waste

Table F-1–9. Existing Wastes Stored at the TSA[a,b,c].

Gen.	IDC[d]	Stream Name	EPA Haz. Waste Numbers	No. of Drums		No. of Boxes		No. of Bins		No. of Other		Tot. Vol.	Waste
				WSF	TSA RE	WSF	TSA RE	WSF	TSA RE	WSF	TSA RE	(cubic meters)	Cat.[d]
ANL-E	100	General Plant Waste	D001,F003	0	2			24	301			1134.0	HD
ANL-E	101	Cut Up Gloveboxes	D008					6	66			251.1	MD
ANL-E	102	Absorbed Liquids	Unknown	26	79			0	13			67.2	IHS
ANL-E	104	Alpha Hot Cell Waste	None	1	399			0	6	0	2	111.1	HD
ANL-E	105	Empty Bottles and Absorbent	Unknown	3	4							1.5	SCW
ANL-E	106	Special Source Material	Unknown	0	1							0.2	TBD
ANL-E	107	Alpha Hot Cell Waste	None	0	217							45.1	RH
ANL-E	110	Research Generated Waste (RGW) Compactible and Combustible Solid	D004,D006,D008,F003	0	2			0	1			3.9	PRPR
ANL-E	111	WIPP Precertified RGW Noncompactible	D004-D009	0	6							1.2	TBD
ANL-E	120	D&D Waste	D004,D006,D008,F003	0	2							0.4	MD
ANL-E	121	WIPP Precertified D&D Waste Noncompactible	D004-D009					0	8			27.9	TBD
B&W	515	Plastic, Paper, Cloth, etc.	None	15	0							3.1	TBD
B&W	516	Steel, Al, Electrical Devices	None	2	0							0.4	TBD
B&W	517	Heavy Metals, Steel, Al, Brass	None	2	0							0.4	TBD
Battelle	201	Noncombustible Solids	D008	0	42			11	27			141.3	ID
Battelle	202	Combustible Solids, Paper, Cloth	Unknown	0	3			0	5			18.1	OD
Battelle	203	Paper, Cloth, Metals, Glass	PCBs	0	26			2	4			26.3	HD
Battelle	204	Solidified Solutions	Unknown	2	5							1.5	IHS
Battelle	UNK	Unknown	Unknown	38	0			6	0			28.8	TBD
Bendix	111	Solidified Wet Sludge	Unknown	1	0							0.2	TBD
Bettis	010	Combustibles (rags, gloves, poly)	F002	27	913							195.5	OD
Bettis	012	Miscellaneous Sources	None	1	0							0.2	RH
Bettis	015	Neutron Sources	None	3	0							0.6	RH
Bettis	020	Noncompressible, Noncombustible	D002,F002	3	791							165.2	HD&MD
Bettis	030	Solidified Grinding Sludge, etc.	F002	0	45					0	2	16.3	RH
Bettis	040	Solid Binary Scrap Powder, etc.	None (lead for shielding only)	0	107	4	0					34.9	MD
Bettis	050	Solidified Solutions	None	1	0							0.2	OHS
Bettis	081	Metal-Metal Samples Fissile	None	16	0							3.3	RH
IN-ICPP	021	Radioactive Mixed Lead Waste	D008			5	0					15.9	TBD
IN-NRF	021	Radioactive Mixed Lead Waste	D008			1	0					3.2	TBD
IN-TAN	021	Radioactive Mixed Lead Waste	D008			42	1					136.4	TBD
IN-TRA	021	Radioactive Mixed Lead Waste	D008			8	0					25.4	TBD
IN-RWMC	021	Radioactive Mixed Lead Waste	D008			2	0					6.3	TBD
IN-ANLW	150	Laboratory Waste	D002,D008	99	13					0	19	89.6	HD
IN-ICPP	150	Laboratory Waste	D002,D008	1	6							1.5	HD

Table F-1–9. Existing Wastes Stored at the TSA[a,b,c].

Gen.	IDC[d]	Stream Name	EPA Haz. Waste Numbers	No. of Drums		No. of Boxes		No. of Bins		No. of Other		Tot. Vol.	Waste
				WSF	TSA RE	WSF	TSA RE	WSF	TSA RE	WSF	TSA RE	(cubic meters)	Cat.[d]
IN-TRA	150	Laboratory Waste	D002,D008	11	0							2.3	HD
IN-ICPP	151	Solidified Fuel Sludge	D008	0	2							0.4	RH
IN-ANLW	152	Pu Neutron Sources	None	2	0					0	1	3.9	RH
IN-ICPP	152	Pu Neutron Sources	None					0	1			3.5	RH
IN-NRF	152	Pu Neutron Sources	None	0	4							0.8	RH
IN-TAN	152	Pu Neutron Sources	None	0	2							0.4	RH
IN-ANLW	153	Combustible Lab Waste	None	1	0					0	7	24.6	RH
IN-NRF	153	Combustible Lab Waste	None	1	28							6.0	RH
IN-ANLW	154	Sample Fuel	None	3	0							0.6	RH
IN-TRA	154	Sample Fuel	None	5	2							1.5	RH
IN-ANLW	155	TRU Scrap	None	3	0							0.6	HD
IN-NRF	155	TRU Scrap	None	2	0							0.4	HD
IN-RWMC	155	TRU Scrap	None	0	4	1	3					13.5	HD
IN-TRA	155	TRU Scrap	None	3	5	0	1					4.8	HD
IN-ICPP	156	Chem Cell Rip-Out	Unknown			0	9					28.5	MD
IN-ARA	157	Miscellaneous Sources	Unknown	0	1							0.2	RH
IN-ICPP	157	Miscellaneous Sources	Unknown	1	0							0.2	RH
IN-RWMC	157	Miscellaneous Sources	Unknown			0	7					22.2	RH
IN-TAN	157	Miscellaneous Sources	Unknown	1	0							0.2	RH
IN-TRA	157	Miscellaneous Sources	Unknown	1	1							0.4	RH
IN-ANLW	160	HFEF Analytical Chem. & Metallographic Combustibles	Unknown							0	1	3.5	RH
IN-ANLW	161	ALC Glassware, Paper, Poly, and Miscellaneous Hardware	Unknown	3	2							1.0	RH
IN-ANLW	162	FMF EFL Zr-U-Pu Fuel Casting Alloy Residues	Unknown	50	0							10.4	HD
IN-ANLW	163	ACL Cold-Line Absorbed Liquid, Misc. Hardware, Polyethylene	Unknown	6	0							1.2	HD
IN-ANLW	164[e]	WETP Process Waste	D005-D009,D011,D022,D028, D029,F001-F005	143	0							29.7	TBD
IN-ANLW	UNK	Unknown	Unknown	2	0							0.4	TBD
IN-RWMC	UNK	Unknown	Unknown			3	0					9.5	TBD
Monsanto	530	Compacted Waste	None	0	5							1.0	TBD
Monsanto	535	Compacted Waste/Lead for Shielding	None	3	13							3.3	TBD
Monsanto	540	Noncompacted Waste	None					4	0			14.0	TBD
Monsanto	545	WEP Shielded Waste	None	0	5							1.0	TBD
Monsanto	550	Solidified Oil	None	0	1							0.2	TBD
Mound	801	Rags, Paper, Wood, etc.	None	4	31							7.3	OD

Table F-1–9. Existing Wastes Stored at the TSA[a,b,c].

Gen.	IDC[d]	Stream Name	EPA Haz. Waste Numbers	No. of Drums		No. of Boxes		No. of Bins		No. of Other		Tot. Vol.	Waste
				WSF	TSA RE	WSF	TSA RE	WSF	TSA RE	WSF	TSA RE	(cubic meters)	Cat.[d]
Mound	802	Dry-Box Gloves and O-Rings	D008	32	89							25.2	PRPR
Mound	803	Metal, Equip., Pipes, Valves, etc.	D009	51	129							37.4	MD
Mound	804	Plastic, Tygon, Mani-Boots, etc.	D009	64	156							45.8	OD
Mound	805	Asbestos Filters	D001,D002,D009	7	31							7.9	ID
Mound	810	Glass, Flasks, Sample Vials, etc.	D009	4	9							2.7	IHS
Mound	811	Evaporator and Dissolver Sludge	D001,D009	0	4							0.8	OHS
Mound	813	Glass Filters and Fiberglas	D001,D002,D009	0	3							0.6	ID
Mound	814	Graphite Waste with Cont'd Hg	D009	0	2							0.4	G
Mound	815	Miscellaneous Waste	Unknown	2	0							0.4	TBD
Mound	824	Equipment Boxes, Noncombustible	D005-D011			39	342					1208.5	MD
Mound	825	Equipment Drums, Noncombustible	Unknown	146	79	0	11					81.7	MD&HD
Mound	826	Equipment Boxes, Combustible	D009	5	0	8	20					89.9	OD
Mound	827	Equipment Drums, Combustible	D008,D009	5	4							1.9	OD
Mound	834	High Level Acid	D001,D002	42	859							187.4	IHS
Mound	835	High Level Caustic	D002	462	1213							348.4	IHS
Mound	836	High Level Sludge/Cement	D006-D011,F001,F002,F003	994	3184							869.0	IHS
Mound	838	<10 nCi/g Noncombustible	Unknown	0	1							0.2	OD
Mound	842	Contaminated Soil	D002,D006-D011			3	36					123.7	S
Mound	847	LSA <100 nCi/g Combustible	Unknown	217	524							154.1	OD
Mound	848	LSA <100 nCi/g Noncombustible	Unknown	9	125							27.9	HD
Mound	UNK	Unknown	Unknown			1	0					3.2	TBD
RFP	000	Retrieved RFP TRU at RWMC	Unknown	0	18961			0	72			4195.0	TBD
RFP	000	Not Recorded-Unknowns from Rocky Flats Plant	Unknown	1	11							2.5	TBD
RFP	001	First Stage Sludge	D002,D004-D011,F001-F003,F005-F007,F009	5785	6201	16	7			0	1	2569.5	IHS
RFP	002	Second Stage Sludge	D002,D004-D011,F001-F003,F005-F007,F009	245	7466	3	0					1613.4	IHS
RFP	003	Organic Setups, Oil Solids	D005,D011,D022,D029,D036, F001-F003,F005,PCBs	2628	4580	0	12					1537.3	OHS
RFP	004	Special Setups (Cement)	D006,D008,F001-F003,F005	430	1112	0	1					323.9	IHS
RFP	005	Evaporated Salts	D001	0	52	0	1					14.0	IHS
RFP	007	Bldg. 374 Dry Sludge	D002,D006-D011,F001-F003,F005-F007,F009	5254	2	20	0					1156.7	IHS
RFP	090	Dirt	F001-F004	0	135							28.1	S
RFP	095	Sludge	Unknown	0	23							4.8	IHS
RFP	241	Americium Process Residue	D001,D002,D008,F002,F003	1	118							24.8	HD
RFP	290	Sludge, Filter	D002,D006,D008,F001-F003	0	1							0.2	SCW

Table F-1–9. Existing Wastes Stored at the TSA[a,b,c].

Gen.	IDC[d]	Stream Name	EPA Haz. Waste Numbers	No. of Drums		No. of Boxes		No. of Bins		No. of Other		Tot. Vol.	Waste
				WSF	TSA RE	WSF	TSA RE	WSF	TSA RE	WSF	TSA RE	(cubic meters)	Cat.[d]
RFP	292	Cemented Sludge	D002,D004-D011,F001-F003, F005	354	225	4	0					133.1	OHS
RFP	300	Graphite Molds	None	1249	919							450.9	G
RFP	301	Graphite Cores	None	5	31							7.5	G
RFP	302	Benelex and Plexiglas	D005,D008,F001	11	12	0	23					77.7	OD
RFP	303	Scarfed Graphite Chunks	None	91	0							18.9	G
RFP	310	Graphite Scarfings	None	1	16							3.5	G
RFP	311	Graphite Heels	Unknown	0	6	0	1					4.4	G
RFP	312	Graphite, Coarse	F001,F002,F005	8	0							1.7	G
RFP	320	Heavy Non-SS Metal	D008,F001,F002,F005	285	289	0	2					125.7	MD
RFP	321	Lead	D008	4	0							0.8	TBD
RFP	328	Filters, Fulflo Incinerator	D002,D005,D007,D008,D011, F001-F003,F005	8	0							1.7	HD
RFP	330	Paper and Rags-Dry	D006-D008,D011,D022,F001-F003,F005-F007,F009	423	4701	402	2470					10175.8	PRPR
RFP	335	Filters, Absolute 8 x 8	D001,D005,D007,D008,D011, F001-F003,F005-F007,F009	28	98	0	5					42.1	ID
RFP	336	Paper and Rags-Moist	D001,D002,D006-D008, D022,F001-F003,F005-F007, F009	685	6786	333	254					3415.9	PRPR
RFP	337	Plastic, Teflon, Wash, polyvinyl chloride	D006-D008,D011,D022,F001-F003,F005-F007,F009	500	1802	6	10					529.6	PRPR
RFP	338	Insulation and CWS Filter Media	D001,D005,D007,D008,D011, F001, F002	28	224	1	77					299.8	ID
RFP	339	Leaded Rubber Gloves and Aprons	D001,D008,D022,F001,F002, F005	435	591	0	4					226.1	PRPR
RFP	360	Insulation	D005,D007,D008,D011,F001, F002	1	238	0	1					52.9	ID
RFP	361	Insulation Heel	None	0	1							0.2	SCW
RFP	368	Magnesium Oxide Crucibles	None	1	0							0.2	TBD
RFP	370	Crucible, LECO	None	3	32							7.3	IHS
RFP	371	Brick, Fire	D004-D011,F001-F003,F005	134	907	1	23					292.7	CBD
RFP	372	Grit	None	13	5							3.7	IHS
RFP	374	Blacktop, Concrete, Dirt, & Sand	D004-D011,D018,F001-F007, F009	459	915	5	43					438.0	HD
RFP	375	Oil-Dri Residues from Incinerator	D004-D011,D022,F001-F003, F005	5	14							4.0	OHS

Table F-1–9. Existing Wastes Stored at the TSA[a,b,c].

Gen.	IDC[d]	Stream Name	EPA Haz. Waste Numbers	No. of Drums		No. of Boxes		No. of Bins		No. of Other		Tot. Vol.	Waste
				WSF	TSA RE	WSF	TSA RE	WSF	TSA RE	WSF	TSA RE	(cubic meters)	Cat.[d]
RFP	376	Cement, Insulation, and Filter Media	D005,D007,D008,D011,F001-F003,F005-F007,F009	1904	888	2	5					602.9	ID
RFP	377	Firebrick, Coarse	D004-D011,F001-F003,F005	30	0							6.2	TBD
RFP	391	Crucible and Sand	None	4	18							4.6	IHS
RFP	392	Sand, Slag, and Crucibles	None	1	6							1.5	IHS
RFP	393	Sand, Slag, and Crucible Heels	D007	28	17							9.4	IHS
RFP	409	Molten Salts, 30% Unpulverized	D028,F001,F002	30	0							6.2	SCW
RFP	410	Molten Salts, 30% Pulverized	None	0	22							4.6	SCW
RFP	411	Electrorefining Salt	None	19	2							4.4	SCW
RFP	412	Gibson Salts	None	1	0							0.2	SCW
RFP	414	Direct Oxide Reduction Salt	F001,F002	5	0							1.0	SCW
RFP	416	Zinc Magnesium Alloy Metal	None	1	0							0.2	MD
RFP	420	Ash, Incinerator (Virgin)	D004-D011,F001-F003,F005	1	9							2.1	IHS
RFP	421	Heels, Ash (>2% G/G)	D004-D011,F001,F002,F005	1	100							21.0	IHS
RFP	422	Soot	D004-D011,D029,F001-F003,F005	10	15							5.2	IHS
RFP	425	Fluid Bed Ash	D007,F003,F005	8	0							1.7	IHS
RFP	430	Resin, Ion Column Unleached	D001	0	29							6.0	OHS
RFP	431	Resin, Leached	None	0	6							1.2	OHS
RFP	432	Resin, Leached and Cemented	D007,D008,D029,F001,F002, F005	87	195							58.7	SCW
RFP	440	Glass	D001,D002,D005,D008,D009, F001, F002,F005	485	956	24	15					423.4	IHS
RFP	441	Raschig Rings, Unleached	D002,D008,F001-F003	8	1566	1	0					330.6	IHS
RFP	442	Raschig Rings, Leached	D008,F001,F002	745	506	22	27					415.6	IHS
RFP	460	Washables, Rubber, Plastics	F001,F002	0	6							1.2	PRPR
RFP	463	Gloves, Drybox	D008,F001,F002	0	53							11.0	PRPR
RFP	464	Benelex and Plexiglas	D005,D008,F001	2	45							9.8	OD
RFP	480	Metal, Scrap (Non-SS)	D001,D004-D011,D028,F001-F003, F005-F007,F009	917	1640	586	3515					13540.2	MD
RFP	481	Metal, Leached (Non-SS)	D006-D008,D011,F001-F003, F005-F007,F009	121	770	1	132					607.2	MD
RFP	488	Glovebox Parts with Lead	D008			3	0					9.5	TBD
RFP	490	Filters, CWS	D001,D005,D007,D008,D011, F001-F003,F006,F007,F009	50	54	171	1014					3780.5	ID
RFP	491	Plenum Prefilters	F001,F002			3	0					9.5	TBD
RFP	700	Organic and Sludge Immobilization System (OASIS) Waste	D022,F001-F003	60	0							12.5	OHS

Table F-1–9. Existing Wastes Stored at the TSA[a,b,c].

Gen.	IDC[d]	Stream Name	EPA Haz. Waste Numbers	No. of Drums		No. of Boxes		No. of Bins		No. of Other		Tot. Vol.	Waste
				WSF	TSA RE	WSF	TSA RE	WSF	TSA RE	WSF	TSA RE	(cubic meters)	Cat.[d]
RFP	800	Solidified Sludge, Bldg. 774	D002,D004-D011,F001-F003, F005-F007,F009	1570	0	1	0					329.7	TBD
RFP	801	Solidified Organics	D022,F001-F003	795	0							165.4	TBD
RFP	802	Solidified Lab Waste	D001,D011,F001-F003,F005	78	0							16.2	TBD
RFP	803	Solidified DCP Sludge	D002,D006-D008,D010,F001-F003,F005-F007,F009	161	0							33.5	TBD
RFP	806	Solidified Process Solids	D004-D011,F001-F003,F005	41	0							8.5	TBD
RFP	807	Cemented Incinerator Sludge & Solidified Bypass Sludge	D004-D011,F001-F003,F005, (also D002,F006,F007,F009)	1245	0	2	0					265.3	TBD
RFP	817	Cemented Sand, Slag, & Crucible Heels	D007,D008,F001-F003	22	0	1	0					7.7	TBD
RFP	818	Cemented Ash	D004-D011,F001-F003,F005	7	0							1.5	TBD
RFP	820	Cemented Soot	D004-D011,F001-F003,F005	27	0							5.6	TBD
RFP	822	Cemented Resin	None	26	0							5.4	TBD
RFP	823	Cemented Miscellaneous Sludge	D004-D011,F001-F003,F005	13	0	1	0					5.9	TBD
RFP	831	Dry Combustibles TRU Mixed	F001,F002			71	0					225.2	TBD
RFP	832	Wet Combustibles TRU Mixed	F001,F002			96	0					304.5	TBD
RFP	833	Plastics TRU Mixed	F001,F002			10	0					31.7	TBD
RFP	900	LSA Paper, Plastic, etc.	D004-D011,D029,F001-F003,F005	27	323	0	6					91.8	PRPR
RFP	950	LSA Metal, Glass, etc.	D004-D011,F001,F002,F005	4	106	12	321					1079.2	HD
RFP	960	Concrete, Asphalt, etc.	D004-D011,F001,F002,F005	55	648	0	171					688.6	HD
RFP	970	Wood	D008,F001-F003,F005	5	17	8	54					201.2	OD
RFP	976	Bldg. 776 Process Sludge	D006-D009,D022,F001-F003	0	7	0	20					64.9	IHS
RFP	978	Laundry Sludge	D006-D009,F001-F003			0	11					34.9	IHS
RFP	980	Equipment (suspected to be IDC 290)	D008,F001,F002	0	1							0.2	SCW
RFP	990	Dirt	F001-F004	0	470							97.8	S
RFP	995	Sludge	None	0	296	0	8					86.9	IHS
RFP	UNK	Unknown	Unknown	31	0	69	0					225.3	TBD
UNK	UNK	Unknown	Unknown	17	0	33	0					108.2	TBD
			TOTALS:	30243	74426	2025	8663	53	504	0	33	57731	

[a] The number and type of containers listed in this table are based on a November 1997 query of the Transuranic Waste Management Information System (TWMIS) database. Volumes are calculated using the following conversion factors: (a) 0.208 cubic meters /drum, (b) 3.172 cubic meters/box, (c) 3.488 cubic meters/bin, and (d) 3.488 cubic meters/other container.

[b] EPA Hazardous Waste Numbers are assigned based on the engineering design file RWMC-803, current revision, *Chemical Constituents in Transuranic Storage Area (TSA) Waste*. Waste streams listed with “none” in the “EPA Haz. Waste Number” column are radioactive-only waste.

[c] Waste streams designated with remote handled, special case waste, and to-be-determined waste categories will be evaluated on a case-by-case basis, as information becomes available, to determine if a more appropriate waste category is warranted. Special case wastes in this table have been included in the Part A permit application under special case waste treatment, although they may not be treated in the special case waste glovebox.

[d] IDC=item description code; HD=heterogeneous debris; IHS=inorganic homogeneous solids; SCW=special case waste; TBD=to be determined; RH=remote-handled; PRPR=paper/rags/plastic/rubber; MD=metal debris; ID=inorganic debris; OD=organic debris; G=graphite; S=soils; OHS=organic homogeneous solids; CBD=Ceramic/Brick debris.

[e] Waste stream IN-ANLW 164 is a newly-generated waste stream that is currently stored at the WSF.

APPENDIX G

ADVANCED MIXED WASTE TREATMENT PROJECT ENVIRONMENTAL IMPACT STATEMENT CONTRACTOR AND SUBCONTRACTOR DISCLOSURE STATEMENTS

The following are disclosure statements, pursuant to 40 CFR 1506.5 (c) provided by Tetra Tech, Inc. and the five major subcontractor involved in the preparation of this EIS.

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