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Storage and Disposition of Weapons-Usable Fissile Materials Final Programmatic Environmental Impact Statement

Volume III

United States Department of Energy
Office of Fissile Materials Disposition

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FOREWORD

This is the *Storage and Disposition of Weapons-Usable Fissile Materials Final Programmatic Environmental Impact Statement* (PEIS), prepared by the U.S. Department of Energy, Office of Fissile Materials Disposition. The document is composed of four volumes and a separate Summary. Changes made since the Draft PEIS are shown by change bar notation (vertical lines adjacent to the changes) in this Final PEIS for both text and tables. Deletion of one or more sentences is indicated by the phrase "Text deleted." in brackets. This Final PEIS includes the Preferred Alternative, which is a combination of alternatives. The Preferred Alternative is described in Section 1.6 and Chapter 2 of Volume I, and analyzed in Chapter 4 of Volume II. For all the alternatives, including the Preferred Alternative, a comparison of alternatives is presented in Section 2.5 of Volume I and a summary of impacts is presented in Section 4.6 of Volume II (Part B). Information from these sections is also presented in the Summary.

Volume I contains Chapters 1 through 3 of the PEIS. Chapter 1 includes a description of the history and background of the fissile materials disposition program, the purpose of and need for the proposed action, a summary of changes made to the Draft PEIS, and the Preferred Alternative. Chapter 2 gives a description of the proposed long-term storage and disposition alternatives, a description of how the alternatives were selected and why others were eliminated from further consideration, and a comparison of the alternatives in terms of their potential environmental impacts. Chapter 3 describes the affected environment at candidate long-term storage locations, and at sites and environmental settings for the disposition alternatives.

Volume II (Parts A and B) contains Chapters 4 through 10 of the PEIS. Chapter 4 describes the potential environmental impacts resulting from construction and operation of the proposed long-term storage and disposition alternatives, including the Preferred Alternative. Also contained in this chapter are intersite transportation impacts, a discussion of environmental justice issues, cumulative impacts due to the implementation of the proposed alternatives in addition to other actions at a site, avoided environmental impacts, and a summary of impacts. Chapter 5 provides a list of references used in the preparation of this document. Chapter 6 provides an index to the main text of the PEIS. Chapter 7 is a glossary of key terms used in the document. Chapter 8 is a list of preparers. Chapter 9 lists government agencies and organizations contacted during the preparation of this PEIS. Chapter 10 provides a distribution list for the document.

Volume III contains the appendices to this PEIS. Appendix A contains the fact sheet on the President's *Nonproliferation and Export Control Policy*, and the Joint Statement Between the United States and Russia on Nonproliferation. Appendix B provides specifications for key buildings within each facility complex analyzed in this PEIS. Appendix C describes requirements for construction and operation of the various facilities required to accomplish the storage and disposition activities essential to the alternatives described in this PEIS. Appendix D provides information on overall water usage for the storage and disposition facilities discussed in this PEIS. Appendix E gives a general overview of the Department of Energy (DOE) environmental restoration and waste management program, baseline waste management at DOE sites, and project-specific waste management activities associated with the proposed long-term storage and disposition alternatives. Appendix F provides detailed data supporting the air quality and noise analyses. Appendix G describes the methodology used for intersite transportation risk analysis and provides a summary of hazardous materials shipped to and from DOE sites, plus information on shipping containers. Appendix H evaluates various plutonium waste forms for potential disposal in a high-level waste repository. Appendix I describes operations of a Canadian Deuterium Uranium Reactor. Appendix J identifies the compliance requirements associated with the Proposed Action, as specified by the major Federal and State environmental, safety, and health statutes, regulations, and orders. Appendix K lists the scientific names of common nonthreatened and nonendangered animal and plant species identified in Chapters 3 and 4. Appendix L includes the supporting data used for assessing the No Action

Alternative in the socioeconomics sections of this PEIS. Appendix M presents detailed information on the potential health risks associated with releases of radioactivity and hazardous chemicals from the proposed storage and disposition alternatives during normal operations and from postulated accidents. Appendix N describes different concepts for, and provides cost and benefit information on, the multipurpose reactor. Appendix O provides a description of facilities and operations for a can-in-canister approach to plutonium immobilization at the Savannah River Site in South Carolina. Appendix P describes the potential environmental impacts of using the Manzano Weapons Storage Area in New Mexico for the long-term storage of plutonium pits. Appendix Q identifies the potential health impacts from the storage of Rocky Flats Environmental Technology Site plutonium pits at the Pantex Plant in Texas. Appendix R discusses the aircraft crash and radioactive release probabilities for proposed storage and disposition facilities at Pantex Plant in Texas. A separate Classified Appendix was also prepared, which provides detailed analysis results for intersite transportation risks based on classified inventories of materials stored at DOE sites.

Volume IV (Parts A and B) is the Comment Response Document. It contains an overview of the public comment process, the comments received on the Draft PEIS during the public review period, and the DOE responses to those comments, including identifying changes made to the Draft PEIS in response to public comments.

The Summary provides a brief overview of the PEIS. It includes the purpose of and need for the Proposed Action, a description of the storage and disposition alternatives including the Preferred Alternative, and the potential environmental impacts resulting from these alternatives.

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LIST OF ACRONYMS AND ABBREVIATIONS

AADT	Average Annual Daily Traffic
ACEC	Area of Critical Environmental Concern
ACGIH	American Conference of Governmental Industrial Hygienists
AEA	*Atomic Energy Act*
AEC	Atomic Energy Commission
AGV	automated guided vehicle
ALARA	as low as reasonably achievable
ALE	Arid Lands Ecology Reserve
ANL-W	Argonne National Laboratory-West
APSF	Actinide Packaging and Storage Facility
AQCR	Air Quality Control Region
ARA	Auxiliary Reactor Area
ARIES	Advanced Recovery and Integrated Extraction System
BEA	Bureau of Economic Analysis
BEIR	biological effects of ionizing radiation
BLM	Bureau of Land Management
BOP	balance-of-plant
BPA	Bonneville Power Administration
BWR	boiling water reactor
CAA	*Clean Air Act*
CANDU	Canadian deuterium uranium
CAS	Chemical Abstracts Service
CCDF	complimentary cumulative distribution function
CEQ	Council on Environmental Quality
CERCLA	*Comprehensive Environmental Response, Compensation, and Liability Act*
CFA	Central Facilities Area
CFR	Code of Federal Regulations
CGTO	Consolidated Group of Tribes and Organizations
CI	confidence interval
CIC	can-in-canister
CLUP	Comprehensive Land-Use Plan
CMR	Chemistry and Metallurgy Research

COE	Corps of Engineers
Complex	Nuclear Weapons Complex
CRD	Comment Response Document
CRT	Cargo Restraint Transporters
CWA	*Clean Water Act*
D&D	decontamination and decommissioning
DAF	Device Assembly Facility
DCG	derived concentration guide
DHLW	defense high-level waste
DNB	departure of nucleate boiling
DNFSB	Defense Nuclear Facilities Safety Board
DNL	day and night average sound levels
DNWR	Desert National Wildlife Range
DoD	Department of Defense
DOE	Department of Energy
DOT	Department of Transportation
DP	Office of Defense Programs
DRCOG	Denver Regional Council of Governments
DWPF	Defense Waste Processing Facility
EA	environmental assessment
EBR	Experimental Breeder Reactor
EDNA	Environmental Design for Noise Abatement
EIA	Energy Information Administration
EIS	environmental impact statement
EM	Office of Environmental Management
EPA	Environmental Protection Agency
ERR	excess relative risk
ES&H	Office of Environment, Safety, and Health
ESA	*Endangered Species Act*
ETF	effluent treatment facility
FAIR	Forest, Agriculture, Industry, and Research
FCF	Fuel Cycle Facility
FEMA	Federal Emergency Management Agency
FFCA	Federal Facility Compliance Agreement
FFTF	Fast Flux Test Facility

FLPMA	*Federal Land Planning Management Act*
FMEF	Fuels and Materials Examination Facility
FMF	Fuel Manufacturing Facility
FONSI	Finding of No Significant Impact
FR	Federal Register
FSAR	Final Safety Analysis Report
GBZ	Glass-bonded zeolite
GESMO	Generic Environmental Statement on Mixed Oxide
GIS	Geographical Information System
GMA	*Growth Management Act*
GMODS	Glass Material Oxidation Dissolution System
HAD	hazard analysis document
Hanford	Hanford Site
HE	high explosives
HEAST	Health Effects Summary Table
HEPA	high-efficiency particulate air
HEU	highly enriched uranium
HEU EIS	*Disposition of Surplus Highly Enriched Uranium Environmental Impact Statement*
HFEF	Hot Fuel Examination Facility
HI	Hazard Index
HLW	high-level waste
HQ	Hazard Quotient
HRA EIS	*Hanford Remedial Action Environmental Impact Statement and Comprehensive Land Use Plan*
HVAC	Heating Ventilation and Air Conditioning
HWR	Heavy Water Reactor
IAEA	International Atomic Energy Agency
ICPP	Idaho Chemical Processing Plant
ICRP	International Commission of Radiological Protection
INEL	Idaho National Engineering Laboratory
IRIS	Integrated Risk Information System
ISCST2	Industrial Source Complex Short-Term Model Version 2
ISO	International Standards Organization
IWG	Interagency Working Group
K-25	K-25 Site

L/ER	Energy Research Program Office
LA	Limited Area
LAA	Limited Access Area
LANL	Los Alamos National Laboratory
LANSCE	Los Alamos Neutron Scattering Center
LCF	latent cancer fatalities
LDR	Land Disposal Restriction
LEU	low-enriched uranium
LIGO	Laser Interferometer Gravitational-Wave Observatory
LLNL	Lawrence Livermore National Laboratory
LLW	low-level waste
LOB	Laboratory Office Building
LWR	Light Water Reactor
MAA	Material Access Area
MACCS	Melcor Accident Consequence Code System
MC&A	Material Control and Accountability
MD	Office of Fissile Materials Disposition
MEI	maximally exposed individual
MHR	Modular Helium Reactor
MMI	Modified Mercalli Intensity
MOX	mixed oxide
MSL	mean sea level
NAAQS	National Ambient Air Quality Standards
NAGPRA	*Native American Graves Protection and Repatriation Act*
NAS	National Academy of Sciences
NCDC	National Climatic Data Center
NCRP	National Commission of Radiological Protection
NEIC	National Earthquake Information Center
NEPA	*National Environmental Policy Act*
NERP	National Environmental Research Park
NESHAP	National Emission Standards for Hazardous Air Pollutants
NFS	Nuclear Fuel Services Fuel Fabrication Plant
NHPA	*National Historic Preservation Act*
NIOSH	National Institute of Occupational Safety and Health
NMSF	Nuclear Material Storage Facility

NMSM	Nuclear Materials and Stockpile Management
NOAA	National Oceanic and Atmospheric Administration
NOI	Notice of Intent
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
NRC	Nuclear Regulatory Commission
NRF	Naval Reactors Facility
NRHP	National Register of Historic Places
NTS	Nevada Test Site
NTS EIS	*Environmental Impact Statement for the Nevada Test Site and Off-Site Locations in the State of Nevada*
NWI	National Wetlands Inventory
NWPA	*Nuclear Waste Policy Act*
NWS	National Weather Service
OCRWM	Office of Civilian Radioactive Waste Management
ORISE	Oak Ridge Institute for Science and Education
ORNL	Oak Ridge National Laboratory
ORR	Oak Ridge Reservation
OSHA	Occupational Safety and Health Administration
PA	Protected Area
Pantex	Pantex Plant
Pantex EIS	*Environmental Impact Statement for the Continued Operation of the Pantex Plant and Associated Storage of Nuclear Weapon Components*
PBF	Power Burst Facility
PCV	Primary Containment Vessel
PEIS	programmatic environmental impact statement
PEL	Permissible Exposure Level
PFP	Plutonium Finishing Plant
PFP EIS	*Plutonium Finishing Plant Stabilization Environmental Impact Statement*
PIDAS	Perimeter Intrusion Detection and Alarm System
PNNL	Pacific Northwest National Laboratory
PPA	Property Protection Area
PRA	probabilistic risk assessment
PSAR	Preliminary Safety Analysis Report
PSD	Prevention of Significant Deterioration

PUREX	Plutonium-Uranium Extraction Plant
PWR	pressurized water reactor
R&D	Research and Development
RCRA	*Resource Conservation and Recovery Act*
REA	regional economic area
RIA	reactivity insertion accident
RFETS	Rocky Flats Environmental Technology Site
RIMS II	Regional Input-Output Modeling System
RL	Richland Operations Office
ROD	Record of Decision
ROI	region of influence
RSWF	Radioactive Scrap and Waste Facility
RWMC	Radioactive Waste Management Complex
RWMS	Radioactive Waste Management Site
SAR	Safety Analysis Report
SARA	*Superfund Amendments and Reauthorization Act*
sd	standard deviation
SDWA	*Safe Drinking Water Act*
SEB	Security Equipment Building
SHPO	State Historic Preservation Officer
SIP	State Implementation Plan
SISMP	Site Integrated Stabilization and Management Plan
SMR	Standardized Mortality Ratio
SNF	spent nuclear fuel
SNL	Sandia National Laboratories
SRR	standardize rate ratio
SRS	Savannah River Site
Stockpile Stewardship and Management PEIS	*Programmatic Environmental Impact Statement for Stockpile Stewardship and Management*
Storage and Disposition PEIS	*Storage and Disposition of Weapons-Usable Fissile Materials Programmatic Environmental Impact Statement*
SST	safe secure trailer
START	Strategic Arms Reduction Talks

TA	Technical Area
TAN	Test Area North
TCLP	toxicity characteristic leaching procedure
TDEC	Tennessee Department of Environmental Conservation
TDS	total dissolved solids
TI	transport index
TLV	Threshold Limit Values
TNRCC	Texas Natural Resources Conservation Commission
TRA	Test Reactor Area
TRU	transuranic
TSCA	*Toxic Substance Control Act*
TSD	Transportation Safeguards Division
TSP	total suspended particulates
TSR PEIS	*Tritium Supply and Recycling Programmatic Environmental Impact Statement*
TVA	Tennessee Valley Authority
USFWS	United States Fish and Wildlife Services
USGS	United States Geological Survey
VOC	volatile organic compound
VRM	Visual Resource Management
WAC	Waste Acceptance Criteria
Waste Management PEIS	*Waste Management Programmatic Environmental Impact Statement for Managing Treatment, Storage, and Disposal of Radioactive and Hazardous Waste*
WIPP	Waste Isolation Pilot Plant
WMIS	Waste Management Information System
WNP	Washington Nuclear Power
WPPSS	Washington Public Power Supply System
WSA	Weapons Storage Area
WSCC	Western Systems Coordinating Council
WSCF	Waste Sampling and Characterization Facility
Y–12	Y–12 Plant
Y–12 EA	*Environmental Assessment for the Proposed Interim Storage of Enriched Uranium Above the Maximum Historical Level at the Y–12 Plant, Oak Ridge, Tennessee*
YMSCO	Yucca Mountain Site Characterization Office
ZPPR	Zero Power Physics Reactor

CHEMICALS AND UNITS OF MEASURE

°C	degrees Celsius
Ci	curie
cm	centimeter
CO	carbon monoxide
CO_2	carbon dioxide
Co-60	cobalt-60
Cs	cesium
Cs-137	cesium-137
CsCl	cesium chloride
Cu	copper
dB	decibel
dBA	decibel A-weighted
°F	degrees Fahrenheit
ft	feet
ft^2	square feet
ft^3	cubic feet
g	gram
G	gravitational acceleration
gal	gallon
Gd	gadolinium
GWd	gigawatt-days
ha	hectare
H_2	hydrogen
HF	hydrogen fluoride
HNO_3	nitric acid
hr	hour
I-129	iodine-129
in	inch
k_{eff}	effective neutron multiplication factor
kg	kilogram
km	kilometer
km^2	square kilometer

Kr	krypton
kV	kilovolt
l	liter
lb	pound
m	meter
m^2	square meter
m^3	cubic meter
mCi	millicurie
mg	milligram
mi	mile
mi^2	square miles
min	minute
mph	miles per hour
mrem	millirem (one thousandth of a rem)
MW	megawatt
MWe	megawatt electric
N_2	nitrogen
nCi	nanocurie (one-billionth of a Curie)
Ni	nickel
NO_2	nitrogen dioxide
NO_x	nitrogen oxides
O_3	ozone
oz	ounce
Pb	lead
PCB	polychlorinated biphenyl
pCi	picocurie (one-trillionth of a Curie)
PM_{10}	particulate matter less than or equal to 10 microns
ppm	parts per million
Pu	plutonium
PuCl	plutonium chloride
PuO_2	plutonium dioxide
rad	radiation absorbed dose
rem	roentgen equivalent man
RfC	Reference Concentration
RfD	Reference Dose

s	second
SO_2	sulfur dioxide
Sr-90	strontium-90
t	metric ton
Tc-99	technetium-99
ton	short ton
U	uranium
U-233	uranium-233
U-234	uranium-234
U-235	uranium-235
U-236	uranium-236
U-238	uranium-238
UF_6	uranium hexafluoride
UNH	uranyl nitrate hexahydrate
UO_2	uranium dioxide
U_3O_8	triuranium octaoxide
VOC	volatile organic compound
yd	yard
yr	year
μg	microgram (one-millionth of a gram)

Metric Conversion Chart

To Convert Into Metric			To Convert Out of Metric		
If You Know	**Multiply By**	**To Get**	**If You Know**	**Multiply By**	**To Get**
Length					
inches	2.54	centimeters	centimeters	0.3937	inches
feet	30.48	centimeters	centimeters	0.0328	feet
feet	0.3048	meters	meters	3.281	feet
yards	0.9144	meters	meters	1.0936	yards
miles	1.60934	kilometers	kilometers	0.6214	miles
Area					
sq. inches	6.4516	sq. centimeters	sq. centimeters	0.155	sq. inches
sq. feet	0.092903	sq. meters	sq. meters	10.7639	sq. feet
sq. yards	0.8361	sq. meters	sq. meters	1.196	sq. yards
acres	0.40469	hectares	hectares	2.471	acres
sq. miles	2.58999	sq. kilometers	sq. kilometers	0.3861	sq. miles
Volume					
fluid ounces	29.574	milliliters	milliliters	0.0338	fluid ounces
gallons	3.7854	liters	liters	0.26417	gallons
cubic feet	0.028317	cubic meters	cubic meters	35.315	cubic feet
cubic yards	0.76455	cubic meters	cubic meters	1.308	cubic yards
Weight					
ounces	28.3495	grams	grams	0.03527	ounces
pounds	0.45360	kilograms	kilograms	2.2046	pounds
short tons	0.90718	metric tons	metric tons	1.1023	short tons
Temperature					
Fahrenheit	Subtract 32 then multiply by 5/9ths	Celsius	Celsius	Multiply by 9/5ths, then add 32	Fahrenheit

Metric Prefixes

Prefix	Symbol	Multiplication Factor
exa-	E	1 000 000 000 000 000 000 = 10^{18}
peta-	P	1 000 000 000 000 000 = 10^{15}
tera-	T	1 000 000 000 000 = 10^{12}
giga-	G	1 000 000 000 = 10^{9}
mega-	M	1 000 000 = 10^{6}
kilo-	k	1 000 = 10^{3}
hecto-	h	100 = 10^{2}
deka-	da	10 = 10^{1}
deci-	d	0.1 = 10^{-1}
centi-	c	0.01 = 10^{-2}
milli-	m	0.001 = 10^{-3}
micro-	µ	0.000 001 = 10^{-6}
nano-	n	0.000 000 001 = 10^{-9}
pico-	p	0.000 000 000 001 = 10^{-12}
femto-	f	0.000 000 000 000 001 = 10^{-15}
atto-	a	0.000 000 000 000 000 001 = 10^{-18}

Appendix A
Nonproliferation Policy and Joint Statement

This appendix contains a copy of the fact sheet on the President's *Nonproliferation and Export Control Policy* released by the White House on September 27, 1993. The fact sheet describes the major principles that guide the policy and the key elements of the policy. This appendix also contains a copy of the *Joint Statement by the President of the Russian Federation and the President of the United States of America on Non-Proliferation of Weapons of Mass Destruction and the Means of Their Delivery* agreed to during their meeting on January 14, 1994.

A.1 NONPROLIFERATION AND EXPORT CONTROL POLICY FACT SHEET

[Text deleted.]

THE WHITE HOUSE

Office of the Press Secretary

For Immediate Release September 27, 1993

FACT SHEET

NONPROLIFERATION AND EXPORT CONTROL POLICY

The President today established a framework for U.S. efforts to prevent the proliferation of weapons of mass destruction and the missiles that deliver them. He outlined three major principles to guide our nonproliferation and export control policy:

- Our national security requires us to accord higher priority to nonproliferation, and to make it an integral element of our relations with other countries.

- To strengthen U.S. economic growth, democratization abroad and international stability, we actively seek expanded trade and technology exchange with nations, including former adversaries, that abide by global nonproliferation norms.

- We need to build a new consensus -- embracing the Executive and Legislative branches, industry and public, and friends abroad -- to promote effective nonproliferation efforts and integrate our nonproliferation and economic goals.

The President reaffirmed U.S. support for a strong, effective nonproliferation regime that enjoys broad multilateral support and employs all of the means at our disposal to advance our objectives.

Key elements of the policy follow.

Fissile Material

The U.S. will undertake a comprehensive approach to the growing accumulation of fissile material from dismantled nuclear weapons and within civil nuclear programs. Under this approach, the U.S. will:

- Seek to eliminate where possible the accumulation of stockpiles of highly-enriched uranium or plutonium to ensure that where these materials already exist they are subject to the highest standards of safety, security, and international accountability.

- Propose a multilateral convention prohibiting the production of highly-enriched uranium or plutonium for nuclear explosives purposes or outside of international safeguards.

- Encourage more restrictive regional arrangements to constrain fissile material production in regions of instability and high proliferation risk.

- Submit U.S. fissile material no longer needed for our deterrent to inspection by the International Atomic Energy Act.

- Pursue the purchase of highly-enriched uranium from the former Soviet Union and other countries and its conversion to peaceful use as reactor fuel.

- Explore means to limit the stockpiling of plutonium from civil nuclear programs, and seek to minimize the civil use of highly-enriched uranium.

- Initiate a comprehensive review of long-term options for plutonium disposition, taking into account technical, nonproliferation, environmental, budgetary and economic considerations. Russia and other nations with relevant interests and experience will be invited to participate in this study.

The United States does not encourage the civil use of plutonium and, accordingly, does not itself engage in plutonium reprocessing for either nuclear power or nuclear explosive purposes. The United States, however, will maintain its existing commitments regarding the use of plutonium in civil nuclear programs in Western Europe and Japan.

Export Controls

To be truly effective, export controls should be applied uniformly by all suppliers. The United States will harmonize domestic and multilateral controls to the greatest extent possible. At the same time, the need to lead the international community or overriding national security or foreign policy interests may justify unilateral export controls in specific cases. We will review our unilateral dual-use export controls and policies, and eliminate them unless such controls are essential to national security and foreign policy interests.

We will streamline the implementation of U.S. nonproliferation export controls. Our system must be more responsible and efficient, and not inhibit legitimate exports that play a key role in American economic strength while preventing exports that would make a material contribution to the proliferation of weapons of mass destruction and the missile that deliver them.

Nuclear Proliferation

The U.S. will make every effort to secure the indefinite extension of the Non-Proliferation Treaty in 1995. We will seek to ensure that the International Atomic Energy Agency has the resources needed to implement its vital safeguards responsibilities, and will work to strengthen the IAEA's ability to detect clandestine nuclear activities.

Missile Proliferation

We will maintain our strong support for the Missile Technology Control Regime. We will promote the principles of the MTCR Guidelines as a global missile nonproliferation norm and seek to use the MTCR as a mechanism for taking joint action to combat missile proliferation. We will support prudent expansion of the MTCR's membership to include additional countries that subscribe to international nonproliferation standards, enforce effective export controls and abandon offensive ballistic missile programs. The United States will also promote regional efforts to reduce the demand for missile capabilities.

The United States will continue to oppose missile programs of proliferation concern, and will exercise particular restraint in missile-related cooperation. We will continue to retain a strong presumption of denial against exports to any country of complete space launch vehicles or major components.

The United States will not support the development or acquisition of space-launch vehicles in countries outside the MTCR.

For MTCR member countries, we will not encourage new space launch vehicle programs, which raise questions on both nonproliferation and economic viability grounds. The United States will, however, consider exports of MTCR-controlled items to MTCR member countries for peaceful space launch programs on a case-by-case basis. We will review whether additional constraints or safeguards could reduce the risk of misuse of space launch technology. We will seek adoption by all MTCR partners of policies as vigilant as our own.

Chemical and Biological Weapons

To help deter violations of the Biological Weapons Convention, we will promote new measures to provide increased transparency of activities and facilities that could have biological weapons applications. We call on all nations -- including our own -- to ratify the Chemical Weapons Convention quickly so that it may enter into force by January 13, 1995. We will work with others to support the international Organization for the Prohibition of Chemical Weapons created by the Convention.

Regional Nonproliferation Initiatives

Nonproliferation will receive greater priority in our diplomacy, and will be taken into account in our relations with countries around the world. We will make special efforts to address the proliferation threat in regions of tension such as the Korean peninsula, the Middle East and South Asia, including efforts to address the underlying motivations for weapons acquisition and to promote regional confidence-building steps.

In Korea, our goal remains a non-nuclear peninsula. We will make every effort to secure North Korea's full compliance with its nonproliferation commitments and effective implementation of the North-South denuclearization agreement.

In parallel with our efforts to obtain a secure, just, and lasting peace in the Middle East, we will promote dialogue and confidence-building steps to create the basis for a Middle East free of weapons of mass destruction. In the Persian Gulf, we will work with other suppliers to contain Iran's nuclear, missile, and Biological Weapons Convention ambitions, while preventing reconstruction of Iraq's activities in these areas. In South Asia, we will encourage India and Pakistan to proceed with multilateral discussions of nonproliferation and security issues, with the goal of capping and eventually rolling back their nuclear and missile capabilities.

In developing our overall approach to Latin America and South Africa, we will take account of the significant nonproliferation progress made in these regions in recent years. We will intensify efforts to ensure that the former Soviet Union, Eastern Europe and China do not contribute to the spread of weapons of mass destruction and missiles.

Military Planning and Doctrine

We will give proliferation a higher profile in our intelligence collection and analysis and defense planning, and ensure that our own force structure and military planning address the potential threat from weapons of mass destruction and missile around the world.

Conventional Arms Transfers

We will actively seek greater transparency in the area of conventional arms transfers and promote regional confidence-building measures to encourage restraint on such transfers to regions of instability. The U.S. will undertake a comprehensive review of conventional arms transfer policy, taking into account national security, arms control, trade, budgetary and economic competitiveness consideration.

A.2 NONPROLIFERATION OF WEAPONS OF MASS DESTRUCTION AND THE MEANS OF THEIR DELIVERY

THE WHITE HOUSE

Office of the Press Secretary

JOINT STATEMENT
BY THE PRESIDENT OF THE RUSSIAN FEDERATION
AND
THE PRESIDENT OF THE UNITED STATES OF AMERICA
ON NON-PROLIFERATION OF WEAPONS OF MASS DESTRUCTION
AND THE MEANS OF THEIR DELIVERY

President Clinton and President Yeltsin, during their meeting in Moscow on January 14, 1994, agreed that the proliferation of weapons of mass destruction and their missile delivery systems represents an acute threat to international security in the period following the end of the Cold War. They declared the resolve of their countries to cooperate actively and closely with each other, and also with other interested states, for the purpose of preventing and reducing this threat.

The Presidents noted that the proliferation of nuclear weapons creates a serious threat to the security of all states, and expressed their intention to take energetic measures aimed at prevention of such proliferation.

- Considering the Treaty on the Non-proliferation of Nuclear Weapons as the basis for efforts to ensure the nonproliferation of nuclear weapons, they called for its indefinite and unconditional extension at conference of its participants in 1995, and they urged that all states that have not yet done so accede to this treaty.

- They expressed their resolve to implement effective measures to limit and reduce nuclear weapons. In this connection, they advocated the most rapid possible entry into force of the START I and START II treaties.

- They agreed to review jointly appropriate ways to strengthen security assurances for the states which have renounced the possession of the nuclear weapons and that comply strictly with their nonproliferation obligations.

- They expressed their support for the International Atomic Energy Agency in its efforts to carry out its safeguards responsibilities. They also expressed their intention to provide assistance to the Agency in the safeguards field, including through joint efforts of their relevant laboratories to improve safeguards.

- They supported the Nuclear Suppliers Group, and agreed with the need for effective implementation of the principle of full-scope IAEA safeguard as a condition for nuclear exports with the need for export controls on dual-use materials and technology in the nuclear field.

- They reaffirmed their countries' commitment to the conclusion as soon as possible of an international treaty to achieve a comprehensive ban on nuclear test explosions and welcomed the decision to begin negotiations at the conference on disarmament. They declared their firm intentions to provide political support for the negotiating process, and appealed to other states to refrain from carrying out nuclear explosions while these talks are being held.

- They noted that an important contribution to the goal of nonproliferation of nuclear weapons would be made by a verifiable ban on the production of fissile materials for nuclear weapons and by the most rapid conclusion of an international convention to this effect with the widest possible participation of states and on a non-discriminatory basis.

- They agreed to cooperate with each other and also with other states to elaborate measures designed to prevent the accumulation of excessive stocks of fissile materials and over time to reduce such stocks.

- They agreed to establish a joint working group to consider:

  - including in their voluntary IAEA safeguards offers all source and special fissionable materials, excluding only those facilities associated with activities having direct national security significance;

  - steps to ensure the transparency and irreversibility of the process of reduction of nuclear weapons, including the possibility of putting a portion of fissionable material under IAEA safeguards. Particular attention would be given to materials released in the process of nuclear disarmament and steps to ensure that these materials would not be used again for nuclear weapons.

- The Presidents also tasked their experts to study options for the long-term disposition of fissile materials, particularly of plutonium, taking into account the issues of nonproliferation, environmental protection, safety, and technical and economic factors.

- They reaffirmed the intention of interested organizations of the two countries to complete within a short time a joint study of the possibilities of terminating the production of weapon-grade plutonium.

- The Presidents agreed that reduction of the risk of theft or diversion of nuclear materials is a high priority, and in this context they noted the usefulness of the September 1993 Agreement to cooperate in improving the system of controls, accounting, and physical protection for nuclear materials. They attached great significance to further joint work on the separate but mutually connected problems of accounting for nuclear materials used in the civilian and military fields.

Both Presidents favored a further increase in the efforts to prevent the proliferation of chemical and biological weapons.

- As the heads of the countries that have the world's largest stockpiles of chemical weapons, they acknowledged particular responsibility for eliminating the threat posed by these weapons. In this context, they declare their resolute support for the Convention of the Prohibition of Chemical Weapons, and their intention to promote ratification as rapidly as possible and entry into force of the Convention no later than 1995.

- To promote implementation of a comprehensive ban on chemical weapons, they welcomed the conclusion of the implementing documents for the Wyoming Memorandum of Understanding and agreed to conclude work in as short a time as possible on the implementing documents for the Bilateral Agreement on the Destruction of Chemical Weapons.

- The Presidents reaffirmed their desire to facilitate the safe, secure, timely, and ecologically sound destruction of chemical weapons in the Russian Federation and the United States. They applauded the joint Chemical Weapons Destruction Work Plan recently concluded between the two countries which leads the way for the United States to provide an additional $30 million in assistance to support an analytical chemical laboratory in Russia to facilitate chemical weapons destruction. The United States also agreed to consider appropriate additional measures to support Russia's chemical weapons destruction program.

- They reiterated the importance of strict compliance with the Convention on the Prohibition of Biological and Toxin Weapons and of continued implementation of measures in accordance with the Russia-America-

British Statement of September 1992, which provided inter alia for the reciprocal visits of facilities and meetings between experts in order to ensure confidence in the compliance with the Convention.

- They supported convening a special conference of the states' parties to the Convention on the Prohibition of Biological and Toxin Weapons in order to consider measures that would contribute to transparency and thereby confidence in compliance with the Convention and its effectiveness.

The Presidents expressed the determination of their countries to cooperate with each other in preventing the proliferation of missiles capable of carrying weapons of mass destruction.

- They welcomed the conclusion of the Bilateral Memorandum of Understanding between the Government of the Russian Federation and the Government of the United States of America Concerning the Export of Missile Equipment and Technologies, signed in September 1993, noted the importance of the Agreement for ensuring mutually beneficial cooperation between the U.S. and Russia in the field of space exploration, and agreed to collaborate closely in order to ensure its full and timely implementation.

- The U.S. welcomed Russia's intention to join the Missile Technology Control Regime and undertook to cooperate with Russia in facilitation its membership at an early date. The Russian Federation and the United Sates of America are certain that further improving the MTCR, including the prudent expansion of membership, will help reduce the threat of proliferation of missiles and missile technologies in the regional context as well.

The Presidents of the two countries agreed that, in addition to strengthening global norms of nonproliferation and working out agreements to this effect, close cooperation is essential in order to develop policies on nonproliferation applicable to specific regions posing the greatest risk of proliferation of weapons of mass destruction and their means of delivery.

- They agreed that nuclear weapons on the Korean Peninsula would represent a grave threat to regional and international security, and decided that their countries would consult with each other on ways to eliminate this danger. They called upon the DPRK to honor fully its obligation under the Treaty on the Non-proliferation of Nuclear Weapons and its safeguards agreement with the IAEA in connection with the Treaty, and to resolve the problems of safeguards implementation, inter alia, through dialogue between IAEA and DPRK. They also urged full and speedy implementation of the Joint Declaration of the ROK and the DPRK on Denuclearization of the Korean Peninsula.

- They support efforts to reach agreement on the establishment of a multilateral forum to consider measures in the field of arms control in nonproliferation that could strengthen security in South Asia. They call on India and Pakistan to join in the negotiation of and become original signatories to the Treaty Banning Nuclear Weapons Test Explosions and the proposed Convention to Ban Production of Fissile Materials for Nuclear Explosives and to refrain from deploying ballistic missiles capable of delivering weapons of mass destruction to each other's territories.

- They agreed that the U.S. and Russia, as co-chairs in the Middle East peace process, would actively promote progress in the activity of the working group for Arms Control and Regional Security in the Middle East, striving for speedy implementation of confidence-building measures and working towards turning the Middle East into a region free of weapons of mass destruction, where conventional forces would not exceed reasonable defense needs.

- They firmly supported the efforts of the UN Special Commission and the IAEA to put into operation a long-term monitoring system of the military potential of Iraq, and called upon Iraq to comply with all UN Security Council resolutions.

Appendix B
Building and Facility Specifications

This appendix provides predesign information on the gross size and type of construction required for key buildings and other structures within each facility complex analyzed in this programmatic environmental impact statement (PEIS). Key buildings and structures are those that perform the unique storage or processing functions required by this program.

B.1 STORAGE FACILITIES

The key building/structure requirements for long-term storage alternatives for the candidate sites are grouped as follows: storage upgrade (modification of existing and/or construction of new storage facilities), consolidated plutonium (Pu) storage facilities, and collocated Pu and highly enriched uranium storage facilities. These requirements are listed in Tables B.1–1 through B.1–20. Within each grouping, the tables are ordered by site as follows: Hanford Site (Hanford), Nevada Test Site (NTS), Idaho National Engineering Laboratory (INEL), Pantex Plant (Pantex), Oak Ridge Reservation (ORR), and Savannah River Site (SRS). The Preferred Alternative for the long-term storage of surplus Pu involves a combination of upgrade (Pantex, ORR, and SRS), No Action (Hanford, NTS, INEL, and Los Alamos National Laboratory [LANL]), and phaseout (Rocky Flats Environmental Technology Site).

Table B.1–1. Facility Requirements for the Upgrade Alternative at Hanford Site

Building/Structure	Footprint[a] (m^2)	Number of Levels	Special Materials	Construction Type
New Hanford Pu Storage Facility (without RFETS Pu or LANL Pu)	4,459	2	Special nuclear materials	Reinforced concrete/metal
New Hanford Pu Storage Facility (with RFETS Pu and LANL Pu)	4,999	2	Special nuclear materials	Reinforced concrete/metal

[a] Indicates required construction for Pu Storage Facility option; option to modify Existing Fuels and Materials Examination Facility does not require new facility construction.

Note: m^2=square meters; LANL= Los Alamos National Laboratory; RFETS=Rocky Flats Environmental Technology Site.

Source: HF DOE 1995e:1.

Table B.1–2. Facility Requirements for the Upgrade Alternative at Idaho National Engineering Laboratory, Argonne National Laboratory-West

Building/Structure	Footprint[a] (m^2)	Number of Levels	Special Materials	Construction Type
Material handling building (without RFETS Pu or LANL Pu)	1,770	2	Special nuclear materials	Concrete
[Text deleted.]				
Material handling building (with RFETS Pu and LANL Pu)	2,550	2	Special nuclear materials	Concrete
Security portals	1,430	1	NA	Concrete
Secure vehicle staging	90	1	NA	Concrete
Secure vehicle staging area	930	NA	NA	Concrete
Tower cooling water facility	200	NA	NA	NA

[a] Indicates required new construction.

Note: m^2=square meters; NA=not applicable; LANL= Los Alamos National Laboratory; RFETS=Rocky Flats Environmental Technology Site.

Source: IN DOE 1996a.

Table B.1–3. Facility Requirements for the Upgrade Alternative at Pantex Plant

Building/Structure	Footprint[a] (m^2)	Number of Levels	Special Materials	Construction Type
Vault	3,490	1	Special nuclear materials	Concrete
AGV service/IAEA inspection, UPS	630	1	Special nuclear materials	Concrete
Unpackaging/packaging	370	2	Special nuclear materials	Concrete
Loading area/dock	580	1	NA	Steel
Ramps	310	1	NA	Concrete/steel

[a] Values shown apply to all Pantex upgrade subalternatives for pit material only. In the event non-pit materials were sent to Pantex for storage under the Upgrade with All or Some RFETS Pu and LANL Pu Subalternative, processing equipment and additional space would have to be provided to add the capability to either remediate or overpack any failed metal and oxide containers.

Note: IAEA=International Atomic Energy Agency.

Source: PX MH 1994a.

Table B.1–4. Facility Requirements for the Upgrade Alternative at Oak Ridge Reservation, Y–12 Plant

Building/Structure	Footprint[a] (m^2)	Number of Levels	Special Materials	Construction Type
9212 E-Wing vault	490	1	Special nuclear materials	Reinforced concrete/steel
9204-2 first floor	1,680	1	Special nuclear materials	Metal structure
9204-2E first floor	1,510	1	Special nuclear materials	Metal structure
9215	1,620	1	Special nuclear materials	Metal structure
9998	520	1	Special nuclear materials	Steel structure

[a] All buildings currently exist. No new facility construction is required.

Note: m^2=square meters.

Source: OR MMES 1996a.

Table B.1–5. Facility Requirements for the Upgrade Alternative at Savannah River Site

Building/Structure	Footprint[a] (m^2)	Number of Levels	Special Materials	Construction Type
Hardened staging building (with all or some RFETS and LANL Pu)	1,100	1.5	Special nuclear materials	Concrete
Hardened staging building (with RFETS non-pit Pu)	840	1.5	Special nuclear materials	Concrete
[Text deleted.]				

[a] Values are for required new construction.

Note: m^2=square meters; LANL=Los Alamos National Laboratory; RFETS=Rocky Flats Environmental Technology Site.

Source: SRS 1996a:4; WSRC 1995e.

Table B.1–6. Facility Requirements for the Consolidation Alternative at Hanford Site

Building/Structure	Footprint[a] (m^2)	Number of Levels	Special Materials	Construction Type
Special nuclear materials storage building	29,200	3	Special nuclear materials	Hardened concrete
Security portals	1,530	1	NA	Hardened concrete
Utility building	1,840	1	NA	Steel frame/metal siding
Sanitary wastewater treatment building	370	1	NA	Steel frame/metal siding
Source calibration facility	550	1	Special nuclear materials	Concrete
Standby generator	290	1	NA	Hardened concrete
Secure vehicle staging	90	1	Special nuclear materials	Concrete
Unit substation (2)	280	1	NA	Concrete
Parking	32,140	NA	NA	NA
Tower cooling water facility	920	NA	NA	NA
Diesel fuel storage	920	NA	NA	NA
Compressed gas supply	280	NA	NA	NA
Liquefied gas supply	460	NA	NA	NA
Sanitary/wastewater treatment facility	1,390	NA	NA	NA

[a] Indicates required new construction.

Note: m^2=square meters; NA=not applicable.

Source: DOE 1996e.

Table B.1–7. Facility Requirements for the Consolidation Alternative Option to Construct a New Facility at Nevada Test Site

Building/Structure	Footprint[a] (m^2)	Number of Levels	Special Materials	Construction Type
Special nuclear materials storage building	29,200	3	Special nuclear materials	Hardened concrete
Security/training center	2,110	1	NA	Hardened concrete and steel frame/metal siding
Security portals	1,580	1	NA	Hardened concrete
Environmental, safety, and health	1,380	1	NA	Steel frame/metal siding
Waste storage	920	1	NA	Steel frame/metal siding
Utility building	1,840	1	NA	Steel frame/metal siding
Sanitary wastewater treatment building	370	1	NA	Steel frame/metal siding
Standby generator	290	1	NA	Hardened concrete
Secure vehicle staging	90	1	Special nuclear materials	Concrete
Unit substation (2)	280	1	NA	Concrete
Parking	32,140	NA	NA	NA
Bus loading & unloading	870	NA	NA	NA
Storage yard	4,590	NA	NA	NA
Effluent monitoring system/meteorological tower (4)	180	NA	NA	NA
Switchyard	1,840	NA	NA	NA
Secure vehicle staging area	920	1	NA	NA
Tower cooling water facility	920	NA	NA	NA
Diesel fuel storage	920	NA	NA	NA
Compressed gas supply	280	NA	NA	NA
Liquefied gas supply	460	NA	NA	NA
Sanitary/wastewater treatment facility	1,390	NA	NA	NA
Construction laydown area	18,370	NA	NA	NA
Stormwater ponds (4)	6,980	NA	NA	NA

[a] Indicates required new construction.

Note: m^2=square meters; NA=not applicable.

Source: DOE 1996e.

Table B.1–8. Facility Requirements for the Consolidation Alternative Option to Modify P-Tunnel at Nevada Test Site

Building/Structure	Footprint[a] (m^2)	Number of Levels	Special Materials	Construction Type
Material handling building	17,650	3	Special nuclear materials	Hardened concrete
Administration and training	2,840	2	NA	Steel frame/metal siding
Fire station	1,490	1	NA	Steel frame/metal siding
Security/training center	2,110	1	NA	Hardened concrete and steel frame/metal siding
Security portals	1,630	1	NA	Hardened concrete
Environmental, safety, and health	1,380	1	NA	Steel frame/metal siding
Central warehouse (at Area 12 Camp)	2,760	1	NA	Steel frame/metal siding
Support warehouse (at P-Tunnel)	1,200	1	NA	Steel frame/metal siding
Facility maintenance shops	1,970	1	NA	Steel frame/metal siding
Utility building	1,840	1	NA	Steel frame/metal siding
Sanitary wastewater treatment facility	370	1	NA	Steel frame/metal siding
Standby generator	290	1	NA	Hardened concrete
Secure vehicle staging building	90	1	Special nuclear materials	Concrete
Unit substation (2)	280	1	NA	Concrete
Bus loading & unloading (2)	870	NA	NA	NA
Effluent monitoring system/meteorological tower (4)	180	NA	NA	NA
Water storage tanks	1,840	NA	NA	NA
Secure vehicle staging area	920	1	NA	NA
Fire water storage tank/pumphouse (2)	920	NA	NA	NA
Tower cooling water facility	1,150	NA	NA	NA
Diesel fuel storage	920	NA	NA	NA
Compressed gas supply	280	NA	NA	NA
Liquefied gas supply	460	NA	NA	NA
Sanitary/wastewater treatment facility	1,390	NA	NA	NA
Stormwater ponds (entry pad)	3,490	NA	NA	NA

[a] Indicates required new construction.
Note: m^2=square meters; NA=not applicable.
Source: NT DOE 1996a.

Table B.1–9. Facility Requirements for the Consolidation Alternative at Idaho National Engineering Laboratory

Building/Structure	Footprint[a] (m²)	Number of Levels	Special Materials	Construction Type
Special nuclear materials storage building	29,200	3	Special nuclear materials	Hardened concrete
Administration and training	3,210	2	NA	Steel frame/metal siding
Environmental, safety, and health	1,380	1	NA	Steel frame/metal siding
Waste storage	920	1	NA	Steel frame/metal siding
Utility building	1,840	1	NA	Steel frame/metal siding
Source calibration facility	550	1	Special nuclear materials	Concrete
Standby generator	290	1	NA	Hardened concrete
Secure vehicle staging	90	1	Special nuclear materials	Concrete
Unit substation (2)	280	1	NA	Concrete
Parking	32,140	NA	NA	NA
Storage yard	4,590	NA	NA	NA
Effluent monitoring system/meteorological tower (4)	180	NA	NA	NA
Switchyard	1,840	NA	NA	NA
Secure vehicle staging area	920	1	NA	NA
Tower cooling water facility	920	NA	NA	NA
Diesel fuel storage	920	NA	NA	NA
Construction laydown area	18,370	NA	NA	NA
Stormwater ponds (4)	6,980	NA	NA	NA

[a] Indicates required new construction.

Note: m^2=square meters; NA=not applicable.

Source: DOE 1996e.

Table B.1–10. Facility Requirements for the Consolidation Alternative Option to Construct a New Facility at Pantex Plant

Building/Structure	Footprint[a] (m^2)	Number of Levels	Special Materials	Construction Type
Special nuclear materials storage building	29,200	3	Special nuclear materials	Hardened concrete
Administration and training	3,210	2	NA	Steel frame/metal siding
Security/training center	2,110	1	NA	Hardened concrete and steel frame/metal siding
Security portals	1,530	1	NA	Hardened concrete
Environmental, safety, and health	1,380	1	NA	Steel frame/metal siding
Waste storage	920	1	NA	Steel frame/metal siding
Utility building	1,840	1	NA	Steel frame/metal siding
Source calibration facility	550	1	Special nuclear materials	Concrete
Standby generator	290	1	NA	Hardened concrete
Unit substation (2)	280	1	NA	Concrete
Parking	32,140	NA	NA	NA
[Text deleted.]				
Storage yard	4,590	NA	NA	NA
Effluent monitoring system/meteorological tower (4)	180	NA	NA	NA
Switchyard	1,840	NA	NA	NA
Fire water storage tank/pumphouse (2)	920	NA	NA	NA
Helicopter pad	8,270	NA	NA	NA
Tower cooling water facility	920	NA	NA	NA
Diesel fuel storage	920	NA	NA	NA
Compressed gas supply	280	NA	NA	NA
Liquefied gas supply	460	NA	NA	NA
Construction laydown area	18,370	NA	NA	NA
[Text deleted.]				
Stormwater ponds (2)	3,490	NA	NA	NA

[a] Indicates required new construction.
Note: m^2=square meters; NA=not applicable.
Source: DOE 1996e.

Table B.1–11. ***Facility Requirements for the Consolidation Alternative Option to Modify Existing and Construct New Facilities in Zone 12 South at Pantex Plant***

Building/Structure	Footprint[a] (m^2)	Number of Levels	Special Materials	Construction Type
Surplus storage building	27,370	3	Special nuclear materials	Hardened concrete
Strategic reserve storage building	2,940	2	Special nuclear materials	Hardened concrete
Administration and training	3,210	2	NA	Steel frame/metal siding
[Text deleted.]				
Security/training center	2,110	1	NA	Hardened concrete and steel frame/metal siding
Security portals	1,530	1	NA	Hardened concrete
Environmental, safety, and health	1,380	1	NA	Steel frame/metal siding
[Text deleted.]				
Waste storage	920	1	NA	Steel frame/metal siding
Utility building	1,840	1	NA	Steel frame/metal siding
[Text deleted.]				
Source calibration facility	550	1	Special nuclear materials	Concrete
Standby generator	290	1	NA	Hardened concrete
[Text deleted.]				
Secure vehicle staging building	90	1	Special nuclear materials	Concrete
Unit substation (2)	280	1	NA	Concrete
Parking	32,140	NA	NA	NA
Bus loading and unloading	870	NA	NA	NA
Storage yard	4,590	NA	NA	NA
Effluent monitoring system/meteorological tower (4)	180	NA	NA	NA
Switchyard	1,840	NA	NA	NA
[Text deleted.]				
Secure vehicle staging area	920	NA	NA	NA
[Text deleted.]				
Tower cooling water facility	920	NA	NA	NA
Diesel fuel storage	920	NA	NA	NA
Compressed gas supply	280	NA	NA	NA
Liquefied gas supply	460	NA	NA	NA
[Text deleted.]				
Construction laydown area	18,370	NA	NA	NA
[Text deleted.]				
Stormwater ponds (2)	3,490	NA	NA	NA
[Text deleted.]				

[a] Indicates required new construction.
Note: m^2=square meters; NA=not applicable.
Source: PX DOE 1996a.

Table B.1–12. Facility Requirements for the Consolidation Alternative at Savannah River Site

Building/Structure	Footprint[a] (m^2)	Number of Levels	Special Materials	Construction Type
Special nuclear materials storage building	29,200	3	Special nuclear materials	Hardened concrete
Administration and training	3,210	2	NA	Steel frame/metal siding
Security/training center	2,110	1	NA	Hardened concrete and steel frame/metal siding
Security portals	1,580	1	NA	Hardened concrete
Environmental, safety, and health	1,380	1	NA	Steel frame/metal siding
Utility building	1,840	1	NA	Steel frame/ metal siding
Source calibration facility	550	1	Special nuclear materials	Concrete
Standby generator	290	1	NA	Hardened concrete
Personnel processing–employees/visitors	280	1	NA	Steel frame/metal siding
Secure vehicle staging	90	1	Special nuclear materials	Concrete
Unit substation (2)	280	1	NA	Concrete
Parking	32,140	NA	NA	NA
Bus loading and unloading	870	NA	NA	NA
Storage yard	4,590	NA	NA	NA
Effluent monitoring system/meteorological tower (4)	180	NA	NA	NA
Switchyard	1,840	NA	NA	NA
Water storage tanks	1,840	NA	NA	NA
Secure vehicle staging area	920	1	NA	NA
Fire water storage tank/ pumphouse (2)	920	NA	NA	NA
Helicopter pad	8,270	NA	NA	NA
Tower cooling water facility	920	NA	NA	NA
Diesel fuel storage	920	NA	NA	NA
Compressed gas supply	280	NA	NA	NA
Liquefied gas supply	460	NA	NA	NA
Construction laydown area	18,370	NA	NA	NA
Stormwater ponds (4)	6,980	NA	NA	NA

[a] Indicates required new construction.

Note: m^2=square meters; NA=not applicable.

Source: DOE 1996e.

Table B.1–13. Facility Requirements for the Collocation Alternative at Hanford Site

Building/Structure	Footprint[a] (m^2)	Number of Levels	Special Materials	Construction Type
Special nuclear materials storage building	29,200	3	Special nuclear materials	Hardened concrete
National security storage facility	13,960	2	HEU	Hardened concrete
Security portals	1,530	1	NA	Hardened concrete
Utility building	3,040	1	NA	Steel frame/metal siding
Sanitary wastewater treatment building	520	1	NA	Steel frame/metal siding
Source calibration facility	550	1	Special nuclear materials	Concrete
Standby generator (2)	440	1	NA	Hardened concrete
[Text deleted.]				
Unit substitution (4)	560	1	NA	Concrete
Secure vehicle staging building (2)	180	1	HEU	Concrete
Parking	47,140	NA	NA	NA
Tower cooling water facility	1,150	NA	NA	NA
Diesel fuel storage (2)	1,840	NA	NA	NA
Compressed gas supply	280	NA	NA	NA
Liquefied gas supply	460	NA	NA	NA
Sanitary wastewater treatment facility	1,950	NA	NA	NA

[a] Indicates required new construction.
Note: m^2=square meters; NA=not applicable.
Source: DOE 1996f.

Table B.1–14. Facility Requirements for the Collocation Alternative Option to Construct a New Facility at Nevada Test Site

Building/Structure	Footprint[a] (m^2)	Number of Levels	Special Materials	Construction Type
Special nuclear materials storage building	29,200	3	Special nuclear materials	Hardened concrete
National security storage facility	13,960	2	HEU	Hardened concrete
Security/training center	3,150	1	NA	Hardened concrete and steel frame/metal siding
Security portals	1,580	1	NA	Hardened concrete
Environmental, safety, and health	1,600	1	NA	Steel frame/metal siding
Waste storage	1,140	1	NA	Steel frame/metal siding
Utility building	3,040	1	NA	Steel frame/metal siding
Sanitary wastewater treatment building	520	1	NA	Steel frame/metal siding
Standby generator (2)	440	1	NA	Hardened concrete
Unit substation (4)	560	1	NA	Concrete
Secure vehicle staging building (2)	180	1	HEU	Concrete
Parking	47,140	NA	NA	NA
Bus loading and unloading	1,250	NA	NA	NA
Storage yard	6,600	NA	NA	NA
Effluent monitoring system/meteorological tower (4)	180	NA	NA	NA
Switchyard	2,760	NA	NA	NA
Secure vehicle staging area (2)	90	1	NA	NA
Tower cooling water facility	1,150	NA	NA	NA
Diesel fuel storage (2)	1,840	NA	NA	NA
Compressed gas supply	280	NA	NA	NA
Liquefied gas supply	460	NA	NA	NA
Sanitary/wastewater treatment facility	1,950	NA	NA	NA
Construction laydown area	18,360	NA	NA	NA
Stormwater ponds (4)	10,600	NA	NA	NA

[a] Indicates required new construction.
Note: m^2=square meters; NA=not applicable.
Source: DOE 1996f.

Table B.1–15. Facility Requirements for the Collocation Alternative Option to Modify P-Tunnel at Nevada Test Site

Building/Structure	Footprint[a] (m^2)	Number of Levels	Special Materials	Construction Type
Material handling building	23,980	3	Special nuclear materials	Hardened concrete
Administration and training	2,840	2	NA	Steel frame/metal siding
Fire station	1,490	1	NA	Steel frame/metal siding
Security/training center	2,110	1	NA	Hardened concrete and steel frame/metal siding
Security portals	1,630	1	NA	Hardened concrete
Environmental, safety, and health	1,380	1	NA	Steel frame/metal siding
Central warehouse	2,760	1	NA	Steel frame/metal siding
Support warehouse	1,200	1	NA	Steel frame/metal siding
Facility maintenance shops	1,970	1	NA	Steel frame/metal siding
Utility building	3,040	1	NA	Steel frame/metal siding
Sanitary wastewater treatment building	520	1	NA	Steel frame/metal siding
[Text deleted.]				
Standby generator	290	1	NA	Hardened concrete
Secure vehicle staging building	180	1	Special nuclear materials	Concrete
Unit substation (2)	280	1	NA	Concrete
Bus loading and unloading	870	NA	NA	NA
Effluent monitoring system/meteorological tower (4)	180	NA	NA	NA
Water storage tanks	1,840	NA	NA	NA
Secure vehicle staging area	920	1	NA	NA
Fire water storage tank/pumphouse (2)	920	NA	NA	NA
Tower cooling water facility	1,150	NA	NA	NA
Diesel fuel storage	920	NA	NA	NA
Compressed gas supply	280	NA	NA	NA
Liquefied gas supply	460	NA	NA	NA
Sanitary/wastewater treatment facility	1,390	NA	NA	NA
Stormwater ponds (entry pad)	3,490	NA	NA	NA

[a] Indicates required new construction.
Note: m^2=square meters; NA=not applicable.
Source: NT DOE 1996a.

Table B.1–16. Facility Requirements for the Collocation Alternative at Idaho National Engineering Laboratory

Building/Structure	Footprint[a] (m^2)	Number of Levels	Special Materials	Construction Type
Special nuclear materials storage building	29,200	3	Special nuclear materials	Hardened concrete
National security storage facility	13,960	2	HEU	Hardened concrete
Administration and training	4,850	2	NA	Steel frame/metal siding
Environmental, safety, and health	1,600	1	NA	Steel frame/metal siding
Waste storage	1,140	1	NA	Steel frame/metal siding
Utility building	3,040	1	NA	Steel frame/metal siding
Source calibration facility	550	1	Special nuclear materials	Concrete
Standby generator (2)	440	1	NA	Hardened concrete
Unit substation (4)	560	1	NA	Concrete
Secure vehicle staging building (2)	180	1	HEU	Concrete
Parking	47,140	NA	NA	NA
Storage yard	6,600	NA	NA	NA
Effluent monitoring system/meteorological tower (4)	180	NA	NA	NA
Switchyard	2,760	NA	NA	NA
Secure vehicle staging area (2)	90	1	NA	NA
Tower cooling water facility	1,150	NA	NA	NA
Diesel fuel storage (2)	1,840	NA	NA	NA
Construction laydown area	18,360	NA	NA	NA
Stormwater ponds (4)	10,600	NA	NA	NA

[a] Indicates required new construction.
Note: m^2=square meters; NA=not applicable.
Source: DOE 1996f.

Table B.1–17. Facility Requirements for the Collocation Alternative at Pantex Plant

Building/Structure	Footprint[a] (m^2)	Number of Levels	Special Materials	Construction Type
Special nuclear materials storage building	29,200	3	Special nuclear materials	Hardened concrete
National security storage facility	13,960	2	HEU	Hardened concrete
Administration and training	4,850	2	NA	Steel frame/metal siding
Security/training center	3,150	1	NA	Hardened concrete and steel frame/ metal siding
Security portals	1,530	1	NA	Hardened concrete
Environmental, safety, and health	1,600	1	NA	Steel frame/metal siding
Waste storage	1,140	1	NA	Steel frame/metal siding
Utility building	3,040	1	NA	Steel frame/metal siding
Source calibration facility	550	1	Special nuclear materials	Concrete
Standby generator (2)	440	1	NA	Hardened concrete
Unit substation (4)	560	1	NA	Concrete
Parking	47,140	NA	NA	NA
[Text deleted.]				
Storage yard	6,600	NA	NA	NA
Effluent monitoring system/meteorological tower (4)	180	NA	NA	NA
Switchyard	2,760	NA	NA	NA
Fire water storage tank/pumphouse (2)	920	NA	NA	NA
Helicopter pad	8,270	NA	NA	NA
Tower cooling water facility	1,150	NA	NA	NA
Diesel fuel storage (2)	1,840	NA	NA	NA
Compressed gas supply	280	NA	NA	NA
Liquefied gas supply	460	NA	NA	NA
Construction laydown area	18,360	NA	NA	NA
[Text deleted.]				
Stormwater ponds (2)	5,100	NA	NA	NA

[a] Indicates required new construction.
Note: m^2=square meters; NA=not applicable.
Source: DOE 1996f.

Table B.1–18. Facility Requirements for the Collocation Alternative Option to Construct a New Facility at Oak Ridge Reservation

Building/Structure	Footprint[a] (m^2)	Number of Levels	Special Materials	Construction Type
Special nuclear materials storage building	29,200	3	Special nuclear materials	Hardened concrete
National security storage facility	13,960	2	HEU	Hardened concrete
[Text deleted.]				
Security portals	1,530	1	NA	Hardened concrete
Environmental, safety, and health	1,600	1	NA	Steel frame/metal siding
[Text deleted.]				
Waste storage	1,140	1	NA	Steel frame/metal siding
Utility building	3,040	1	NA	Steel frame/metal siding
Source calibration facility	550	1	Special nuclear materials	Concrete
Standby generator (2)	440	1	NA	Hardened concrete
Unit substation (4)	560	1	NA	Concrete
[Text deleted.]				
Parking	47,140	NA	NA	NA
Bus loading and unloading	1,250	NA	NA	NA
Storage yard	6,600	NA	NA	NA
Effluent monitoring system/meteorological tower (4)	180	NA	NA	NA
Switchyard	2,760	NA	NA	NA
[Text deleted.]				
Secure vehicle staging area (2)	90	1	NA	NA
[Text deleted.]				
Helicopter pad	8,270	NA	NA	NA
Tower cooling water facility	1,150	NA	NA	NA
Diesel fuel storage (2)	1,840	NA	NA	NA
Compressed gas supply	280	NA	NA	NA
Liquefied gas supply	460	NA	NA	NA
Construction laydown area	18,360	NA	NA	NA
[Text deleted.]				
Stormwater ponds (4)	10,600	NA	NA	NA

[a] Indicates required new construction.
Note: m^2=square meters; NA=not applicable.
Source: DOE 1996f.

Table B.1–19. Facility Requirements for the Collocation Alternative Option to Construct a New Plutonium Storage Facility at Oak Ridge Reservation; Modify or Maintain Existing Highly Enriched Uranium Storage Facilities at Y–12 Plant

Building/Structure	Footprint[a] (m^2)	Number of Levels	Special Materials	Construction Type
Special nuclear materials storage building	29,200	3	Special nuclear materials	Hardened concrete
[Text deleted.]				
Security portals	1,530	1	NA	Hardened concrete
Environmental, safety, and health	1,380	1	NA	Steel frame/metal siding
[Text deleted.]				
Waste storage	920	1	NA	Steel frame/metal siding
Utility building	1,840	1	NA	Steel frame/metal siding
Source calibration facility	550	1	Special nuclear materials	Concrete
Standby generator	290	1	NA	Hardened concrete
[Text deleted.]				
Unit substation (2)	280	1	NA	Concrete
Parking	32,140	NA	NA	NA
Bus loading and unloading	870	NA	NA	NA
Storage yard	4,590	NA	NA	NA
Effluent monitoring system/meteorological tower (4)	180	NA	NA	NA
Switchyard	1,840	NA	NA	NA
[Text deleted.]				
Secure vehicle staging area	920	1	NA	NA
[Text deleted.]				
Helicopter pad	8,270	NA	NA	NA
Tower cooling water facility	920	NA	NA	NA
Diesel fuel storage	920	NA	NA	NA
Compressed gas supply	280	NA	NA	NA
Liquefied gas supply	460	NA	NA	NA
Construction laydown area	18,370	NA	NA	NA
[Text deleted.]				
Stormwater ponds (4)	6,980	NA	NA	NA

[a] Indicates required new construction.
Note: m^2=square meters; NA=not applicable.
Source: DOE 1996e.

Table B.1–20. Facility Requirements for the Collocation Alternative at Savannah River Site

Building/Structure	Footprint[a] (m^2)	Number of Levels	Special Materials	Construction Type
Special nuclear materials storage building	29,200	3	Special nuclear materials	Hardened concrete
National security storage facility	13,960	2	HEU	Hardened concrete
Administration and training	4,850	2	NA	Steel frame/metal siding
Security/training center	3,150	1	NA	Hardened concrete and steel frame/ metal siding
Security portals	1,580	1	NA	Hardened concrete
Environmental, safety, and health	1,600	1	NA	Steel frame/metal siding
Utility building	3,040	1	NA	Steel frame/metal siding
Source calibration facility	550	1	Special nuclear materials	Concrete
Standby generator (2)	440	1	NA	Hardened concrete
Unit substation (4)	560	1	NA	Concrete
Secure vehicle staging building (2)	180	1	HEU	Concrete
Personnel processing–employees/visitors	280	1	NA	Steel frame/metal siding
Parking	47,140	NA	NA	NA
Bus loading and unloading	1,250	NA	NA	NA
Storage yard	6,600	NA	NA	NA
Effluent monitoring system/meteorological tower (4)	180	NA	NA	NA
Switchyard	2,760	NA	NA	NA
Water storage tanks	2,190	NA	NA	NA
Secure vehicle staging area (2)	90	1	NA	NA
Fire water storage tank/ pumphouse (2)	920	NA	NA	NA
Helicopter pad	8,270	NA	NA	NA
Tower cooling water facility	1,150	NA	NA	NA
Diesel fuel storage (2)	1,840	NA	NA	NA
Compressed gas supply	280	NA	NA	NA
Liquefied gas supply	460	NA	NA	NA
Construction laydown area	18,360	NA	NA	NA
Stormwater ponds (4)	10,600	NA	NA	NA

[a] Indicates required new construction.
Note: m^2=square meters; NA=not applicable.
Source: DOE 1996f.

B.2 FACILITIES COMMON TO MULTIPLE PLUTONIUM DISPOSITION ALTERNATIVES

Tables B.2–1, B.2–2, and B.2–3 list the key building/structure requirements for the pit disassembly/conversion facility, Pu conversion facility, and mixed oxide fuel fabrication facility, respectively. Under the Preferred Alternative for surplus Pu disposition, the pit disassembly/conversion facility and the mixed oxide fuel fabrication facility could each be located at either Hanford, INEL, Pantex, or SRS, and the Pu conversion facility could be located at Hanford or SRS. The facility requirements for these alternatives could be reduced by using existing facilities for portions of the operations. The next tier of *National Environmental Policy Act* (NEPA) review will examine locations for the selected alternatives including the use of existing facilities.

Table B.2–1. Facility Requirements for the Pit Disassembly/Conversion Facility

Building/Structure	Footprint[a] (m^2)	Number of Levels	Special Materials	Construction Type
Pu processing	4,600	2	Special nuclear materials	Concrete
Administration	2,300	2	NA	Steel frame/metal skin
Pu operations support	1,500	1	NA	Steel frame/metal skin
Warehouse	465	1	NA	Steel frame/metal skin
Utilities	215	1	NA	Steel frame/metal skin
Generator	190	1	NA	Steel frame/metal skin
Guard/vehicle monitoring station	325	1	NA	Steel frame/metal skin
Covered parking garage	2,800	2	NA	Concrete

[a] Indicates required new construction.
Note: m^2=square meters; NA=not applicable.
Source: LANL 1996d.

Table B.2–2. Facility Requirements for the Plutonium Conversion Facility

Building/Structure	Footprint[a] (m^2)	Number of Levels	Special Materials	Construction Type
Process building	9,300	2	Special nuclear materials	Concrete
Cold support building	7,900	2	NA	Steel frame/metal skin
Waste treatment facility	6,500	1	Special nuclear materials	Concrete
Staging/storage facility (feeds)	2,800	1	Special nuclear materials	Concrete
Source calibration building	195	1	Special nuclear materials	Heavy concrete
Standby generator building	195	1	NA	Concrete
Administration building	2,300	3	NA	Concrete
Long-term waste storage building	2,800	1	NA	Concrete
Utility support building	1,900	1	NA	Steel frame/metal skin
Central warehouse/shipping/receiving	2,800	1	NA	Concrete
Maintenance shops	2,200	1	NA	Steel frame/metal skin

[a] Indicates required new construction.
Note: m^2=square meters; NA=not applicable.
Source: LANL 1996c.

Table B.2–3. Facility Requirements for the Mixed Oxide Fuel Fabrication Facility

Building/Structure	Footprint[a] (m^2)	Number of Levels	Special Materials	Construction Type
Receiving and storage	1,900	1	Special nuclear materials	Type-1, FR, SC-1[b]
Fuel fabrication	9,300	2	Special nuclear materials	Type-1 FR, SC-1[a]
Waste management	2,800	1	Special nuclear materials	Type-1 FR, SC-1[a]
Cold support and utilities	1,400	1	NA	Metal frame
General administration and security	2,800	1	NA	Type-1 FR
Fire station	470	1	NA	Type-1 FR

[a] Indicates required new construction.

[b] Type-1 Fire Resistive, reinforced concrete Safety Class-1 according to the Uniform Building Code.

Note: m^2=square meters; NA=not applicable.

Source: LANL 1996b.

B.3 PLUTONIUM DISPOSITION FACILITIES

Tables B.3–1 through B.3–7 list the key building/structure requirements for facilities required to support the various Pu disposition alternatives. The tables are in the same order as the technology alternatives appear in Chapter 2 of this PEIS. Under the Preferred Alternative for surplus Pu disposition, the ceramic immobilization facility, or the vitrification facility could be located at Hanford or SRS. The facility requirements for these alternatives could be reduced by using existing facilities for portions of the operations. The next tier of NEPA review will examine locations for the selected alternatives including the use of existing facilities.

Table B.3–1. Facility Requirements for the Deep Borehole Complex—Direct Disposition Alternative

Building/Structure	Footprint[a] (m^2)	Number of Levels	Special Materials	Construction Type
Main Area Facilities				
Administration	1,394	1	NA	Light steel frame
Personnel services	1,394	1	NA	Light steel frame
Medical center	929	1	NA	Light steel
Environmental, safety, and health	929	1	NA	Light steel
Security center	1,858	1	NA	Light steel
Security and fire training area	929	1	NA	Light steel
Fire station	929	1	NA	Light steel
Warehouse and maintenance	2,323	1	NA	Light steel frame
Receiving and storage	4,181	2	Special nuclear materials	Concrete
Plant utilities	929	1	NA	Masonry
Plant waste management	650	1	Special nuclear materials, special nuclear material wastes	Light steel frame
Drilling and emplacing operations center	929	1	NA	Light steel frame
Electrical substation	650	1	NA	Steel, concrete
Cooling tower	743	NA	NA	Steel
Drilling Facilities				
Drill rig	1,858	NA	NA	Steel frame
Drilling shift office trailers	1,858	1	NA	Light steel frame
Treated water storage	3,716	1	NA	Steel, concrete
Drilling mud pits	7,432	1	NA	Earth
Emplacing Facilities				
Emplacing crane	1,858	NA	NA	Steel frame
Process waste management	1,742	1	Special nuclear materials waste	Concrete
Emplacing shift office trailers	1,858	1	NA	Light steel frame

[a] Indicates required new construction.
Note: m^2=square meters; NA=not applicable.
Source: LLNL 1996a.

Table B.3–2. Facility Requirements for the Deep Borehole Complex—Immobilized Disposition Alternative

Building/Structure	Footprint[a] (m^2)	Number of Levels	Special Materials	Construction Type
Main Area Facilities				
Administration	1,394	1	NA	Light steel frame
Personnel services	1,394	1	NA	Light steel frame
Medical center	929	1	NA	Light steel
Environmental, safety, and health	929	1	NA	Light steel
Security center	1,858	1	NA	Light steel
Security and fire training area	929	1	NA	Light steel
Fire station	929	1	NA	Light steel
Warehouse and maintenance	2,323	1	NA	Light steel frame
Receiving and storage	4,181	2	Special nuclear materials	Concrete
Plant utilities	929	1	NA	Masonry
Plant waste management	650	1	Special nuclear materials, special nuclear material wastes	Light steel frame
Drilling and emplacing operations center	929	1	NA	Light steel frame
Electrical substation	650	1	NA	Steel, concrete
Cooling tower	743	NA	NA	Steel
Drilling Facilities				
Drill rig	1,858	NA	NA	Steel frame
Drilling shift office trailers	1,858	1	NA	Light steel frame
Treated water storage	3,716	1	NA	Steel, concrete
Drilling mud pits	7,432	1	NA	Earth
Emplacing Facilities				
Emplacing crane	1,858	NA	NA	Steel frame
Pellet-grout mixing facility	743	1	Special nuclear materials	Concrete
Process waste management	1,742	1	Special nuclear materials waste	Concrete
Emplacing shift office trailers	1,858	1	NA	Light steel frame

[a] Indicates required new construction.
Note: m^2=square meters; NA=not applicable.
Source: LLNL 1996h.

Table B.3–3. Facility Requirements for the Ceramic Immobilization Facility—Immobilized Disposition Alternative

Building/Structure	Footprint[a] (m^2)	Number of Levels	Special Materials	Construction Type
Pu processing building	4,500	2	Special nuclear materials	Reinforced concrete[b]
Radwaste management building	2,300	1	Special nuclear materials	Reinforced concrete
Radiologically controlled maintenance building	1,400	1	Special nuclear materials	Reinforced concrete
Product storage building	460	1	Special nuclear materials	Reinforced concrete
Support utilities building	1,400	1	NA	Metal frame
Administration building	1,700	1	NA	Metal frame
Warehouse	2,300	1	NA	Metal frame
Shops building	2,300	1	NA	Metal frame
Industrial waste treatment building	930	1	NA	Metal frame
Sanitary waste treatment building	150	1	NA	Metal frame
Security portals	150	2	NA	Reinforced concrete
Cold chemical storage building	460	1	NA	Metal frame
Cooling tower	930	NA	NA	Reinforced concrete

[a] Indicates required new construction.
[b] Type-1 Fire Resistive, reinforced concrete Safety Class-1 according to the Uniform Building Code.
Note: m^2=square meters; NA=not applicable.
Source: LLNL 1996e.

Table B.3–4. Facility Requirements for the Vitrification Alternative

Building/Structure	Footprint[a] (m^2)	Number of Levels	Special Materials	Construction Type
Vitrification building	2,675	3	Special nuclear materials	Reinforced concrete
Service building	1,858	2	NA	Metal frame
Maintenance building	929	2	NA	Metal frame
Fan house	56	1	Special nuclear materials[b]	Reinforced concrete
Exhaust stack	6	1	NA	Metal
Radwaste building	595	2	Special nuclear materials[b]	Reinforced concrete
Chemical storage tank	10	1	NA	Metal
Cooling tower	558	NA	NA	Reinforced concrete
Substation	28	1	NA	Metal
Water treatment	372	1	NA	Metal frame
Security portals	140	1	NA	Reinforced concrete
Waste treatment	140	1	NA	Metal frame
Boiler house	446	1	NA	Metal frame

[Text deleted.]

[a] Indicates required new construction.
[b] Radiological constituents in offgas or liquid.
Note: m^2=square meters; NA=not applicable.
Source: LLNL 1996c.

Table B.3–5. Facility Requirements for the Ceramic Immobilization Alternative

Building/Structure	Footprint[a] (m^2)	Number of Levels	Special Materials	Construction Type
Pu processing building	2,700	2	Special nuclear materials	Reinforced concrete
Radwaste management building	1,700	1	Special nuclear materials	Reinforced concrete
Hot maintenance building	930	1	Special nuclear materials	Reinforced concrete
Canister storage building	93	2 (one below grade)	Special nuclear materials	Reinforced concrete
Support utilities building	930	1	NA	Metal frame
Administration building	1,400	1	NA	Metal frame
Warehouse	1,900	1	NA	Metal frame
Shops and equipment mock-up	1,900	1	NA	Metal frame
Industrial waste treatment building	740	1	NA	Metal frame
Sanitary waste treatment building	150	1	NA	Metal frame
Security portals	150	2	NA	Reinforced concrete
Cold chemical storage building	190	1	NA	Metal frame
Cooling tower	560	NA	NA	Reinforced concrete

[a] Indicates required new construction.
Note: m^2=square meters; NA=not applicable.
Source: LLNL 1996d.

Table B.3–6. Facility Requirements for the Electrometallurgical Treatment Alternative (Glass-Bonded Zeolite)

Building/Structure	Footprint[a] (m^2)	Number of Levels	Special Materials	Construction Type
Fuel Conditioning Facility (FCF)	2,100	4	Special nuclear materials	Reinforced concrete and steel frame, PC-3
Safety Equipment Building (SEB)	230	1	NA	Reinforced concrete, PC-3
Hot Fuel Exam. Facility (HFEF)	1,700	4	Special nuclear materials	Reinforced concrete and steel frame, PC-3
Zero Power Physics Reactor (ZPPR)	400	1	Special nuclear materials	Reinforced concrete, PC-2
ZPPR Vault/Workroom/Equip. Room	470	1	Special nuclear materials	Reinforced concrete, PC-2
Laboratory and Office Building	7,800	1	Lab samples only	Reinforced concrete and masonry, PC-2
Fuel Manufacturing Facility (FMF)	440	1	Special nuclear materials	Reinforced concrete, PC-2

[a] Indicates required new construction.
Note: m^2=square meters; NA=not applicable; FCF has four levels: subbasement (logout room), a basement service floor, the main operating level, and a "roof" level (which is slated for decommissioning). The HFEF has four levels: service area basement, operating floor, office/data collection level, and the high-bay area with a "hot repair" area and an area for Waste Isolation Pilot Plant (WIPP) characterization. PC-2/PC-3=seismically qualified to standard PC-2/PC-3, respectively.
Source: LLNL 1996b.

Table B.3–7. Facility Requirements for the Evolutionary Light Water Reactor Alternative

Building/Structure	Footprint[a] (m^2)	Number of Levels	Special Materials	Construction Type
Reactor building	3,900	5	Special nuclear materials	Reinforced concrete
Turbine building	8,640	4	NA	Reinforced concrete
Control building	1,400	4	NA	Reinforced concrete
Radwaste building	6,600	1	Special nuclear materials	Reinforced concrete
Service building (hot)	3,510	1	Special nuclear materials	Reinforced concrete
Spent fuel storage	3,160	1	Special nuclear materials	Reinforced concrete
Fresh fuel storage	3,200	1	Special nuclear materials	Reinforced concrete
Access building	1,000	1	NA	Reinforced concrete
Pump house	1,250	1	NA	Reinforced concrete
Warehouse	4,300	1	NA	Steel frame or concrete
Switch yard	7,100	NA	NA	Outside equipment
Cooling towers	800	NA	NA	Reinforced concrete
Heat sink pool	10,000	1	NA	Reinforced concrete

[a] Indicates required new construction.
Note: m^2=square meters; NA=not applicable.
Source: LLNL 1996g.

Appendix C
Materials, Resources, and Employment Requirements for Construction and Operations

This appendix provides predesign data on the construction and operations requirements for the various facilities required to accomplish the storage and disposition activities essential to the alternatives described in this programmatic environmental impact statement (PEIS). The data assume separate facilities as listed. While it may be possible to combine several activities into a single facility, design information was not available for all the various possible combinations, so a one-activity-per facility concept was used for this analysis. This appendix presents data on material and resources required for construction, construction worker requirements, utilities required on an annual basis for operations, chemicals required on an annual basis for operations, and annual personnel requirements to operate the listed facilities.

C.1 CONSTRUCTION REQUIREMENTS

C.1.1 MATERIALS/RESOURCES REQUIRED

C.1.1.1 Long-Term Storage Alternatives

The materials and resources required to construct new or modify interim storage facilities to meet long-term storage standards are listed in the tables that follow. Tables C.1.1.1–1 and C.1.1.1–2 list the materials and/or resources required during construction of the Upgrade Alternative. Tables C.1.1.1–3 and C.1.1.1–4 list materials and resources required during construction of the Consolidation Alternative and Collocation Alternative, respectively. The Preferred Alternative for the long-term storage of surplus Pu involves a combination of upgrade (Pantex Plant [Pantex], Oak Ridge Reservation [ORR], and Savannah River Site [SRS]), No Action (Hanford Site [Hanford], Nevada Test Site [NTS], Idaho National Engineering Laboratory [INEL], and Los Alamos National Laboratory [LANL]), and phaseout (Rocky Flats Environmental Technology Site [RFETS]).

Table C.1.1.1–1. Materials/Resources Required During Construction of the Upgrade Without Rocky Flats Environmental Technology Site Plutonium or Los Alamos National Laboratory Plutonium Subalternative[a]

	Total Consumption			
Materials/Resources	**Hanford [b]**	**INEL**	**Pantex**	**ORR**
Utilities				
Electricity				
Total consumption (MWh)	5,000	7,000	170	20
Peak demand[c] (MWe)	1.0	1.0	1.0	0.1
Water				
Total consumption (l)	20,000,000	29,000,000	193,000	3,000,000
[Text deleted.]				
Solids				
Concrete (m^3)	4,300	5,100	230	27
Steel (t)	700	1,300	4.5	48
Liquids				
Fuel (l)	150,000	280,000	8,000	16,000
Gases				
Industrial gases (m^3)	3,000	5,600	170	1,200

[a] This subalternative does not apply to SRS.

[b] Of the two Hanford storage upgrade options, the New Hanford Pu Storage Facility option represents the upper bound in terms of construction impacts and is presented here for comparison. The other storage option, Modify Fuels and Materials Examination Facility, has smaller construction impacts associated with its implementation. It is not shown for simplicity.

[c] Peak demand is the maximum rate expected during any hour for electricity.

Note: l=liter; m^3=cubic meters; MWe=megawatts electric; MWh=megawatt hours; t=metric tons.

Source: HF DOE 1995e:1; IN DOE 1996a; OR MMES 1996a; PX MH 1994a.

Table C.1.1.1–2. Materials/Resources Required During Construction of the Upgrade With All or Some Rocky Flats Environmental Technology Site Plutonium and Los Alamos National Laboratory Plutonium Subalternative[a]

	Total Consumption			SRS[b]	
Materials/Resources	**Hanford[c]**	**INEL**	**Pantex[d]**	**(With All or Some RFETS and LANL Pu)**	**(With RFETS Non-Pit Pu)**
Utilities					
Electricity					
Total consumption (MWh)	6,200	8,300	22,000	1,000	800
Peak demand[e] (MWe)	1.0	1.0	3.0	0.2	0.1
Water					
Total consumption (l)	25,400,000	34,400,000	480,000,000	3,000,000	2,220,000
[Text deleted.]					
Solids					
Concrete (m^3)	7,300	8,100	84,000	2,600	1,930
Steel (t)	1,090	1,690	17,000	280	195
Liquids					
Fuel (l)	203,000	334,000	4,600,000	17,600	13,000
Gases					
Industrial gases (m^3)	4,100	6,700	95,000	1,180	860

[a] ORR is not eligible to receive RFETS or LANL Pu material under this upgrade subalternative.
[b] SRS is only eligible to receive RFETS Pu and LANL Pu material under the Upgrade Alternative.
[c] Of the two Hanford storage upgrade options, the New Hanford Pu Storage Facility option represents the upper bound in terms of construction impacts and is presented here for comparison. The other storage option, Modify Fuels and Materials Examination Facility, has smaller construction impacts associated with its implementation. It is not shown for simplicity.
[d] Values shown are based on an upgrade designed to accommodate the Consolidation Alternative.
[e] Peak demand is the maximum rate expected during any hour for electricity.
Note: l=liter; m^3=cubic meters; MWe=megawatts electric; MWh=megawatt hours; t=metric tons.
Source: HF DOE 1995e:1; IN DOE 1996a; PX DOE 1996a; SRS 1996a:4; WSRC 1995e.

Table C.1.1.1–3. Materials/Resources Required During Construction of the Consolidation Alternative

	Total Consumption						
	Hanford	NTS		INEL	Pantex		SRS
Materials/ Resources		New Pu Storage Facility	Modify P-Tunnel		New Pu Storage Facility	New and Modified Zone 12 South Facilities	
Utilities							
Electricity							
Total consumption (MWh)	14,000	14,000	14,000	14,000	22,000	22,000	22,000
Peak demand[a] (MWe)	2	2	2	2	3	3	3
Water							
Total consumption (l)	510,000,000	510,000,000	210,000,000	510,000,000	510,000,000	480,000,000	510,000,000
[Text deleted.]							
Solids							
Concrete (m^3)	78,000	83,000	80,000	82,000	89,000	84,000	88,000
Steel (t)	13,000	14,000	14,000	14,000	16,000	17,000	15,000
Liquids							
Fuel (l)	4,300,000	4,500,000	4,500,000	4,500,000	4,700,000	4,600,000	4,600,000
Gases							
Industrial gases (m^3)	88,000	91,000	91,000	91,000	95,000	95,000	94,000

[a] Peak demand is the maximum rate expected during any hour for electricity.

Note: l=liter; m^3=cubic meters; MWe=megawatts electric; MWh=megawatt hours; t=metric tons.

Source: DOE 1996e; NT DOE 1996a; PX DOE 1996a.

Table C.1.1.1–4. Materials/Resources Required During Construction of the Collocation Alternative

Materials/ Resources	Total Consumption							
	Hanford	NTS		INEL	Pantex	ORR		SRS
		New Pu and HEU Storage Facility	Modify P-Tunnel			New Pu and HEU Storage Facility	New Pu Storage Facility Only[a]	
Utilities								
Electricity								
Total consumption (MWh)	25,000	29,000	22,000	29,000	29,000	29,000	22,000	29,000
Peak demand[b] (MWe)	3.5	4	3	4	4	4	3	4
Water								
Total consumption (l)	628,000,000	628,000,000	210,000,000	628,000,000	628,000,000	628,000,000	510,000,000	628,000,000
[Text deleted.]								
Solids								
Concrete (m^3)	102,000	110,000	100,000	116,000	115,000	116,000	88,000	115,000
Steel (t)	16,600	18,600	20,000	19,600	20,600	18,800	15,000	19,600
Liquids								
Fuel (l)	5,700,000	5,900,000	5,300,000	6,000,000	6,100,000	5,900,000	4,500,000	6,100,000
Gases								
Industrial gases (m^3)	115,000	119,000	110,000	122,000	123,000	120,000	92,000	123,000

[a] The materials/resources required during construction of the Upgrade Alternative at ORR (Table C.1.1.1–1) are added to obtain the total materials/resources required during construction of the Collocation Alternative Option to Construct a New Plutonium Storage Facility at ORR and Modify Existing Highly Enriched Uranium Storage Facilities at Y–12 Plant.

[b] Peak demand is the maximum rate expected during any hour for electricity.

Note: l=liter; m^3=cubic meters; MWe=megawatts electric; MWh=megawatt hours; t=metric tons.

Source: DOE 1996e; DOE 1996f; NT DOE 1996a.

C.1.1.2 Activities Common to Multiple Plutonium Disposition Alternatives

The materials and resources required to construct the facilities that perform precursor activities on Plutonium (Pu) materials prior to certain Pu disposition alternatives are shown in Tables C.1.1.2–1, C.1.1.2–2, and C.1.1.2–3. Under the Preferred Alternative for surplus Pu disposition, the pit disassembly/conversion facility and the mixed oxide (MOX) fuel fabrication facility could each be located at either Hanford, INEL, Pantex, or SRS, and the Pu conversion facility could be located at Hanford or SRS. The facility construction requirements for these alternatives could be reduced by using existing facilities for portions of the operations. The next tier of *National Environmental Policy Act* (NEPA) review will examine locations for the selected alternatives including the use of existing facilities.

Table C.1.1.2–1. Materials/Resources Required During Construction of the Pit Disassembly/Conversion Facility

Materials/Resources	Total Consumption	Peak Demand
Utilities		
Electricity[a]	15,000 MWh	5 MWe
Water (l)	11,356,000	NA
Solids		
Concrete (m^3)	30,500	NA
Steel (t)	3,100	NA
Liquids		
Fuel (l)	757,000	NA
Gases		
Industrial gases[b] (m^3)	21,200	NA

[a] Peak demand is the maximum rate expected during any hour for electricity.
[b] Standard cubic meters measured at 1 atmosphere and 15.6 °C.
Note: l=liter; m^3=cubic meters; MWe=megawatts electric; MWh=megawatt hours; NA=not applicable; t=metric tons.
Source: LANL 1996d.

Table C.1.1.2–2. Materials/Resources Required During Construction of the Plutonium Conversion Facility

Materials/Resources	Total Consumption	Peak Demand
Utilities		
Electricity[a]	6,550 MWh	<1 MWe
Water (l)	14,142,300	NA
Solids		
Concrete (m^3)	36,700	NA
Steel (t)	4,100	NA
Liquids		
Fuel (l)	947,100	NA
Gases		
Industrial gases[b] (m^3)	19,800	NA

[a] Peak demand is the maximum rate expected during any hour for electricity.
[b] Standard cubic meters measured at 1 atmosphere and 15.6 °C.
Note: l=liter; m^3=cubic meters; MWe=megawatts electric; MWh=megawatt hours; NA=not applicable; t=metric tons.
Source: LANL 1996c.

Table C.1.1.2–3. Materials/Resources Required During Construction of the Mixed Oxide Fuel Fabrication Facility

Materials/Resources	Total Consumption	Peak Demand
Utilities		
Electricity[a]	<5,000 MWh	1 MWe
Water (l)	<11,400,000	NA
Solids		
Concrete (m^3)	<30,600	NA
Steel (t)	<3,630	NA
Liquids		
Fuel (l)	<757,080	NA
Gases		
Industrial gases[b] (m^3)	<15,600	NA

[a] Peak demand is the maximum rate expected during any hour for electricity.
[b] Standard cubic meters measured at 1 atmosphere and 15.6 °C.
Note: l=liter; m^3=cubic meters; MWe=megawatts electric; MWh=megawatt hours; NA=not applicable; t=metric tons.
Source: LANL 1996b.

C.1.1.3 Plutonium Disposition Alternatives

Tables C.1.1.3–1 through C.1.1.3–8 show the materials and resources required to construct the various disposition facilities. Under the Preferred Alternative for surplus Pu disposition, the ceramic immobilization facility, or the vitrification facility could be located at Hanford or SRS. The facility construction requirements for these alternatives could be reduced by using existing facilities for portions of the operations. The next tier of NEPA review will examine locations for the selected alternatives including the use of existing facilities.

Table C.1.1.3–1. Materials/Resources Required During Construction of the Deep Borehole Complex—Direct Disposition Alternative

Materials/Resources	Total Consumption	Peak Demand
Utilities		
Electricity[a]	1,800 MWh	0.8 MWe
Water (l)	45,400,000	NA
Solids		
Concrete (m^3)	27,000	NA
Steel (t)	6,400	NA
Liquids		
Fuel (gas & diesel) (l)	5,990,000	NA
Propane (l)	360,000	NA
Gases		
Industrial gases[b] (m^3)	NA	NA

[a] Peak demand is the maximum rate expected during any hour for electricity.
[b] Standard cubic meters measured at 1 atmosphere and 15.6 °C.
Note: l=liter; m^3=cubic meters; MWe=megawatts electric; MWh=megawatt hours; NA=not applicable; t=metric tons.
Source: LLNL 1996a.

Table C.1.1.3–2. Materials/Resources Required During Construction of the Deep Borehole Complex—Immobilized Disposition Alternative

Materials/Resources	Total Consumption	Peak Demand
Utilities		
Electricity[a]	1,700 MWh	0.8 MWe
Water (l)	41,630,000	NA
Solids		
Concrete (m^3)	25,000	NA
Steel (t)	5,800	NA
Liquids		
Fuel (gas & diesel) (l)	5,678,000	NA
Propane (l)	341,000	NA
Gases		
Industrial gases[b] (m^3)	NA	NA

[a] Peak demand is the maximum rate expected during any hour for electricity.
[b] Standard cubic meters measured at 1 atmosphere and 15.6 °C.
Note: l=liter; m^3=cubic meters; MWe=megawatts electric; MWh=megawatt hours; NA=not applicable; t=metric tons.
Source: LLNL 1996h.

Table C.1.1.3–3. Materials/Resources Required During Construction of the Ceramic Immobilization Facility—Immobilized Disposition Alternative

Materials/Resources	Total Consumption	Peak Demand
Utilities		
Electricity [a]	51,000 MWh	2.1 MWe
Water (l)	190,000,000	NA
Solids		
Concrete (m^3)	28,000	NA
Steel (t)	11,000	NA
Liquids		
Fuel (gas & diesel) (l)	15,000,000	NA
Propane (l)	18,000	NA
Gases		
Industrial gases[b] (m^3)	NA	NA

[a] Peak demand is the maximum rate expected during any hour for electricity.
[b] Standard cubic meters measured at 1 atmosphere and 15.6 °C.
Note: l=liter; m^3=cubic meters; MWe=megawatts electric; MWh=megawatt hours; NA=not applicable; t=metric tons.
Source: LLNL 1996e.

Table C.1.1.3–4. Materials/Resources Required During Construction of the Vitrification Alternative

Materials/Resources	Total Consumption	Peak Demand
Utilities		
Electricity [a]	10,000 MWh	5 MWe
Water (l)	53,000,000	NA
Solids		
Concrete (m^3)	34,000	NA
Steel (t)	13,600	NA
Liquids		
Fuel (gas & diesel) (l)	470,000	NA
Gases		
Industrial gases[b] (m^3)	14,000	NA

[a] Peak demand is the maximum rate expected during any hour for electricity.
[b] Standard cubic meters measured at 1 atmosphere and 15.6 °C.
Note: l=liter; m^3=cubic meters; MWe=megawatts electric; MWh=megawatt hours; NA=not applicable; t=metric tons.
Source: LLNL 1996c.

Table C.1.1.3–5. Materials/Resources Required During Construction of the Ceramic Immobilization Alternative

Materials/Resources	Total Consumption	Peak Demand
Utilities		
Electricity[a]	40,000 MWh	1.5 MWe
Water (l)	190,000,000	NA
Solids		
Concrete (m^3)	27,000	NA
Steel (t)	9,100	NA
Liquids		
Fuel (gas & diesel) (l)	11,000,000	NA
Gases		
Industrial gases[b] (m^3)	76	NA

[a] Peak demand is the maximum rate expected during any hour for electricity.
[b] Standard cubic meters measured at 1 atmosphere and 15.6 °C.
Note: l=liter; m^3=cubic meters; MWe=megawatts electric; MWh=megawatt hours; NA=not applicable; t=metric tons.
Source: LLNL 1996d.

Table C.1.1.3–6. Materials/Resources Required During Construction of the Electrometallurgical Treatment Alternative (Glass-Bonded Zeolite)

Materials/Resources	Total Consumption	Peak Demand
Utilities		
Electricity[a]	5,300 MWh	3 MWe
Water (l)	15,000,000	NA
Solids	NA	NA
Liquids		
Fuel (oil) (l)	570,000	NA
Gases	NA	NA

[a] Peak demand is the maximum rate expected during any hour for electricity.
Note: l=liter; MWe=megawatts electric; MWh=megawatt hours; NA=not applicable; no construction is required for this alternative. The additional process equipment required by the Pu disposition project would be shipped in from offsite and installed in existing spaces. For this evaluation, 2 months operation of the site and facilities are allocated to this effort in lieu of any actual construction.
Source: LLNL 1996b.

Table C.1.1.3–7. Materials/Resources Required During Construction of the Partially Completed Light Water Reactor Alternative

Materials/Resource	Total Consumption	Peak Demand
Utilities		
Electricity[a]	1,075,000 MWh	160 MWe
Water (l)	440,000,000	NA
Solids		
Concrete (m^3)	3,980	NA
Steel (t)	450	NA
Liquids		
Fuel (l)	13,438,000	NA
Gases	NA	NA

[a] Peak demand is the maximum rate expected during any hour for electricity.
Note: l=liter; m^3=cubic meters; MWe=megawatts electric; MWh=megawatt hours; NA=not applicable; t=metric tons.
Source: TVA 1995b:1.

Table C.1.1.3–8. Materials/Resources Required During Construction of the Evolutionary Light Water Reactor Alternative

	Total Consumption	
Materials/Resources	Single Large Evolutionary LWR	Single Small Evolutionary LWR
Utilities		
Electricity (MWh)	120,000	120,000
Water (l)	757,000,000	454,000,000
Solids		
Concrete (m^3)	290,500	153,000
Steel (t)	61,700	45,400
Liquids		
Fuel (l)	5,677,000	5,677,000
Gases	NA	NA

Note: l=liter; LWR=light water reactor; m^3=cubic meters; MWh=megawatt hours; t=metric tons.
Source: LLNL 1996g.

C.1.2 CONSTRUCTION WORKER REQUIREMENTS

C.1.2.1 Long-Term Storage Alternatives

Tables C.1.2.1–1 through C.1.2.1–20 show the construction worker requirements for the Upgrade, Consolidation, and Collocation Alternatives. The Preferred Alternative for the long-term storage of surplus Pu involves a combination of upgrade (Pantex, ORR, and SRS), No Action (Hanford, NTS, INEL, and LANL), and phaseout (RFETS).

Table C.1.2.1–1. Employment Required During Construction of the Upgrade Alternative at Hanford Site

Employees	Year 1	Year 2	Year 3	Year 4
Total craft workers	22	39	32	21
Construction management and support staff	9	15	12	8
Total Employment Without RFETS Pu or LANL Pu Material	31	54	44	29
Total Employment With All or Some RFETS Pu and LANL Pu Material	54	78	55	29

Source: HF DOE 1995e:1.

Table C.1.2.1–2. Employment Required During Construction of the Upgrade Alternative at Idaho National Engineering Laboratory, Argonne National Laboratory-West

Employees	Year 1	Year 2	Year 3
Total craft workers	60	89	55
Construction management and support staff	25	33	21
Total Employment Without RFETS Pu or LANL Pu Material	85	122	76
Total Employment With All or Some RFETS Pu and LANL Pu Material	108	144	90

Source: IN DOE 1996a.

Table C.1.2.1–3. Employment Required During Construction of the Upgrade Alternative at Pantex Plant

Employees	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Total craft workers	1	17	5	0	0	0
Construction management and support staff	0	2	1	0	0	0
Total Employment Without RFETS Pu or LANL Pu Material	1	19	6	0	0	0
Total Employment With All or Some RFETS Pu and LANL Pu Material[a]	455	936	1,142	947	803	470
Total Employment With RFETS Pit Material	1	19	6	0	0	0

[a] Values shown are based on an Upgrade designed to accommodate the Consolidation Alternative Option to Modify Existing and Construct New Facilities in Zone 12 South.

Source: PX DOE 1996a; PX MH 1994c.

Table C.1.2.1–4. Employment Required During Construction of the Upgrade Alternative at Oak Ridge Reservation[a]

Employees	Year 1	Year 2	Year 3
Total craft workers	32	48	29
Construction management and support staff	12	18	11
Total Employment	44	66	40

[a] ORR is not eligible to receive RFETS Pu or LANL Pu material under the Upgrade Alternative.
Source: OR MMES 1996a.

Table C.1.2.1–5. Employment Required During Construction of the Upgrade Alternative at Savannah River Site[a]

Employees	Year 1
Total craft workers	140
Construction management and support staff	53
Total Employment With All or Some RFETS Pu and LANL Pu Material	193[b]
Total Employment With RFETS Non-Pit Pu Material	193[c]

[a] SRS is only eligible to receive RFETS and LANL Pu material under the Upgrade Alternative.
[b] The construction duration of this subalternative is 5 months.
[c] The construction duration of this subalternative is 4 months.
Source: SRS 1996a:4.

Table C.1.2.1–6. Employment Required During Construction of the Consolidation Alternative at Hanford Site

Employees	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Total craft workers	307	632	771	639	542	318
Construction management and support staff	116	240	293	243	206	121
Total Employment	423	872	1,064	882	748	439

Source: DOE 1996e.

Table C.1.2.1–7. Employment Required During Construction of the Consolidation Alternative Option to Construct a New Facility at Nevada Test Site

Employees	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Total craft workers	315	649	793	657	557	327
Construction management and support staff	121	246	301	250	212	124
Total Employment	436	895	1,094	907	769	451

Source: DOE 1996e.

Table C.1.2.1–8. Employment Required During Construction of the Consolidation Alternative Option to Modify P-Tunnel at Nevada Test Site

Employees	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Total craft workers	316	654	799	662	561	330
Construction management and support staff	102	248	304	251	213	144
Total Employment	418	902	1,103	913	774	474

Source: NT DOE 1996a.

Table C.1.2.1–9. Employment Required During Construction of the Consolidation Alternative at Idaho National Engineering Laboratory

Employees	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Total craft workers	317	654	798	661	561	329
Construction management and support staff	121	248	304	251	213	125
Total Employment	438	902	1,102	912	774	454

Source: DOE 1996e.

Table C.1.2.1–10. Employment Required During Construction of the Consolidation Alternative Option to Construct a New Facility at Pantex Plant

Employees	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Total craft workers	330	679	829	687	583	342
Construction management and support staff	127	258	315	261	221	130
Total Employment	457	937	1,144	948	804	472

Source: DOE 1996e.

Table C.1.2.1–11. Employment Required During Construction of the Consolidation Alternative Option to Modify Existing and Construct New Facilities in Zone 12 South at Pantex Plant

Employees	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Total craft workers	329	678	828	686	582	341
Construction management and support staff	126	258	314	261	221	129
Total Employment	455	936	1,142	947	803	470

Source: PX DOE 1996a.

Table C.1.2.1–12. Employment Required During Construction of the Consolidation Alternative at Savannah River Site

Employees	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Total craft workers	329	676	826	685	581	340
Construction management and support staff	126	256	314	261	221	129
Total Employment	455	932	1,140	946	802	469

Source: DOE 1996e.

Table C.1.2.1–13. Employment Required During Construction of the Collocation Alternative at Hanford Site

Employees	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Total craft workers	399	932	984	817	718	321
Construction management and support staff	152	355	374	311	273	122
Total Employment	551	1,287	1,358	1,128	991	443

Source: DOE 1996f.

Table C.1.2.1–14. Employment Required During Construction of the Collocation Alternative Option to Construct a New Facility at Nevada Test Site

Employees	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Total craft workers	414	964	1,021	847	744	335
Construction management and support staff	157	367	388	322	284	127
Total Employment	571	1,331	1,409	1,169	1,028	462

Source: DOE 1996f.

Table C.1.2.1–15. Employment Required During Construction of the Collocation Alternative Option to Modify P-Tunnel at Nevada Test Site

Employees	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Total craft workers	373	770	940	779	661	388
Construction management and support staff	138	293	357	296	251	152
Total Employment	511	1,063	1,297	1,075	912	540

Source: NT DOE 1996a.

Table C.1.2.1–16. Employment Required During Construction of the Collocation Alternative at Idaho National Engineering Laboratory

Employees	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Total craft workers	424	986	1,046	868	763	345
Construction management and support staff	163	375	398	330	289	131
Total Employment	587	1,361	1,444	1,198	1,052	476

Source: DOE 1996f.

Table C.1.2.1–17. Employment Required During Construction of the Collocation Alternative at Pantex Plant

Employees	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Total craft workers	428	991	1,056	877	769	351
Construction management and support staff	161	377	402	333	293	134
Total Employment	589	1,368	1,458	1,210	1,062	485

Source: DOE 1996f.

Table C.1.2.1–18. Employment Required During Construction of the Collocation Alternative Option to Construct a New Plutonium Storage Facility at Oak Ridge Reservation; Maintain Existing Highly Enriched Uranium Storage Facilities at Y–12 Plant[a]

Employees	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Total craft workers	321	661	808	669	568	333
Construction management and support staff	122	251	307	254	216	127
Total Employment	443	912	1,115	923	784	460

[a] To obtain the total construction employment required for the Collocation Alternative Option to Construct a New Plutonium Storage Facility at ORR and Modify Existing HEU Storage Facilities at Y–12 Plant, add the numbers from this table to the construction employment required for the Upgrade Alternative at ORR (Table C.1.2.1–4).

Source: DOE 1996e.

Table C.1.2.1–19. Employment Required During Construction of the Collocation Alternative Option to Construct a New Facility at Oak Ridge Reservation

Employees	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Total craft workers	450	1,042	1,112	924	810	372
Construction management and support staff	175	395	422	350	307	142
Total Employment	625	1,437	1,534	1,274	1,117	514

Source: DOE 1996f.

Table C.1.2.1–20. Employment Required During Construction of the Collocation Alternative at Savannah River Site

Employees	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Total craft workers	429	996	1,060	880	772	351
Construction management and support staff	163	379	403	334	294	134
Total Employment	592	1,375	1,463	1,214	1,066	485

Source: DOE 1996f.

C.1.2.2 Activities Common to Multiple Plutonium Disposition Alternatives

Tables C.1.2.2–1, C.1.2.2–2, and C.1.2.2–3 show the construction worker requirements to construct facilities that perform precursor activities on Pu materials prior to certain Pu disposition alternatives. Under the Preferred Alternative for surplus Pu disposition, the pit disassembly/conversion facility and the MOX fuel fabrication facility could each be located at either Hanford, INEL, Pantex, or SRS, and the Pu conversion facility at Hanford or SRS. The facility construction requirement for these alternatives could be reduced by using existing facilities for portions of the operations. The next tier of NEPA review will examine locations for the selected alternatives including the use of existing facilities.

Table C.1.2.2–1. Employment Required During Construction of the Pit Disassembly/Conversion Facility

Employees	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Total craft workers	60	120	135	90	90	60
Construction management and support staff	20	40	50	35	35	20
Total Employment	80	165	185	125	125	80

Source: LANL 1996d.

Table C.1.2.2–2. Employment Required During Construction of the Plutonium Conversion Facility

Employees	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Total craft workers	115	232	260	202	168	104
Construction management and support staff	42	87	98	78	64	36
Total Employment	157	319	358	280	232	140

Source: LANL 1996c.

Table C.1.2.2–3. Employment Required During Construction of the Mixed Oxide Fuel Fabrication Facility

Employees	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Total craft workers	125	265	300	230	195	115
Construction management and support staff	75	155	175	135	115	65
Total Employment	200	420	475	365	310	180

Source: LANL 1996b.

C.1.2.3 Plutonium Disposition Alternatives

Tables C.1.2.3–1 through C.1.2.3–8 list the construction worker requirements to construct facilities for the various Pu disposition alternatives. Under the Preferred Alternative for surplus Pu disposition, the ceramic immobilization facility, or the vitrification facility could be located at Hanford or SRS. The facility construction requirements for these alternatives could be reduced by using existing facilities for portions of the operations. The next tier of NEPA review will examine locations for the selected alternatives including the use of existing facilities.

Table C.1.2.3–1. Employment Required During Construction of the Deep Borehole Complex—Direct Disposition Alternative

Employees	Year 1	Year 2	Year 3
Total craft workers	280	785	425
Construction management and support staff	30	85	45
Total Employment	310	870	470

Source: LLNL 1996a.

Table C.1.2.3–2. Employment Required During Construction of the Deep Borehole Complex—Immobilized Disposition Alternative

Employees	Year 1	Year 2	Year 3
Total craft workers	260	725	405
Construction management and support staff	30	85	45
Total Employment	290	810	450

Source: LLNL 1996h.

Table C.1.2.3–3. Employment Required During Construction of the Ceramic Immobilization Facility—Immobilized Disposition Alternative

Employees	Year 1	Year 2	Year 3	Year 4	Year 5
Total craft workers	270	540	900	720	450
Construction management and support staff	30	60	100	80	50
Total Employment	300	600	1,000	800	500

Source: LLNL 1996e.

Table C.1.2.3–4. Employment Required During Construction of the Vitrification Alternative

Employees	Year 1	Year 2	Year 3	Year 4	Year 5
Total craft workers	200	320	320	300	200
Construction management and support staff	53	62	62	44	40
Total Employment	253	382	382	344	240

Source: LLNL 1996c.

Table C.1.2.3–5. Employment Required During Construction of the Ceramic Immobilization Alternative

Employees	Year 1	Year 2	Year 3	Year 4	Year 5
Total craft workers	270	540	900	720	450
Construction management and support staff	30	60	100	80	50
Total Employment	300	600	1,000	800	500

Source: LLNL 1996d.

Table C.1.2.3–6. Employment Required During Construction of the Electrometallurgical Treatment Alternative (Glass-Bonded Zeolite)

Employees	Period[a]
Officials and managers	30
Professionals	90
Technicians	79
Office and clerical	30
Operators/line supervisors	222
Safeguards and security	42
Total Employment	493

[a] Construction employment needs based upon labor associated with a 6-month equipment installation and checkout period.
Source: LLNL 1996b.

Table C.1.2.3–7. Employment Required During Construction of the Partially Completed Light Water Reactor Alternative

Employees	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
Total craft workers	0	375	1,075	1,490	1,525	770	30
Construction management and support staff	40	325	580	815	615	310	25
Total Employment	40	700	1,655	2,305	2,140	1,080	55

Source: TVA 1995b:1.

Table C.1.2.3–8. Employment Required During Construction of the Evolutionary Light Water Reactor Alternative

Employees	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Single large reactor	300	3,000	3,500	3,500	2,000	300
Single small reactor	180	1,000	2,200	2,200	1,060	460

Source: LLNL 1996g.

C.2 REQUIREMENTS DURING OPERATIONS

C.2.1 UTILITIES REQUIRED

C.2.1.1 Long-Term Storage Alternatives

Tables C.2.1.1–1 through C.2.1.1–4 show utility requirements for all long-term storage alternatives.

Table C.2.1.1–1. Utilities Required During Operation of the Upgrade Without Rocky Flats Environmental Technology Site Plutonium or Los Alamos National Laboratory Plutonium Subalternative[a]

	Annual Average Consumption			
Utility	**Hanford**	**INEL**	**Pantex**	**ORR**
Electricity				
Annual average consumption (MWh)	20,000	3,800	1,375	7,260
Peak demand[b] (MWe)	5	0.7	0.25	1.1
Liquid fuel (l)	3,940	640,000	13,248	0
Natural gas (m^3)	0	0	164,000	949
Coal (t)	0	0	0	160
Water (l)	8,440,000	17,000,000	27,500,000	240,000

[a] This subalternative does not apply to SRS.
[b] Peak demand is the maximum rate expected during any hour for electricity.
Note: l=liter; m^3=cubic meters; MWe=megawatts electric; MWh=megawatt hours; t=metric tons.
Source: HF DOE 1995e:1; IN DOE 1996a; OR MMES 1996a; PX MH 1994a.

Table C.2.1.1–2. Utilities Required During Operation of the Upgrade With All or Some Rocky Flats Environmental Technology Site Plutonium and Los Alamos National Laboratory Plutonium Subalternative[a]

	Annual Average Consumption					
			Pantex		SRS	
Utility	**Hanford**	**INEL**	**(With RFETS Pits)**	**(With All or Some RFETS and LANL Pu)[b]**	**(With All or Some RFETS and LANL Pu)**	**(With RFETS Non-Pit Pu)**
Electricity						3,600
Annual average consumption (MWh)	21,150	4,500	1,375	48,000	4,900	
Peak demand[c] (MWe)	515	0.8	0.25	9	0.1	0.1
Liquid fuel (l)	3,940	720,000	13,248	38,000	0	0
Natural gas (m^3)	0	0	164,000	5,100,000	0	0
Coal (t)	0	0	0	0	400	290
Water (l)	8,892,000	22,000,000	27,500,000	110,000,000	7,100,000	5,678,000

[a] ORR is not eligible to receive RFETS or LANL Pu material under this upgrade subalternative.
[b] Values shown are based on an upgrade designed to accommodate the Consolidation Alternative Option to Modify Existing and Construct New Facilities in Zone 12 South.
[c] Peak demand is the maximum rate expected during any hour for electricity.
Note: l=liter; m^3=cubic meters; MWe=megawatts electric; MWh=megawatt hours; t=metric tons.
Source: HF DOE 1995e:1; IN DOE 1996a; PX DOE 1996a; SRS 1996a:4; WSRC 1995e.

Table C.2.1.1–3. Utilities Required During Operation of the Consolidation Alternative

	Average Annual Consumption						
	Hanford	NTS		INEL	Pantex		SRS
Utility		New Pu Storage Facility	Modify P-Tunnel		New Pu Storage Facility	New and Modified Zone 12 South Facilities	
Electricity							
Annual average consumption (MWh)	71,000	49,000	72,000	45,000	43,000	48,000	57,000
Peak demand[a] (MWe)	9	8	10	8	8	9	10
Liquid fuel (l)	38,000	38,000	38,000	120,000	38,000	38,000	46,000
Natural gas (m^3)	NA	2,800,000	3,200,000	NA	4,500,000	5,100,000	NA
Coal (t)	NA	NA	NA	11,000	NA	NA	4,200
Raw water (l)	110,000,000	110,000,000	130,000,000	66,000,000	98,000,000	110,000,000	360,000,000

[a] Peak demand is the maximum rate expected during any hour for electricity.

Note: l=liter; m^3=cubic meters; MWe=megawatts electric; MWh=megawatt hours; NA=not applicable; t=metric tons.

Source: DOE 1996e; NT DOE 1996a; PX DOE 1996a.

Table C.2.1.1–4. Utilities Required During Operation of the Collocation Alternative

	Average Annual Consumption							
	Hanford	NTS		INEL	Pantex	ORR		SRS
Utility		New Pu and HEU Storage Facility	Modify P-Tunnel			New Pu and HEU Storage Facility	New Pu Storage Facility Only[a]	
Electricity								
Annual average consumption (MWh)	92,000	65,000	89,000	58,000	58,000	68,000	53,000	76,000
Peak demand (MWe)[b]	18	11	13	10	10	11	9	13
Liquid fuel (l)	38,000	38,000	38,000	140,000	38,000	50,000	48,000	47,000
Natural gas (m^3)	NA	3,200,000	3,600,000	NA	5,200,000	NA	NA	NA
Coal (t)	NA	NA	NA	14,000	NA	6,300	5,500	4,800
Raw water (l)	150,000,000	150,000,000	190,000,000	87,000,000	130,000,000	360,000,000	280,000,000	460,000,000

[a] For modification of the Y–12 HEU Storage Facility, see Table C.2.1.1–1.

[b] Peak Demand is the maximum rate expected during any hour for electricity.

Note: HEU=highly enriched uranium; l=liter; m^3=cubic meters; MWe=megawatts electric; MWh=megawatt hours; NA=not applicable; t=metric tons.

Source: DOE 1996e; DOE 1996f; NT DOE 1996a.

C.2.1.2 Activities Common to Multiple Plutonium Disposition Alternatives

Tables C.2.1.2–1, C.2.1.2–2, and C.2.1.2–3 show utility requirements for facilities that perform precursor activities on Pu prior to certain Pu disposition alternatives.

Table C.2.1.2–1. Utilities Required During Operation of the Pit Disassembly/Conversion Facility

Utility	Average Annual Consumption	Peak Demand
Electricity[a]	20,000 MWh	5 MWe
Liquid fuel (l)	28,000	NA
Natural gas[b] (m^3)	3,398,000	NA
[Text deleted.]		
Raw water (l)	94,635,000	NA

[a] Peak demand is the maximum rate expected during any hour for electricity.
[b] Standard cubic meters measured at 1 atmosphere and 15.6 °C.
Note: l=liter; m^3=cubic meters; MWe=megawatts electric; MWh=megawatt hours; NA=not applicable.
Source: LANL 1996d.

Table C.2.1.2–2. Utilities Required During Operation of the Plutonium Conversion Facility

Utility	Average Annual Consumption	Peak Demand
Electricity[a]	21,000 MWh	5 MWe
Liquid fuel (l)	39,750	NA
Natural gas[b] (m^3)	4,361,000	NA
Raw water (l)	80,500,000	NA

[a] Peak demand is the maximum rate expected during any hour for electricity.
[b] Standard cubic meters measured at 1 atmosphere and 15.6 °C.
Note: l=liter; m^3=cubic meters; MWe=megawatts electric; MWh=megawatt hours; NA=not applicable.
Source: LANL 1996c.

Table C.2.1.2–3. Utilities Required During Operation of the Mixed Oxide Fuel Fabrication Facility

Utility	Average Annual Consumption	Peak Demand
Electricity [a]	13,000 MWh	5 MWe
Liquid fuel (l)	20,000	NA
Natural gas[b] (m^3)	2,350,000	NA
Raw water (l)	56,781,000	NA

[a] Peak demand is the maximum rate expected during any hour for electricity.
[b] Standard cubic meters measured at 1 atmosphere and 15.6 °C.
Note: l=liter; m^3=cubic meters; MWe=megawatts electric; MWh=megawatt hours; NA=not applicable.
Source: LANL 1996b.

C.2.1.3 Plutonium Disposition Alternatives

Tables C.2.1.3–1 through C.2.1.3–7 show the utilities and fuel expected to be required during a typical year of operation for each of the facilities required for Pu disposition.

Table C.2.1.3–1. Utilities Required During Operation of the Deep Borehole Complex—Direct Disposition Alternative

Utility	Average Annual Consumption	Peak Demand
Electricity[a]	6,500 MWh	2.3 MWe
Liquid fuel (l)	774,000	NA
Natural gas[b] (m^3)	5,100,000	NA
Raw water (l)	165,400,000	NA

[a] Peak demand is the maximum rate expected during any hour for electricity.
[b] Standard cubic meters measured at 1 atmosphere and 15.6 °C.
Note: l=liter; m^3=cubic meters; MWe=megawatts electric; MWh=megawatt hours; NA=not applicable.
Source: LLNL 1996a.

Table C.2.1.3–2. Utilities Required During Operation of the Deep Borehole Complex—Immobilized Disposition Alternative

Utility	Average Annual Consumption	Peak Demand
Electricity[a]	6,100 MWh	2.3 MWe
Liquid fuel (l)	773,300	NA
Natural gas[b] (m^3)	4,810,000	NA
Raw water (l)	138,000,000	NA

[a] Peak demand is the maximum rate expected during any hour for electricity.
[b] Standard cubic meters measured at 1 atmosphere and 15.6 °C.
Note: l=liter; m^3=cubic meters; MWe=megawatts electric; MWh=megawatt hours; NA=not applicable.
Source: LLNL 1996h.

Table C.2.1.3–3. Utilities Required During Operation of the Ceramic Immobilization Facility—Immobilized Disposition Alternative

Utility	Average Annual Consumption	Peak Demand
Electricity[a]	35,000 MWh	5 MWe
Liquid fuel (l)	210,000	NA
Natural gas[b] (m^3)	3,800,000	NA
Raw water (l)	320,000,000	NA

[a] Peak demand is the maximum rate expected during any hour for electricity.
[b] Standard cubic meters measured at 1 atmosphere and 15.6 °C.
Note: l=liter; m^3=cubic meters; MWe=megawatts electric; MWh=megawatt hours; NA=not applicable.
Source: LLNL 1996e.

Table C.2.1.3–4. Utilities Required During Operation of the Vitrification Alternative

Utility	Average Annual Consumption	Peak Demand
Electricity[a]	12,000 MWh	3 MWe
Liquid fuel (l)	378,500	NA
Natural gas (m^3)	0	NA
Raw water (l)	250,000,000	NA

[a] Peak demand is the maximum rate expected during any hour for electricity.
[Text deleted.]
Note: l=liter; m^3=cubic meters; MWe=megawatts electric; MWh=megawatt hours; NA=not applicable.
Source: LLNL 1996c.

Table C.2.1.3–5. Utilities Required During Operation of the Ceramic Immobilization Alternative

Utility	Average Annual Consumption	Peak Demand
Electricity [a]	25,000 MWh	3 MWe
Liquid fuel (l)	190,000	NA
Natural gas[b] (m^3)	3,500,000	NA
Raw water (l)	250,000,000	NA

[a] Peak demand is the maximum rate expected during any hour for electricity.
[b] Standard cubic meters measured at 1 atmosphere and 15.6 °C.
Note: l=liter; m^3=cubic meters; MWe=megawatts electric; MWh=megawatt hours; NA=not applicable.
Source: LLNL 1996d.

Table C.2.1.3–6. Utilities Required During Operation of the Electrometallurgical Treatment Alternative (Glass-Bonded Zeolite)

Utility	Average Annual Consumption	Peak Demand
Electricity[a]	2,400 MWh	8 kWe
Liquid fuel (l)	0	NA
Natural gas (m^3)	0	NA
Raw water (l)	17,413,000	NA

[a] Peak demand is the maximum rate expected during any hour for electricity.
Note: kWe=kilowatts electric; l=liter; m^3=cubic meters; MWh=megawatt hours; NA=not applicable.
Source: LLNL 1996b.

Table C.2.1.3–7. Utilities Required During Operation of the Evolutionary Light Water Reactor Alternative

	Average Annual Consumption	
Utility	**Single Large Evolutionary LWR**	**Single Small Evolutionary LWR**
Electricity		
Average Annual Consumption (MWh)		
Wet site	700,000	380,000
Dry site	1,100,000	580,000
Peak Demand[a] (MWe)		
Wet site	96	52
Dry site	140	75
Natural gas (m^3)	0	0
Liquid fuel (l)	757,000	416,000
Raw Water (l)		
Wet site	60,560,000,000	27,252,000,000
Dry site	340,600,000	189,300,000

[a] Peak demand is the maximum rate expected during any hour for electricity.

Note: l=liter; LWR=light water reactor; m^3=cubic meters; MWe=megawatts electric; MWh=megawatt hours.

Source: LLNL 1996g.

C.2.2 CHEMICALS UTILIZED

The tables in this section show annual chemical requirements during operation of facilities proposed for the various storage and disposition alternatives.

C.2.2.1 Long-Term Storage Alternatives

Annual chemical use during operation of long-term storage facilities for the upgrade, consolidation, and collocation alternatives is listed in Tables C.2.2.1–1 through C.2.2.1–4.

Table C.2.2.1–1. Chemicals Required During Operation of the Upgrade Without Rocky Flats Environmental Technology Site Plutonium or Los Alamos National Laboratory Plutonium Subalternative[a]

Chemical	Annual Quantity (kg)			
	Hanford	INEL	Pantex	ORR
Solid				
Adsorbent material	NA	2	NA	NA
Aluminum sulfate	NA	230[b]	NA	NA
Bentonite	NA	80[b]	NA	NA
[Text deleted.]				
Calcium hydroxide	NA	18[b]	NA	NA
Ethylene diaminetetra	NA	NA	NA	0.5
Ferrous ammonium sulfate	NA	NA	NA	0.5
Graphite	NA	NA	NA	0.5
Lithium tetraborate	NA	NA	NA	2
Magnesium oxide (crucible)	NA	7	NA	NA
Potassium dichromate	NA	NA	NA	0.5
Resin beads	NA	NA	NA	5
Sodium hydroxide	NA	NA	NA	0.5
[Text deleted.]				
Sodium sulfate	NA	18[b]	NA	NA
Sodium sulfite	NA	7[b]	54	NA
Titanium chloride	NA	NA	NA	5
Uranium oxide	NA	NA	NA	0.5
Liquid				
Ammonium hydroxide	NA	NA	NA	57
Cleaning solvents	50	140[c]	NA	NA
Diethylaminoethanol	NA	1[b]	NA	NA
Hydrazine	NA	1[b]	NA	NA
Hydrochloric acid	NA	NA	NA	57
Hydrogen peroxide	NA	NA	NA	80
Inorganic phosphate	NA	35[b]	NA	NA
Isopropyl alcohol	NA	NA	NA	8
Liquid nitrogen	34,000	860	118	NA
Nitric acid	NA	NA	NA	250
Oils and lubricants	NA	820	3	NA
Organic phosphate	NA	29[b]	NA	NA
Organic solvents	NA	NA	NA	80

Table C.2.2.1–1. Chemicals Required During Operation of the Upgrade Without Rocky Flats Environmental Technology Site Plutonium or Los Alamos National Laboratory Plutonium Subalternative[a]—Continued

Chemical	Annual Quantity (kg)			
	Hanford	**INEL**	**Pantex**	**ORR**
Liquid (continued)				
Perchloric acid	NA	NA	NA	8
Phosphoric acid	NA	40[b]	NA	20
Polyelectrolyte	NA	58[b]	NA	NA
Polyphosphate	NA	78[b]	82	NA
Sulfuric acid	NA	510[b]	277	20
Gas				
Argon	NA	1,000	2,500	NA
[Text deleted.]				
Chlorine	NA	38[b]	168	NA
Helium	NA	200	50	NA
Nitrogen	NA	2,600	NA	NA
Oxygen	NA	1	NA	NA
P-10 (calibration gas)	NA	1	NA	NA

[a] This subalternative does not apply to SRS.
[b] Chemicals used for water treatment.
[c] Cleaning solvents will be selected from the following list of non-halogenated liquids: 1-Hexanol, Dodecane, De-solve-it without surfactant, 1-Octanol, Spartan TH-9-33A, Diglyme, 3-Methylcyclohexanol, Methylacetoacetate, Actrel 1960 L, Tetradecane, 2-Butoxyethanol, Actrel 3360 L, Ashland 140-Solvent-66, Butyl Lactate, Pensolv L 1060, and Diacetone.
[Text deleted.]
Note: NA=not applicable.
Source: HF DOE 1995e:1; IN DOE 1996a; OR MMES 1996a; PX MH 1994a.

Table C.2.2.1–2. Chemicals Required During Operation of the Upgrade With All or Some Rocky Flats Environmental Technology Site Plutonium and Los Alamos National Laboratory Plutonium Subalternative

	Annual Quality (kg)					
			Pantex		SRS	
Chemical	Hanford	INEL	(With RFETS Pits)	(With All or Some RFETS and LANL Pu)[a]	(With All or Some RFETS and LANL Pu)	(With RFETS Non-Pit Pu)
Solid						
Absorbent material	NA	2	NA	2	NA	NA
Alumina	NA	NA	NA	440	NA	NA
Aluminum nitrate	NA	NA	NA	750	NA	NA
Aluminum sulfate	NA	303[b]	NA	910	NA	NA
Bentonite	NA	107[b]	NA	450	NA	NA
Betz slimicide (CE-77 PE)	NA	NA	NA	NA	3[c]	2[c]
Betz 25k series corrosion inhibitors	NA	NA	NA	NA	15[c]	12[c]
Calcium fluoride	NA	NA	NA	1	NA	NA
Calcium hydroxide	NA	23[b]	NA	NA	NA	NA
Magnesium oxide (crucible)	NA	7	NA	7	NA	NA
Oxalic acid	NA	NA	NA	8	NA	NA
Resin (zeolites)	NA	NA	NA	3	NA	NA
Sodium hydroxide	NA	NA	NA	NA	5[b]	3[b]
Sodium hypochlorite	NA	NA	NA	NA	7[b]	5[b]
Sodium nitrite	NA	NA	NA	210	NA	NA
Sodium sulfate	NA	23[b]	NA	NA	NA	NA
Sodium sulfite	NA	8[b]	54	62	NA	NA
Ta-W-Mo (crucible)	NA	NA	NA	1	NA	NA
Urea	NA	NA	NA	140	NA	NA
Liquid			NA			
Cleaning solvents	50	140[d]	NA	140	0	0
Diethylaminoethanol	NA	1	NA	9	NA	NA
Hydrazine	NA	19	NA	3	NA	NA
Hydrofluoric acid	NA	NA	NA	1	NA	NA
Hydrogen peroxide	NA	NA	NA	1	NA	NA
Hydroxylamine nitrate	NA	NA	NA	230	NA	NA
Inorganic phosphate	NA	45[b]	NA	220	NA	NA
Liquid nitrogen	34,000	860	118	860	NA	NA
Nitric acid	NA	NA	NA	4,300	NA	NA
Oils and lubricants	NA	820	3	1,600	NA	NA
Organic phosphate	NA	37[b]	NA	170	NA	NA
Phosphoric acid	NA	53[b]	NA	230	NA	NA
Polyelectrolyte	NA	76[b]	NA	230	NA	NA
Polyphosphate	NA	98[b]	82	490	14[b]	10[b]
Sulfuric acid	NA	650[b]	277	3,100	NA	NA

Table C.2.2.1–2. Chemicals Required During Operation of the Upgrade With All or Some Rocky Flats Environmental Technology Site Plutonium and Los Alamos National Laboratory Plutonium Subalternative—Continued

	Annual Quality (kg)					
			Pantex		SRS	
Chemical	**Hanford**	**INEL**	**(With RFETS Pits)**	**(With All or Some RFETS and LANL Pu)[a]**	**(With All or Some RFETS and LANL Pu)**	**(With RFETS Non-Pit Pu)**
Gas						
Argon	NA	1,000	2,500	7,300	0	0
Chlorine	NA	51[b]	168	220	NA	NA
Helium	NA	200	50	230	0	0
Hydrogen	NA	NA	NA	1	NA	NA
Nitrogen	NA	2,600	NA	2,600	10	10
Oxygen	NA	1	NA	1	NA	NA
P-10 (Calibration gas)	NA	1	NA	1	NA	NA

[Text deleted.]

[a] Values shown are based on an upgrade designed to accommodate the consolidation alternative Option to Modify Existing and Construct New Facilities in Zone 12 South.

[b] Chemicals used for water treatment.

[c] Chemicals used for cooling tower water treatment.

[d] Cleaning solvents will be selected from the following list of non-halogenated liquids: 1-Hexanol, Dodecane, De-solve-it without surfactant, 1-Octanol, Spartan TH-9-33A, Diglyme, 3-Methylcyclohexanol, Methylacetoacetate, Actrel 1960 L, Tetradecane, 2-Butoxyethanol, Actrel 3360 L, Ashland 140-Solvent-66, Butyl Lactate, Pensolv L 1060, and Diacetone.

Note: NA=not applicable.

Source: HF DOE 1995e:1; IN DOE 1996a; PX DOE 1996a; SRS 1996a:4; WSRC 1995e.

Table C.2.2.1–3. Chemicals Required During Operation of the Consolidation Alternative

	Annual Quantity (kg)						
	Hanford	NTS		INEL	Pantex		SRS
Chemical		New Pu Storage Facility	Modify P-Tunnel		New Pu Storage Facility	New and Modified Zone 12 South Facilities	
Solid							
Adsorbent material	2	2	2	2	2	2	2
Alumina	440	440	440	440	440	440	440
Aluminum nitrate	750	750	750	750	750	750	750
Aluminum sulfate[a]	780	850	950	770	810	910	3,400
Bentonite[a]	390	420	480	380	410	450	420
Calcium fluoride	1	1	1	1	1	1	1
Calcium hydroxide[a]	NA	NA	NA	NA	NA	NA	630
Glass frit	1,400	1,400	1,400	1,400	1,400	1,400	1,400
Magnesium oxide (crucible)	7	7	7	7	7	7	7
Oxalic acid	8	8	8	8	8	8	8
Resin (zeolites)	3	3	3	3	3	3	3
Sodium chloride[a]	NA	NA	NA	NA	NA	NA	58
Sodium nitrite	210	210	210	210	210	210	210
Sodium sulfate[a]	NA	NA	38	NA	NA	NA	630
Sodium sulfite[a]	NA	34	NA	97	55	62	36
Ta-W-Mo (crucible)	1	1	1	1	1	1	1
Urea	140	140	140	140	140	140	140
[Text deleted.]							
Liquid							
Cleaning solvent[b]	140	140	140	140	140	140	140
Diethylaminoethanol[a]	NA	5	6	15	8	9	5
Hydrazine[a]	NA	2	2	5	3	3	2
Hydrofluoric acid	1	1	1	1	1	1	1
Hydrogen peroxide	1	1	1	1	1	1	1
Hydroxylamine nitrate	230	230	230	230	230	230	230
Inorganic phosphate[a]	220	230	270	130	190	220	1,300

Table C.2.2.1–3. Chemicals Required During Operation of the Consolidation Alternative—Continued

	Annual Quantity (kg)						
	Hanford	NTS		INEL	Pantex		SRS
Chemical		New Pu Storage Facility	Modify P-Tunnel		New Pu Storage Facility	New and Modified Zone 12 South Facilities	
Liquid (continued)							
Liquid nitrogen	860	860	860	860	860	860	860
Nitric acid	4,300	4,300	4,300	4,300	4,300	4,300	4,300
Oils and lubricants	1,600	1,600	1,600	1,600	1,600	1,600	1,600
Organic phosphate[a]	170	180	210	100	150	170	1,000
Phosphoric acid[a]	200	210	240	190	200	230	210
Polyelectrolyte[a]	200	210	240	190	200	230	840
Polyphosphate[a]	430	480	570	360	440	490	2,600
Sulfuric acid[a]	3,100	3,200	3,800	1,900	2,800	3,100	18,000
Gas							
Argon	7,300	7,300	7,300	7,300	7,300	7,300	7,300
Chlorine[a]	200	210	240	170	200	220	420
Helium	230	230	230	230	230	230	230
Hydrogen	1	1	1	1	1	1	1
Nitrogen	2,600	2,600	2,600	2,600	2,600	2,600	2,600
Oxygen	1	1	1	1	1	1	1
P-10 (calibration gas)	1	1	1	1	1	1	1

[a] Chemicals used for water treatment.

[b] Cleaning solvents will be selected from the following list of non-halogenated liquids: 1-Hexanol, Ashland 140-Solvent-66, 3-Methylcyclohexanol, De-solve-it without surfactant, 1-Octanol, Pensolv L1060, 2-Butoxyethanol, Methylacetoacetate, Diglyme, Dodecane, Butyl Lactate, Actrel 1960 L, Tetradecane, Spartan TH-9-33A, Diacetone, and Actrel 3360 L.

Note: kg=kilograms; NA=not applicable.

Source: DOE 1996e; NT DOE 1996a; PX DOE 1996a.

Table C.2.2.1–4. Chemicals Required During Operation of the Collocation Alternative

Chemicals	Annual Quantity (kg)							
	Hanford	NTS		INEL	Pantex	ORR		SRS
		New Pu and HEU Storage Facility	Modify P-Tunnel			New Pu and HEU Storage Facility	New Pu Storage Facility Only[a]	
Solid								
Absorbent material	2	2	2	2	2	2	2	2
Alumina	440	440	440	440	440	440	440	440
Aluminum nitrate	750	750	750	750	750	750	750	750
Aluminum sulfate[b]	990	1,100	1,200	980	1,000	3,400	2,700	4,300
Bentonite[b]	500	530	580	490	510	490	390	520
Calcium fluoride	1	1	1	1	1	1	1	1
Calcium hydroxide[b]	NA	NA	NA	NA	NA	610	490	810
Ethylene diamine tetra (acetic acid)	1	1	NA	1	1	1	NA	1
Ferrous ammonium sulfate	1	1	NA	1	1	1	NA	1
Glass frit	1,400	1,400	1,400	1,400	1,400	1,400	1,400	1,400
Graphite	1	1	NA	1	1	1	NA	1
Lithium	2	2	NA	2	2	2	NA	2
Magnesium oxide (crucible)	7	7	7	7	7	7	7	7
Oxalic acid	8	8	8	8	8	8	8	8
Potassium dichromate	1	1	NA	1	1	1	NA	1
Resin (zeolites)	8	8	3	8	8	8	3	8
Sodium chloride[b]	NA	NA	NA	NA	NA	79	71	64
Sodium hydroxide	1	1	NA	1	1	1	NA	1
Sodium nitrite	210	210	210	210	210	210	210	210
Sodium sulfate[b]	NA	NA	NA	NA	NA	610	490	810
Sodium sulfite[b]	NA	38	43	120	63	54	47	41
Ta-W-Mo (crucible)	1	1	1	1	1	1	1	1
Titanium chloride	5	5	NA	5	5	5	NA	5
Uranium dioxide	1	1	NA	1	1	1	NA	1
Urea	140	140	140	140	140	140	140	140
Liquid								
Ammonium hydroxide	50	50	NA	50	50	50	NA	50
Cleaning solvent[c]	200	200	140	200	200	200	140	200
Diethylaminoethanol[b]	NA	5	6	17	10	8	7	6

Table C.2.2.1–4. Chemicals Required During Operation of the Collocation Alternative—Continued

	Annual Quantity (kg)							
	Hanford	NTS		INEL	Pantex	ORR		SRS
Chemicals		New Pu and HEU Storage Facility	Modify P-Tunnel			New Pu and HEU Storage Facility	New Pu Storage Facility Only[a]	
Liquid (continued)								
Hydrazine[b]	NA	2	2	6	3	3	2	2
Hydrochloric acid	84	84	NA	84	84	84	NA	84
Hydrofluoric acid	1	1	1	1	1	1	1	1
Hydrogen peroxide	110	110	1	110	110	110	1	110
Hydroxylamine nitrate	230	230	230	230	230	230	230	230
Inorganic phosphate[b]	290	300	370	170	260	1,200	980	1,600
Isoprophy alcohol	6	6	NA	6	6	6	NA	6
Liquid nitrogen	860	860	860	860	860	860	860	860
Nitric acid	4,700	4,700	4,300	4,700	4,700	4,700	4,300	4,700
Oils & lubricants	2,300	2,300	1,600	2,300	2,300	2,300	1,600	2,300
Organic phosphate[b]	230	240	300	140	200	980	780	1,300
Perchloric acid	13	13	NA	13	13	13	NA	13
Phosphoric acid[b]	280	300	290	280	290	280	190	290
Polyelectrolyte[b]	250	260	290	240	260	860	680	1,100
Polyphosphate[b]	580	640	790	460	570	2,500	2,000	3,300
Sulfuric acid[b]	4,200	4,400	5,300	2,500	3,700	17,000	14,000	23,000
Gas								
Argon	7,300	7,300	7,300	7,300	7,300	7,300	7,300	7,300
Chlorine[b]	250	260	300	220	250	430	350	530
Helium	230	230	230	230	230	230	230	230
Hydrogen	1	1	1	1	1	1	1	1
Nitrogen	2,600	2,600	2,600	2,600	2,600	2,600	2,600	2,600
Oxygen	1	1	1	1	1	1	1	1
P-10 (calibration gas)	1	1	1	1	1	1	1	1

[a] The chemicals required for the Upgrade Alternative at ORR (Table C.2.2.1–1) are added to obtain the total chemicals required for the Collocation Alternative Option to construct a New Pu Storage Facility at ORR and Modify Existing HEU Storage Facilities at Y–12 Plant.

[b] Chemicals used for water treatment.

[c] Cleaning solvents will be selected from the following list of non-halogenated liquids: 1-Hexanol, Ashland 140-Solvent-66, 3-Methylcyclohexanol, De-solve-it without surfactant, 1-Octanol, Pensolv L 1060, 2-Butoxyethanol, Methylacetoacetate, Diglyme, Dodecane, Butyl Lactate, Actrel 1960L, Tetradecane, Spartan TH-9-33A, Diacetone, and Actrel 3360 L.

Note: kg=kilograms; NA=not applicable.

Source: DOE 1996e; DOE 1996f; NT DOE 1996a.

C.2.2.2 Activities Common to Multiple Plutonium Disposition Alternatives

Annual chemical use during operation of the Pit Disassembly/Conversion Facility and the Plutonium Conversion Facility is listed in the classified appendix to this PEIS. Annual chemical use during operation of the Mixed Oxide Fuel Fabrication Facility is listed in Table C.2.2.2–1.

Table C.2.2.2–1. Chemicals Required During Operation of the Mixed Oxide Fuel Fabrication Facility

Chemicals	Annual Quantity
Solid (kg)	
Aluminum nitrate	<3
Burnable neutron absorbers (rare earth oxides)	2,000
Calcium fluoride	<90
Calcium metal	<3
Cobalt nitrate	<3
Iron, magnesium, calcium	<3
Magnesium oxide	<3
Magnesium oxide (sand)	<3
Oxalic acid	<910
Portland cement	<45,400
Resin (reillex)	<180
Sodium hydroxide	<91,000
Sodium nitrate	<180
Sucrose	<3
Urea	<90
Zinc stearate	<450
Liquid (kg)	
Ammonia	<23,000
Cleaning solvent	<23,000
Hydrofluoric acid	<230
Hydroxylamine nitrate	<2,300
Liquid nitrogen	<182,000
Nitric acid	<953,100
Gas (m^3)	
Argon	<283,000
Helium	<28,000
Hydrogen	<28,000

Note: kg=kilograms; m^3=cubic meters.
Source: LANL 1996b.

C.2.2.3 Plutonium Disposition Alternatives

Tables C.2.2.3–1 through C.2.2.3–7 list the annual chemical use during operation of facilities proposed for each of the Pu disposition alternatives under consideration.

Table C.2.2.3–1. Chemicals Required During Operation of the Deep Borehole Complex—Direct Disposition Alternative

Chemical	Annual Quantity
Solid (kg)	
Bentonite	90,700
Cements	3,630,000
Decontamination detergent	1,360
Kaolinite (sealant)	1,200,000
Nonionic polymers for cooling water	136
Phosphates and phosphonates for cooling water	907
Polymers	36,300
[Text deleted.]	
Silica flour	36,300
Sodium citrate	36,300
Liquid	NA
Gas	
Nitrogen	120 cylinders

Note: kg=kilograms; NA=not applicable.
Source: LLNL 1996a.

Table C.2.2.3–2. Chemicals Required During Operation of the Deep Borehole Complex—Immobilized Disposition Alternative

Chemical	Annual Quantity
Solid (kg)	
Bentonite	90,700
Cements	3,610,000
Cement additives	10,000
Decontamination detergent	5,440
Filler ceramic pellets	500,000
Nonionic polymers for cooling water	136
Phosphates and phosphonates for cooling water	907
Polymers	34,000
Silica flour	34,000
Sodium citrate	34,000
[Text deleted.]	
Liquid (kg)	
Decon detergent	703
Gas	
Nitrogen	500 cylinders

Note: kg=kilograms.
Source: LLNL 1996h.

Table C.2.2.3–3. Chemicals Required During Operation of the Ceramic Immobilization Facility—Immobilized Disposition Alternative

Chemical	Annual Quantity (kg)
Solid	
Cements	1,100
Ceramic precursors (as oxides)	500,000
Decontamination detergent	3,000
Gadolinium–as $Gd(NO_3)_3 6H_2O$	9,500
Nonionic polymers for cooling water	150
Pellet coating oxide	5,000
Phosphates for cooling water	750
Phosphonates for cooling water	150
Resins	140
Silver nitrate	430
Liquid	
Nitric acid	3,500
Pellet binder	11,000
Potassium hydroxide	110
Sodium hydroxide	1,800
Urea	8,600
Gas	
Helium	900
Nitrogen	9,000

Note: kg=kilograms.
Source: LLNL 1996e.

Table C.2.2.3–4. Chemicals Required During Operation of the Vitrification Alternative

Chemical	Annual Quantity (kg)
Solid	
Borosilicate glass frit	95,500
Neutron absorber	3,400
Sodium hydroxide	4,545
Liquid	
Nitric acid	28,550
Gas	
Nitrogen	530
Welding gases	4,550[a]

[a] Assumes 200 cylinders (50 pounds each).
Note: kg=kilograms.
Source: LLNL 1996c.

Table C.2.2.3–5. Chemicals Required During Operation of the Ceramic Immobilization Alternative

Chemical	Annual Quantity (kg)
Solid	
Cements	730
Ceramic precursors	32,000
Decontamination detergent	2,000
Gadolinium	7,300
Nonionic polymers for cooling water	100
Phosphates for cooling water	500
Phosphonates for cooling water	100
Resins	120
Silver nitrate	250
Titanium oxide	26,000
Titanium metal	830
Liquid	
Nitric acid	3,500
Potassium hydroxide	110
Sodium hydroxide	1,800
Urea	8,600
Gas	
Welding gases	4,550[a]

[a] Assumes 200 cylinders (50 pounds each).

Note: kg=kilograms.

Source: LLNL 1996d.

Table C.2.2.3–6. Chemicals Required During Operation of the Electrometallurgical Treatment Alternative (Glass-Bonded Zeolite)

Chemical	Annual Quantity (kg)
Solid	
Cesium Chloride Salt in Steel Capsules	64
Potassium/Lithium/ Gadolinium Chloride Salts	34,000
Zeolite, Glass	77,000
Liquid	NA
Gas	NA

Note: kg=kilograms; NA=not applicable.

Source: LLNL 1996b.

Table C.2.2.3–7. Chemicals Required During Operation of the Evolutionary Light Water Reactor Alternative

Chemical	Annual Quantity (t)	
	Single Large Evolutionary LWR	**Single Small Evolutionary LWR**
Solid		
Aluminum oxide	2	1
Inconel	1	1
Lithium carbonate	1	1
Stainless steel	8	4
Zircalloy	21	11
Liquid		
Nitric acid	953	545
Water treatment chemicals[a]	907	499
Gas		
Ammonia	23	12
Argon	33	18
Hydrogen	1	1
Nitrogen	331	182

[a] Includes aluminum sulfate, bentonite, chlorine, diethylaminoethanol, hydrazine, inorganic phosphate, phosphoric acid, polyelectrolyte, polyphosphate, sodium sulphite, and sulfuric acid. May be solid, liquid, or gas.

Note: LWR=light water reactor; t=metric tons.

Source: LLNL 1996g.

C.2.3 PERSONNEL REQUIREMENTS

The tables in this section show annual employment requirements during operation of facilities proposed for the various storage and disposition alternatives.

C.2.3.1 Long-Term Storage Alternatives

Annual personnel requirements to operate long-term storage facilities under the upgrade, consolidation, and collocation alternatives are listed in Tables C.2.3.1–1, C.2.3.1–2, and C.2.3.1–3.

Table C.2.3.1–1. Employment Required During Operation of the Upgrade Alternative

	Number of Employees				
Labor Category	**Hanford**	**INEL**	**Pantex**	**ORR**	**SRS**
Officials and managers	31	10	2	14	NA
Professionals	28	17	17	25	NA
Technicians	84	33	25	16	NA
Office and clerical	15	7	5	12	NA
Craft workers	0	1	10	36	NA
Operators	30	3	27	8	NA
Laborers	0	1	0	0	NA
Service workers	37	9	4	0	NA
Total Employment Without RFETS Pu or LANL Pu Material	225	81	90	111	NA[a]
Total Employment With All or Some RFETS Pu and LANL Pu Material	252	116	509[b]	NA[c]	30
Total Employment With RFETS Non-Pit Pu Material	NA	NA	NA	NA	30
Total Employment With RFETS Pits	NA	NA	90	NA	NA

[a] This subalternative does not apply to SRS.

[b] Values shown are based on an upgrade alternative designed to accommodate the Consolidation Alternative Option to Modify Existing and Construct New Facilities in Zone 12 South.

[c] ORR is not eligible to receive RFETS or LANL Pu Material under this upgrade subalternative.

Note: NA=not applicable.

Source: HF DOE 1995e:1; IN DOE 1996a; OR MMES 1996a; PX DOE 1996a; PX MH 1994a; SRS 1996a:4; WSRC 1995e.

Table C.2.3.1–2. Employment Required During Operation of the Consolidation Alternative

Labor Category	Number of Employees: Hanford	NTS: New Pu Storage Facility	NTS: Modify P-Tunnel	INEL	Pantex: New Pu Storage Facility	Pantex: New and Modified Zone 12 South Facilities	SRS
Officials and managers	45	50	52	45	51	53	50
Professionals	84	84	89	84	84	90	84
Technicians[a]	124.5	129.5	128.5	124.5	129.5	149	129.5
Office and clerical	34	43	42	34	43	48	46
Craft workers	40	40	42	40	40	41	40
Operators[a]	33.5	43.5	38.5	33.5	33.5	31	33.5
Laborers	8	8	8	8	8	9	8
Service workers	74	94	127	63	84	88	94
Total Employment	443	492	527	432	471	509	485

[a] Values reflected in this table are for full-time equivalent person-year.
Source: DOE 1996e; NT DOE 1996a; PX DOE 1996a.

Table C.2.3.1–3. Employment Required During Operation of the Collocation Alternative

Labor Category	Number of Employees: Hanford	NTS: New Pu and HEU Storage Facility	NTS: Modify P-Tunnel	INEL	Pantex	ORR: New Pu and HEU Storage Facility	ORR: New Pu Storage Facility Only[a]	SRS
Officials and managers	60	66	64	60	65	60	51	65
Professionals	106	106	102	106	106	107	85	106
Technicians[b]	148.5	153.5	154	148.5	153.5	146.5	122.5	153.5
Office and clerical	36	45	46	36	45	36	34	48
Craft workers	54	54	59	54	54	54	40	54
Operators[b]	52.5	62.5	55	52.5	52.5	58.5	39.5	52.5
Laborers	17	17	11	17	17	17	8	17
Service workers	98	118	150	87	108	87	63	118
Total Employment	572	622	641	561	601	566	443	614

[a] The operation employment required for the Upgrade Alternative at ORR (Table C.2.3.1–1) is added to obtain the total operation employment required for the Collocation Alternative Option to construct a New Pu Storage Facility at ORR and modify existing HEU Storage Facilities at Y–12 Plant.
[b] Values reflected in this table are for full-time equivalent person-year.
Source: DOE 1996e; DOE 1996f; NT DOE 1996a.

C.2.3.2 Activities Common to Multiple Plutonium Disposition Alternatives

Annual personnel requirements to operate facilities that perform precursor activities on Pu prior to certain disposition alternatives are provided in Tables C.2.3.2–1, C.2.3.2–2, and C.2.3.2–3.

Table C.2.3.2–1. Employment Required During Operation of the Pit Disassembly/Conversion Facility

Labor Category	Number of Employees
Officials and managers	80
Professionals	240
Technicians	65
Office and clerical	30
Craft workers	80
Operators	290
Laborers	15
Service workers	30
Total Employment	830

Note: Change from Draft PEIS reflects increase in throughput to 3.25 MT/yr.
Source: LANL 1996d.

Table C.2.3.2–2. Employment Required During Operation of the Plutonium Conversion Facility

Labor Category	Number of Employees
Officials and managers	114
Professionals	88
Technicians	63
Office and clerical	117
Craft workers	129
Operators	186
Laborers	93
Service workers	93
Total Employment	883

Source: LANL 1996c.

Table C.2.3.2–3. Employment Required During Operation of the Mixed Oxide Fuel Fabrication Facility

Labor Category	Number of Employees
Officials and managers	80
Professionals	40
Technicians	40
Office and clerical	50
Craft workers	140
Operators	100
Laborers	20
Service workers	30
Total Employment	500

Note: Change from Draft PEIS reflects increased capability to process increased throughput from Pit Disassembly/ Conversion Facility.

Source: LANL 1996b.

C.2.3.3 Plutonium Disposition Alternatives

Annual personnel requirements to operate facilities proposed for each of the Pu disposition alternatives under consideration are provided in Tables C.2.3.3–1 through C.2.3.3–7.

Table C.2.3.3–1. Employment Required During Operation of the Deep Borehole Complex—Direct Disposition Alternative

Labor Category	Number of Employees
Officials and managers	23
Professionals	45
Technicians	40
Office and clerical	8
Craft workers	82
Operators	98
Laborers	6
Service workers	40
Total Employment	342

Source: LLNL 1996a.

Table C.2.3.3–2. Employment Required During Operation of the Deep Borehole Complex—Immobilized Disposition Alternative

Labor Category	Number of Employees
Officials and managers	21
Professionals	31
Technicians	55
Office and clerical	4
Craft workers	42
Operators/line supervisors	85
Laborers	2
[Text deleted.]	
Service workers	40
Total Employment	280

Source: LLNL 1996h.

Table C.2.3.3–3. Employment Required During Operation of the Ceramic Immobilization Facility—Immobilized Disposition Alternative

Labor Category	Number of Employees
Officials and managers	40
Professionals	40
Technicians	100
Office and clerical	20
Craft workers	180
Operators/line supervisors	300
[Text deleted.]	
Safeguards and security	220
[Text deleted.]	
Total Employment	900

Source: LLNL 1996e.

Table C.2.3.3–4. Employment Required During Operation of the Vitrification Alternative

Labor Category	Number of Employees
Officials and managers	10
Professionals	65
Technicians	60
Office and clerical	50
Craft workers	125
Operators	250
Laborers	50
Safeguards and security	158
Total Employment	768

Source: LLNL 1996c.

Table C.2.3.3–5. Employment Required During Operation of the Ceramic Immobilization Alternative

Labor Category	Number of Employees
Officials and managers	40
Professionals	40
Technicians	90
Office and clerical	20
Craft workers	170
Operators/line supervision	280
Safeguards and security	220
Total Employment	860

Source: LLNL 1996d.

Table C.2.3.3–6. Employment Required During Operation of the Electrometallurgical Treatment Alternative (Glass-Bonded Zeolite)

Labor Category	Number of Employees
Officials and managers	5
Professionals	15
Technicians	14
Office and clerical	5
Operators/line supervisors	37
Safeguards and security	7
Total Employment	83

Source: LLNL 1996b.

Table C.2.3.3–7. Employment Required During Operation of the Evolutionary Light Water Reactor Alternative

	Number of Employees	
Labor Category	Single Large Evolutionary LWR	Single Small Evolutionary LWR
Officials and managers	130	70
Professionals	300	180
Technicians	200	120
Office and clerical	20	10
Craft workers	40	30
Operators	80	50
Laborers	10	10
Service workers	50	30
Total Employment	830	500

Source: LLNL 1996g.

Appendix D
Water Usage

This appendix provides information on overall water usage for the storage and disposition facilities covered by this programmatic environmental impact statement. This information is portrayed in a single water balance diagram for each facility. Gross quantities for intakes to the facility, and effluents from it, are provided. No quantities are estimated internal to the facility, but pathways are shown. Intakes are assumed to be from groundwater, surface water, and rainwater (stormwater).

D.1 STORAGE ALTERNATIVES

The water balance diagrams with flow rates in liter/year (l/yr) in Figure D.1–1 to D.1–20 for the plutonium (Pu) and highly enriched uranium (HEU) storage alternatives are organized into three groups: modification of existing and/or construction of new storage facilities, consolidated Pu storage facilities, and collocated Pu and HEU storage facilities. Figures within each group are arranged in the following order: Hanford Site (Hanford), Nevada Test Site (NTS), Idaho National Engineering Laboratory (INEL), the Pantex Plant (Pantex), Oak Ridge Reservation (ORR), and Savannah River Site (SRS). The Preferred Alternative for the long-term storage of surplus Pu involves a combination of upgrade (Pantex, ORR, and SRS), No Action (Hanford, NTS, INEL, and Los Alamos National Laboratory), and phaseout (Rocky Flats Environmental Technology Site).

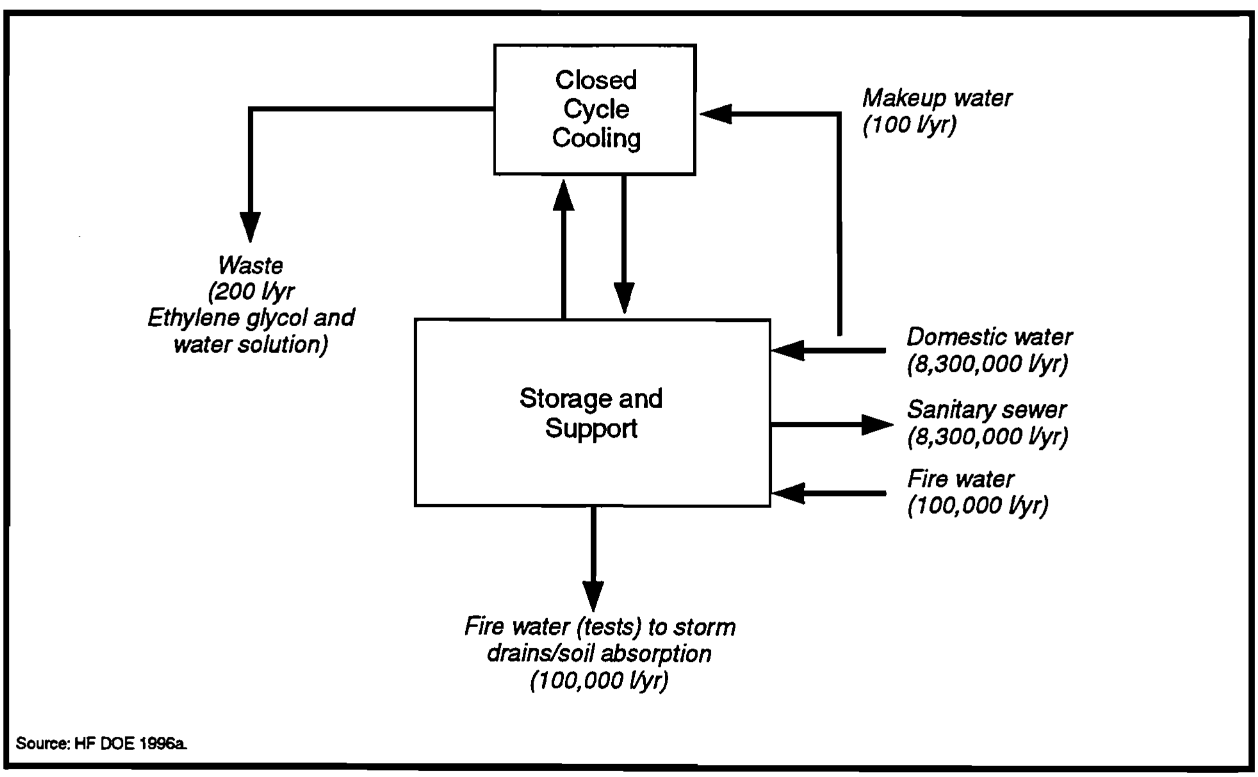
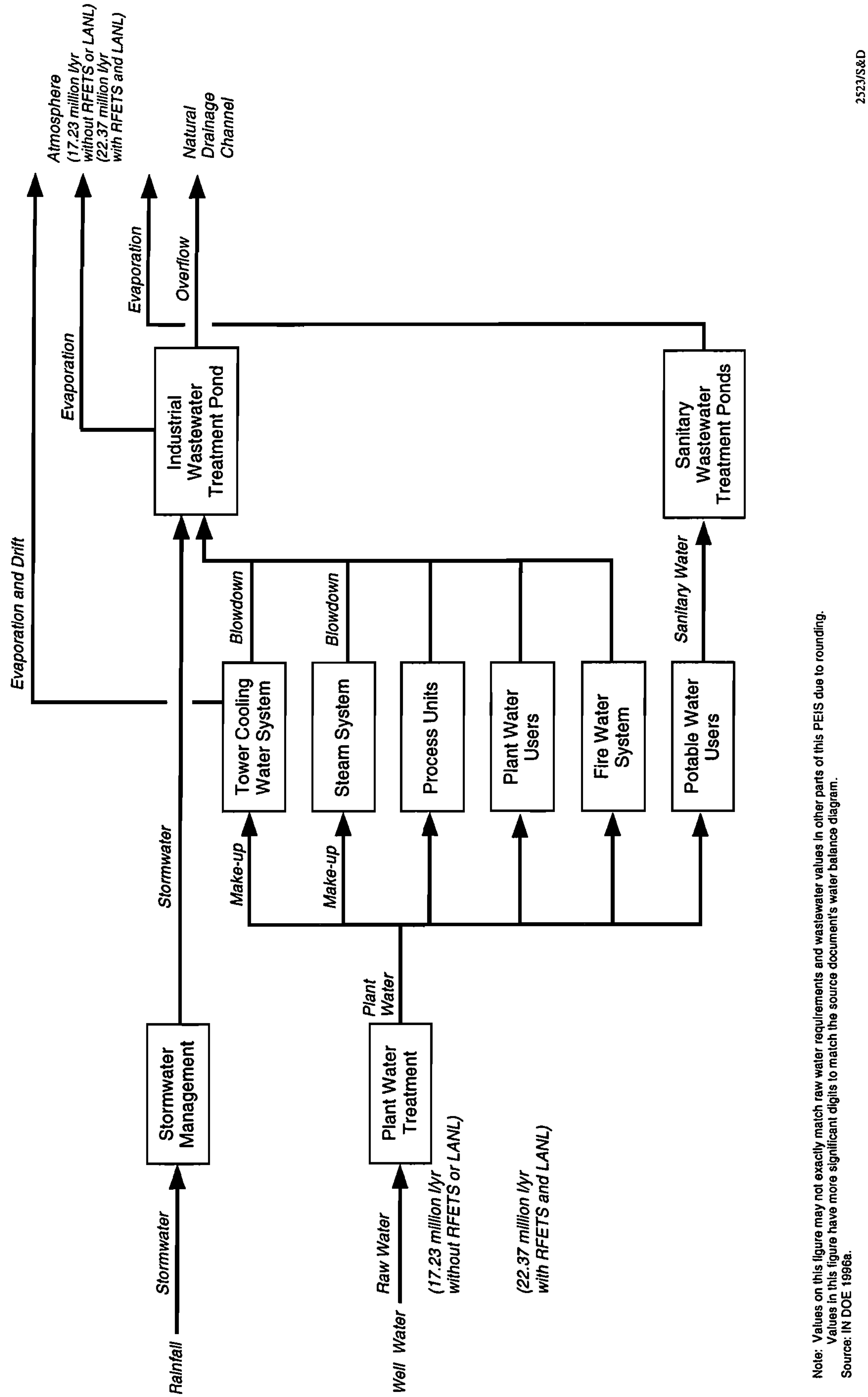
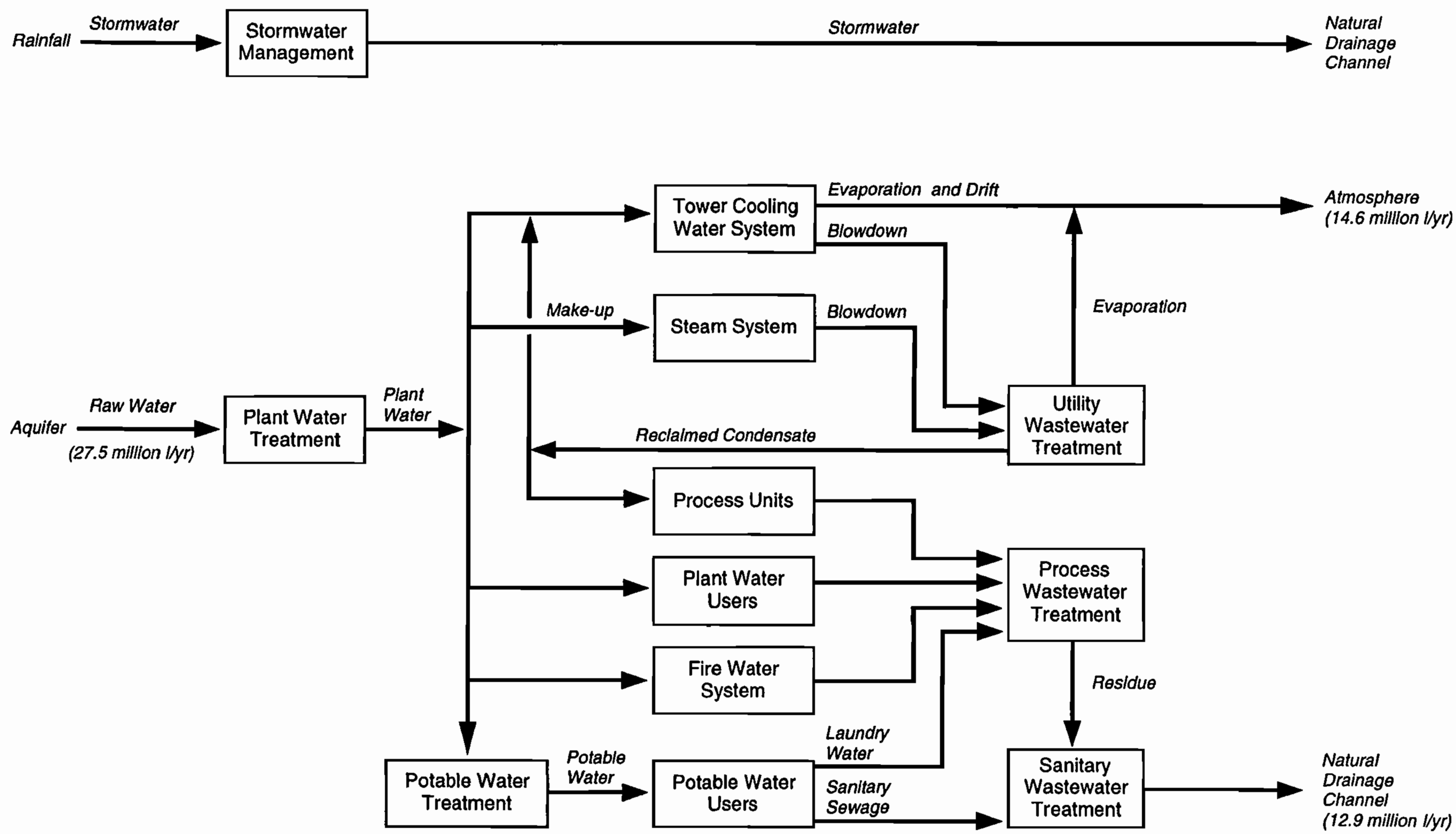


Figure D.1–1. Annual Water Balance for the Upgrade Alternative at Hanford Site.



Note: Values on this figure may not exactly match raw water requirements and wastewater values in other parts of this PEIS due to rounding.
Values in this figure have more significant digits to match the source document's water balance diagram.
Source: IN DOE 1996a.

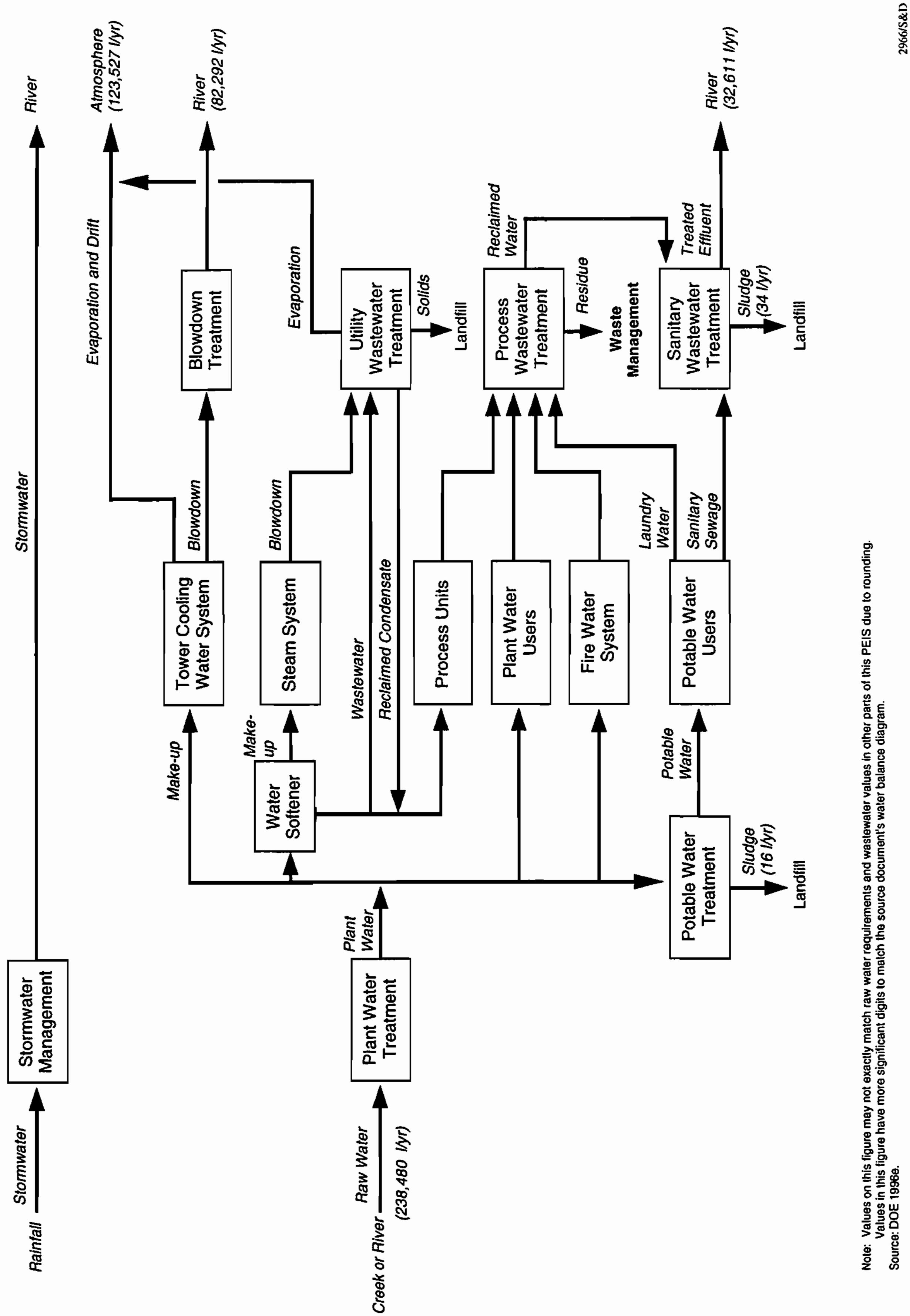
Figure D.1–2. Annual Water Balance for the Upgrade Alternative at Idaho National Engineering Laboratory, Argonne National Laboratory–West.



Note: Values on this figure may not exactly match raw water requirements and wastewater values in other parts of this PEIS due to rounding.
Values in this figure have more significant digits to match the source document's water balance diagram.
Source: PX MH 1994a.

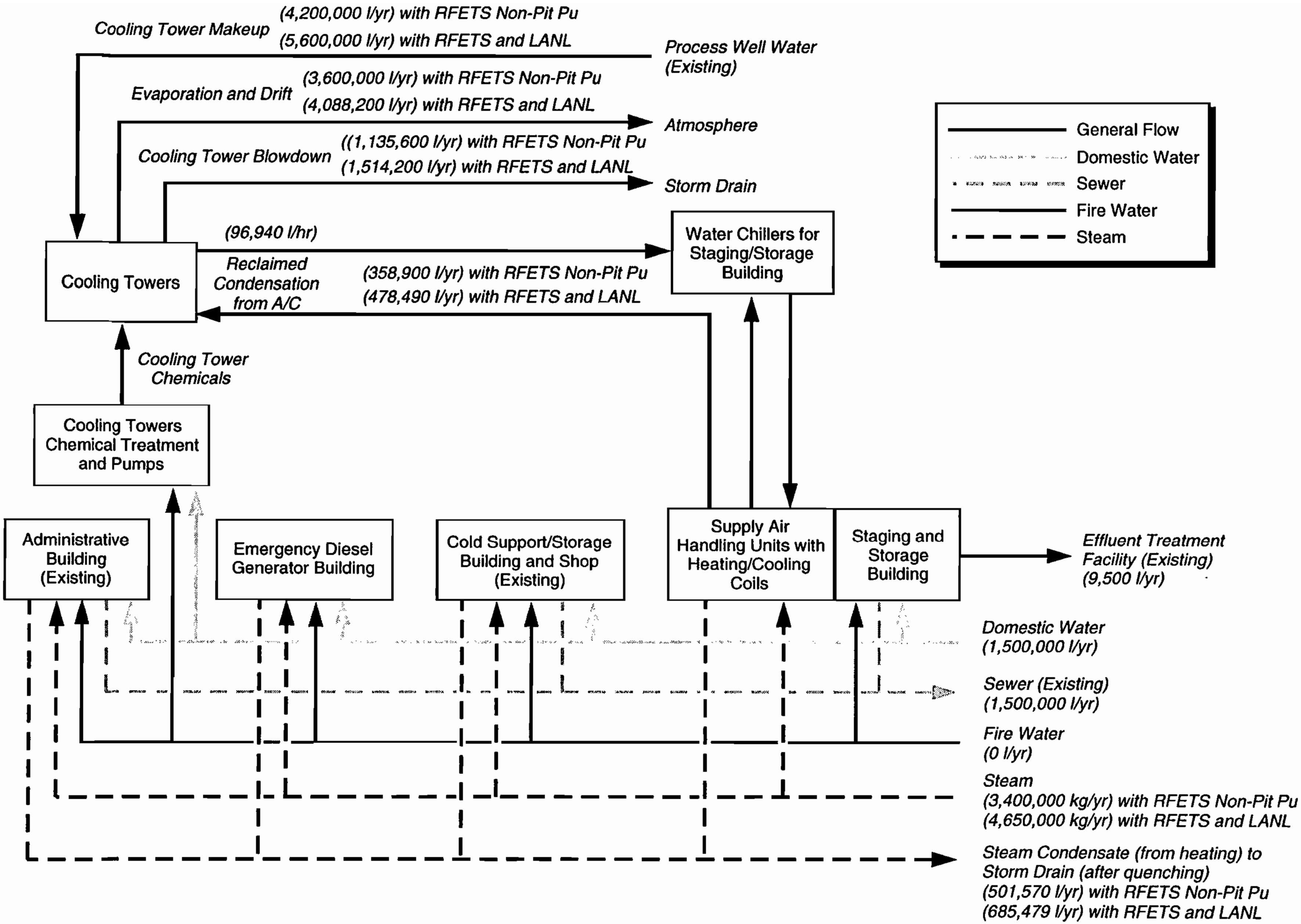
2965/S&D

Figure D.1–3. Annual Water Balance for the Upgrade Alternative at Pantex Plant.



Note: Values on this figure may not exactly match raw water requirements and wastewater values in other parts of this PEIS due to rounding.
Values in this figure have more significant digits to match the source document's water balance diagram.
Source: DOE 1996e.

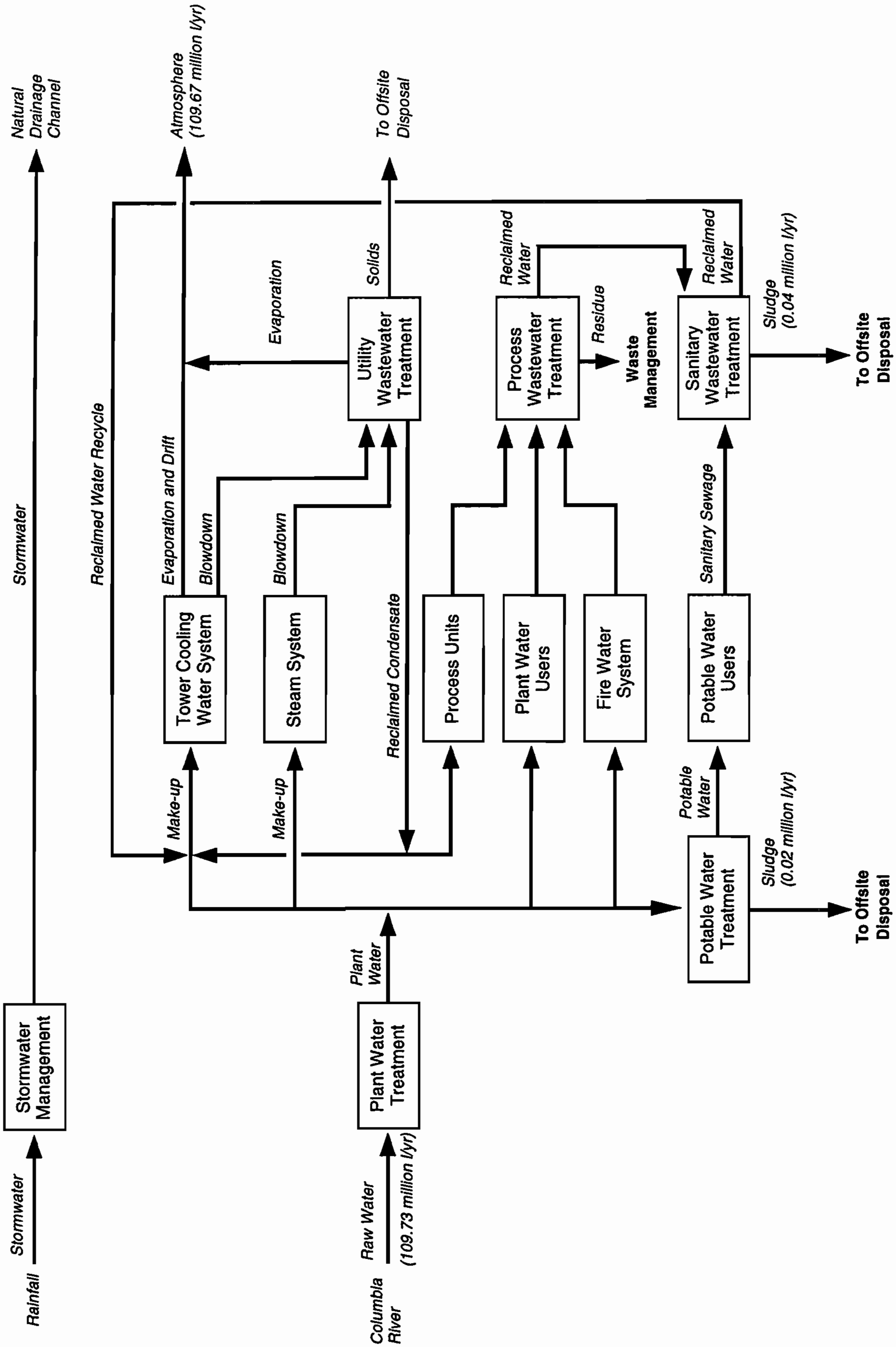
Figure D.1–4. Annual Water Balance for the Upgrade Alternative at Oak Ridge Reservation, Y–12 Plant.



Note: All values are with RFETS Pu and LANL Pu; values on this figure may not exactly match raw water requirements and wastewater values in other parts of this PEIS due to rounding. Values in this figure have more significant digits to match the source document's water balance diagram.
Source: SR DOE 1994e; SRS 1996a:4; WSRC 1995e.

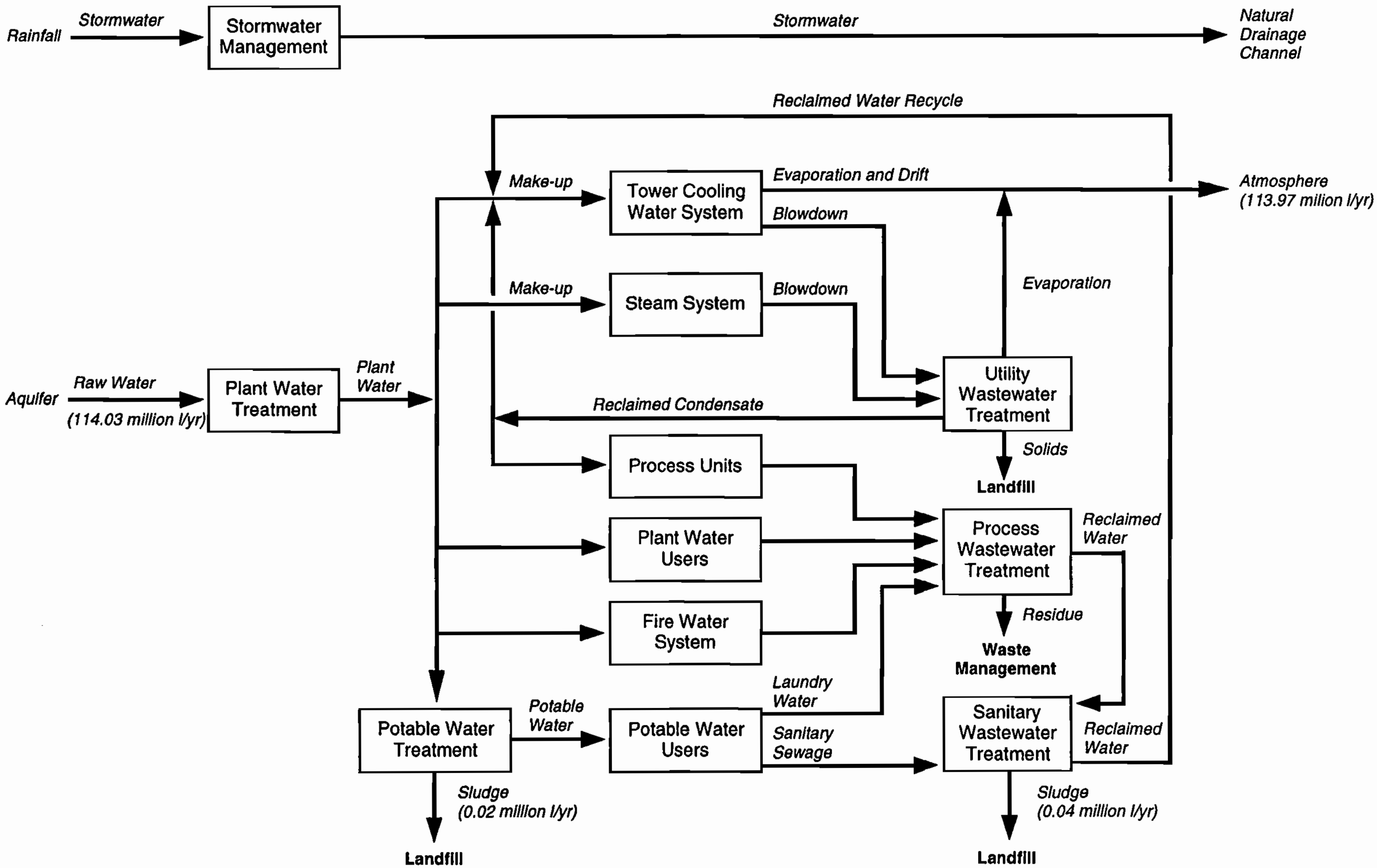
2471/S&D

Figure D.1–5. Annual Water Balance for the Upgrade Alternatives at Savannah River Site.



Note: Values on this figure may not exactly match raw water requirements and wastewater values in other parts of this PEIS due to rounding. Values in this figure have more significant digits to match the source document's water balance diagram.
Source: DOE 1996e.

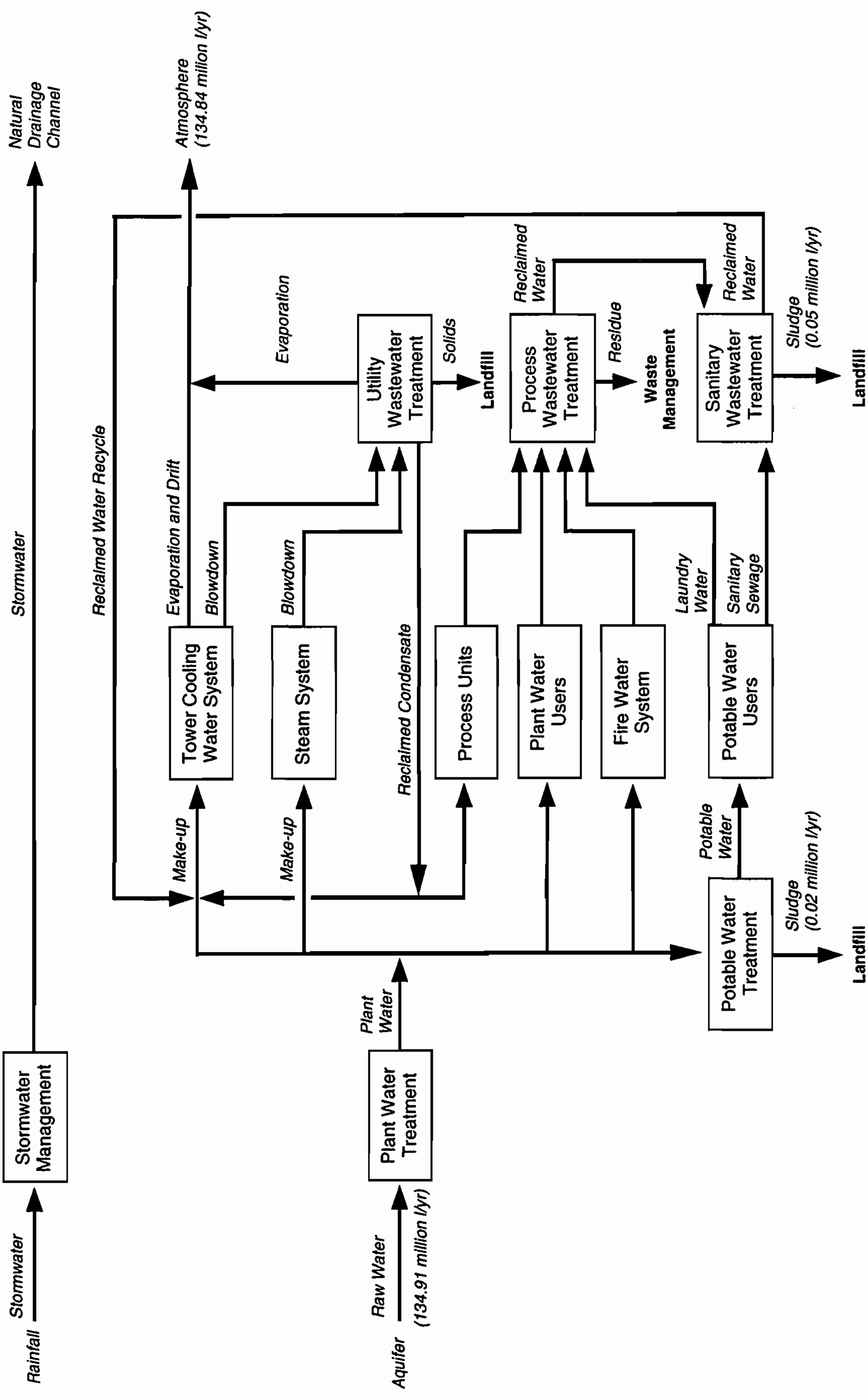
Figure D.1–6. Annual Water Balance for the Consolidation Alternative at Hanford Site.



Note: Values on this figure may not exactly match raw water requirements and wastewater values in other parts of this PEIS due to rounding.
Values in this figure have more significant digits to match the source document's water balance diagram.
Source: DOE 1996e.

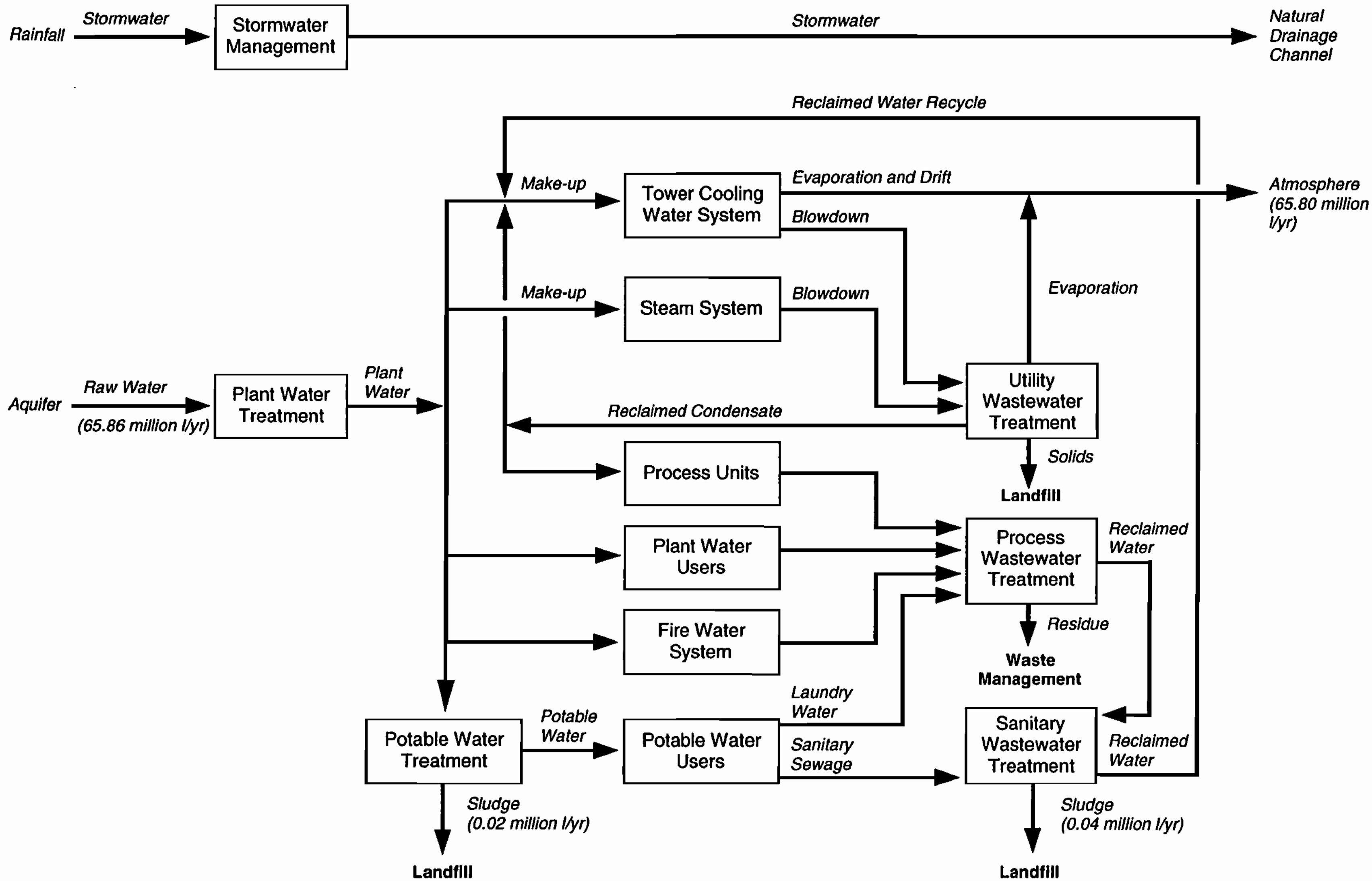
2496/S&D

Figure D.1–7. Annual Water Balance for the Consolidation Alternative Constructing a New Facility at Nevada Test Site.



Note: Values on this figure may not exactly match raw water requirements and wastewater values in other parts of this PEIS due to rounding.
Values in this figure have more significant digits to match the source document's water balance diagram.
Source: NT DOE 1996a.

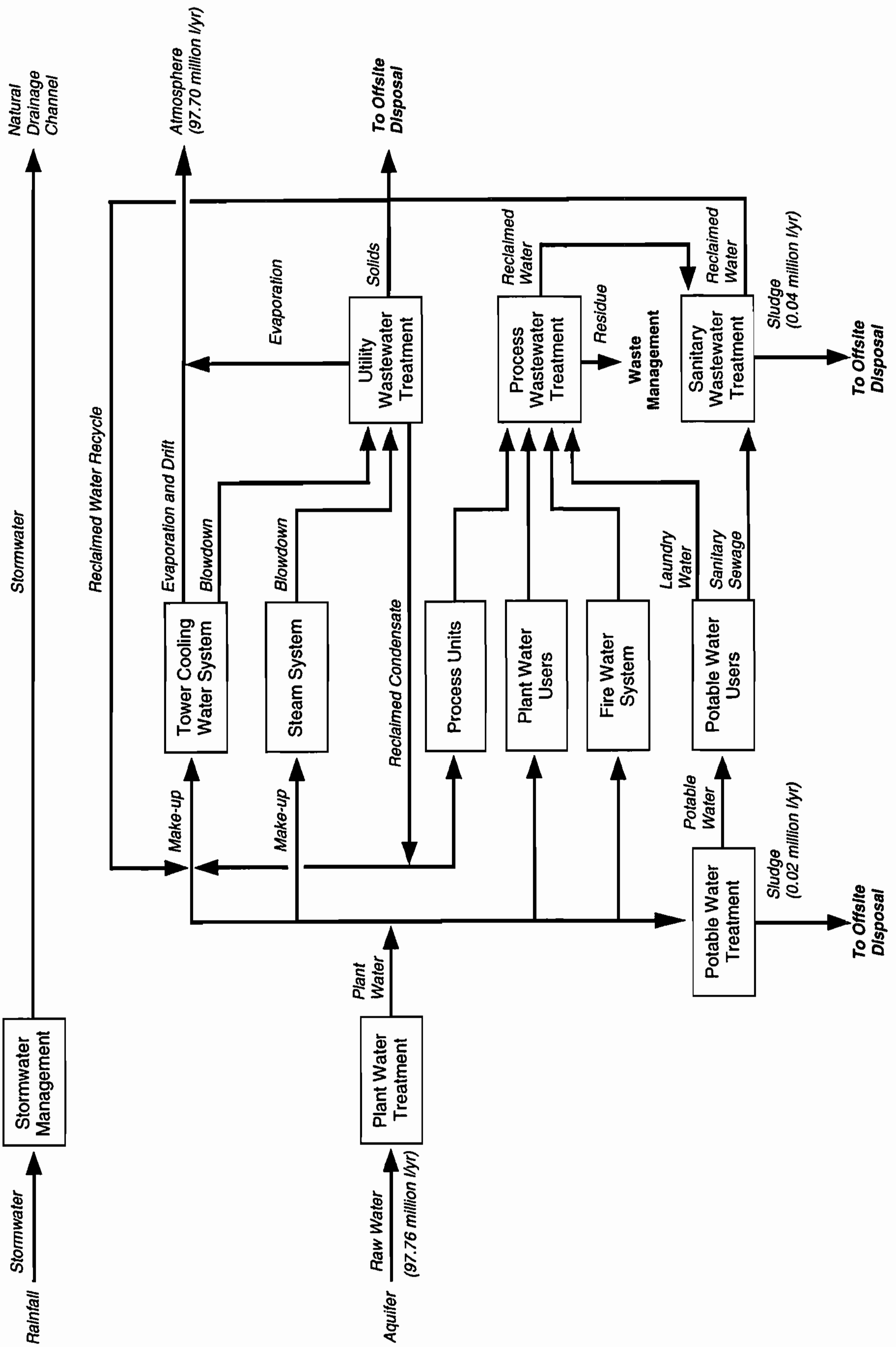
Figure D.1–8. Annual Water Balance for the Consolidation Alternative Modifying P-Tunnel at Nevada Test Site.



Note: Values on this figure may not exactly match raw water requirements and wastewater values in other parts of this PEIS due to rounding.
Values in this figure have more significant digits to match the source document's water balance diagram.
Source: DOE 1996e.

2495/S&D

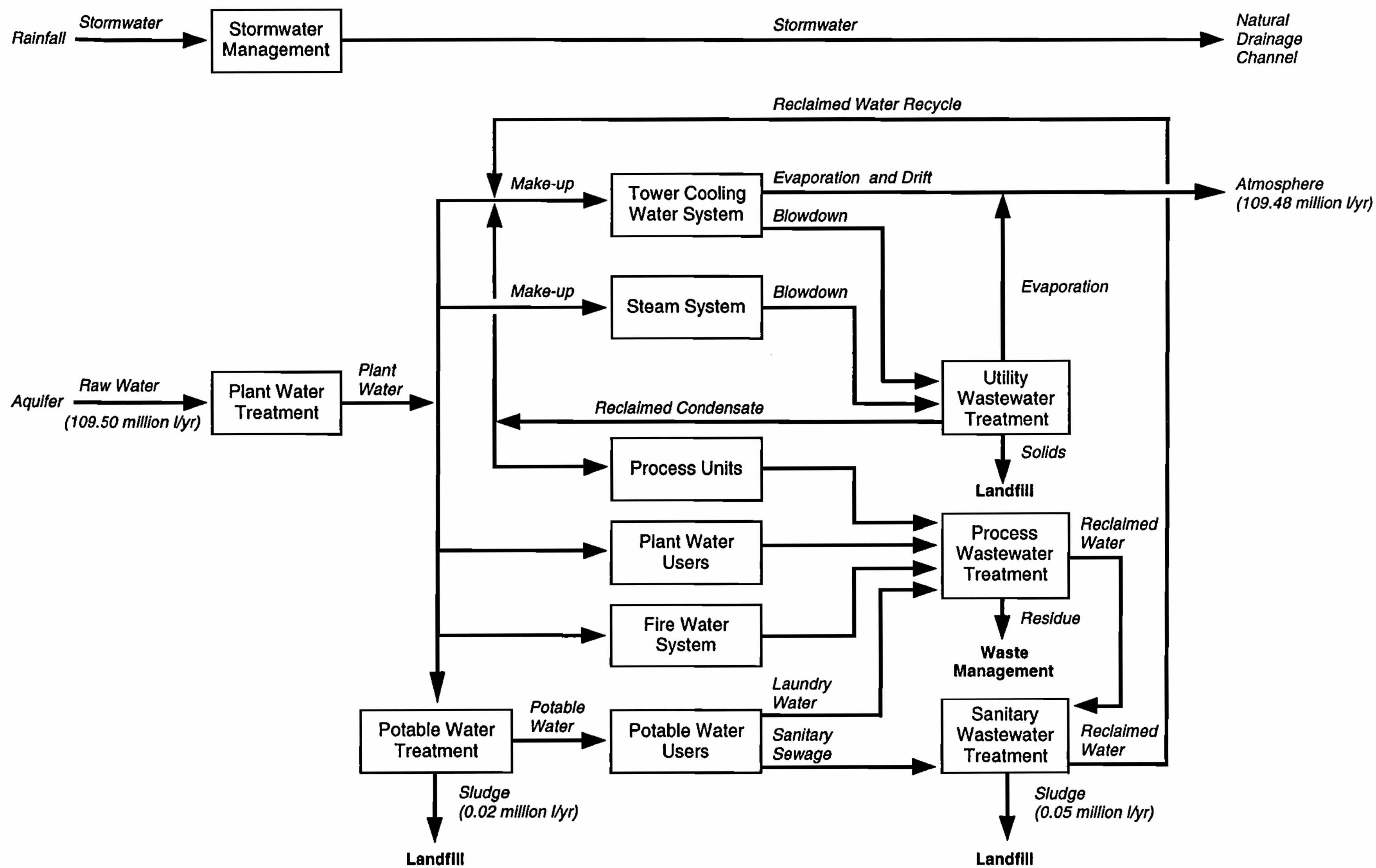
Figure D.1–9. Annual Water Balance for the Consolidation Alternative at Idaho National Engineering Laboratory.



Note: Values on this figure may not exactly match raw water requirements and wastewater values in other parts of this PEIS due to rounding.
Values in this figure have more significant digits to match the source document's water balance diagram.
Source: DOE 1996e.

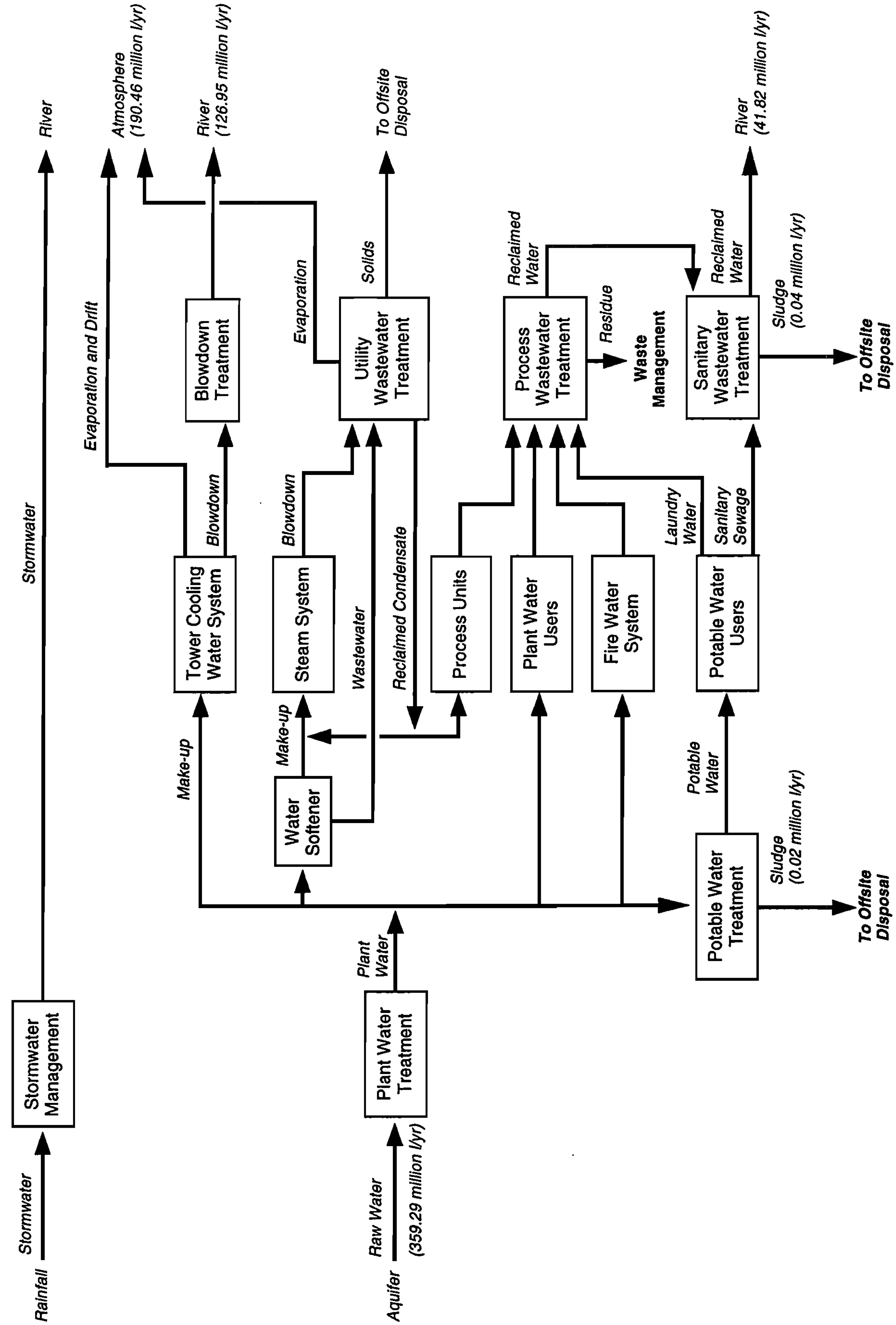
249R/S&1)

Figure D.1–10. Annual Water Balance for the Consolidation Alternative Constructing a New Facility at Pantex Plant.



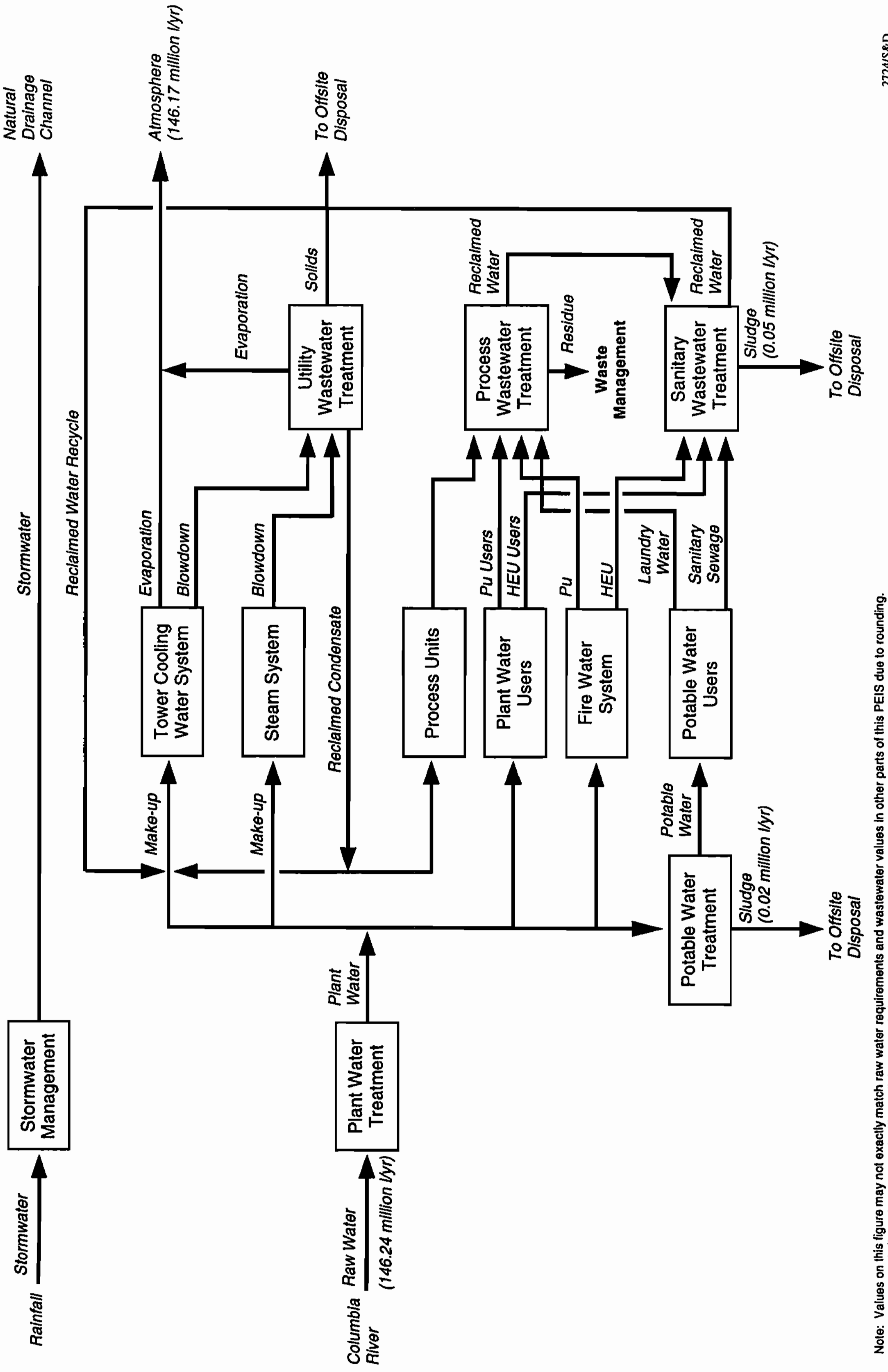
Note: Values on this figure may not exactly match raw water requirements and wastewater values in other parts of this PEIS due to rounding.
Values in this figure have more significant digits to match the source document's water balance diagram.
Source: PX DOE 1996a.

Figure D.1–11. Annual Water Balance for the Consolidation Alternative Modifying Zone 12 South at Pantex Plant.



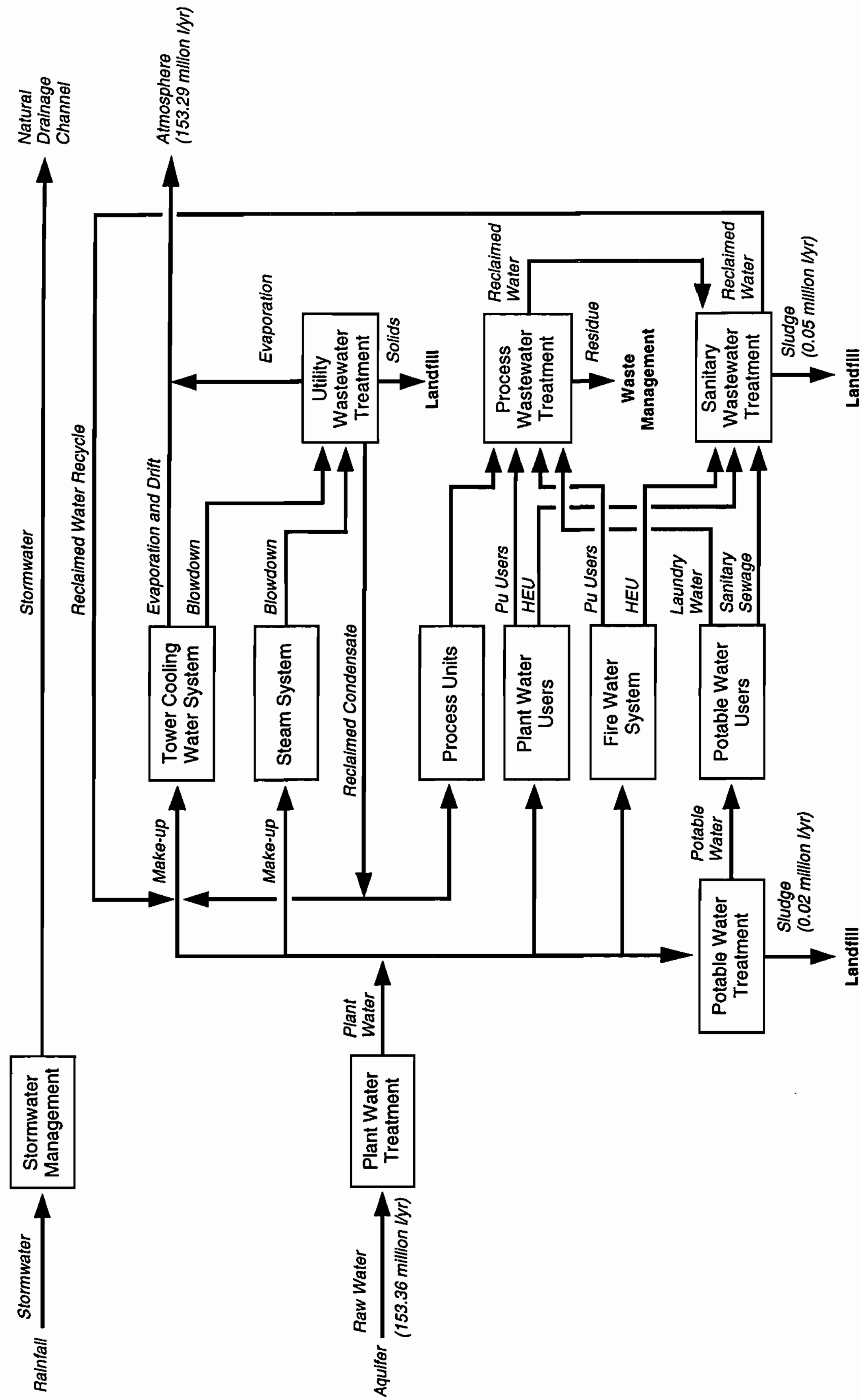
Note: Values on this figure may not exactly match raw water requirements and wastewater values in other parts of this PEIS due to rounding. Values in this figure have more significant digits to match the source document's water balance diagram.
Source: DOE 1996e.

Figure D.1–12. Annual Water Balance for the Consolidation Alternative at Savannah River Site.



Note: Values on this figure may not exactly match raw water requirements and wastewater values in other parts of this PEIS due to rounding.
Values in this figure have more significant digits to match the source document's water balance diagram.
Source: DOE 1996f.

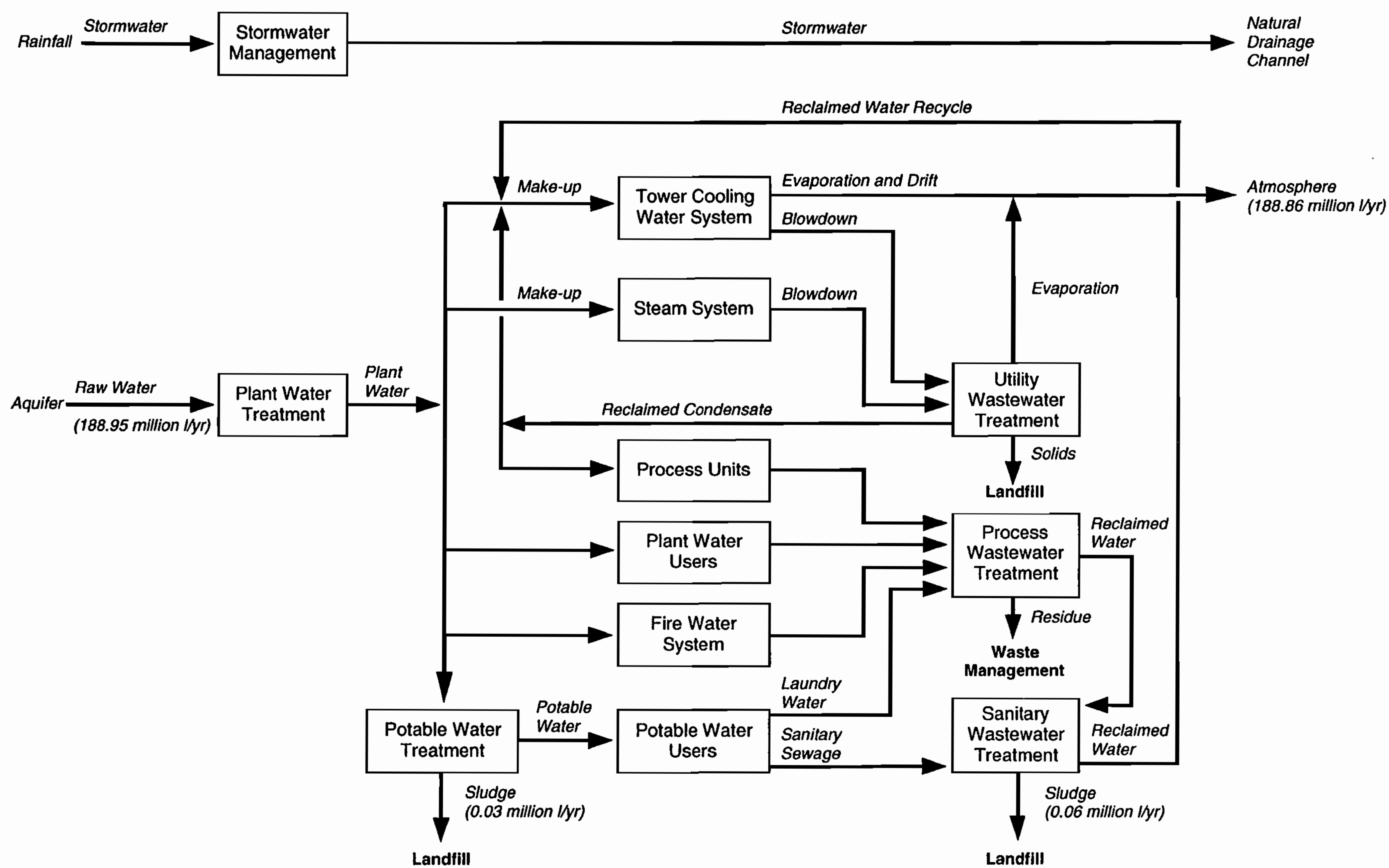
Figure D.1–13. Annual Water Balance for the Collocation Alternative at Hanford Site.



2482/S&D

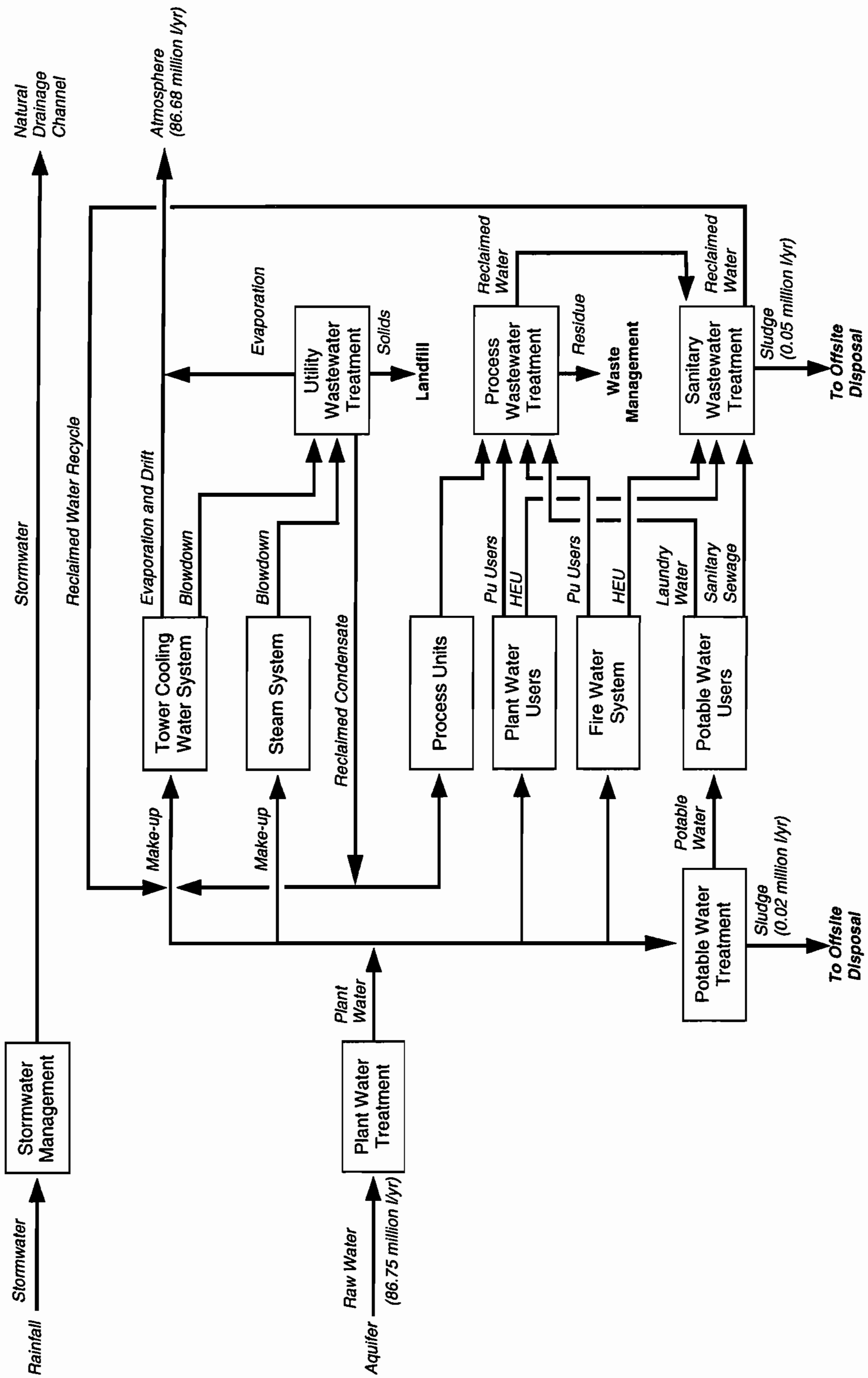
Note: Values on this figure may not exactly match raw water requirements and wastewater values in other parts of this PEIS due to rounding. Values in this figure have more significant digits to match the source document's water balance diagram.
Source: DOE 1996f.

Figure D.1–14. Annual Water Balance for the Collocation Alternative Constructing a New Facility at Nevada Test Site.



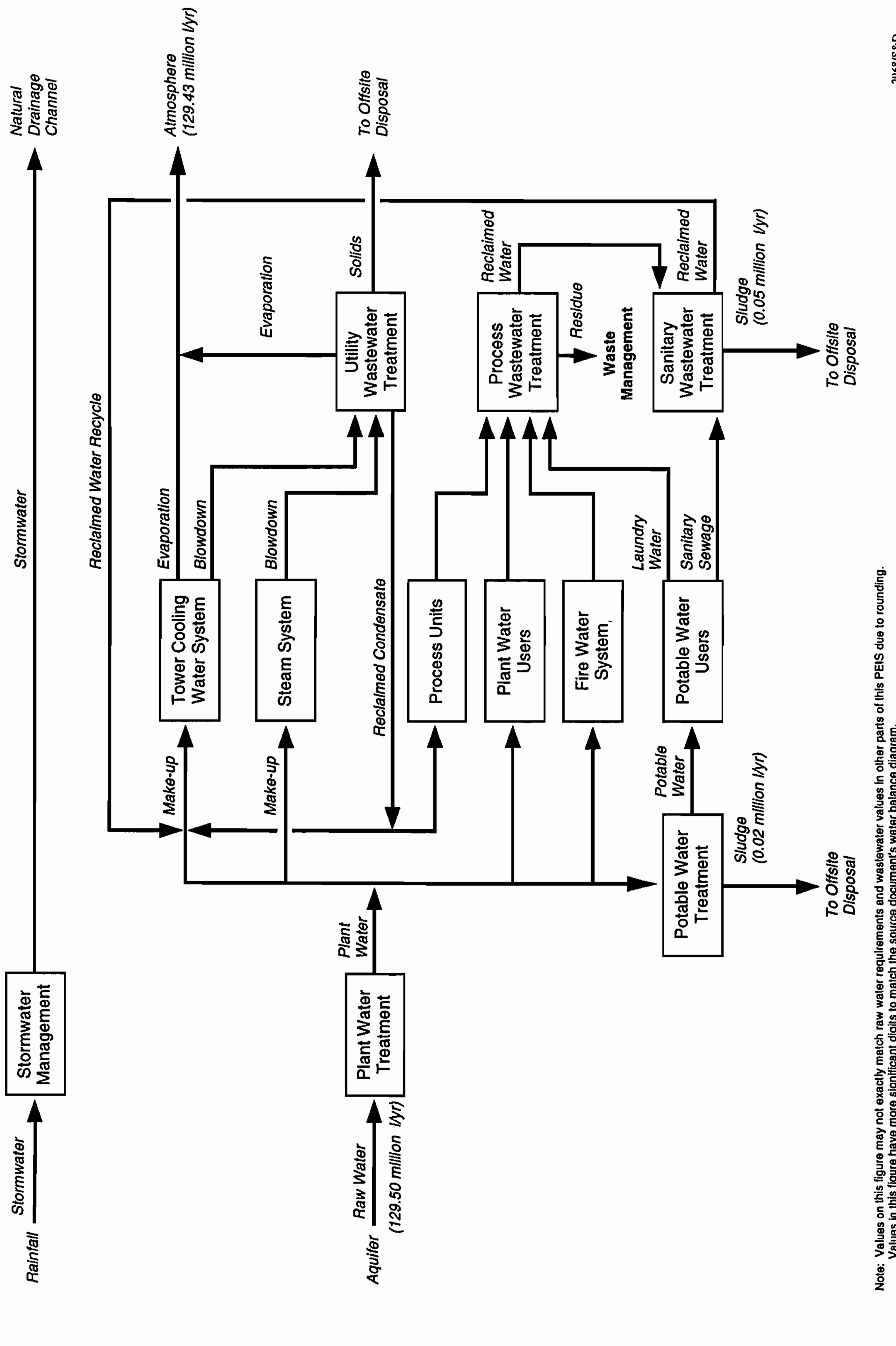
Note: Values on this figure may not exactly match raw water requirements and wastewater values in other parts of this PEIS due to rounding.
Values in this figure have more significant digits to match the source document's water balance diagram.
Source: NT DOE 1996a.

Figure D.1–15. Annual Water Balance for the Collocation Alternative Modifying P-Tunnel at Nevada Test Site.



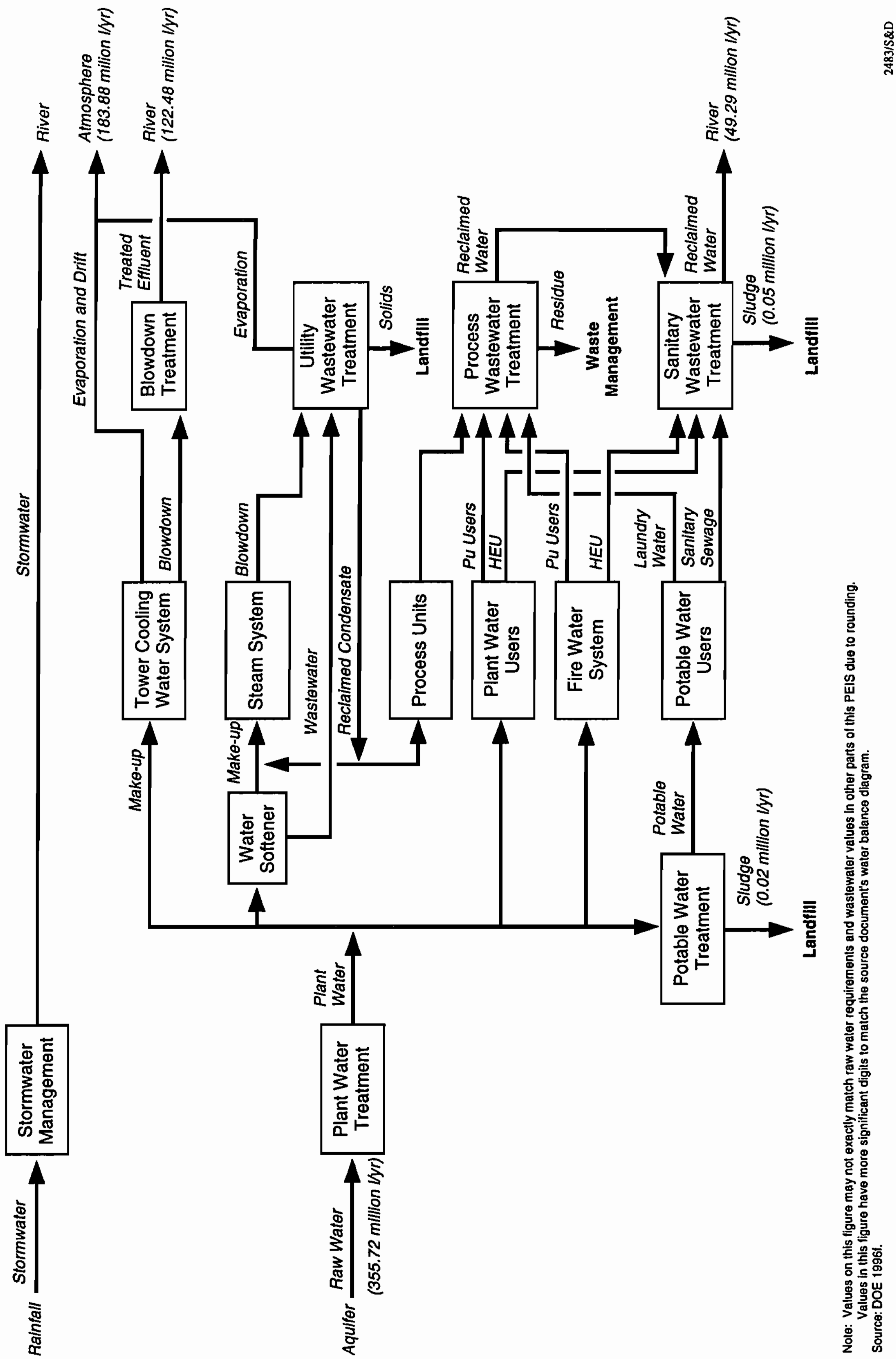
Note: Values on this figure may not exactly match raw water requirements and wastewater values in other parts of this PEIS due to rounding.
Values in this figure have more significant digits to match the source document's water balance diagram.
Source: DOE 1996f.

Figure D.1–16. Annual Water Balance for the Collocation Alternative at Idaho National Engineering Laboratory.



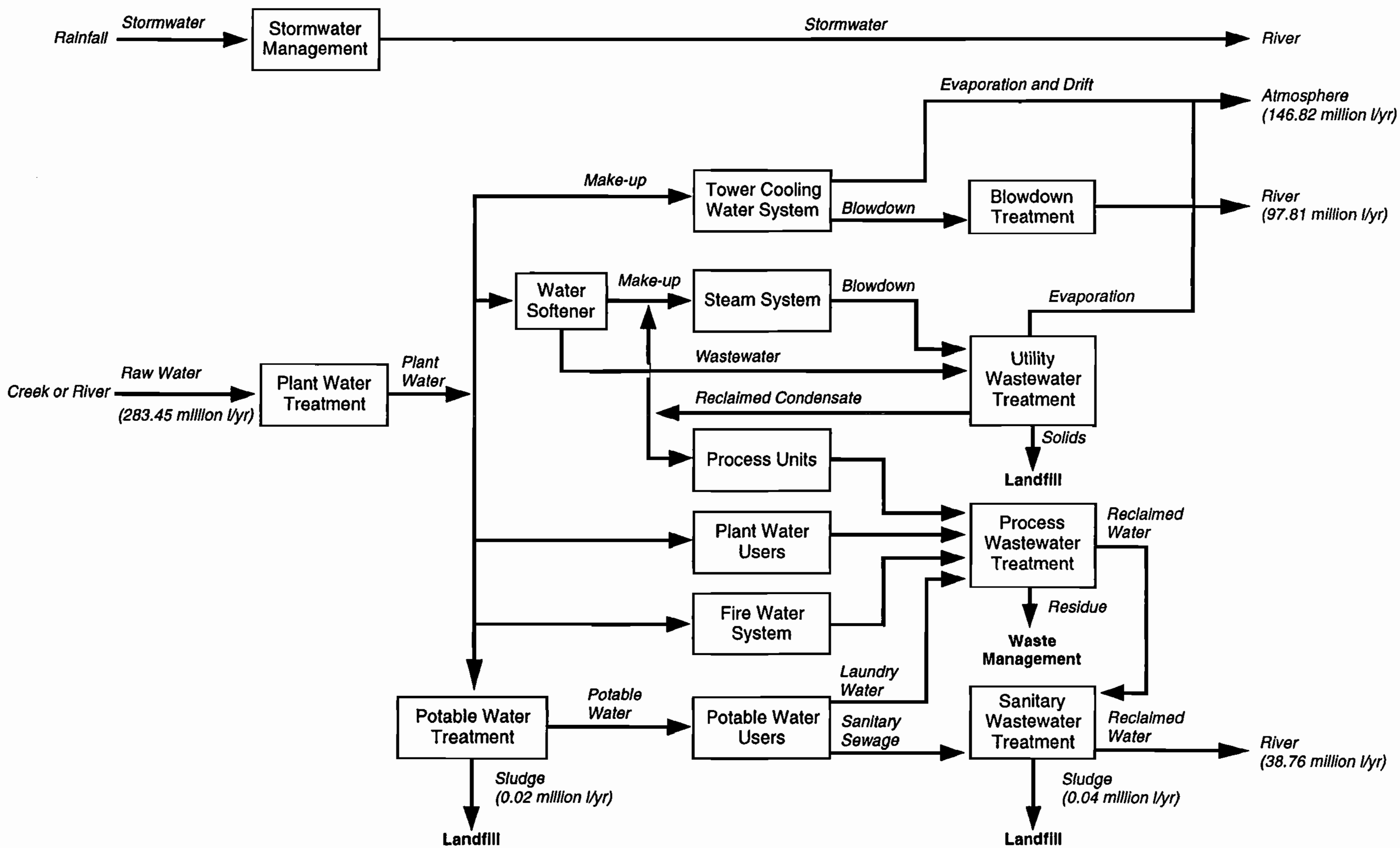
Note: Values on this figure may not exactly match raw water requirements and wastewater values in other parts of this PEIS due to rounding. Values in this figure have more significant digits to match the source document's water balance diagram.
Source: DOE 1996f.

Figure D.1–17. Annual Water Balance for the Collocation Alternative at Pantex Plant.



Note: Values on this figure may not exactly match raw water requirements and wastewater values in other parts of this PEIS due to rounding.
Values in this figure have more significant digits to match the source document's water balance diagram.
Source: DOE 1996f.

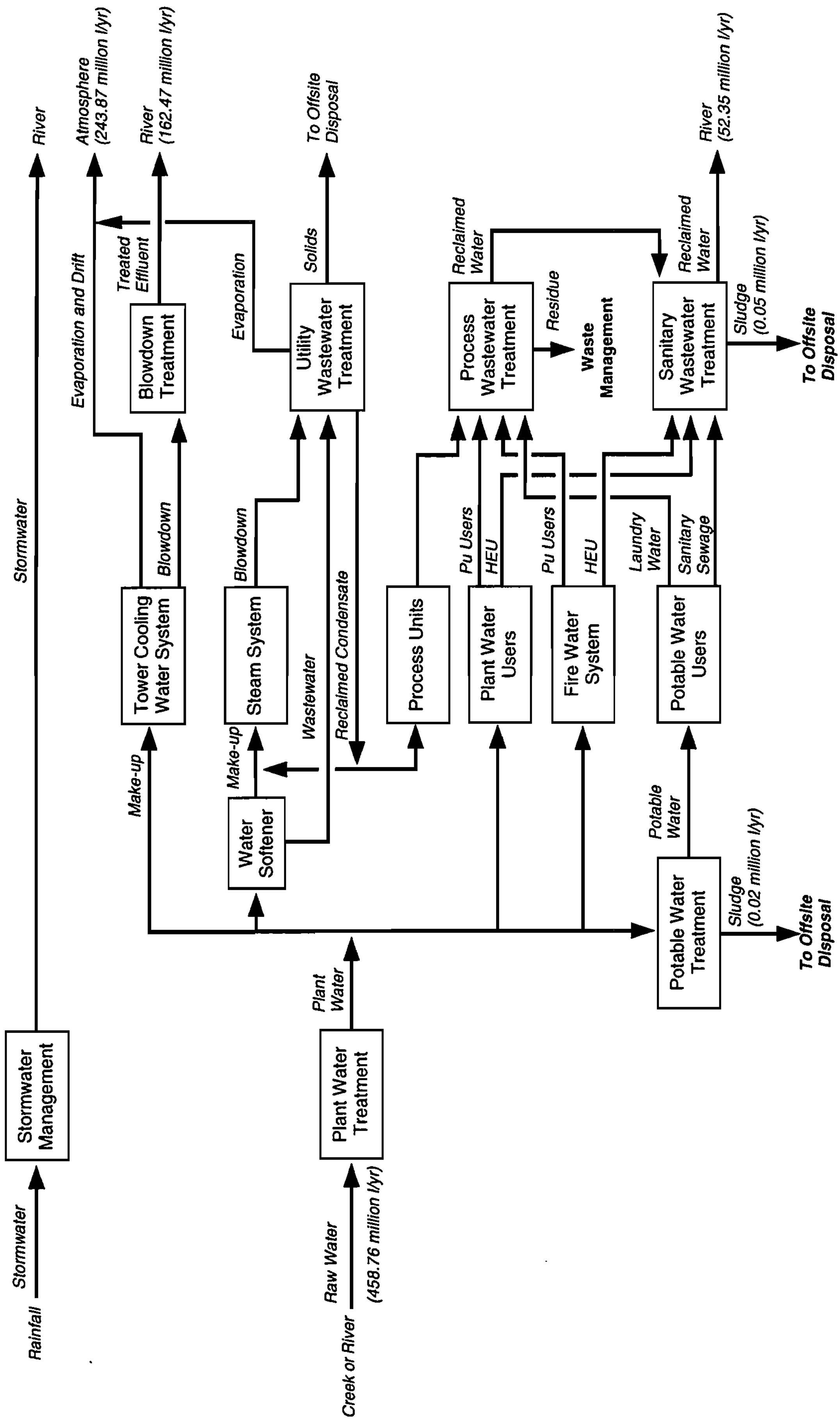
Figure D.1–18. Annual Water Balance for the Collocation Alternative Constructing a New Facility at Oak Ridge Reservation.



Note: Values on this figure may not exactly match raw water requirements and wastewater values in other parts of this PEIS due to rounding.
Values in this figure have more significant digits to match the source document's water balance diagram.
Source: DOE 1996e.

2967/S&D

Figure D.1–19. Annual Water Balance for the Collocation Alternative Constructing a New Plutonium Storage Facility at Oak Ridge Reservation; Maintain Existing Highly Enriched Uranium Storage Facilities at Y–12 Plant.



Note: Values on this figure may not exactly match raw water requirements and wastewater values in other parts of this PEIS due to rounding.
Values in this figure have more significant digits to match the source document's water balance diagram.
Source: DOE 1996f.

Figure D.1–20. Annual Water Balance for the Collocation Alternative at Savannah River Site.

D.2 FACILITIES COMMON TO MULTIPLE PLUTONIUM DISPOSITION ALTERNATIVES

The typical water balance diagrams for facilities that perform precursor activities on Pu materials before certain Pu disposition alternatives are provided in Figures D.2–1, D.2–2, and D.2–3. Under the Preferred Alternative for surplus Pu disposition, the pit disassembly/conversion facility and the mixed oxide fuel fabrication facility could each be located at either Hanford, INEL, Pantex, or SRS, and the Pu conversion facility could be located at Hanford or SRS. The facility water usage for these alternatives could be reduced by using existing facilities for portions of the operations. The next tier of *National Environmental Policy Act* (NEPA) review will examine locations for the selected alternatives including the use of existing facilities.

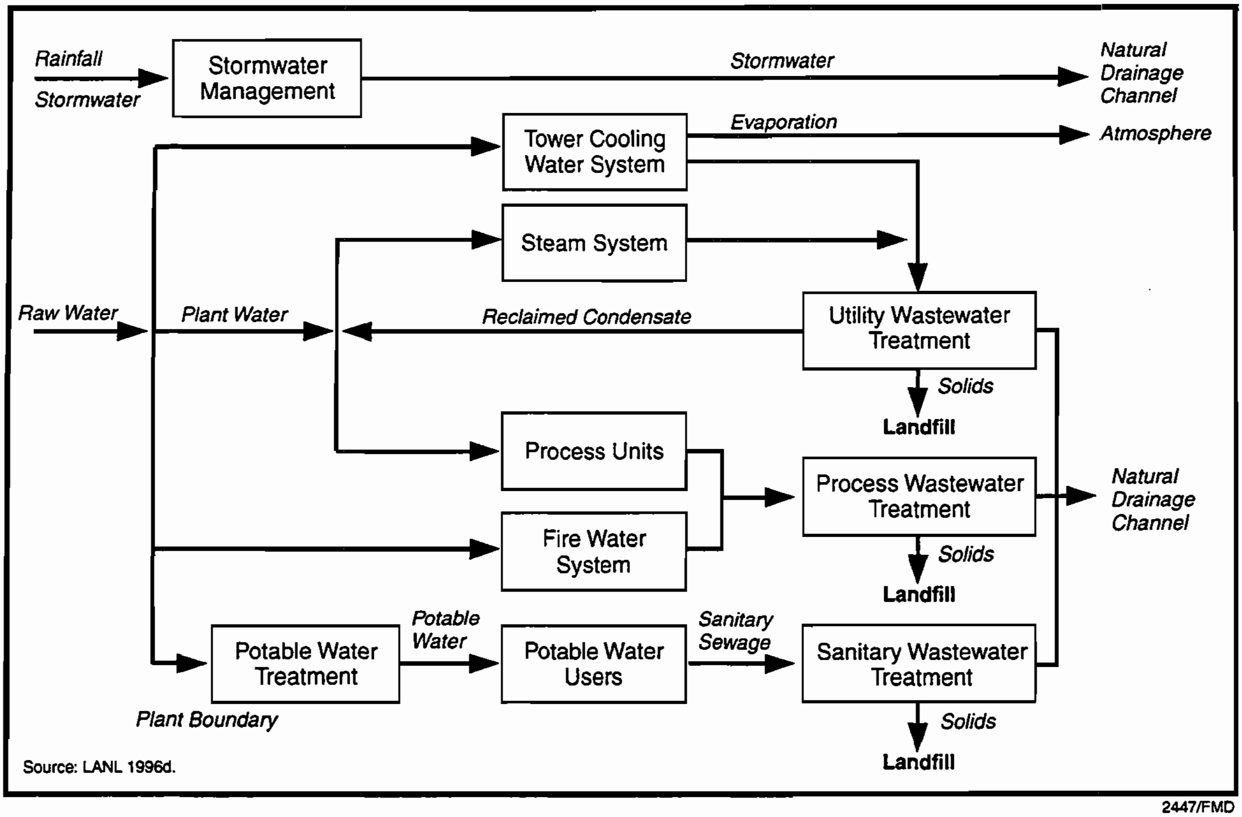


Figure D.2–1. Typical Water Balance for the Pit Disassembly/Conversion Facility.

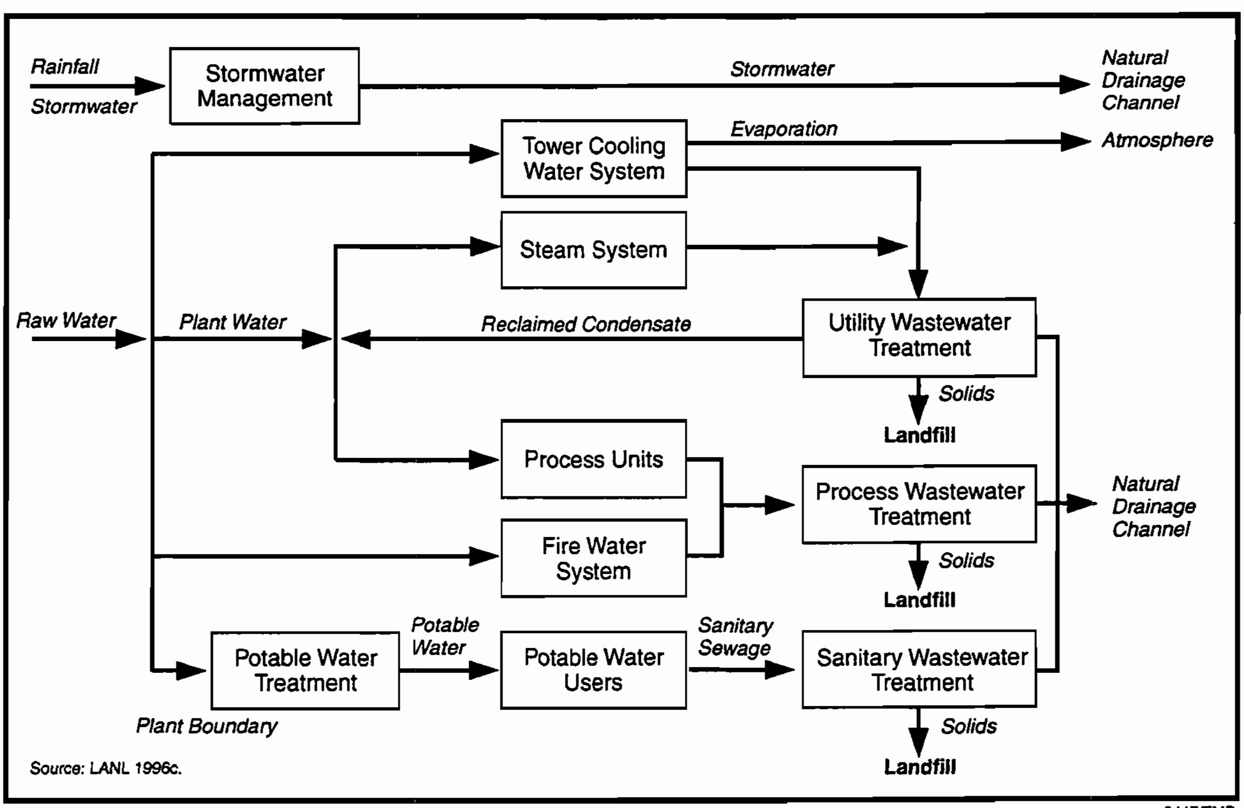
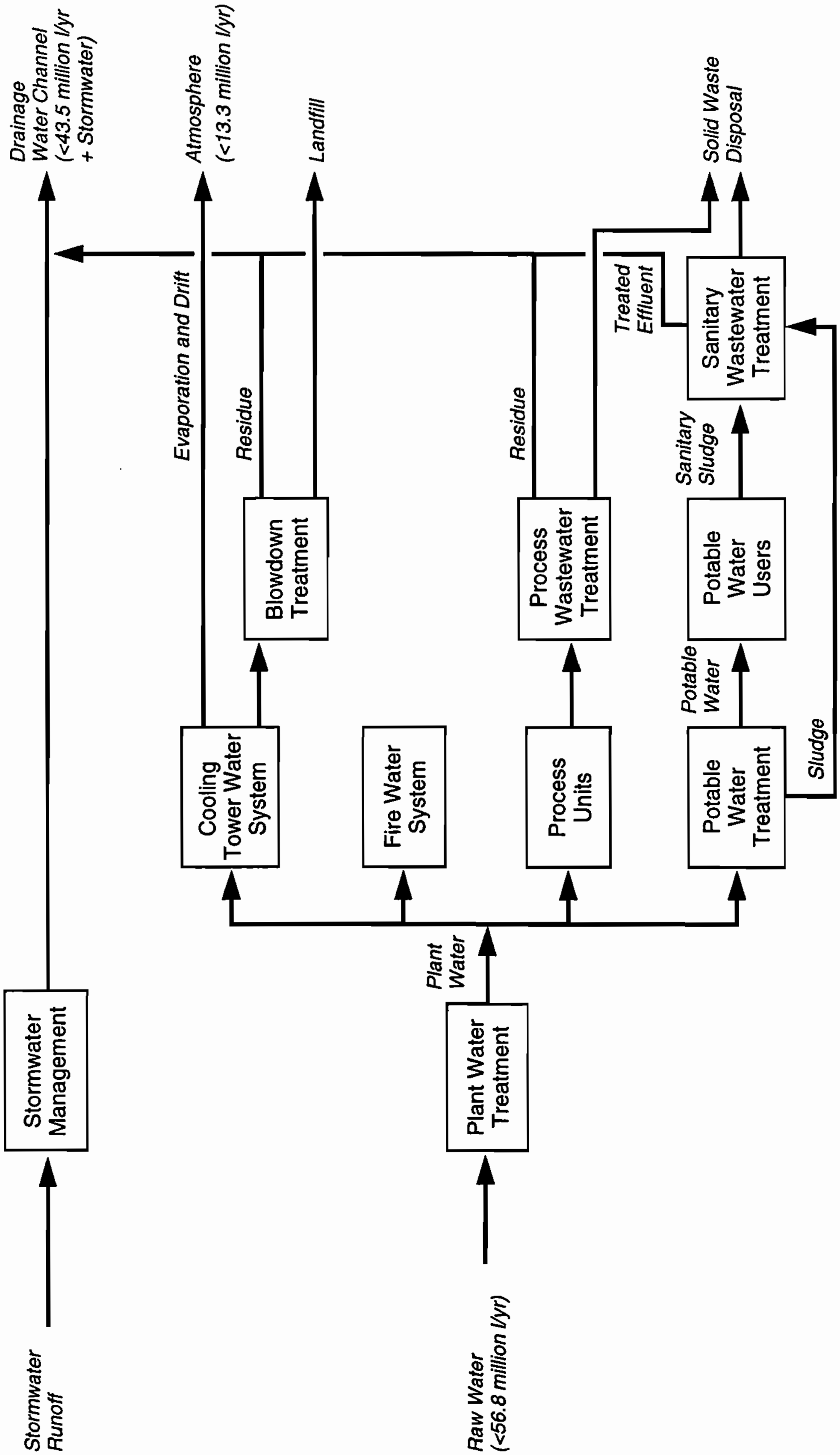


Figure D.2–2. Typical Water Balance for the Plutonium Conversion Facility.



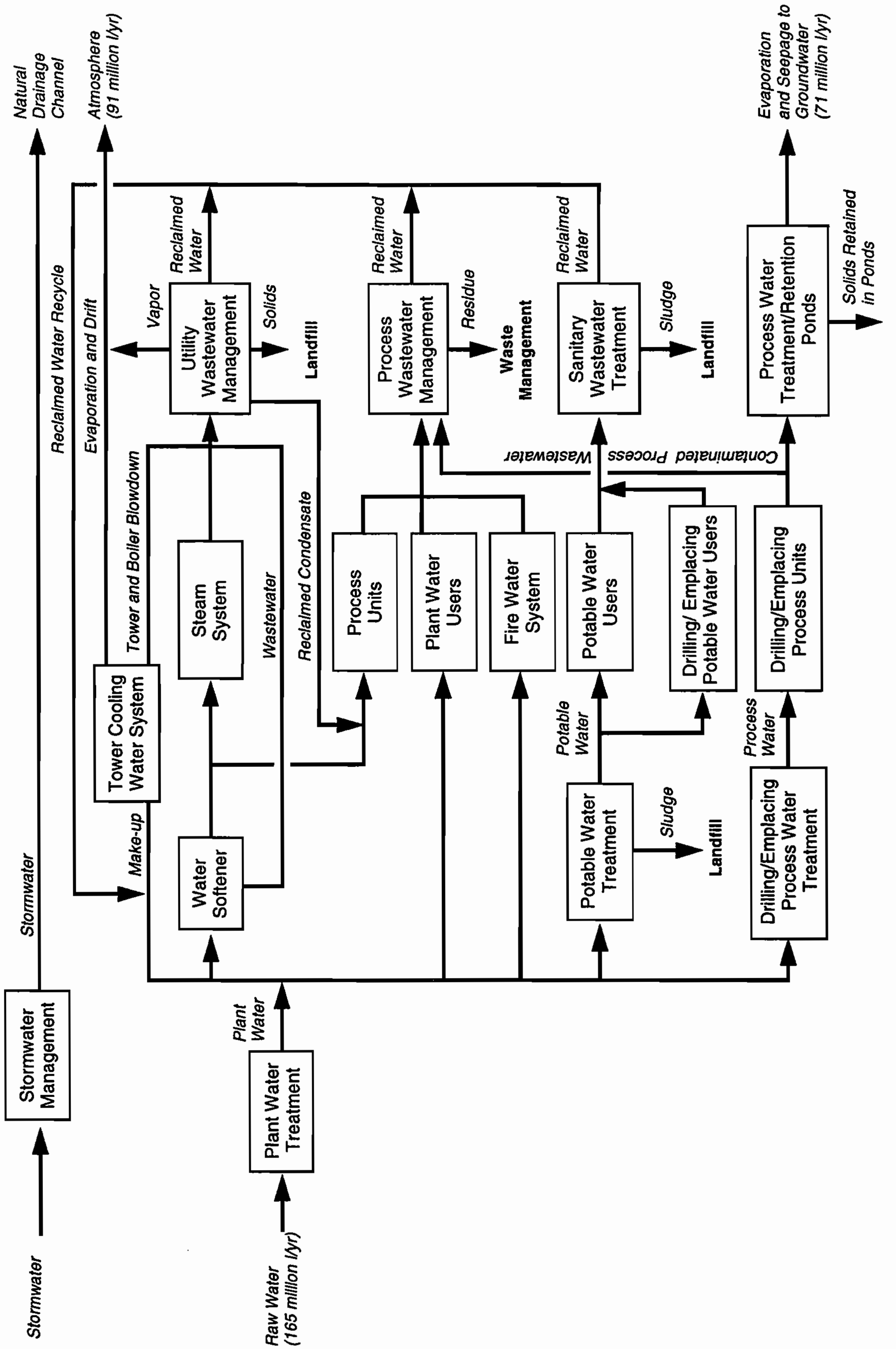
Source: LANL 1996b.

2437/FMD

Figure D.2–3. Typical Water Balance for the Mixed Oxide Fuel Fabrication Facility.

D.3 DISPOSITION ALTERNATIVES

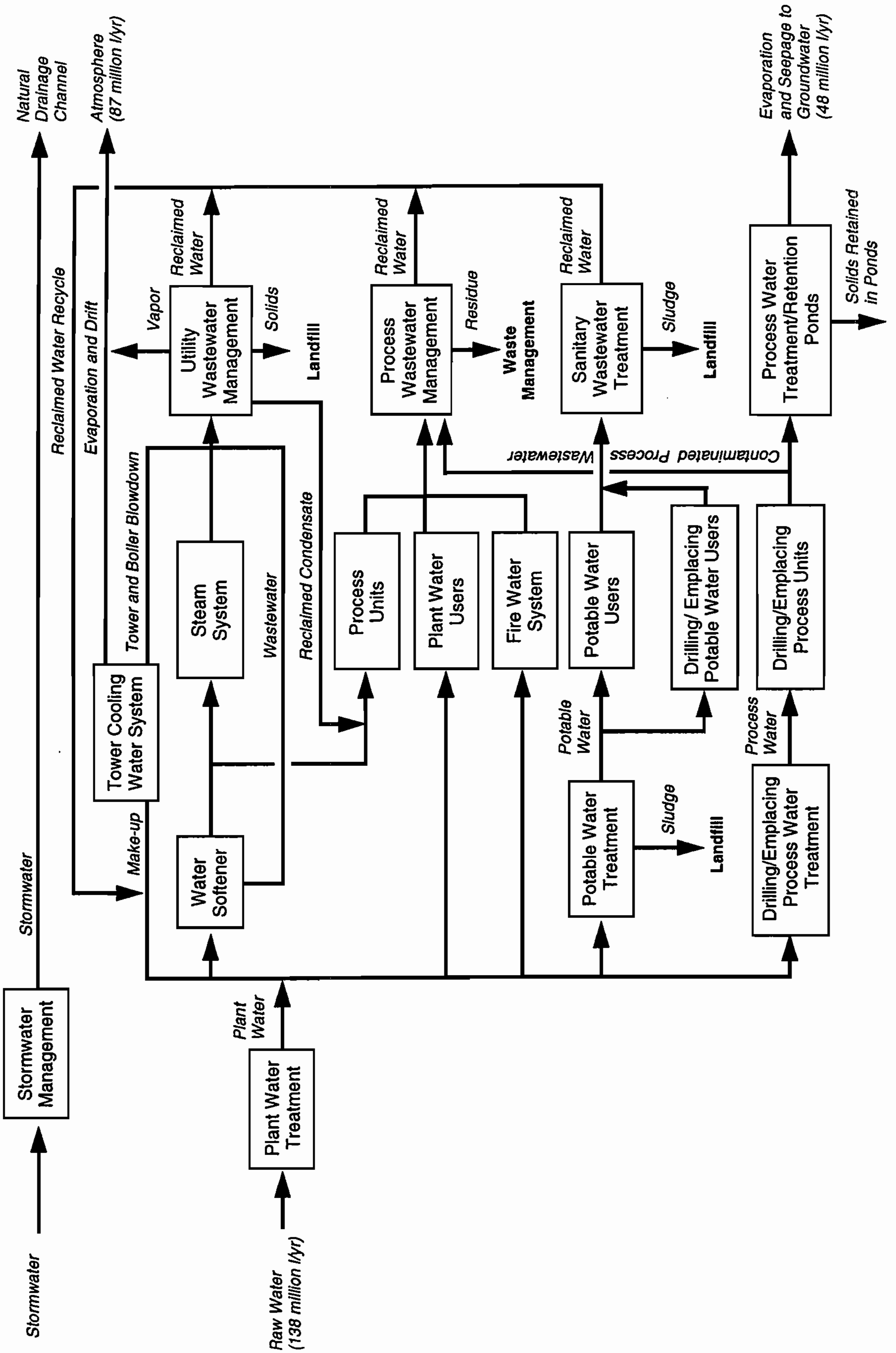
The typical water balance diagrams for each of the various Pu disposition alternatives are provided in Figures D.3–1 through D.3–7. The figures are in the same order as their description appears in Chapter 2. Under the Preferred Alternative for surplus Pu disposition, the ceramic immobilization facility or the vitrification facility could be located at Hanford or SRS. The facility water usage for these alternatives could be reduced by using existing facilities for portions of the operations. The next tier of NEPA review will examine locations for the selected alternatives including the use of existing facilities.



Source: LLNL 1996a.

2456/FMD

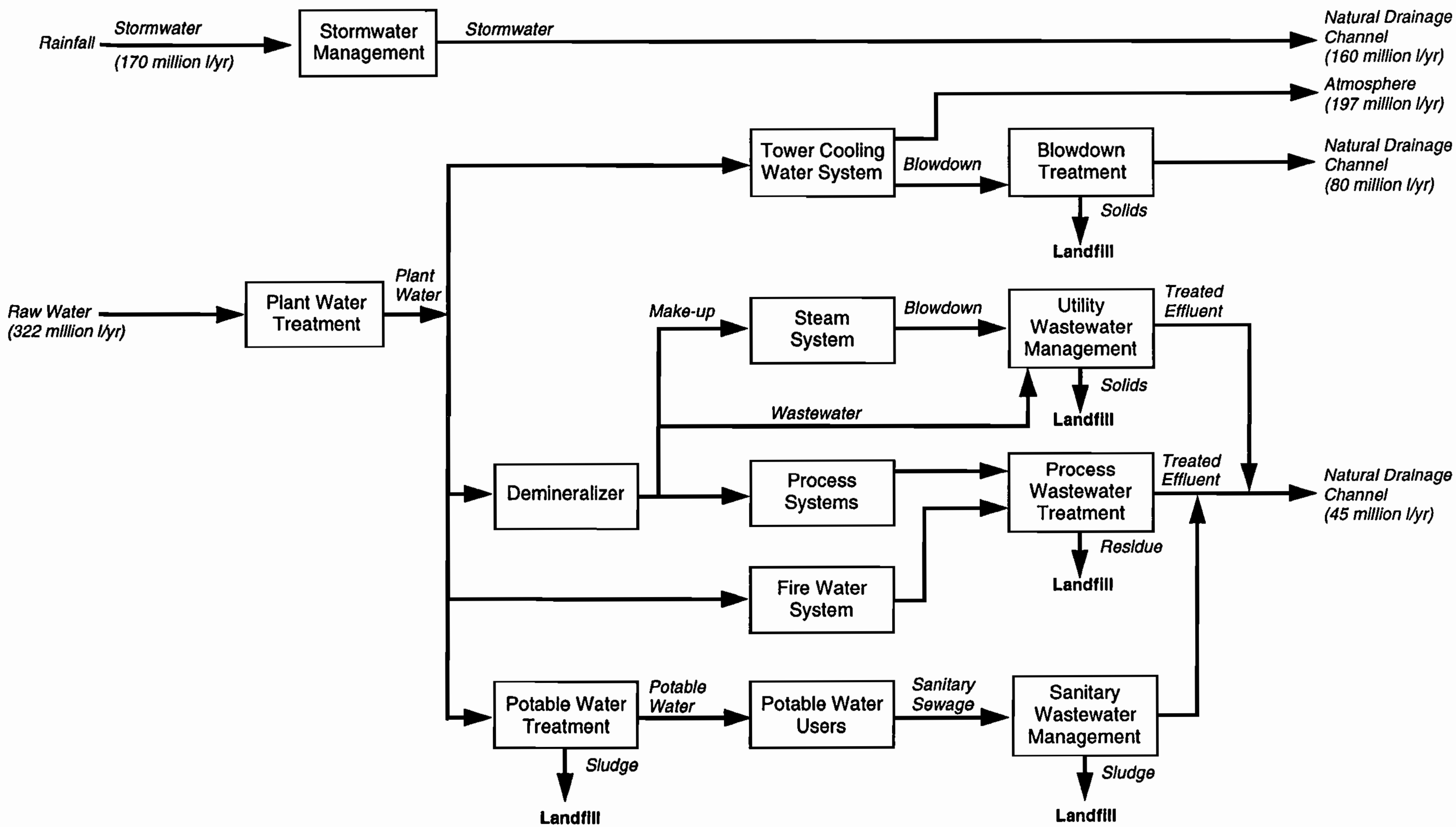
Figure D.3–1. Typical Water Balance for the Deep Borehole Complex—Direct Disposition Alternative.



Source: LLNL 1996h.

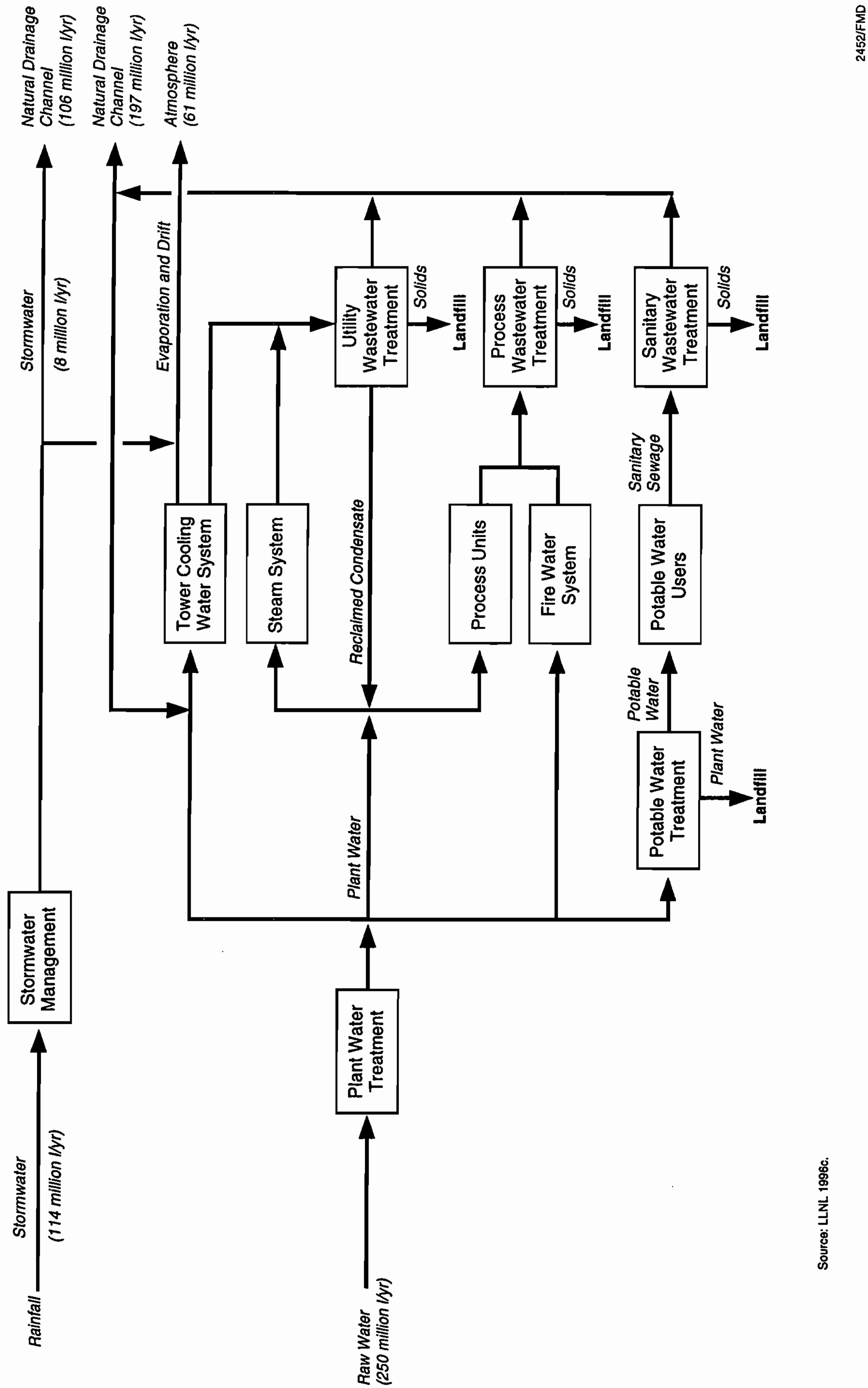
2697/FMD

Figure D.3–2. Typical Water Balance for the Deep Borehole Complex—Immobilized Disposition Alternative.



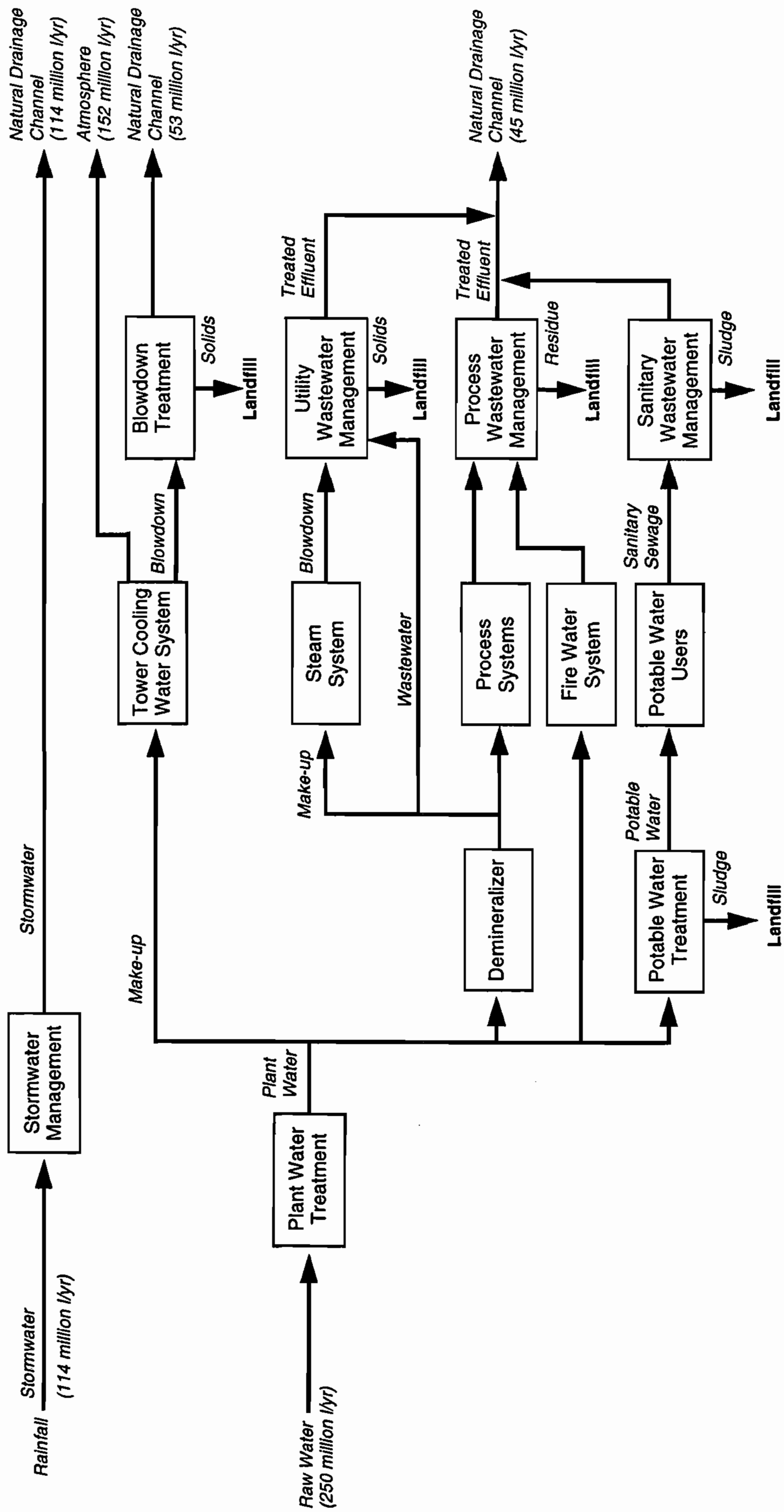
Source: LLNL 1996a.

Figure D.3–3. Typical Water Balance for the Ceramic Immobilization Facility—Immobilized Disposition Alternative.



Source: LLNL 1996c.

Figure D.3–4. Typical Water Balance for the Vitrification Alternative.



Source: LLNL 1996d.

2431/FMD

Figure D.3–5. Typical Water Balance for the Ceramic Immobilization Alternative.

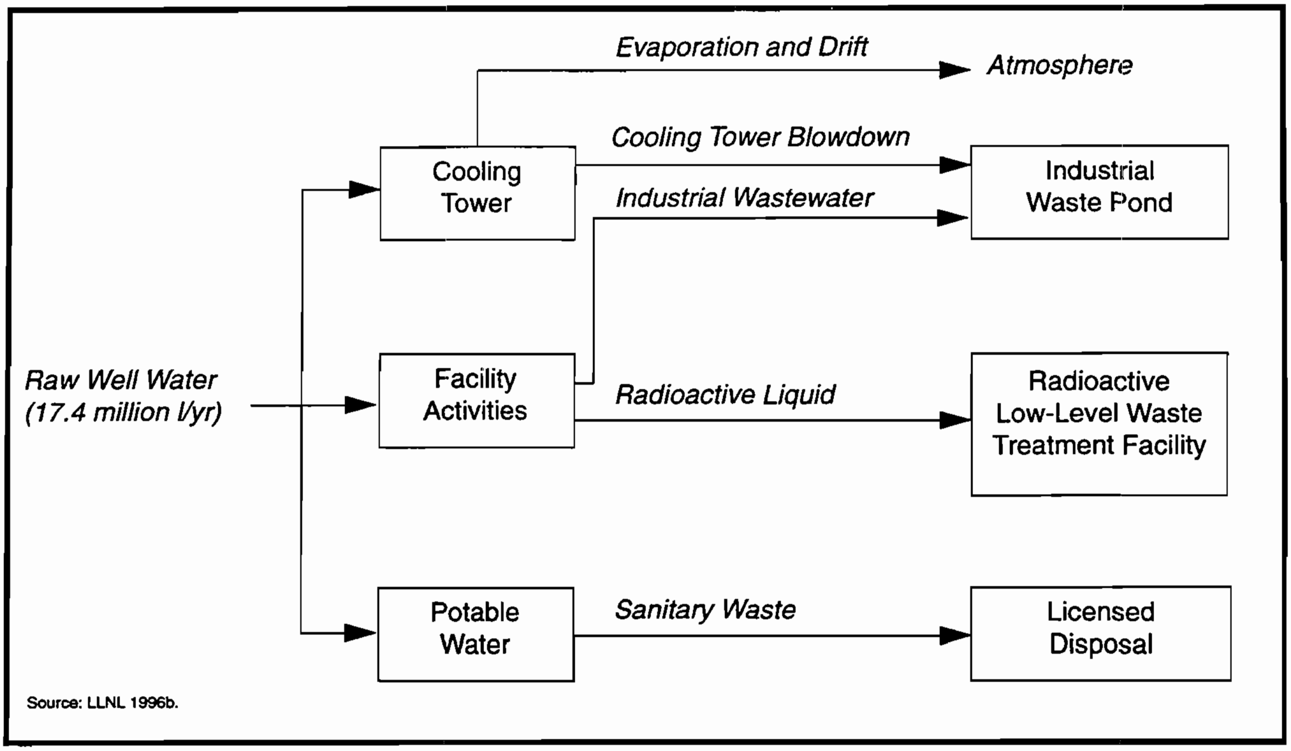


Figure D.3–6. Typical Water Balance for the Electrometallurgical Treatment Alternative (Glass-Bonded Zeolite).

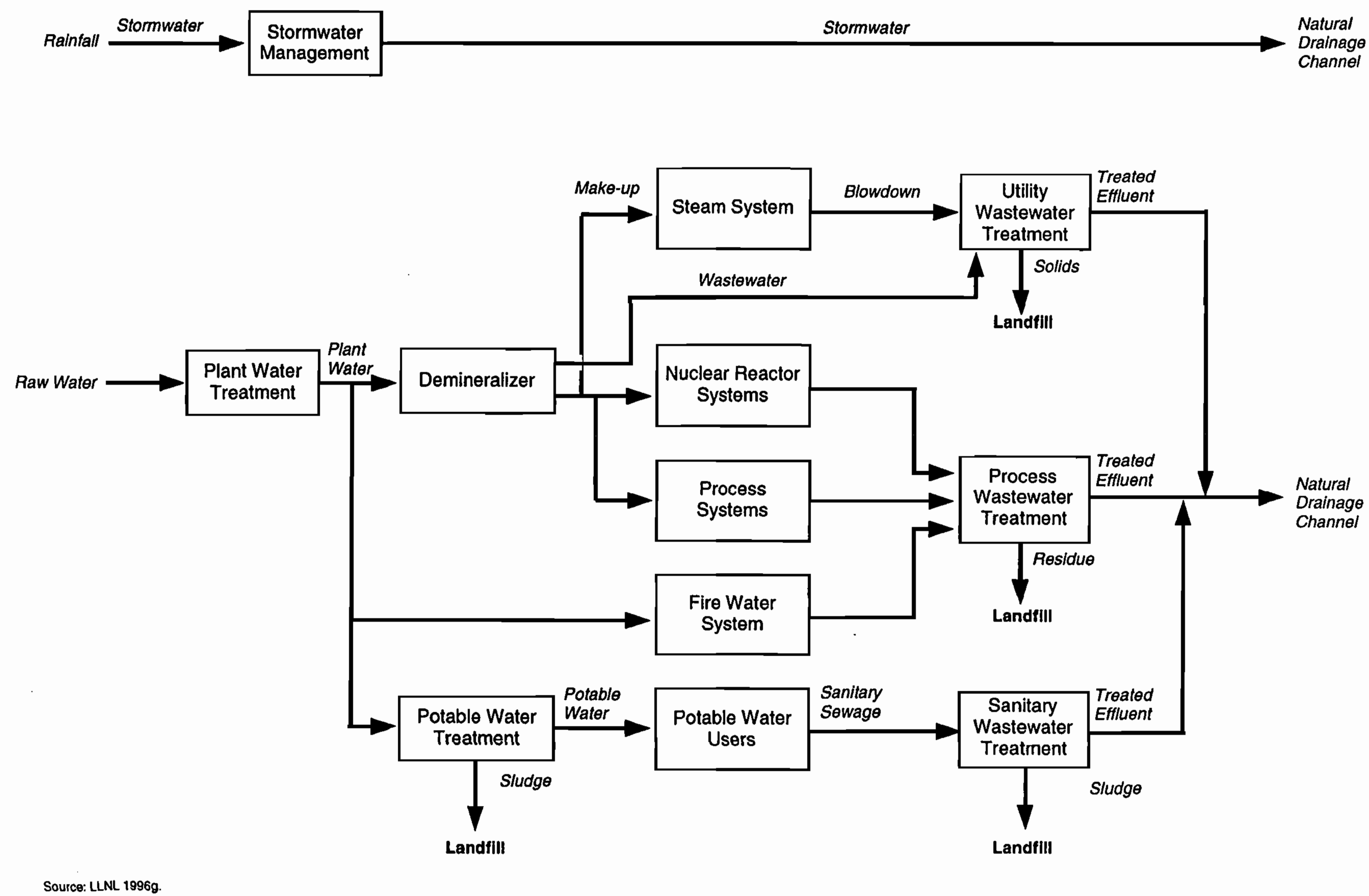


Figure D.3–7. Typical Water Balance for the Evolutionary Light Water Reactor Alternative.

Appendix E
Waste Management

E.1 OVERVIEW

This appendix provides a general overview of the Department of Energy (DOE) environmental restoration and waste management program including the categories of waste streams managed by the Department; the applicable Federal statutes and DOE Orders; waste minimization and pollution prevention; waste treatment, storage, and disposal; transportation of wastes; and facility transition management. Current site-specific waste management activities will follow in Section E.2. Project-specific waste management activities are addressed in Section E.3.

E.1.1 WASTE CATEGORIES

Wastes are generated in gaseous, liquid, and solid form and are categorized by their health hazard and handling requirements. The categories are listed in Table E.1.1–1.

Table E.1.1–1. Waste Categories

Category	Characterization
Spent nuclear fuel	Nuclear reactor fuel that has been irradiated to the extent that it has undergone significant isotopic change to the point that fission-product poisons have reached an uneconomic threshold. DOE is no longer reprocessing spent nuclear fuel solely to recover fissile and fertile material. Although spent nuclear fuel is not categorized as a nuclear waste, the definition is provided here since it is radioactive material that must be stored, managed, and handled.
High-level (HLW)	Highly radioactive material that results from the reprocessing of spent nuclear fuel, including liquid waste produced directly in reprocessing and any solid waste derived from the liquid that contains fission products in sufficient concentrations; and other highly radioactive material that the Nuclear Regulatory Commission (NRC), consistent with existing law, determines by rule to require permanent isolation.
Transuranic (TRU)	Radioactive waste that is contaminated with alpha-emitting elements with an atomic number greater than uranium, half-lifes greater than 20 years, and in concentrations greater than 100 nanocuries per gram (nCi/g). Such wastes result primarily from fuel reprocessing, and from the fabrication of Pu weapons components and Pu-bearing reactor fuel. Generally, little or no shielding is required ("contact-handled" TRU waste), but energetic gamma and neutron emissions from certain transuranic nuclides and fission-product contaminants may require shielding or remote handling ("remote-handled" TRU waste).
Low-level (LLW)	Radioactive waste that is not spent nuclear fuel, HLW, TRU waste, or byproduct material as defined by DOE Order 5820.2A, *Radioactive Waste Management.* Includes research and development fissionable test specimens with TRU waste less than 100 nCi/g. The radiation level from this waste may sometimes be high enough to require shielding for handling and transport. In 10 CFR 61, NRC defines four disposal categories of LLW that require differing degrees of confinement and/or monitoring: classes A, B, C, and Greater-Than-Class C.

Table E.1.1–1. Waste Categories—Continued

Category	Characterization
Hazardous	Nonradioactive waste that has characteristics identified by either or both of the following Federal statutes: *Resource Conservation Recovery Act* (RCRA) (40 CFR 261), as amended, or the *Toxic Substance Control Act.* These toxic, corrosive, reactive, or ignitable substances, or RCRA-listed wastes have been identified as posing health or environmental risks. Hazardous waste includes chemicals (such as chlorinated and nonchlorinated hydrocarbons), explosives, leaded oil, paint solvents, sludges, acids, organic solvents, heavy metals, and pesticides.
Mixed	Waste that contains both hazardous and radioactive constituents.
Nonhazardous (sanitary)	Solid sanitary waste that includes garbage, is routinely generated by normal housekeeping activities, and does not have a defined health risk (neither radioactive nor hazardous). Liquid sanitary waste includes sewage and industrial waste, and is treated in a wastewater process before discharge to a publicly owned treatment works or to surface waters. The management of liquid sanitary waste is regulated by the *Clean Water Act* and the National Pollutant Discharge Elimination System.
Nonhazardous (other)	Other wastes that do not have a defined health risk, such as process wastewater.

E.1.2 APPLICABLE FEDERAL STATUTES AND DEPARTMENT OF ENERGY ORDERS

Most of the regulations that govern the storage, treatment, and disposal of wastes were promulgated since the original Nuclear Weapons Complex (Complex) was established. In many cases, the technology available at the time the Complex was constructed does not meet current requirements for full compliance and, as a result, interim agreements have been made with the regulatory agencies. Through continuous upgrade programs, processes have been improved or added to meet the new regulations. Operations continue on the basis of using "best available technology" for facilities that were in operation before the regulation came into effect. In the siting and construction of new facilities, the intent is to meet current regulations and to reach the goal of maximum recycle, minimal waste generation, no liquid discharges to the surface, and treatment and stabilization of unavoidable wastes sufficient for long-term storage or permanent disposal either onsite or offsite.

In order to operate at most of its facilities, DOE has entered into numerous agreements with States and the Environmental Protection Agency (EPA) to address compliance issues concerning certain aspects of environmental regulatory requirements that have arisen due either to the age of DOE facilities or the uniqueness of DOE operations. For the most part, DOE facilities are in compliance with the major portion of all environmental regulatory requirements, and these compliance agreements address specific situations. At the same time, most of these compliance agreements include a commitment from DOE to achieve compliance with the specific requirement by a specified date and according to a schedule and milestones for achieving that compliance. These schedules and milestones are renegotiated on an ongoing basis as a result of changing budgets, additional environmental findings, and other factors. These agreements guide DOE activities at the sites under applicable environmental laws, regulations, and other standards. Compliance with the terms of these negotiated agreements is one of the highest DOE priorities. Site operations would be conducted consistent with commitments DOE has made and would make in these agreements. DOE would work with the regulators to amend existing agreements and to develop new agreements to ensure continued compliance. Under no circumstances would DOE's performance pursuant to any existing compliance agreement be compromised or diminished as a result of the proposed action.

The following summarizes the applicable Federal statutes and DOE Orders:

Atomic Energy Act. The *Atomic Energy Act* gives (AEA) DOE the authority to manage and regulate nuclear materials handled and generated at its facilities; however, DOE seeks to make its internal guidelines consistent with standards applied to commercial nuclear facilities regulated by the Nuclear Regulatory Commission (NRC). Pursuant to the AEA, DOE is committed to the practice of "as low as reasonably achievable" exposure to radiation from its operations whereby exposures and resultant doses are maintained as low as social, economic, technical, and practical considerations permit.

Resource Conservation and Recovery Act. The *Resource Conservation and Recovery Act* (RCRA) was passed in 1976 as an amendment to the *Solid Waste Disposal Act* of 1965. RCRA regulates the "cradle to grave" management (that is, generation, accumulation, storage, treatment, recycle, transport, and disposal) of hazardous waste, nonhazardous waste, underground storage tanks containing petroleum products and hazardous substances, and medical waste. Subtitle C of RCRA mandates that hazardous wastes be treated, stored, and disposed of in a matter that will minimize the threat to human health and the environment. To carry out this mandate, RCRA requires that owners and operators of hazardous waste treatment, storage, and disposal facilities obtain operating or post-closure care permits for certain waste management activities. RCRA defines the requirements for treatment, storage, and disposal facilities. Subtitle D of the law addresses the management of nonhazardous solid waste. Title 40 of the *Code of Federal Regulations* (CFR) implements the statutory provisions of RCRA. RCRA is a program that may be delegated to the States; such delegation has occurred for most States where DOE facilities are located.

Land Disposal Restrictions. The Hazardous and Solid Waste Amendments to RCRA enacted in 1984 required EPA to evaluate all listed and characteristic hazardous wastes according to a strict schedule and to develop requirements by which disposal of these wastes would be protective of human health and the environment. The implementing regulations for accomplishing this statutory requirement are established with the Land Disposal Restrictions (LDR) program. The LDR of RCRA (40 CFR 268) impose significant requirements on waste management operations and environmental restoration activities. For hazardous wastes restricted by statute from land disposal, EPA is required to set levels or methods of treatment that substantially reduce the waste's toxicity or the likelihood that the waste's hazardous constituents will migrate. After the LDR effective date, restricted wastes that do not meet treatment standards are prohibited from land disposal unless they qualify for certain variances or exemptions. EPA has promulgated standards for each of the five statutorily designated categories (40 CFR 268.31–35).

In addition to prohibiting disposal before appropriate treatment, land disposal restrictions prohibit any storage of land disposal restricted hazardous wastes (including mixed waste) except "for the purpose of the accumulation of such quantities of hazardous waste as are necessary to facilitate proper recovery, treatment, or disposal" (40 CFR 268.50). EPA has determined that storage of a hazardous waste pending development of treatment capacity does not constitute storage to accumulate sufficient quantities to facilitate proper recovery, treatment, or disposal.

Underground Storage Tank Provisions. The requirements for the facilities that use tank systems for storing or treating hazardous waste are outlined in 40 CFR 264, Subpart J. These requirements include the assessment of the existing tank system's integrity, the design and installation of new tank systems or components, and secondary containment. Hazardous wastes or treatment reagents are not placed in a tank system if they could cause the tank, its ancillary equipment, or the containment system to rupture, leak, corrode, or otherwise fail. Controls and practices to prevent spills and overflows from tank or containment systems are also required. Inspection requirements, procedures for response to leaks or spills, the disposition of leaking or unfit-for-use tanks, and closure and post-closure care requirements are also outlined in 40 CFR 264, Subpart J. Ignitable or reactive and incompatible hazardous wastes have special requirements.

Resource Conservation and Recovery Act Corrective Action Program. Hazardous waste permits require sites to institute corrective action programs for investigating and remediating Solid Waste Management Units. This program applies to all operating, closed, or closing RCRA facilities.

Federal Facility Compliance Act. The *Federal Facility Compliance Act* was passed in 1992. It waived sovereign immunity for Federal facilities and included provisions concerning DOE compliance with RCRA hazardous waste treatment for mixed waste. The *Federal Facility Compliance Act* requires DOE to have approved site-specific mixed waste treatment plans and related consent orders in place 3 years (October 1995) from the date of enactment in order to avoid the imposition of fines and penalties (except for sites already subject to a permit, agreement, or order addressing compliance with the RCRA LDR storage prohibition).

In an April 6, 1993, *Federal Register* (FR) notice (58 FR 17875), DOE published its schedule for submitting plans for treating mixed wastes for each facility at which DOE generates or stores mixed waste. Two interim versions of the plans were used to facilitate discussions among states and other interested parties. A subsequent consent order signed by the regulatory agency requires implementation of the final site treatment plan. For mixed waste for which identified treatment technologies exist, the plans provide a schedule for submitting permit applications, entering into contracts, initiating construction, conducting systems testing, starting operations, and processing mixed wastes. For mixed waste without an identified treatment technology, the plans include a schedule for identifying and developing technologies, identifying the funding requirements for research and development (R&D), submitting treatability study exemptions, and submitting R&D permit applications. In cases where DOE proposes radionuclide separation, the plans also provide an estimate of the volume of waste that would exist without such separation, and cost estimates and underlying assumptions. DOE will also prepare summary documents of the final plans to provide a national picture of DOE's technology needs and possible options for treatment of its mixed waste. The summaries will be provided to all states and made available to other interested parties.

Comprehensive Environmental Response, Compensation, and Liability Act. The *Comprehensive Environmental Response, Compensation, and Liability Act* (CERCLA), as amended by the *Superfund Amendments and Reauthorization Act* (SARA) of 1986, provides liability, compensation, cleanup, and emergency response for hazardous substances (including radionuclides) released to the environment. The cleanup of inactive waste disposal sites is one of the major requirements of CERCLA. It provides for prioritization of cleanup actions (National Priorities List [NPL] or Superfund List). Federal Facility Compliance Agreements are negotiated with EPA and the State to coordinate CERCLA and RCRA compliance activities in comprehensive strategies. CERCLA also requires public participation in the selection of remediation alternatives. Title III of CERCLA further requires that the National Response Center (operated by the U.S. Coast Guard) be notified in the event that a non-permitted release of a reportable quantity of hazardous substance or radionuclide occurs. In the case of such a release, the National Response Center alerts the appropriate Federal emergency personnel who assess the event, formulate response, and notify cognizant local emergency agencies. SARA requires industries to report the hazardous substances used at their facilities to include reporting inventories of these substances.

National Contingency Plan. The National Contingency Plan is an implementation regulation that sets forth requirements necessary to comply with CERCLA and SARA. For every site that is targeted for remedial response action under Section 104 of CERCLA, the National Contingency Plan requires that a detailed remedial investigation/feasibility study be conducted. The remedial investigation emphasizes data collection and site characterization. Its purpose is to define the nature, extent, and significance of contamination at a site in order to evaluate, select, and design a cost-effective remedial action. The feasibility study emphasizes analysis of data and decisionmaking; it uses results from the remedial investigation to develop response objectives and alternative remedial responses. These alternatives are then evaluated in terms of their engineering feasibility, public health protection, environmental impacts, and costs. The remedial investigation/feasibility study leads to a decision that sets forth the method selected for remedial action to clean up the NPL site. Under the provisions of CERCLA, Federal facilities have the lead for CERCLA actions.

Toxic Substances Control Act. The *Toxic Substances Control Act* (TSCA) was enacted in 1976 to ensure that the manufacture, sale, storage, and disposal of toxic chemical substances do not present an unreasonable risk of injury to health or the environment. Its applicability to DOE sites deals principally with the management and disposal of polychlorinated biphenyls (PCBs), asbestos, and dioxin. The problem created by radioactively-contaminated PCBs, asbestos, and dioxin is that currently there is a limited capability to treat these materials. Although the concentrations of radionuclides are relatively low, approximately 2 million pounds of radioactively-contaminated PCBs and PCB-contaminated material are destroyed annually by the K–1435 TSCA incinerator at the K–25 site (K–25) at the Oak Ridge Reservation (ORR).

Clean Air Act. The original *Clean Air Act* (CAA) was passed in 1955 and was wholly replaced by the *Air Quality Act* of 1967, although the name *Clean Air Act* is still used. It was reauthorized in 1990. The CAA establishes air quality requirements and pollutant emission limits. The National Emissions Standards of Hazardous Air Pollutants (NESHAP) is a section of the CAA that sets air quality standards for air emissions such as radionuclides, benzene, beryllium, and asbestos. NESHAP regulations require the use of EPA-approved monitoring instrumentation, sampling methodology, calculations, and modeling for each Federal facility.

Clean Water Act. The *Federal Water Pollution Control Act*, as amended by the *Clean Water Act* (CWA) of 1977, establishes a Federal/State scheme for controlling the introduction of pollutants into the Nation's waters. The CWA created the National Pollutant Discharge Elimination System (NPDES) program. This program regulates nonradiological effluent discharges to ensure that surface water bodies meet applicable water quality standards. Each discharge point (outfall) is permitted through the NPDES program. The CWA also requires permits for stormwater discharges.

Safe Drinking Water Act. The *Safe Drinking Water Act* (SDWA) was enacted in 1975 and is designed to protect drinking water resources. Primary drinking water standards set by SDWA apply to drinking water "at the tap" as delivered by public water systems. Of equal significance is that drinking water standards are used to determine groundwater protection regulations under a number of other statutes. The SDWA requires DOE to meet drinking water standards and complete sample analyses for DOE supplied drinking water at its sites. It also imposes requirements on installation and maintenance of drinking water wells.

Department of Energy Orders. The primary DOE Orders governing waste management are the following:

- DOE O 231.1, *Environment, Safety, and Health Reporting.* Establishes environmental protection program requirements, authorities, and responsibilities for DOE operations for assuring compliance with applicable Federal, State, and local environmental protection laws and regulations, Executive Orders, and internal department policies. Requires the preparation of waste minimization plans that describe how waste minimization activities will be promoted and implemented.

  [Text deleted.]

- DOE O 460.1, *Packaging and Transportation Safety.* Establishes the requirements for the packaging and transportation of hazardous materials, hazardous substances, and hazardous wastes.

  [Text deleted.]

- DOE Order 5820.A, *Radioactive Waste Management.* Establishes policies and guidelines by which DOE manages its radioactive waste, waste byproducts, and radioactively-contaminated surplus facilities.

E.1.3 WASTE MINIMIZATION AND POLLUTION PREVENTION

Waste minimization is the reduction, to the extent feasible, of radioactive and hazardous waste that is generated before treatment, storage, or disposal of the waste. Pollution prevention fully utilizes source reduction techniques in order to reduce risk to public health, safety, welfare, and the environment, and environmentally sound recycling to achieve these same goals. Each DOE site is required to have a Waste Minimization and Pollution Prevention Awareness Plan. To report progress towards their goals in the plan, each site prepares an Annual Report on Waste Generation and Waste Minimization Progress. When planning for facilities to be constructed by 2010, it will be necessary to consider currently available technology while providing modular, flexible designs that can incorporate process improvements as they become available. In accordance with Executive Orders 12856 and 12873, and DOE policy, the facilities that would support the long-term storage or disposition of weapons-usable fissile materials would be designed for waste minimization with an overall operating philosophy of pollution prevention. This waste minimization program would contribute to decreases in waste treatment, storage, and disposal costs and lower health risks to workers and the public. Technical approaches are being sought to optimize the number of production operations required, increase the use of nonhazardous chemicals and environmentally benign waste-producing chemicals, increase the use of recyclable chemicals and materials, and implement the new design or redesign of existing processes and products. Some criteria useful in determining successful technology include improved processing yield, reduced quantities of scrap, reduced waste and processing of byproducts, reduced use of hazardous chemicals, positive return on investment, and continued product quality.

E.1.4 WASTE TREATMENT, STORAGE, AND DISPOSAL

For the purpose of analyses, waste management activities that would support the Material Disposition Program are assumed to be per current site practice, although future management of the waste would be contigent in part upon decisions to be made in the Record of Decision (ROD) for the *Waste Management Programmatic Environmental Impact Statement for Managing Treatment, Storage, and Disposal of Radioactive and Hazardous Waste* (Waste Management PEIS [DOE/EIS-0200-D]). Any future waste management facilities that may be required to support the Material Disposition Program would be coordinated with any decisions resulting from the Waste Management PEIS and any respective site-specific *National Environmental Policy Act* (NEPA) documentation.

Treated waste is waste that, following generation, has been altered chemically or physically to reduce its toxicity or prepare it for storage or disposal. Waste treatment can include volume reduction activities, such as incineration or compaction, that may be performed on a waste prior to storage or disposal, or both. Stored waste is waste that, following generation (and usually some treatment), is being temporarily retained in a retrievable manner and monitored pending disposal. Disposed waste is waste that has been emplaced to ensure its isolation from the environment, with no intention of retrieval. Deliberate action is required to regain access to the waste. Disposed wastes include materials placed in a geologic repository and buried in landfills.

Waste that is staged for processing would be stored according to its characterization and form. The disposal of waste from fissile material storage and disposition facilities would be managed by the DOE Office of the Assistant Secretary for Environmental Management (EM). A facility for disposal of retrievable and newly generated transuranic (TRU) waste near Carlsbad, New Mexico, is planned. All surface facilities at the Waste Isolation Pilot Plant (WIPP) have been completed. To date, only portions of the underground excavations have been completed. The remaining excavation would be completed once the facility is operational. Once operational, WIPP would become a permanent disposal site. The total projected capacity of WIPP is 175,543 cubic meters (m^3) (229,602 cubic yards [yd^3]), of which 7,080 m^3 (9,260 yd^3) can be remote-handled. A supplemental environmental impact statement (EIS) is being prepared for the proposed continued phased development of WIPP for disposal of TRU waste. This supplemental EIS will analyze the impacts of waste storage, characterization, certification, processing or treatment, and loading at the generator sites. It will also discuss the impacts of transportation of TRU waste between the generator sites and WIPP. The impacts of waste disposal operations at WIPP will also be analyzed, including the impacts of waste receipt, waste package inspection, monitoring, emplacement, and subsequent activities associated with eventual closure, decommissioning, and institutional control of WIPP once disposal operations have been completed. Options for the interim storage of TRU waste are evaluated in the Waste Management PEIS. Yucca Mountain is a site being studied to determine its suitability for the disposal of commercial spent nuclear fuel and defense high-level waste (HLW). To date, no decisions to utilize either Yucca Mountain repository or WIPP have been made. The remainder of this section discusses some of the treatment, storage, and disposal options that may be utilized with the various waste streams from fissile material storage and disposition facilities.

Gaseous Waste. Gaseous wastes can be nonhazardous (for example, inert gases and air), hazardous (chlorinated hydrocarbon vapor and polyaromatic hydrocarbon vapor), or radioactive (for example, tritium and xenon). Hazardous gaseous wastes that are combustible may be incinerated to destroy the hazardous constituents, converting the combustibles into carbon dioxide and water vapor, while capturing any particulates that may result. When a particulate (ash) is contaminated with heavy metals, the end-product must be stabilized into an approved solid form suitable for disposal.

Gaseous radioactive wastes are held for interim storage in tanks; adsorbed on surfaces in filters, molecular sieves, or active beds; refrigerated and liquefied or solidified; or reacted to an aqueous solution. A minimal quantity of radioactive gas below the permitted limits will escape to the atmosphere because it is not possible to retain every atom of gas within the process with today's technology. The expected release of radioactive gases from the project alternatives is listed in Appendix M. Gaseous waste may be oxidized, mixed with other liquid wastes, or solidified in a stable form for long-term disposal. Reactive gases such as tritium are captured on reactive beds, in molecular sieves, or in cryogenic traps for recycling back to the process. Inert radioactive gases such as xenon and argon can be separated by cryogenic capture and held in storage tanks until they decay sufficiently to permit release. Gases that decay to metals can be captured on activated charcoal beds and held until they can be stabilized, packaged, and disposed of as solid waste. When sufficiently decayed, gases may be released to the atmosphere.

Liquid Waste. Liquid waste includes both wastewaters and nonwastewaters. Wastewaters are a mixture containing water together with organic, inorganic, or radioactive contaminants. Liquid radioactive wastes are processed according to their chemical nature and radiological sources and activities. Liquid wastes that meet release criteria in applicable regulations can be released at permitted discharge points. Where conditions permit, liquids can be processed and recycled to replace virgin feedstocks. Waste processing removes the hazardous or radioactive contaminants from the releasable or recyclable liquids. The largest volume of liquid radioactive waste is low-level waste (LLW), typically in aqueous solution from process operations. Some of this waste is contaminated with hazardous compounds such as solvents or resins, and the result is a liquid mixed waste. Liquid HLW would not be generated in fissile material storage and disposition facilities, but is part of the reference conditions at candidate sites where spent fuel or target processing was conducted. The desired final waste form for liquid wastes is a stable solid that is resistant to stresses from heat generation and from internal and external physical loads. The form must remain stable while stored and not allow the radioactive constituents to migrate to the surroundings.

Mixed waste often has combustible constituents. These are most readily decomposed in thermal treatment (incineration) or chemical reaction resulting in the creation of an ash. The resulting material would be granular and suitable for stabilization in a cemented form in which the hazardous constituents (radionuclides and heavy metal compounds) are bound in compounds that have an affinity for heavy metals and radionuclides. These processes have been utilized in various forms, and their retention properties have been credibly demonstrated.

Liquid LLW is normally processed to reclaim or remove the excess water, leaving a saturated salt solution. This can be accomplished by clarification processes normal to water treatment, or by evaporation. This usually results in the greatest volume reduction for liquid waste. The subsequent stabilization and solidification of the concentrated solution results in a waste form that does not leach its active constituents for a time sufficient to allow the radioactive constituents to decay.

A method for stabilizing HLW for disposal is to process it into borosilicate glass casts within stainless steel cylinders. These are shock-resistant, elastic forms suitable for permanent disposal in an engineered repository. They also provide excellent retention during interim storage. In the preferred practice, the liquid waste stored in large tanks is pumped directly into the vitrification process where the liquid would be evaporated and the remaining salt would be fused with borosilicate into the glass waste form. In some processes (that is, at Idaho National Engineering Laboratory's [INEL] Idaho Chemical Processing Plant [ICPP]), the waste would be evaporated to calcine which is stored in a granular form for later processing. The disadvantage of this process is that airborne particulate matter is generated when the product is handled. The advantage is that the calcine can be stored safely in a stable form until it can be vitrified.

Liquid radioactive and hazardous wastes are usually stored in tanks where they are staged for further processing. Processes are employed to concentrate the hazardous constituents. These processes result in very significant volume reductions, with the reclaimed water processed to a purity sufficient for permitted discharge or recycle.

Liquid hazardous waste concentrates may contain combustive hydrocarbons and heavy metal contaminants. These can be treated by incineration to produce a dry waste. If this waste is still hazardous after treatment, it then can be processed into a stabilized solid that would not leach its hazardous constituents while in storage or in a disposal facility. Liquid low-level and noncombustible hazardous waste can also be processed into a stabilized solid form for storage and disposal.

Solid Waste. Solid radioactive wastes typically consist of contaminated materials (for example, filters, clothing, storage vessels, cleaning materials, and tools) that have been used in, or contaminated by, nuclear materials processing. The term is also applied to those stabilized forms resulting from gaseous or liquid waste processing. In solid waste handling, forms and materials would be segregated, combustibles could be incinerated, and the resultant materials would be reduced in volume, stabilized if necessary, and packaged in specified containers for storage or disposal.

HLW is stored at three of the sites considered for fissile material storage and disposition. It is stored as calcine granules at INEL in underground vaults, as liquids in tanks at Savannah River Site (SRS) and Hanford Site (Hanford). It would be processed to a glass/ceramic (at INEL) and borosilicate glass (at SRS), stored in an engineered facility onsite, and eventually shipped to a Federal repository.

Dry LLW that consists of protective clothing, containers, process materials, and equipment is stored in specified containers designed to retain the waste constituents for a time sufficient to permit decay of the radioactive constituents.

Solid hazardous wastes may contain combustible hydrocarbon compounds or mixtures with heavy metal contamination. These wastes are usually shipped to RCRA-permitted commercial facilities where they are treated, if required, and disposed of. Wastes that retain their hazardous constituents after processing must be packaged into forms that would retain the hazardous constituents safely within the waste form. For LLW or hazardous waste that results from liquid waste processing or incineration, the accepted form is solidification with a cement-like bonding agent.

Some mixed waste can be processed to remove its hazardous constituents and be disposed of as LLW. Otherwise, it can be processed into stabilized forms and packaged for storage in an engineered facility until a licensed facility is available for permanent disposal. Solid nonhazardous wastes from process wastewater evaporation ponds or from sanitary waste treatment plants are usually deposited as sludge in a landfill.

All DOE sites under consideration for fissile material storage and disposition facilities, except Pantex, either have or have planned an onsite LLW disposal facility. For the purposes of this programmatic environmental impact statement (PEIS), it was assumed that all LLW generated at the Pantex Plant (Pantex) would be shipped to the Nevada Test Site (NTS) per current practice. As shown in Table E.1.4–1, data from the DOE Integrated Data Base was used to calculate LLW disposal land usage factors from 1990 to 1993 for Hanford, INEL, SRS, and NTS. To determine a usage factor to use in the waste management impact analysis, an average value was calculated and then rounded down to the nearest hundred cubic meters. For the proposed Class II LLW disposal facility at ORR, a 3,300 m^3/hectares (ha) (1,700 yd^3/acres) usage factor was assumed (OR DOE 1995e:1).

Spent Nuclear Fuel. Spent nuclear fuel from the reactor-based fissile material disposition alternative would be stored within the fissile material disposition facility. The fuel would be kept in water-cooled storage until its decay heat had decreased sufficiently to permit dry storage. Several commercially available options for dry storage have been licensed by NRC, and the facilities required would be relatively small, utilizing a small percentage of the land area required for the fissile material storage and disposition facility. Spent nuclear fuel would not be reprocessed but would eventually be placed in a Federal repository. Spent nuclear fuel is not categorized with nuclear waste, and thus is not included in waste inventories. Since it is radioactive material that must be stored, managed, and handled, it is included here for each site to provide baseline information on its impact on land and facility use.

Table E.1.4–1. Low-Level Waste Disposal Land Usage Factors for Department of Energy Sites

Site	Total Cumulative Volume (m^3)	Estimated Area Utilized (ha)	Land Usage Factor (m^3/ha)
1993			
Hanford	601,610	171.8	3,502
NTS	458,435	174.2	2,632
INEL	147,084	32.3	4,554
SRS	665,239	67.9	9,797
1992			
Hanford	589,506	169.8	3,472
NTS	439,700	55.0	7,995
INEL	145,300	21.2	6,854
SRS	649,700	78.2	8,308
1991			
Hanford	582,800	167.8	3,473
NTS	419,600	55.0	7,629
INEL	145,300	21.2	6,854
SRS	636,700	78.2	8,142
1990			
Hanford	578,900	166.8	3,471
NTS	408,400	No Data	No Data
INEL	144,000	21.2	6,792
SRS	612,800	72.1	8,499
Average			
Hanford	NA	NA	3,480
NTS	NA	NA	6,085
INEL	NA	NA	6,264
SRS	NA	NA	8,687

Note: NA=not applicable.

Source: DOE 1991h; DOE 1992f; DOE 1994c; DOE 1994d.

E.1.5 TRANSPORTATION

The DOE complies with applicable Department of Transportation (DOT) regulations (10 CFR 71 and 49 CFR) when shipping hazardous materials over public roads. Transportation, especially for radioactive material, is highly regulated by Federal, State, and local laws. The stringent packaging requirements, combined with strict regulations and procedures governing the shipment of hazardous and radioactive material, ensure that transport is a safe activity. Federal DOT regulations require the use of appropriate warning placards on vehicles and labels on packages to alert workers, officials, and the public to the hazardous nature of the shipped material. The use of placards on vehicles and warning labels on packages is a joint responsibility of the carrier and the shipper. The labels and placards are familiar to emergency response personnel and are valuable in determining content and hazard information.

Shipments of hazardous materials, including radioactive materials, must be accompanied by properly completed shipping papers such as bills of lading and cargo manifests, which contain detailed information on the material being transported. These papers must be kept in the vehicle transporting the material and must be available for inspection by responsible officials at any time. The shipper must certify on the shipping papers that the hazardous material offered for transportation is properly classified, packaged, marked, labeled, and made ready for transportation according to all DOT regulations.

Radioactive material is shipped in secure packages. Type A packages are designed to contain small amounts of radioactive material and to withstand normal conditions of transport. Type A packages are subjected to rigorous water spray, free-fall compression, and penetration tests carried out in sequence to ensure that radioactive materials are contained. Type B packaging is designed to contain more hazardous, and larger amounts of, radioactive waste. It can withstand severe accident conditions and contain radioactive materials under any credible circumstance. Type B package rigorous testing conditions are discussed in Appendix G.

If WIPP is determined to be a suitable disposal facility for TRU and mixed TRU wastes pursuant to the requirements of 40 CFR 191 and 40 CFR 268, TRU wastes would be shipped in TRUPACT-II (contact-handled) and RH-72B (remote-handled) containers. No remote-handled waste is expected to be generated in any of the fissile material storage and disposition facilities. To determine the number of TRU waste shipments required, 8.7 m^3 (11.4 yd^3) per truck shipment, or if applicable, 17.5 m^3 (22.9 yd^3) per regular train shipment and 52.4 m^3 (68.6 yd^3) per dedicated train shipment was assumed (DOE 1994v:B-4). Transportation by rail may not be applicable at all sites.

As noted earlier, all sites being considered, except Pantex, either have or have planned an onsite LLW disposal facility. The additional shipments of LLW from Pantex as a result of locating fissile material storage and/or disposition functions at Pantex were estimated. All LLW would be transported in a solid form. A typical shipment consists of eighty 208-liter (l) (55-gallon [gal]) drums loaded into an enclosed semi-trailer type truck. Each drum is assumed to be fully loaded, resulting in a total shipment volume of 16.6 m^3 (21.7 yd^3). The truck is assumed to operate as an "exclusive-use" vehicle.

E.1.6 FACILITY TRANSITION MANAGEMENT

Any transition activities of facilities from a production mode to a cleanup mode that are part of the baseline for this PEIS are discussed in the facility impacts section of Chapter 4 and in Section E.2. Decontamination and decommissioning (D&D) considerations of fissile material disposition facilities have been planned for in the design.

The DOE Program Secretarial Officer is responsible for the safe operation, shutdown, and ultimate disposition of facilities used to support his or her program. EM is responsible for final facility disposition, which may include D&D of inactive facilities or refurbishing them for further economic development. Transition activities would require appropriate NEPA evaluation and would proceed consistent with the PEISs within the DOE

Offices of Environmental Management (EM), Defense Programs, and Materials Disposition. Depending on the site, facility transition activities are in different stages of planning. The dominant time-intensive activities are characterizations of the environmental hazards related to the building and the deactivation of the facility.

At the end of their useful lives, all potential facilities would require decommissioning. The transition process begins when DOE management decides to stop operating the facility and ends when responsibility for the facility is formally turned over to EM. Transition plans would be required for all facility transfers to EM. These plans define the actions necessary to bring the identified facilities into a condition acceptable for transfer to EM. Some facility transition issues raised in EM's scoping process for its PEIS, and which would be considered in the facilities design process, are the following:

- Land-use criteria defined for the period after cleanup
- Interim storage of mixed waste and spent nuclear fuel
- Disposal facilities for hazardous and LLW

The cleanup of fissile material storage and disposition facilities would be significantly less difficult because consideration for waste minimization and ease of decontamination would be included in the facility design. The surfaces that come in contact with potential contaminants would be easier to decontaminate. In-process decontamination (to reduce operational exposures) would significantly reduce the cleanup required at the end of life.

In spite of the best design and process practices, many of the fissile material storage and disposition facilities would require decontamination efforts at the end of life. Because of the necessity of working inside contaminated areas during the cleanup phase, the potential for exposure to cleanup workers is higher than during the operations phase. Workers would wear protective clothing and would be supplied breathing air to minimize their exposure.

Technologies for cleanup are established and are improving as experience in working with nuclear facilities increases. The use of robotics, improved task planning, and new materials to prevent the spread of contamination have already improved current cleanup activities. By the time the fissile material storage and disposition facilities are decommissioned, DOE would have gained considerable cleanup experience; thus, further improvements should be expected.

E.2 WASTE MANAGEMENT ACTIVITIES

E.2.1 HANFORD SITE

Established in 1943, Hanford facilities were primarily dedicated to the production of weapons-grade plutonium (Pu) and management of the wastes generated by defense activities. In later years, these missions were expanded to include increasingly diverse programs involving R&D for advanced reactors, renewable energy technologies, waste disposal technologies, and the cleanup of contamination from past activities.

Today, production of enriched fuel at Hanford reactors and recovery of Pu no longer occur. Hanford's primary mission is the cleanup of the site. On May 15, 1989, DOE, the Washington State Department of Ecology, and the EPA signed the *Hanford Federal Facility Agreement and Consent Order* (Tri-Party Agreement), an agreement to clean up radioactive and chemical waste at the site over the next 30 years. It contains a blueprint for the cleanup and uses enforceable milestones to keep the program on schedule. The Tri-Party Agreement negotiations—completed in 1993 and approved in January 1994—changed and added many new milestones. Most of the changes were related to the tank waste remediation system.

The waste management program accounts for the majority of lifecycle costs at Hanford. Much of the emphasis is placed on tank waste, which, when processed, will yield vitrified HLW and LLW fractions. Waste management programs at Hanford are divided into five key areas: (1) the tank waste remediation system program managing HLW, (2) spent nuclear fuel storage at the K-Basins and other locations, (3) cesium (Cs) and strontium capsule management at the waste encapsulation and storage facility at B-Plant, (4) liquid waste management, and (5) solid waste management. Each waste management program is described in the discussions that follow with regard to treatment, storage and handling, and disposal activities associated with spent nuclear fuel and the following waste categories: high-level, TRU, low-level, mixed, hazardous, and nonhazardous. Figure E.2.1–1 depicts tank waste management at Hanford.

Pollution Prevention. Radioactive, hazardous, and mixed wastes are treated, stored, or disposed of at Hanford. The total amount of waste generated and disposed of at Hanford has been, and is being, reduced through the efforts of the pollution prevention and waste minimization programs at the site. The Hanford Site Pollution Prevention Program is an ambitious program aimed at source reduction, product substitution, recycling, surplus chemical exchange, and waste treatment. The program is tailored to meet Executive Order 12780, DOE Orders, RCRA, and EPA guidelines. All wastes at Hanford, including radioactive, mixed, hazardous, and nonhazardous regulated wastes, are included in the Hanford Pollution Prevention Program. Reductions in the volumes of radioactive wastes generated have been achieved through methods such as intensive surveying, waste segregation, recycling, and the use of administration and engineering controls.

Spent Nuclear Fuel. [Text deleted.] Two spent nuclear fuel EISs were prepared that will eventually define the management of spent nuclear fuel at Hanford. The first is the *Department of Energy Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Program Final Environmental Impact Statement* (DOE/EIS-0203-F) referred to in Section 4.2.1, which led to a ROD published in June 1995 (60 FR 28680) and amended in March 1996 (61 FR 9441). That ROD specifies what spent nuclear fuel will be managed at Hanford, INEL, and SRS. Hanford production reactor fuel will remain at Hanford. As of 1995, Hanford has 2,133 metric tons (t) (2,351 short tons [tons]) or 81 percent of the total DOE existing spent fuel inventory. The published ROD projects 12 shipments (either truck or rail) of non-Hanford production reactor spent fuel will be sent to INEL. Each shipment, either by truck or by rail, was assumed to consist of one shipping container. Hanford would not receive any additional fuel. As a result of this action, and assuming no final disposition, by the year 2035 Hanford would have 2,132 t (2,350 tons), or 78 percent, of the total existing DOE redistributed and newly generated inventory in the form of production reactor spent nuclear fuel (61 FR 9441).

A follow-on tiered, site-specific NEPA analysis for the management of the spent nuclear fuel from the K-Basins was published in the January 1996, *Final Environmental Impact Statement on the Management of Spent Nuclear Fuel from the K Basins at the Hanford Site, Richland, Washington* (DOE/EIS-0245). Based on the analysis a ROD was published in March 1996 (61 FR 10736). The decision consists of removing the spent nuclear fuel from the basins, vacuum drying, conditioning and sealing the spent nuclear fuel in inert-gas filled canisters for dry vault storage in a new facility, to be built at Hanford, for up to 40 years pending decisions on ultimate disposition. The K-Basins will continue to be operated during the period over which the decision is implemented. If possible, the basin sludge will be transferred to the double-shell tanks for management. If not possible, the basin sludge will continue to be managed as spent nuclear fuel, or disposed of as solid TRU waste. Non-spent nuclear fuel debris will be disposed of in the low-level burial ground at Hanford. The spent nuclear fuel will be loaded in multicanister overpacks that are already in transportation casks, then the multicanister overpacks will be drained and vacuum dried.

Spent nuclear fuel is presently located in 11 facilities at Hanford: 105-KE and 105-KW basins in the 100 Area at the north end of Hanford; T-Plant, LLW burial grounds, and Plutonium Finishing Plant (PFP) in the 200 West Area; Plutonium and Uranium Recovery through Extraction (PUREX) Plant in the 200 East Area; Fast Flux Test Facility (FFTF) in the 400 Area; and Buildings 308, 324, 325, and 327 in the 300 Area at the southeast corner of the site (DOE 1995o:3-3). A summary of the inventory of spent nuclear fuel is shown in Table E.2.1–1.

As of December 1994, the following spent nuclear fuel and associated facilities are at Hanford:

- **N-Reactor Spent Nuclear Fuel.** Zirconium-alloy-clad metallic uranium fuel stored in water in the 105-KW and 105-KE basins and exposed to air in the PUREX Plant dissolver cells A, B, and C.

- **Single-Pass Reactor Spent Nuclear Fuel.** Aluminum-clad metallic uranium fuel stored in water in the 105-KE and 105-KW basins and stored in water in the PUREX Plant basin.

- **Shippingport Core II Spent Nuclear Fuel.** Zirconium-alloy-clad uranium dioxide fuel stored in water in T-Plant canyon pool cell 4.

- **Fast Flux Test Facility Spent Nuclear Fuel.** Stainless steel-clad fuel stored in liquid sodium at the FFTF, consisting mostly of Pu and uranium oxide fuel, but also uranium and Pu metals, and carbide and nitride fuel.

- **Miscellaneous Commercial and Experimental Spent Nuclear Fuel.** Consisting mainly of zirconium-alloy-clad uranium dioxide fuel stored in air in Buildings 324, 325, and 327; training, research, and isotope reactors (built by General Atomics [TRIGA]) fuel stored in water in Building 308; miscellaneous fuel stored in air-filled shielded containers at the 200 West Area burial grounds; and aluminum-clad, uranium-aluminum alloy fuel stored in air in the PFP.

Hanford has developed a *Site Integrated Stabilization Management Plan* (WHC-EP-0853, August 1995) identifying the plans for placing spent nuclear fuel and other Pu-bearing materials in safe interim storage.

High-Level Waste. HLW at Hanford was generated from the reprocessing of production reactor fuel for the recovery of Pu and uranium for defense and other national programs of spent reactor fuel and irradiated targets. HLW has been accumulating at Hanford since 1944. Most of this HLW has undergone one or more treatment steps (for example, neutralization, precipitation, decantation, or evaporation) and will eventually require incorporation into a stable, solid medium (for example, glass) for final disposal. The HLW came from many different processes and sources and has been processed and transferred among tanks so that chemical and physical characteristics of the wastes vary greatly among tanks and even within individual tanks.

Hanford HLW is stored in underground carbon-steel tanks and consists of alkaline liquid, sludge, and salt cake in single-shell tanks; slurry in double-shell tanks; and Cs and strontium (Sr) salts in double-metal alloy capsules. HLW, TRU waste, and liquid mixed LLW were stored in single-shell tanks. These tanks eventually developed leaks and double-shell tanks were built to replace them. Liquids were drawn from the single-shell tanks, concentrated, and pumped to the double-shell tanks to be held for further processing. Sludge, salt cake, and interstitial liquid remains in the single-shell tanks, as they are not readily retrievable. Plans to remove and process this waste are being made. Some of these tanks presented special hazardous conditions because of the generation of explosive gases or the generation of excessive heat that required the addition of water for active cooling, while the tank continues to leak. These "watch list tanks" are being continuously monitored, and remedies are provided until such time as the waste can be removed and processed. There is not sufficient volume in the double-shell tanks to handle the process storage requirements for cleanup of the single-shell tank waste. Additional double-shell tanks and other liquid storage facilities are being designed, and processes are being developed to treat these wastes for disposal. The management and disposition of Hanford's tank waste, and encapsulated strontium and cesium will be in accordance with decisions resulting from the *Final Environmental Impact Statement for the Tank Waste Remediation System* (DOE/EIS-0189).

Between 1956 and 1990, the PUREX Plant processed irradiated reactor fuel to extract Pu and uranium. The PUREX process was a solvent extraction process that used a tributyl phosphate in a kerosene-like solvent for recovering uranium and Pu from nitric acid solutions of irradiated uranium. The waste from the PUREX process was placed in double-shell tanks after 1970. In December 1992, DOE decided to deactivate the PUREX Plant.

All wastes contained in double-shell tanks consist of mixtures of HLW, TRU waste, and LLW, and are managed as if they contain HLW. The aging waste storage unit comprises four double-shell tanks in the 241-AY (Tanks 241-AY-101 and -102) and 241-AZ (Tanks 241-AZ-101 and -102) tank farms in the 200 East Area of Hanford.

There are currently 261,700 m^3 (342,291 yd^3) of HLW stored as alkaline liquid (24,900 m^3 [6.5 million gal]), sludge (46,000 m^3 [60,166 yd^3]), and salt cake (93,000 m^3 [121,639 yd^3]) in single-shell tanks; slurry (97,800 m^3 [127,918 yd^3]) in double-shell tanks; and as Cs and Sr salts in double-metal alloy capsules (DOE 1994c:48). The single-shell tank wastes make up 95 percent of the Hanford mixed HLW. The single-shell tanks consist of 149 tanks containing approximately 136,600 m^3 [178,666 yd^3] of waste (HF DOE 1995d:3-14). The wastes in the single-shell tanks are multi-phased: most is sludge with interstitial liquids; some is in the form of crystalline solids, along with some supernatant liquids.

Eighty-three of the single-shell tanks are located in the 200 West Area and 66 are in the 200 East Area. One hundred thirty-three of the tanks are 22.9 meters (m) (25 yards [yd]) in diameter with nominal capacities between 2,000 and 3,800 m^3 (2,616 and 4,970 yd^3). Sixteen tanks are 6.1 m (7 yd) in diameter with capacities of 210 m^3 (275 yd^3). The single-shell tanks wastes are scheduled under the Tri-Party agreement to be retrieved and vitrified in the same manner as the double-shell tanks wastes. The single-shell tanks will be closed in accordance with schedules negotiated in the Tri-Party Agreement.

Twenty-eight double-shell tanks, each with a 4,300 m^3 (5,624 yd^3) capacity, stored 78,706 m^3 (102,944 yd^3) of waste as of December 31, 1994. The double-shell tanks do not simply accumulate and store waste; the tanks are a waste-handling system. The inflows to the double-shell tank system include supernate and interstitial liquids pumped from single-shell tanks, laboratory wastes, dilute wastes from across Hanford, and waste from inactive facilities. Outflows include waste destined for evaporation and future pretreatment and vitrification processes. Evaporation decreases the double-shell tank waste volume; pretreatment and vitrification remove double-shell tank waste and prepare it for disposal. The wastes in double-shell tanks consist of solids and liquids. Typically, the solids fraction has settled out as a sludge layer. LLW, TRU waste, and HLW are further designated as ignitable, corrosive, toxic, persistent, and carcinogenic extremely hazardous waste. Many RCRA-listed waste codes are also present. Because of heavy metals contamination, double-shell tank waste also is designated as toxic by the toxicity characteristic leaching procedure. Treatment plans are to recover the contents of the tanks, separate the waste into high- and low-level fractions, and immobilize them for disposal. The TRU and high-level fractions will be vitrified for disposal in a geologic repository; the low-level fraction would be disposed of onsite in near-surface retrievable disposal vaults covered with a thick earthen barrier following evaporation and vitrification. The 242-A evaporator is a key unit in volume minimization with this process. This unit was out of service but was restarted in April 1994 after upgrades were completed. The 242-A evaporator will be replaced by the 242-H evaporator when the new liquid effluent retention facility has been completed, replacing the practice of discharge of evaporator effluent to the soil column.

Cesium and strontium salts in double-metal alloy capsules (commonly referred to as cesium [Cs-137] and strontium [Sr-90] capsules) are part of the current HLW inventory. From 1968 to 1985, most of the high-heat-emitting nuclides (Sr-90 and Cs-137, plus their daughter products) were extracted from the old tank waste, converted to solids (strontium fluoride and cesium chloride [CsCl]), placed in double-walled metal cylinders (capsules) about 50 centimeters (cm) (20 inches [in]) in length and 5 cm (2 in) in diameter, and stored in the Waste Encapsulation and Storage Facility in water-filled pools.

The total number of Cs capsules produced is 1,577. As of August 19, 1993, the number of known dismantled Cs capsules is 249. These have been put to beneficial use and are not expected to be returned. The total number of remaining capsules requiring disposal is 1,328. Of the 1,328 remaining capsules, 959 are in storage at Hanford and 369 capsules have been leased for beneficial use. One of these capsules developed a small leak, and others have shown signs of bulging, so current plans are to bring all leased capsules back to Hanford (DOE 1995o:4-119).

The total number of Sr capsules produced is 640. As of August 19, 1993, the number of known dismantled Sr capsules was 35. These have been put to beneficial use and are not expected to be returned. The total number of remaining capsules requiring disposal is 605. Of the 605 remaining capsules, 601 are in storage at Hanford, and 4 have been leased offsite for beneficial use (DOE 1995o:4-119).

Therefore, at present 1,328 Cs capsules (2.47 m^3 [3.23 yd^3]) and 605 Sr capsules (1.08 m^3 [1.41 yd^3]) require storage. Nine hundred and fifty-nine Cs capsules and 601 Sr capsules are stored in pools of water in the Waste Encapsulation and Storage Facility. The capsules will be stored at Hanford until they can be transported to a proposed national repository (DOE 1995o:4-120). Tables E.2.1–2, E.2.1–3, and E.2.1–4 list HLW inventories and treatment and storage facilities at Hanford.

Transuranic Waste. TRU waste is primarily generated by R&D activities, Pu recovery, environmental restoration, and D&D. Most TRU waste is in solid form (for example, protective clothing, paper trash, rags, glass, miscellaneous tools, and equipment). Some TRU waste is in liquid form (sludges) resulting from chemical processing for recovery of Pu or other TRU elements.

Before 1970, all DOE-generated TRU waste was disposed of onsite in shallow, unlined trenches. From 1970 to 1986, TRU wastes were segregated from other waste types and disposed in trenches designated for retrieval. Since 1986, all TRU waste has been segregated and placed in retrievable storage pending shipment and final disposal in a permanent geologic repository.

Currently, all TRU wastes are stored in above-grade storage facilities in the Hanford Central Waste Complex and Transuranic Waste Storage and Assay Facility. The plan is to ship the stored TRU waste to WIPP near Carlsbad, New Mexico, for final disposal once WIPP can demonstrate compliance with 40 CFR 191 and 40 CFR 268. Current planning calls for all shipments to WIPP to be managed through module 1 of the Waste Receiving and Processing Facility or the proposed module 2B of the Waste Receiving and Processing Facility. If WIPP proves unsatisfactory as a TRU waste disposal facility, then another disposal facility would be selected. Should additional treatment be necessary for the disposal of TRU wastes, then Hanford would develop the appropriate treatment capability. Table E.2.1–5 lists the TRU and mixed TRU waste inventories. Tables E.2.1–6 and E.2.1–7 present the TRU and mixed TRU waste treatment and storage facilities at Hanford.

Low-Level Waste. From 1944 to 1991, approximately 558,916 m^3 (731,034 yd^3) of LLW was buried at Hanford (DOE 1995o:4-123). Between 1944 and 1986, no differentiation was made between LLW and mixed LLW.

Solid LLW is currently placed in unlined, near-surface trenches at the 200 Area LLW Burial Grounds. The site continues to receive LLW from offsite generators for disposal. Major sources of this waste are the Puget Sound Naval Shipyard in Washington, Brookhaven National Laboratory in New York, and Lawrence Berkeley Laboratory in California. Other points of origin include DOE facilities at nuclear power stations in Shippingport, Pennsylvania; Bechtel in Albany, Oregon; and Wood River in Charleston, Rhode Island. U.S. Ecology operates a licensed commercial LLW burial ground at Hanford on a site that is leased to the State of Washington. Although physically located on Hanford, it is not considered part of Hanford. The commercial LLW burial ground site area comprises 40 ha (99 acres), of which 29.5 ha (73 acres) are considered usable, with 11.9 ha (29 acres) used by the end of 1991. Through 1991, 338,500 m^3 (442,741 yd^3) of LLW had been disposed of at this site (DOE 1995o:4-123).

The LLW resulting from the tank waste remediation system waste pretreatment program will be vitrified by the end of 2035, under the tank waste remediation system LLW (vitrification) program. As a near-term contingency, the grout facility will be maintained in a standby condition. The program will utilize commercially available melters and other key processing technologies as much as possible. The program has contracts in place with several commercial melter vendors, and melter tests with Hanford waste simulants are currently being conducted. From the results of these tests, the reference melter and reference low-level glass formulation will be selected and incorporated into the design of the LLW vitrification facility. The current program baseline calls for the following: (1) initiation of hot operations of the LLW vitrification facility by June 2005 and (2) completion of vitrification of Hanford tank LLW by December 2035. The vitrified LLW will be disposed of onsite in the 200 Areas at Hanford by the tank waste remediation system program.

Mixed Low-Level Waste. Mixed LLW includes a variety of contaminated materials, including air filters, cleaning materials, engine oils and grease, paint residues, photographic materials, soils, building materials, and decommissioned plant equipment. The following special nuclear material production and site restoration activities have generated, or may generate, mixed waste:

- Fabrication of reactor fuel elements
- Operation of the production reactors
- Processing of irradiated fuel
- Separation and extraction of Pu and uranium
- Preparation of Pu metal
- Environmental restoration
- R&D support projects
- Maintenance and operations support

Between 1987 and 1991, 16,745 m^3 (21,901 yd^3) of mixed LLW were buried at Hanford (between 1944 and 1986, no differentiation was made between LLW and mixed LLW). Another 4,225 m^3 (5,526 yd^3) of mixed waste has been accumulating in storage in the Central Waste Complex, located in the 200 West Area (DOE 1995o:4-123).

Hanford also receives defueled submarine reactor compartments that are contaminated with PCBs and lead. These compartments are managed as mixed waste. In 1993, seven defueled submarine reactor compartment disposal packages were received and placed in Trench 94 of the 200-East Area LLW waste burial grounds. The Naval Nuclear Propulsion Program will prepare an EIS for its proposal to bury additional reactor compartments at Hanford. As of November 1993, there were a total of 35 submarine reactor compartments stored in Trench 94.

In 1993, 5,260 m^3 (6,880 yd^3) of mixed LLW were generated. The 78 mixed LLW streams at Hanford make up 85,000 m^3 (111,175 yd^3) of the mixed LLW. Ninety-six percent of the total is beta/gamma-emitting waste, mostly in the form of aqueous liquid in the double-shell tanks. One stream (double-shell tank miscellaneous waste) accounts for 40,000 m^3 (52,318 yd^3) of the mixed LLW, and in combination, the double-shell tank double-shell slurry feed, double-shell tank complex concentrate, and double-shell tank double-shell slurry make up another 34,500 m^3 (45,124 yd^3). Three mixed LLW streams related to the 183-H solar evaporation basin cleaning contain 2,500 m^3 (3,269 yd^3) (DOE 1995o:4-121). These inorganic sludge/particulate wastes have been neutralized and treated for packaging.

It is expected that 49 percent of all the mixed LLW at Hanford cannot be treated until the technology is modified or verified. The remaining 51 percent is to be processed through the 242-A Evaporator (a closed system in which distillates are passed through an ion-exchange system to remove Cs). Treatment for these wastes is being evaluated as part of the design of the Effluent Treatment Facility (ETF) and the Waste Receiving and Processing Facility. The Waste Receiving and Processing Facility, to be located near the Central Waste Complex, would provide size reduction, decontamination, condensation, melting, amalgamation, incineration, ash stabilization, and shipping for Hanford mixed waste. The Waste Receiving and Processing Facility will be constructed in two phases: module 1 and module 2 (2A and 2B). The separation of module 2 into the 2A and 2B components has not been formally approved through the Tri-Party Agreement change request process. Module 1 will be designed to prepare retrieved and stored TRU and would be operational in 1999. Module 2A, or the proposed commercial treatment alternative, would be designed to process LLW, TRU wastes, mixed LLW, and mixed TRU wastes, and would be operational in 1997. Module 2B, if authorized, would be designed to process LLW, TRU wastes, mixed LLW, and mixed TRU wastes with a dose rate greater than 200 millirem (mrem)/hour (hr). Module 2B has an undetermined startup date. Other technologies and plans are also being considered and will be the subject of appropriate NEPA documentation during the selection process. In a recent modification to the Tri-Party Agreement, DOE has agreed to begin design of a vitrification facility to treat liquid mixed LLW in the future.

[Text deleted.]

The RCRA components of mixed waste at Hanford are mainly the following listed wastes: D002B (alkaline liquids, 22 streams), D006B (cadmium, 29 streams), D007 (chromium, 34 streams), D008B (lead, 30 streams), and F003 (nonchlorinated solvents, 30 streams). Waste sources are primarily the separation and extraction processes that were used to produce special nuclear material. Inventory, treatment, disposal, and storage facilities for LLW and mixed LLW are listed in Tables E.2.1–8, E.2.1–9, E.2.1–10, and E.2.1–11.

Hazardous Waste. Hazardous wastes are categorized by Washington Administrative Code, *Dangerous Waste Regulations*, as dangerous waste and extremely hazardous waste. As of March 15, 1993, Hanford contained 64 interim-status treatment, storage, or disposal units. Present plans are that final RCRA permits will be sought for 24 of these 64 units, 34 units will be closed, and 6 units will be dispositioned through other regulatory options. Future circumstances may cause these numbers to change. The treatment, storage, or disposal units within the Hanford facility include, but are not limited to, tank systems, surface impoundments, container storage areas, waste piles, landfills, and miscellaneous units. Other RCRA permits, such as research, development, and demonstration permits (for example, the 200 Area Liquid ETF), are also being pursued. A summary of the hazardous waste treatment and storage facilities at Hanford is shown in Tables E.2.1–12 and E.2.1–13.

The principal present waste management practice for newly generated hazardous waste is to ship it offsite for treatment, recycling, recovery, and disposal. Table E.2.1–14 lists the hazardous waste quantities shipped offsite in 1994. The Nonradioactive Dangerous Waste Storage Facility (Building 616) and the 305-B waste storage facility are the only active facilities storing hazardous waste (other than the less-than-90-day storage areas and two boxes (one containing mixed and one containing hazardous waste) stored in the 222-S laboratory complex).

Nonhazardous (Sanitary) Waste. Onsite treatment facilities (such as septic tanks, subsurface soil absorption systems, and a sanitary treatment plant) treat an average of 0.60 million l (0.158 million gal) of sewage per day (DOE 1995cc:4-55). The 200 Area Treated Effluent Disposal Facility industrial sewer will collect the treated wastewater streams from various plants in the 200 Areas and dispose of the clean effluent at two new 20,235-square meters (m^2) (5-acre) ponds permitted by the State of Washington. The 300 Area Treated Effluent Disposal Facility provides collection, treatment, and disposal for laboratory wastewater, boiler blowdown, steam condensate, spent softener regenerant, and heating, ventilation, and air conditioning generated in the 300 Area. The treated wastewater is discharged to the Columbia River under the conditions of a NPDES permit. Solid wastes are disposed of in the 600 Area Central Landfill. Coal waste is disposed of in landfills near the 200 East and 200 West Area powerhouses. A quantity of 246,051,000 l (64,999,793 gal) of liquid sanitary waste and 43,006 m^3 (56,249 yd^3) of solid sanitary waste are estimated to be generated each year at Hanford.

Other Nonhazardous Wastes. Solid wastes are generated in all areas of Hanford. Nonhazardous solid wastes include the following:

- Construction debris, office trash, cafeteria waste/garbage, empty containers and packaging materials, medical waste, inert materials, bulky items such as appliances and furniture, solidified filter backwash and sludge from the treatment of river water, failed and broken equipment and tools, air filters, uncontaminated used gloves and other clothing, and certain chemical precipitates such as oxalates

- Nonradioactive friable asbestos (regulated under CAA)

- Ash generated from powerhouses

- Nonradioactive demolition debris from decommissioning projects

The active Hanford Site Solid Waste Landfill, located in the 200 Area, began operation in 1973. In 1992, 22,213 m^3 (29,053 yd^3) of solid waste and 1,017 m^3 (1,330 yd^3) of asbestos were deposited in the solid waste section of the landfill (DOE 1995o:4-127). Pit 10 was opened for disposal of inert material as defined in Washington Administrative Code 173-304, and 11,389 m^3 (14,896 yd^3) of waste were disposed of there. The landfill is currently scheduled for closure in 1997.

E.2.2 NEVADA TEST SITE

After underground nuclear tests at NTS, radioactive and hazardous materials were extracted and analyzed. These activities have resulted in the accumulation of low-level, hazardous, and mixed wastes that must be treated, stored, and disposed of. The *Site Book for Waste Management* (May 1994), the *Waste Management Plan for the Nevada Test Site* (February 1995), the *NTS Site Treatment Plan and Federal Facility Compliance Act Consent Order* (March 1996), and the *Final Environmental Impact Statement for the Nevada Test Site and Off-Site Locations in the State of Nevada* (DOE/EIS 0243) (NTS Site-Wide EIS) detail waste management activities at NTS.

Radioactive and hazardous wastes (according to the current definition of hazardous wastes) generated from past nuclear testing activities were disposed of in Areas 2, 3, 5, 6, 8, 9, 12, and 23. These were mixed wastes and LLW composed of debris, drilling mud, decontamination wastes, laboratory, and classified wastes. Areas 3 and 5 are still currently active for waste storage and disposal. Area 3 receives offsite and onsite bulk waste for disposal in subsidence craters. An RCRA closure plan for this facility has been submitted to the Nevada Division of Environmental Protection. The Radioactive Waste Management Site in the north of Area 5 contains LLW management units and receives packaged classified and unclassified LLW. NTS also has TRU waste from Lawrence Livermore National Laboratory (LLNL) in storage and a hazardous waste storage unit. The NTS currently is not accepting mixed wastes from any locations. Mixed waste could be accepted from Defense-related generators within the State of Nevada; however, there is no mixed waste ready for disposal that meets the land disposal restrictions of RCRA. Mixed waste from out-of-state generators has been disposed at NTS in the past. This practice is planned for the future contingent on approval and permitting (RCRA Part B) of future mixed waste disposal units and on actions resulting from the ROD for the Waste Management PEIS.

In the past, NTS hazardous waste was disposed of in landfills, through underground injection, in leachfields, and offsite. A goal of the NTS Environmental Restoration Project is to remove or immobilize hazardous substances, pollutants, and contaminants while achieving compliance with environmental laws and regulations. Environmental restoration activities will be guided by the ROD from the NTS Site-Wide EIS and the NTS Site Treatment Plan.[Text deleted.]

Pollution Prevention. The DOE Nevada Operations Office is an active participant in DOE's national waste minimization and pollution prevention program. A comprehensive waste minimization plan for NTS, completed in 1991, defines specific goals, methods, responsibility, and achievements for organizations. A waste minimization organization promotes waste minimization and pollution prevention and ensures compliance with DOE orders at NTS. A report on waste generation and waste minimization progress is published annually.

The DOE Nevada Operations Office publishes sitewide plans and guidance, and each contractor develops its own implementation plan. Plans and procedures have been developed limiting the number and types of hazardous materials used on the site. Since initiation of the waste minimization program, several steam-cleaning operations have been eliminated, and half of the hazardous solvents used at NTS have been replaced with nonhazardous solvents. Recycling and reclamation activities have been established to reuse lead, silver, lubricating oil, and trichlorotrifluoroethane. Automatic decontamination equipment, recycling fabrication tool coolant systems, and continuous oil change and reburn systems have been placed in service to reduce hazardous waste generation. Closed-loop effluent recycling for steam cleaning has eliminated the production of 17.8 million l (4.7 million gal) of wastewater annually and reduced hazardous waste generation by 90 percent. Two solvent waste stills recycle 85 percent of all solvents and thinners used. Nonhazardous aqueous solution parts cleaners have eliminated the need for parts cleaning solvents.

The procurement of all materials is also reviewed for the opportunity to reduce the purchase of hazardous materials for NTS operations. [Text deleted.] In addition, an education and training program for all site personnel and for the surrounding community is helping to increase awareness of practices and lessons learned in waste reduction.

Transuranic Waste. TRU and mixed TRU waste at NTS, which was generated at LLNL and shipped to NTS between 1974 and 1990, is stored on the TRU Waste Storage Pad in Area 5. All NTS TRU and mixed TRU waste is expected to be certified for disposal at WIPP in Carlsbad, NM, or at another suitable repository should WIPP prove to be unsatisfactory. The DOE Nevada Operations Office has the option to construct a TRU Waste Certification Building for breaching, sampling, and certifying containers of TRU waste to meet the WIPP waste acceptance criteria, which is expected to be finalized by June 1997 (NT DOE 1996b:BV-37). Other technologies, such as mobile characterization capabilities, are also being considered. This waste inventory consists of 612 m^3 (800 yd^3) of heterogeneous debris. The TRU waste is stored in the TRU Pad Cover Building on the TRU Waste Storage Pad to protect the containers from the environment. [Text deleted.] In addition, TRU and suspected TRU wastes from weapons tests were emplaced in boreholes. Decisions to retrieve this waste or leave it in place will be based on performance assessments required by 40 CFR 191 and/or on risk assessments required by the *CERCLA National Contingency Plan* or RCRA corrective action. Table E.2.2–1 lists the mixed TRU waste storage units at NTS.

Low-Level Waste. Contaminated soils created from past atmospheric nuclear weapons tests occur at various locations on NTS. Some of this surface contamination has been, or is planned to be, removed and disposed of as waste. Although the debris from underground weapons tests remains underground, samples of this debris brought to the surface for analysis must be disposed of as waste. The majority of LLW generated at NTS is disposed in subsidence craters in Area 3. This area also receives substantial quantities of containerized bulk waste from offsite DOE facilities. Some waste disposal units are being closed in this area, while others are being readied for future use. Area 5 receives low-level radioactive waste from both onsite and offsite generators. New disposal capacity is planned for this area, and the offsite generators will be required to meet the NTS waste acceptance criteria (which includes periodic reviews by the DOE Nevada Operations Office) to permit them to ship LLW for disposal at NTS.

Historically, the volume of waste received from offsite is approximately equal to or slightly greater than the volume of waste generated onsite. Onsite waste generation (other than environmental restoration waste) has declined due to cessation of nuclear testing with offsite receipts now dominating waste disposal activities. Remediation activities at NTS will produce waste streams that will have to be treated, stored, and disposed. Any incoming offsite waste shipments must meet NTS waste acceptance criteria. Fifteen generators currently ship LLW to NTS and nine additional generators are applying or are waiting for approval (NT DOE 1996c:4-48,4-49). The LLW disposal capacity in use or planned at NTS is listed in Table E.2.2–2.

Mixed Low-Level Waste. Mixed LLW is generated by Defense-related support activities, environmental restoration activities, and activities supporting TRU waste disposal at WIPP or at another suitable repository should the WIPP prove to be unacceptable. Wastes were generated by the analytical activities supporting weapons tests and consist of drilling muds and debris generated from tunnel reentry and rehabilitation. Additional wastes result from radiochemical analysis and from the decontamination of equipment and facilities used in sample extraction and analysis. NTS has received mixed wastes from other DOE sites and may receive additional waste in the future, pending the completion of the Site Treatment Plans for all DOE sites and issuance of proper permits. Mixed waste generated in the State of Nevada that meets the land disposal restrictions of RCRA can be disposed of in the Area 5 Mixed Waste Disposal Unit, Pit 3. Mixed wastes not meeting the land disposal restrictions requirements can be stored on the TRU Waste Storage Pad. A RCRA Part B Permit application for a new mixed waste storage unit was submitted in January 1995. Mixed LLW streams are being characterized to fully determine what technologies and capabilities are required for safe, environmentally sound, and compliant disposal. [Text deleted.]

Table E.2.2–2 lists mixed LLW storage and disposal facilities at NTS. Table E.2.2–3 lists the mixed LLW streams inventory and 5-year projected generation at NTS. The total volume is 296 m^3 (388 yd^3), including a 20,425-kilogram (kg) (45,000-pound [lb]) empty spent shipping cask. [Text deleted.]

Hazardous Waste. Hazardous waste is generated from ongoing operations at NTS. This waste consists of solvents, lubricants, fuel, lead, metals, and acids and is accumulated at various sites around NTS while awaiting shipment offsite to an RCRA-permitted facility. Over the next 5 years, additional satellite storage locations are planned. A separate accumulation site is located across the road from Area 5 to avoid potential cross-contamination with radioactive waste. The generation of hazardous waste at NTS is expected to decrease significantly because of the cessation of nuclear testing, the completion of environmental restoration activities, and the impact of waste minimization activities. Hazardous waste is stored on a 279-m^2 (365-square yard [yd^2]) covered pad in Area 5 (NT REECO 1995a:33).

Nonhazardous Waste. Nonhazardous sanitary waste is expected to be generated at the current rate for several more years, then at a lower rate due to the cessation of nuclear weapons testing. Recycling of paper, metals, glass, plastics, and cardboard has already resulted in some decrease in waste quantities. NTS has several sanitary landfills and construction landfills in operation.

Table E.2.2–1. Mixed Transuranic Waste Storage Facility at Nevada Test Site

Storage Unit	Input Capability	Total Area (m^2)	Comment
Asphalt Storage Pad	Mixed TRU solid, mixed LLW	8,300 (1,995 in TRU pad cover building)	Available storage capacity on the TRU Pad to be used for storage of future, onsite-generated mixed LLW that does not meet RCRA Land Disposal Restriction provisions.

Source: NT DOE 1996b.

Table E.2.2–2. Low-Level and Mixed Low-Level Waste Storage and Disposal Facilities at Nevada Test Site

Disposal Unit	Input Capability	Total Capacity[a] (m^3)	Comment
Mixed Waste, P03U Management Unit	Mixed LLW solid	118,908	Interim status. Onsite use only. RCRA Part A 1988. Environmental Assessment published, withdrawn. Considered in Site-Wide EIS.
LLW Disposal, P05U	LLW solid, wood, metal, rubble, debris	66,946	Operational. Additional 616,300 m^3 capacity available for expansion.
LLW Disposal, P06U	LLW solid	27,002	Operational, reserved for future use.
Classified Shallow Land Burial, T02C	LLW solid, metal in approved containers	1,698	Operational, no remaining capacity.
Shallow Land Burial, T03U	LLW solid, metal, debris, unclassified	7,086	Reserved for LLW disposal.
Classified Shallow Land Burial, T04C	LLW solid, metal in approved containers	1,518	Operational.
Mixed Waste Storage Pad	Mixed LLW solid	6,040[b]	Planned. RCRA Part B submitted in 1992.
Bulk LLW Disposal, U3AHAT	LLW solid, wood, metal, soil, biological	424,800	Operational.

[a] Schedules and capacity for facilities under design or construction are subject to changes such as availability of funds and permit issuance.

[b] Estimated assuming no aisle space and containers stacked 2-m high.

Source: NT DOE 1996b; NT REECO 1994a.

E.2.3 IDAHO NATIONAL ENGINEERING LABORATORY

Activities associated with the development of reactor technology and the extraction of useful nuclear materials at INEL have produced radioactive, mixed, and hazardous wastes that are treated, stored, or disposed of on the site. The Argonne National Laboratory-West (ANL-W) facilities generate and treat TRU, LLW, hazardous, and nonhazardous wastes that are disposed of by INEL per agreement between the DOE Idaho and Chicago Operations Offices. The ROD for the *Department of Energy Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs Final Environmental Impact Statement* (60 FR 28680), as amended (61 FR 9441), lists decisions dealing with site-wide environmental restoration and waste management programs at INEL.

Pollution Prevention. The DOE Idaho Operations Office has an active Waste Minimization and Pollution Prevention Program to reduce the total amount of waste generated and disposed of at INEL. This is accomplished by eliminating waste through source reduction or material substitution, by recycling potential waste materials that cannot be minimized or eliminated, and by treating all waste that is generated to reduce its volume, toxicity, or mobility prior to storage or disposal. The DOE Idaho Operations Office published its first waste minimization plan in 1990, which defined specific goals, methodology, responsibility, and achievements of programs and organizations. The achievements and progress have since been updated at least annually.

Spent Nuclear Fuel. The inventory of spent nuclear fuel at INEL is cited here in metric tons (t) of heavy metal based on currently available references. There are 109 t (120 tons) of spent nuclear fuel stored at ICPP, 129 t (142 tons) at the Test Area North (TAN), 30 t (32.6 tons) at ANL-W, and 6 t (6.6 tons) at the Naval reactors, test reactors, and power burst facilities. Spent nuclear fuel is stored in facilities designed for a specific fuel type; therefore, storage capacities are not additive for the site. There are 11.6 t (12.8 tons) of graphite reactor fuel, 10.2 t (11.2 tons) of naval reactor fuel, and 252.2 t (278 tons) of commercial and research reactor fuels in the inventory (DOE 1995j:2-7,2-8,3-7). Naval Reactor Facility and Test Reactor Area fuel will be sent to the ICPP for storage. The TAN fuel pool is nearing its design life expectancy. The Three Mile Island core debris stored there will be repackaged and placed in dry storage. Experimental Breeder Reactor-II at ANL-W has its own fuel reconstitution facility to process waste.

The treatment of spent nuclear fuel for long-term storage and disposal is expected to continue at INEL for the next 40 years. Existing rulings designate spent nuclear fuel as a recoverable resource; as such, waste regulations for treatment, storage, and disposal do not apply. There are no plans to dispose of spent nuclear fuel at INEL. Figure E.2.3–1 illustrates spent nuclear fuel management at INEL. As a result of the amended ROD (61 FR 9441) from the *Department of Energy Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs Final Environmental Impact Statement* (DOE/EIS-0203-F), non-aluminum-clad fuels and naval spent fuel will be shipped to INEL for storage. This will increase the spent nuclear fuel to be managed at INEL from 274 t (302 tons) to 381 t (420 tons). INEL will make 114 shipments of aluminum clad spent nuclear fuel to SRS and receive 1,133 shipments of non-aluminum-clad spent nuclear fuel from other DOE sites.

High-Level Waste. HLW has been generated during the reprocessing of spent nuclear fuel at the ICPP. Most of this fuel was from the naval reactors program. The liquid HLW is concentrated by evaporation and converted to metallic oxides by calcination in a fluidized bed. These are then stored in a stable granular solid form. This waste form is stored in stainless steel bins in concrete vaults, where it can be held long enough that the short half-life isotopes have decayed and its activity is reduced. This waste form is a mixed HLW because of the toxic metals it contains.

Liquid HLW in acidic solution is stored in stainless steel tanks. All of this waste will be calcined to allow INEL to meet requirements of a December 9, 1991, Consent Order with the State of Idaho and EPA to cease the use of existing storage tanks without building new tanks. The Department proposes to construct a facility to treat the calcined waste (and any remaining liquid waste) in accordance with RCRA on a schedule to be negotiated with the State of Idaho under the *Federal Facility Compliance Act.* The Department has selected radionuclide partitioning followed by grouting to immobilize the low-activity waste and vitrification to immobilize the high-activity waste. The HLW inventory, treatment and storage facilities (for example, the High Efficiency Particulate Air [HEPA] Filter Storage Facility) at INEL are listed in Tables E.2.3–1, E.2.3–2, and E.2.3–3. Figure E.2.3–2 illustrates HLW management at INEL.

Transuranic Waste. TRU and mixed TRU wastes are stored at the Radioactive Waste Management Complex (RWMC). Prior to 1970, when the Atomic Energy Commission determined that TRU waste required segregation from other wastes, TRU waste was buried in earthen trenches. Since that time, TRU waste has been segregated into contact-handled and remote-handled categories, then packaged and stored for ultimate retrieval and transport to an offsite repository at WIPP. INEL contains 58 percent of DOE's TRU waste. The majority of TRU waste at INEL was shipped from other sites, particularly Rocky Flats Plant (now known as the Rocky Flats Environmental Technology Site [RFETS]), but this practice was stopped in 1989.

The existing treatment facilities for TRU waste at INEL are limited to testing, characterization, and repackaging. The Idaho Waste Characterization Facility, now in the planning phase, will characterize TRU waste and either reclassify it (if it is found to be LLW) for disposal onsite, or prepare it so that it meets the WIPP waste acceptance criteria. The use of commercial treatment facilities is being considered. Modifications of the RWMC to support commercial treatment of alpha-contaminated mixed LLW, the construction of the Advanced Mixed Waste Treatment Project and the Mixed LLW Disposal Facility, and the Plasma Hearth Process Project are being considered subject to funding restraints and additional NEPA review.

The TRU waste at INEL is being stored pending the outcome of the WIPP program. Assuming WIPP is determined to be a suitable repository for these wastes, pursuant to the requirements of 40 CFR 191 and 40 CFR 268, these wastes will be transported there for disposal. DOE will begin discussions with the State of Idaho regarding treatment options for mixed TRU waste in January 1998, if the Secretary of Energy does not decide to operate WIPP as a disposal facility by that time; or at such earlier time as DOE determines that (1) there will be a delay in the opening of WIPP substantially beyond 1998 or (2) the No-Migration Variance Petition is not granted by the EPA. DOE will propose modification to the INEL Site Treatment Plan for approval by the State of Idaho within a timeframe agreed upon between DOE and the State of Idaho. These modifications will describe planned activities and schedules for the new mixed TRU waste strategy. Figure E.2.3–3 illustrates TRU waste management at INEL. Tables E.2.3–4, E.2.3–5, and E.2.3–6 list the TRU and mixed TRU wastes inventory, and treatment and storage facilities at INEL. Some TRU waste at INEL will never meet WIPP waste acceptance criteria and therefore cannot be sent to WIPP. Other options will have to be developed for these wastes. Approximately one-half of the TRU waste is expected to be reclassified as alpha-contaminated LLW in the future. This waste does not meet INEL waste acceptance criteria for LLW and therefore will be managed as TRU waste. Additionally, INEL may accept TRU waste from other sites for treatment. The treated waste would be returned to the generator or sent to an offsite disposal facility (assumed to be WIPP).

Low-Level Waste. LLW is generated in various forms at INEL facilities. This waste is disposed of at the RWMC. Most of this waste is processed onsite or offsite before disposal by incineration, compaction, or sizing to reduce volume and to stabilize the waste to the maximum extent possible. Some LLW does not meet criteria for onsite disposal. This waste is stored temporarily until treatment and disposal options are developed. Liquid LLW is either evaporated and processed to calcine, or solidified and disposed of. The volume of LLW disposed of at INEL's RWMC is 145,000 m^3 (189,600 yd^3). As of 1991, the facility had an 180,000-m^3 (235,345-yd^3) capacity, with an additional 67,000 m^3 (88,000 yd^3) of expansion capacity available (DOE 1995j:4.14-2). Figure E.2.3–4 illustrates LLW management at INEL.

Mixed Low-Level Waste. Mixed LLW is generated in small quantities at INEL and is stored in several areas onsite (ANL-W, ICPP, Special Power Excursion Reactors Test). INEL may also receive limited volumes of mixed LLW from other sites for treatment, with the residuals being returned to the generator. The Waste Experimental Reduction Facility, the Waste Reduction Operations Complex, the ICPP, ANL-W and TAN will process mixed LLW. [Text deleted.] Additional facilities (Advanced Mixed Waste Treatment Project, Mixed/LLW Disposal Facility, and Remote Mixed Waste Treatment Facility) planned for INEL would be able to treat mixed waste and render it acceptable for disposal. Figure E.2.3–5 illustrates mixed waste management at INEL.

Although mixed liquid and solid wastes generated from past operations are stored in many locations at INEL, the bulk of that volume is solid waste stored at the RWMC. Its volume is approximately 66 percent of the TRU waste volume also stored there and is 11 percent of the total volume of waste stored or disposed of at that facility. The inventory of mixed LLW, and treatment and storage facilities at INEL are listed in Tables E.2.3–7, E.2.3–8, and E.2.3–9.

Hazardous Waste. Hazardous waste is staged in a RCRA-permitted building at the Central Facilities Area (CFA) prior to shipment to an offsite commercial RCRA-permitted facility. Table E.2.3–10 lists the hazardous waste quantities shipped offsite in 1994. The INEL waste minimization program is expected to significantly reduce the quantities of hazardous wastes generated at INEL over the next 5 years. By that time, the use of nonhazardous chemicals and the recycle of those for which there is no substitute should nearly eliminate the generation of hazardous waste.

Nonhazardous Waste. Nonhazardous (industrial and sanitary) wastes are processed at each facility on the INEL site and disposed of at the CFA or at the Bonneville County landfill. Wastes are segregated into sanitary, industrial, and asbestos wastes before emplacement. Increased recycling is expected to reduce nonhazardous waste generation by 50 percent by 1997. A new multipurpose facility is planned to be in operation at ANL-W by 1996 to collect, monitor, and consolidate ANL-W nonhazardous wastes before shipment to the CFA. INEL will continue its existing industrial waste program in the future; this will require expansion of the 4.8 ha (12 acres) CFA landfill by 91 ha (225 acres) to provide capacity for the next 30 years (60 FR 28680).

E.2.4 PANTEX PLANT

This section describes the baseline conditions and specific waste management operations at Pantex. As part of its normal operations, Pantex generates low-level, mixed low-level, hazardous, and nonhazardous wastes. Tables E.2.4–1 and E.2.4–2 present a detailed description of treatment and storage facilities with estimated capacities.

Pantex's goals regarding the management of LLW, mixed LLW, and hazardous wastes are as follows:

- Minimize the volumes of low-level radioactive, mixed low-level, and hazardous wastes generated to the extent technologically and economically practicable
- Recycle those wastes applicable to the best available technology
- Minimize contamination of existing or proposed real property and facilities
- Ensure safe and efficient long-term management of all wastes

Pollution Prevention. Pantex has a waste minimization program that was created to define an effective waste minimization system for the site. A committee provides awareness of the program, identifies tasks, and provides liaison between the site and outside entities. Some of the accomplishments of this program are as follows:

- Compactor used to compact 1,200 drums to approximately 250 drums. Disposal cost savings of approximately $300,000 was achieved.
- Separation of radioactive and hazardous waste materials when shearing weapons components. Reclamation of gold from this process netted $243,000 in the first year.
- Reclamation of oil, antifreeze, and refrigerant.
- Substitution of scintillation solution that is nonhazardous.
- Reuse of explosives and solvents.
- Repackaging of paint into smaller containers.
- Substitution of naphtha with nonhazardous biodegradable cleaning solution.

Transuranic Waste. No TRU waste or mixed TRU waste is currently generated at Pantex during normal operation. However, there is a potential for an off-normal event to generate small amounts of contact-handled TRU waste or mixed TRU waste during a weapon-dismantlement activity. Three drums of TRU waste were generated several years ago from an incident during weapon dismantlement. Ultimately, Pantex plans to ship its TRU waste to a DOE-approved storage site when available. In the interim, approximately 1 m^3 (1.3 yd^3) of TRU waste is temporarily stored in Building 12-42 (DOE 1995gg).

Low-Level Waste. The following options are available for the management of LLW streams:

- Continue to ship to an approved DOE disposal site such as NTS
- Compact solid waste, if possible

- Continue improvements to computerized tracking of radioactive waste
- Implement improved segregation program

Solid LLW generated at Pantex consists of contaminated parts from weapons assembly and disassembly functions and waste materials associated with these functions, such as protective clothing, cleaning materials, filters, and other similar materials. The compactible components of this waste are processed at the Pantex Solid Waste Compaction Facility and staged along with the noncompactible components for shipment to a DOE-approved disposal site. Table E.2.4–3 lists Pantex's LLW streams, how they are generated, primary radioactive constituents, and method of storage or disposal. Table E.2.4–4 presents the inventory of LLW at Pantex as of December 2, 1994, as well as a 5-year projection.

Mixed Low-Level Waste. The following options are available for the management of mixed LLW streams:

- Store onsite pending treatment to satisfy LDR requirements. This is the current option now being used at Pantex (PX DOE 1996b:4-193).
- Treat to satisfy LDR requirements and ship to an approved commercial facility or other DOE-approved facility for storage or disposal.
- Ship off site for treatment and disposal.

Pantex manages its mixed waste in accordance with the *Pantex Plant Federal Facility Compliance Act Compliance Plan.* Pantex generates solid mixed LLW during weapons component testing functions. These wastes consist primarily of depleted uranium and beryllium residue and fragments from explosive components tests, contaminated soils, cleaning materials, and protective clothing associated with these operations. Other mixed LLW streams include cleaning materials from weapons assembly and disassembly operations. Mixed LLW (high explosives [HE] contaminants only) is currently treated at the Burning Ground, which has a permitted capacity of 180 m^3/yr (236 yd^3/yr) (DOE 1995gg). The Hazardous Waste Treatment and Processing Facility is being planned to treat mixed waste in mobile treatment units. Table E.2.4–5 lists Pantex's primary mixed waste streams, composition, method of process, and treatment alternatives. Table E.2.4–6 lists organic liquid mixed LLW stream candidates that are being evaluated for commercial treatment and/or disposal. Table E.2.4–7 lists the mixed waste storage inventory as of September 1995, as well as a 5-year projection.

Hazardous Waste. The following options are available for the management of hazardous waste streams:

- Continue to ship to approved hazardous waste disposal facilities
- Encapsulate solid waste and ship to a DOE-approved disposal site
- Treat onsite for neutralization of corrosive wastes

Table E.2.4–8 presents the inventory for hazardous waste at Pantex as of December 2, 1994, as well as a 5-year projection. The treatment of hazardous waste is done at the following facilities:

- The Burning Ground is an open-burning area where explosives, explosive-contaminated waste, and explosive-contaminated spent solvents are burned. A large volume reduction is attained by this treatment, and some wastes are rendered nonhazardous due to elimination of the HE reactivity hazard.

- The Hazardous Waste Treatment and Processing Facility will house liquid-phase and solid-phase hazardous, low-level, and mixed waste processing activities. The facility has been planned and approved and should be available in 2000.

Not all of the hazardous waste is treated at Pantex. The amount of hazardous waste shipped offsite in 1994 is shown in Table E.2.4–9. There are several separate storage facilities for hazardous wastes.

- In the Hazardous Waste Drum Storage Area, all liquid drums are placed in spill-containment pans. The facility is inspected weekly for leakers. Small lab samples of hazardous waste are stored in two chemical storage containers in this area. The materials stored in the area include asbestos, mercury-contaminated wastes, Burning Ground ash, and electroplating sludge.

- At Building 16-1, used crank case oil is stored underground until sufficient quantities are generated for offsite processing.

Class 1 non-RCRA-hazardous waste includes asbestos-contaminated materials, PCBs with a concentration greater than 50 parts per million (ppm), and oils with a total petroleum hydrocarbon concentration greater than 1,500 ppm. Table E.2.4–10 presents the Class 1 non-RCRA hazardous waste streams, current inventories as of December 2, 1994, and projected generation volumes.

Medical waste is defined as any solid waste that is generated in the diagnosis, treatment, or immunization of human beings or animals; in research; or in the production or testing of biologicals. This waste includes cultures and stocks, pathological wastes, human blood and blood products, sharps, animal waste, and isolation wastes. Pantex currently generates approximately two boxes per week, each with a capacity of 0.142 m^3 (0.186 yd^3). The annual generation rate of medical waste at Pantex is approximately 15 m^3 (19 yd^3) (PX DOE 1995i:14–15). Medical waste is dispositioned through a commercial vendor who picks up and transports the medical facility's biomedical and infectious waste.

Nonhazardous Waste. The Sewage Treatment Quality Upgrade is a 1996 project at Pantex. This project would upgrade the Pantex sanitary system to ensure that wastewater standards are met through secondary/tertiary treatment. Included in this project is the upgrade of the existing sewage treatment lagoon, repair and replacement of existing deteriorated sewer lines, construction of a closed system to eliminate the use of open ditches for conveyance of industrial wastewater discharges, and implementation of a plant stormwater management system.

Class 2 nonhazardous waste (general refuse) is collected at each building from trash cans and placed in dumpsters. This includes cardboard, computer paper, white paper, colored paper, mixed steel, steel and aluminum cans, mixed metal, mixed plastic, foam rubber, and glass. Currently, telephone directories, paper, certain plastics, and some steel and aluminum cans are being recycled. The weights of Class 2 nonhazardous waste disposed from 1989 to 1994, and the estimated amounts for 1995 through 1999, are given in Table E.2.4–11.

E.2.5 OAK RIDGE RESERVATION

The Oak Ridge Reservation consists of three operating industrial complexes in and around the City of Oak Ridge. The Energy Systems Waste Management Organization provides the waste management oversight for ORR. It also provides guidance to each of the operating facility waste management divisions that are responsible for operating and managing their respective waste management facilities and activities.

Y–12 Plant

Laboratory, maintenance, construction, demolition, and cleanup activities; machining operations; and waste produced in the purification of uranium for recycle are the primary waste generation activities at the Y–12 Plant (Y–12). In addition, metal-plating operations generate plating waste solutions, while various laboratory activities generate reactive wastes and waste laboratory chemicals. Liquid process waste and the sludge resulting from their treatment are generated throughout the plant. Waste oils and solvents are generated from machining and cleaning operations. Daily operations, such as janitorial services and floor sweepings, generate both noncontaminated and uranium-contaminated industrial trash.

Pollution Prevention. The Y–12 Pollution Prevention Awareness Program Plan describes the overall program in detail. The program is designed to maintain the flow of information pertaining to waste minimization and pollution prevention and to facilitate activities to implement real reductions in waste generation. A summary description of the four key elements of the Waste Minimization and Pollution Prevention Program includes a promotional campaign, information exchange, a waste tracking system, and waste assessment performance.

One goal of the program is to sustain an effective pollution prevention effort by improving the employee awareness of waste minimization opportunities and activities. Improved awareness is accomplished through including training, posters, publications, seminars, promotional campaigns, and recognition of individuals and teams for activities that reduce waste generation. Waste minimization activities at other ORR sites and other weapons sites provide useful input to the program. Using ideas developed by others is an important aspect that can save time and resources.

Tracking waste generation in a manner that lends itself to waste minimization reporting is a prerequisite to documenting successes or failures in waste minimization efforts. Y–12 is improving its ability to record and track waste shipments. Process waste assessments are being conducted as part of the ongoing program to identify, screen, and analyze options to reduce the generation of waste. This determines the amount of material in a workplace that is disposed of as waste during work operations. The assessment provides a summary of hazardous materials usage and waste production, and it identifies those processes and operations that need to be improved or replaced to promote waste minimization.

Spent Nuclear Fuel. Y–12 does not generate any spent nuclear fuel; however, it does store and safeguard a small amount of reactor-irradiated nuclear material in Building 9720-5, a large warehouse facility containing numerous vaults for storage. Some features of the facility are classified and it is distinguished by its high level of security. Operations consist of transfers, storage, and inventory of highly enriched uranium (HEU) in containers of various types.

High-Level Radioactive Waste. Y–12 does not generate or manage HLW.

Transuranic Waste. Y–12 does not generate or manage TRU waste.

Low-Level Waste. Machining operations that use stock materials including steel, stainless steel, aluminum, depleted uranium, and other materials produce machine turnings and fines as waste products. Waste treatment provides controlled conversion of these waste streams to an environmentally acceptable, or more efficiently handled or stored, form. This activity includes continuing operation and maintenance of facilities that treat wastewaters and solid waste generated from production and production support activities. Waste minimization and planned treatment facilities are expected to reduce the magnitude of these wastes. In 1994, Y–12 treated approximately 899,000 l (237,000 gal) of liquid LLW and 2,730 m^3 (3,580 yd^3) of solid LLW (OR LMES 1996a:5-6). Table E.2.5–1 summarizes the LLW treatment facilities at Y–12. The major facilities are described below.

The Uranium Chip Oxidation Facility thermally oxidizes depleted and natural uranium (less than 1-percent enrichment) machine chips under controlled conditions to a stable uranium oxide. Upon arrival, chips are weighed, placed into an oxidation chamber, and ignited. The oxide is transferred to drums and transported to the uranium oxide storage vaults. Since the facility is not designed to treat uranium sawfines, these are currently blended with uranium oxide and placed in the oxide vaults as a short-term treatment method.

The Waste Feed Preparation Facility processes and prepares solid LLW for volume reduction through incineration by an outside contractor or storage at Y–12. The facility utilizes a 200 t capacity baler to reduce the waste volume to one-eighth of its original size. Waste comes to the facility from areas known to generate contaminated material, or from dumpsters that were analyzed at the trash monitoring station and deemed to be above the radioactive acceptability limits for the sanitary landfill. The compacted bales are placed in DOT-approved metal boxes and staged in an adjacent warehouse prior to offsite shipment for incineration or storage at Y–12.

The Uranium Treatment Unit is near Building 9206 and was used to treat uranium-contaminated nitrate waste solutions that were generated in enriched uranium recovery operations in Buildings 9212 and 9206. The RCRA closure plan for this unit was issued in March 1995 and is awaiting approval from the State.

The Waste Coolant Processing Facility is a biodegradation and storage facility for waste coolants that may be LLW. It uses the following equipment for coolant treatment:

- Three storage tanks
- Feed tank
- Waste processing reactor/clarifier
- Sludge holding tank
- Two sludge blenders/dryers
- Effluent holding tank
- Transfer pumps

Microorganisms biodegrade approximately 114,000 l (30,000 gal) of waste coolant per month into harmless products. Each batch of coolant takes approximately 30 days to treat. After treatment, the clarifier separates the wastes into three process streams: floating oily solids, liquid effluent, and settled biological solids. Floating solids are dewatered in the dryer/ribbon blender and are transferred to drums. Liquid effluent is sent to the Central Pollution Control Facility or West End Treatment Facility/West Tank Farm for final treatment prior to NPDES discharge. Biological solids are further treated in the aeration tank and then recycled or sent through the blender for dewatering. Nonrecycled solids are currently pumped into tankers for storage. This practice will continue until adequate treatment and disposal methods are established.

Long-term storage options include warehouses, tanks, and vaults, as well as storage of Y–12 wastes in buildings at K–25. The major Y–12 LLW storage facilities, described below, are summarized in Table E.2.5–2. As of June

1995, approximately 2,320 m^3 (3,040 yd^3) of LLW and 4,740 m^3 (6,200 yd^3) of uranium-contaminated scrap metal were stored at Y–12 (OR LMES 1996a:5-12).

The Classified Waste Storage Facility will provide for the permitted storage of solid LLW and mixed LLW, which is classified for national security purposes under provisions of the AEA. These wastes are currently being stored by the waste generators. The facility, located in Building 9720-25, will meet plant security requirements for classified waste management and guidelines for the management of LLW and mixed LLW.

The Containerized Waste Storage Area near Buildings 9206 and 9212 provide storage for cans of ash resulting from the combustion of uranium-contaminated solid wastes. Combustible solid wastes contaminated with enriched uranium are ashed during the uranium recovery process. The cans of ash are stored until uranium accountability results have been obtained and the material can be returned to the uranium recovery process for further processing to recover the enriched uranium.

The Depleted Uranium Oxide Storage Vaults I and II are on Chestnut Ridge, northeast of Building 9213. The vaults are constructed of reinforced concrete and provide a retrievable storage repository for uranium oxide, uranium metal, and a blended mixture of uranium sawfines and oxide. The vaults contain a negative-pressure exhaust system that operates during material entry. The exhaust is filtered and monitored prior to its release to the atmosphere. The facility uses forklift trucks, electric hoists, and a motorized drum dumper during operation. Depleted uranium oxide and blended sawfines are delivered in sealed 113- and 208-l (30- and 55-gal) drums, with a weight limit of 386 kg (850 lb).

The Old Salvage Yard contains both low-level uranium-contaminated and nonradioactive scrap metal. Most scrap currently sent to this facility is contaminated. The Contaminated Scrap Metal Storage Area of the Old Salvage Yard is used to store uranium-contaminated scrap metal. Contaminated scrap is placed in approved containers and eventually will be transferred to above-ground storage pads. Noncontaminated scrap is sold when offsite shipments are allowed. This facility is at the west end of Y–12.

Y–12 has no current onsite LLW disposal capability. All disposal activities at the Bear Creek Burial Ground were terminated on June 30, 1991. This landfill was used to dispose of radiologically contaminated solid waste. These wastes are currently containerized and stored at Y–12 in above-grade storage pads or are shipped offsite for incineration. In 1994, approximately 1,710 m^3 (2,240 yd^3) of solid nonmetallic LLW were sent offsite to be compacted or incinerated and the ash returned to Y–12 for storage (OR LMES 1996a:5-8). Also, 1,630 m^3 (2,140 yd^3) of contaminated scrap were sent offsite to be smelted. The proposed LLW disposal facilities project would provide new disposal facilities at a centralized ORR location. The proposed LLW disposal facilities would use state-of-the-art disposal technologies, including lined trenches with leachate collection treatment capabilities and tumulus confinement disposal units. The Class-II facility, for wastes contaminated with very low concentrations of short (less than 30 years) half-life radionuclides, is expected to be operational in 2002. DOE has indefinitely postponed construction of the Class-I facility, for wastes contaminated with very low concentrations of predominantly long (greater than 30 years) half-life radionuclides.

Mixed Low-Level Waste. Mixed LLW is generated from the development, metal preparation, fabrication, and assembly/industrial engineering functions at Y–12. Mixed LLW is hazardous waste such as solvents, degreasers, biodegradable coolants, organic and inorganic acids, biodenitrification sludge, and wastewater that is contaminated with enriched and/or depleted uranium. There is no disposal of mixed waste at Y–12; however, future plans include disposal of mixed waste at a permitted offsite commercial facility. Mixed wastes are put in storage awaiting treatment or disposal, treated at Y–12, or sent to another ORR facility for treatment or disposal. Table E.2.5–3 presents the inventory of mixed LLW at Y–12 as of December 1994, along with a 5-year projection. In 1994, approximately 766,000 l (202,000 gal) of liquid mixed LLW was treated at Y–12 (OR LMES 1996a:7-6). The Y–12 Waste Management Division operates several mixed LLW treatment facilities, which are described below and are summarized in Table E.2.5–1.

The Groundwater Treatment Facility treats wastewater from the liquid storage facility at Y–12 and seepwater collected at K–25 to remove volatile and nonvolatile organic compounds and iron. The facility is part of the disposal area remedial action program to collect and treat contaminated groundwater from the Bear Creek Burial Grounds. The facility, located at the far west end of Y–12 adjacent to the West End Treatment Facility, utilizes an air stripping operation to remove volatile organics. In addition, carbon adsorption eliminates nonvolatile organics and PCBs. Iron removal equipment is also operational. After treatment, wastewater is sampled and recycled if additional processing is required. Wastewater that meets discharge specifications is pumped into East Fork Poplar Creek through an NPDES monitoring station. The Groundwater Treatment Facility treated and discharged approximately 1,206,000 l (319,000 gal) during 1992 (DOE 1994k).

The West End Treatment Facility/West Tank Farm treats the following nitrate-bearing wastes generated by Y–12 production operations: nitric acid wastes, nitrate-bearing rinsewaters, mixed acid wastes, waste coolants, mop water, caustic wastes, and biodenitrification sludges. Treatment operations consist of biological denitrification, biological oxidation, metals precipitation, coagulation, flocculation, clarification, filtration, pH adjustment, degassification, and carbon adsorption. Wastes are received at the West End Treatment Facility/West Tank Farm in 18,900-l (5,000-gal) tankers, 2,270-l (600-gal) polytanks, and in smaller, approved waste transportation containers such as drums, bottles, and carboys. Detailed waste analysis documentation is used to determine the treatment scheme and temporary storage location of each shipment. The West End Treatment Facility effluent polishing system facilitates the removal of uranium, trace metals, and suspended solids. The treated wastewater is then discharged to East Fork Poplar Creek through an NPDES monitoring station. Sludges, spent carbon and spent filter material generated during the treatment processes are currently stored in 1,890,000-l (500,000-gal) tanks. A major modification to the West End Treatment Facility/West Tank Farm is currently in the design phase. This modification will remove all heavy metals up front, thus separating the hazardous sludge from the nonhazardous sludge. Approximately two-thirds of the current sludge volume generated can then be disposed of as nonhazardous waste.

The Y–12 Cyanide Treatment Unit provides storage and treatment of waste solutions containing metallic cyanide compounds from spent plating baths and precious metal recovery operations or other areas. The cyanide reduction process is currently performed in 208-l (55-gal) containers. After waste is treated at the Cyanide Treatment Unit, it is transferred to the West End Treatment Facility, where it is further treated then discharged to the East Fork Poplar Creek.

As of June 1995, approximately 15,000 m^3 (19,600 yd^3) of mixed LLW were projected to be stored at Y–12 (OR LMES 1996a:7-21). Table E.2.5–2 summarizes the mixed LLW storage facilities at Y–12 that are described below.

The Containerized Waste Storage Area consists of three concrete pads covering approximately 2,320 m^2 (24,800 square feet [ft^2]). These pads provide storage for LLW, RCRA hazardous, and mixed LLW. An impermeable dike surrounding each pad provides 0.3 m (1 foot) of spill containment. Fire protection at this facility will be upgraded, contingent on funding.

The Building 9811-1 RCRA Storage Facility (OD7 and OD8) contains a diked tank storage area (OD7) and an enclosed containers storage area (OD8) with a capacity of 1,000 drums. OD7 contains four 114,000-l (30,000-gal) tanks, two 37,900-l (10,000-gal) tanks, and associated piping and pumps. At OD8, RCRA waste oil/solvent mixtures containing various concentrations of chlorinated and nonchlorinated hydrocarbon solvents, uranium, trace PCBs, and water for specific chemical constituents are stored in 208-l (55-gal) drums and 1,140-l (300-gal) Tuff-tanks to await sampling and analytical results. Wastes deemed compatible with OD7 materials are pumped into the OD8 Tuff-tanks. Noncompatible wastes are transported to other facilities.

The Waste Oil/Solvent Storage Facility (OD9), a permitted RCRA/TSCA hazardous waste storage facility, consists of a diked area supporting five 151,000-l (40,000-gal) tanks, a tanker transfer station with five centrifugal transfer pumps, and a drum storage area. Three tanks house PCB wastes contaminated with uranium, one tank contains nonradioactive PCB wastes, and one tank holds RCRA hazardous wastes. A diked and covered pad furnishes space for 33 m^3 (43 yd^3) of containerized wastes. Wastes assigned to this facility are first stored at OD8 (Building 9811-1 RCRA storage facility) to await laboratory results. The diked area has additional space for a sixth 151,000-l (40,000-gal) tank. This facility is projected to be used until 2010, due to the anticipated lack of disposal outlets for uranium-contaminated organic liquids.

The Liquid Organic Waste Solvent Storage Facility (OD10) contains four 24,600-l (6,500-gal) and two 11,400-l (3,000-gal) stainless steel tanks for storage of ignitable nonreactive liquids, including those contaminated with PCBs and uranium. In addition, a diked and covered storage area provides space for 40,000 l (10,600 gal) of containerized waste. The facility is capable of segregating various spent solvents for collection and storage. Major solvent waste streams are transferred to tanks until final disposition.

The Building 9720-9 Storage Area has a drum storage area for mixed and PCB wastes, including an area designed to contain flammable wastes. The western half of the facility, with space for approximately 1,500 drums, stores both PCB and RCRA hazardous waste. The facility's eastern half is not currently in use. Upgrades are under way on ventilation, diking, and fire-suppression systems to comply with RCRA, TSCA, and DOE standards and to allow for mixed and PCB waste storage.

The RCRA Staging and Storage Facility (Building 9720-31) prepares solid, liquid, and sludge wastes for offsite shipment. The facility consists of seven storage rooms and seven staging rooms, each with a separate ventilation system. The staging rooms house small containers that are packed with compatible materials and shipped. The storage rooms hold larger containers, such as 208-l (55-gal) drums. Each room, which can hold up to 90 drums, accommodates a different class of hazardous waste.

The RCRA and PCB Container Storage Area (Building 9720-58) is a warehouse facility used for staging prior to treatment or disposal of PCB-contaminated equipment (transformers, capacitors, and electrical switchgear) and nonreactive, nonignitable RCRA waste contaminated with uranium. Waste containers received at Building 9720-58 include 114- and 208-l (30- and 55-gal) drums, 1,250- and 2,500-l (330- and 660-gal) portable tanks, B-25 boxes, and self-contained PCB equipment.

The Solid Storage Facility provides 1,630 m^2 (17,500 ft^2) of storage space for PCB- and uranium-contaminated soil. The facility also has a synthetic liner for leachate collection and a leak detection system. Collected leachate is transferred to the liquid storage facility for pretreatment. The solid storage facility is currently undergoing the RCRA Part B permitting process. No additional wastes are being added to the facility.

Hazardous Waste. Plating rinsewaters; waste oil and solvents from machining and cleaning operations; contaminated soil, soil solutions, and soil materials from RCRA closure activities; and waste contaminated with hazardous constituents from construction/demolition activities are the major sources of hazardous waste at Y–12. In 1994, approximately 15,500,000 l (4,090,000 gal) of hazardous liquid were treated (OR LMES 1996a:6-3). [Text deleted.] In 1994, approximately 190 m^3 (250 yd^3) of PCB hazardous material was shipped offsite for treatment (DOE 1995h). The Y–12 Waste Management Division operates several hazardous treatment facilities that are described below and are summarized in Table E.2.5–4.

The Plating Rinsewater Treatment Facility treats dilute plating rinsewaters contaminated primarily with chromium, copper, nickel, and zinc. It can also treat cyanide-bearing wastes and remove chlorinated hydrocarbons. The design capacity for this facility is 30.3 million l/yr (8 million gal/yr). Under normal conditions, the facility treats 852,000 l (225,000 gal) of plating rinsewater per year (DOE 1995gg). The facility is across the street from the Building 9401-2 Plating Shop, which produces most of Y–12's rinsewaters. The facility neutralization, equalization, and cyanide destruction equipment is located outdoors in a diked basin. The remainder of the process is located in Building 9623. Rinsewaters are received via a direct pipeline from the plating shop, but they can also be received in tankers, polytanks, or in any acceptable waste shipping container. The Plating Rinsewater Treatment Facility performs the following treatment operations: potential of hydrogen (pH) adjustment, flow equalization, heavy metal removal by electrochemical precipitation, flocculation, and clarification. After the clarification operation, the rinsewater is transferred to the Central Pollution Control Facility. That facility provides the carbon adsorption operation, final filtration, and discharge to East Fork Poplar Creek through an NPDES monitoring station. Treated rinsewater is sometimes recycled for use as makeup water for Central Pollution Control Facility processes. Sludge from the clarification process is transferred to the Central Pollution Control Facility, then taken to the West Tank Farm for interim storage.

The Steam Plant Wastewater Treatment facility treats approximately 233 million l/yr (61.5 million gal/yr) of wastewater from steam plant operations, demineralizers, and coal pile runoff (OR LMES 1996a:8-4). Treatment processes include wastewater collection/sedimentation, neutralization, clarification, pH adjustment, and dewatering. The facility, which is managed by the Y–12 utilities department, uses automated processes for continuous operation. All solids generated during treatment are nonhazardous and are disposed of in the sanitary landfill. The treated effluent is monitored prior to NPDES discharge to the East Fork Poplar Creek.

Hazardous waste is being stored until the management and operations contractor and DOE approve shipment for offsite disposal under the DOE "No Rad Added" performance objective. As of June 1995, approximately 34 m^3 (44 yd^3) of hazardous waste was stored at Y–12 (OR LMES 1996a:6-6). Table E.2.5–5 summarizes some of the major existing Y–12 hazardous waste storage facilities described below.

The Oil Landfarm Soils Storage Facility contains approximately 420 m^3 (550 yd^3) of soil contaminated with PCBs and volatile organics (OR DOE 1993a:9-21). The soil was excavated from the oil landfarm and tributary 7 in 1989. The soil is contained in a covered, double-lined concrete dike with a leak-detection system. The leak-detection system will soon be modified to enhance detection capabilities.

The Liquid Storage Facility of the Disposal Area Remedial Actions Liquid Storage Treatment Unit is a hazardous waste storage facility built during the Bear Creek Burial Ground closure activities. It is located in Bear Creek Valley approximately 3.2 kilometers (2 miles) west of Y–12. It collects and stores groundwater and other wastewaters received from the seep collection lift station, the solid storage facility, tankers, polytanks, and the diked area rainfall accumulation. Feed streams may contain oil contaminated with PCBs, volatile and nonvolatile organic compounds, and heavy metals. Processing and storage equipment include:

- Two 284,000-l (75,000-gal) bulk storage tanks
- 22,700-l (6,000-gal) oil storage tank
- Gravity separator
- Filtering unit
- Composite sampling station
- Tanker transfer station

The wastewater travels through the gravity separator, cartridge filters, and composite sampling station prior to storage in the bulk tanks. A reinforced concrete dike surrounds all equipment to provide spill containment. After sufficient wastewater accumulates in the bulk storage tanks, it is processed at the groundwater treatment facility. A new leachate collection system collects and pumps hazardous waste seepage from the burial ground to the Liquid Storage Facility.

The Y–12 Waste Management Division operates Industrial Landfill V, which is used for disposal of industrial and institutional solid waste and special waste, such as asbestos materials, empty aerosol cans, materials contaminated with glass, fly ash, coal pile runoff sludge, empty pesticide containers, and steam plant wastewater treatment facility sludge. The landfill area is on Chestnut Ridge, near the eastern end of the plant, and serves Y–12, Oak Ridge National Laboratory (ORNL), K–25, and other DOE prime contractors at Oak Ridge. The landfill utilizes shallow land burial by the area fill method and is permitted by the State of Tennessee. Requests are filed with the state to provide disposal for additional materials as needed.

The Chestnut Ridge borrow area waste pile (Industrial Waste Landfill III) consists of mercury-contaminated soil removed from the Oak Ridge Civic Center area and deposited at Y–12 Chestnut Ridge. No other waste has been disposed of at this site.

Nonhazardous Waste. Major waste-generating activities include construction and demolition activities that produce large volumes of noncontaminated wastes, including lumber, concrete, metal objects, soil, and roofing materials. Industrial trash is generated by daily operations throughout the plant. These operations include janitorial services, floor sweepings in production areas, and production activities. In 1994, the Y–12 Plant generated 228 million l (60.3 million gal) of industrial and sanitary liquid waste that included oils and solvents, operational wastewater, Central Pollution Control Facility/Plating Rinsewater Treatment Facility wastewater, steam plant wastewater, environmental restoration waste, and liquid waste received from ORNL and K–25 (OR LMES 1996a:8-3). The waste storage facility in Building 9720-25 has a solid waste baler with an 8:1 compaction ratio (DOE 1994n). Approximately 41,700 m^3 (54,700 yd^3) of solid nonhazardous waste was compacted and/or stored during 1994 (OR LMES 1996a:8-3).

The Sludge Handling Facility (T-118) was designed and constructed to provide water filtration and sludge dewatering in support of a storm sewer cleaning and relining project. Filtered water was reused by the sewer-cleaning contractor, and the dewatered sludge was stored in specially constructed containers for future disposal. The facility is currently being used to store containers of LLW.

The Steam Plant Ash Disposal Facility is used to collect, dewater, and dispose of sluiced bottom ash generated during operation of the coal-fired steam plant. An additional trench was constructed for the disposal of sanitary and industrial wastes generated by ORNL, K–25, and Y–12. In order to comply with environmental regulations for landfill operations, the Steam Plant Ash Disposal Facility includes a leachate collection system, a transfer system to discharge the collected leachate into the Oak Ridge public sewage system, groundwater monitoring wells, and a gas migration/ventilation system.

In 1992, approximately 677 m^3 (887 yd^3) of clean scrap metal was stored at Y–12 (OR DOE 1993b:9-6). The New Salvage Yard is used for the staging and public sale of nonradioactive, nonhazardous scrap metal. Sales have been suspended, however, until procedures to meet the DOE "No Rad Added" performance objective have been approved. The New Salvage Yard provides accumulation and sorting activities for nonradiologically contaminated scrap metal. Plans are in place to provide an automotive lead cell battery repository for used batteries until recycling options are initiated. This facility is located near the Bear Creek Burial Ground.

The new Industrial Landfill V and Construction Demolition Landfill VI permit disposal of 93,500 m^3/year (yr) (122,000 yd^3/yr) of industrial and sanitary waste (OR LMES 1996a:8-7). The facilities were designed and are operated in accordance with Tennessee solid waste disposal regulations. A baler, located in Building 9720-25, is used to compact sanitary/industrial waste destined for Industrial Landfill V.

Oak Ridge National Laboratory

Because ORNL is a research facility, it has many diverse waste-generating activities, each of which may produce only a small quantity of waste. Isotope production, utilities, and support functions such as photography are additional sources of waste. The radioactive wastes produced by each activity reflect the nature of its operation. A large number of radioisotopes are handled in isotope production and packaging, in reactor and accelerator operations, in reprocessing studies on nuclear fuel, and in investigations into the interactions of radioactivity with living systems. The radioactive wastes generated by these activities can be classified as follows:

- Concentrates generated by the treatment of intermediate-level wastes, which are disposed of by hydrofracture.
- LLW contaminated with beta/gamma-emitting radioactivity. These wastes, which have a low surface dose rate, are compacted if possible and disposed of in earthen trenches; those wastes which exhibit a high surface dose rate are disposed of in augered holes.
- TRU wastes, which are retrievably stored.
- Low-level alpha-emitting wastes, which are evaluated for criticality hazards before disposal in augered holes.

Pollution Prevention. Waste segregation is used to minimize the generation of solid LLW. By providing collection barrels for both radioactive and nonradioactive wastes, the volume of wastes that requires handling as radioactive waste has been reduced. Before these procedures were implemented, radioactive and nonradioactive wastes were discarded in the same barrel. This contaminated the nonradioactive portion and inflated the amount of waste that required special disposal.

Spent Nuclear Fuel. ORNL generates small quantities of spent nuclear fuel. Several facilities are used to house spent nuclear fuel (DOE 1993r:28-29):

- The Irradiated Fuels Examination Laboratory (Building 3525) only contains hot cells. Disassembly and examination of irradiated fuel and components continue to be the mission of the facility.
- The High Level Radiochemical Laboratory (Building 4501) contains centrally located hot cells supported by various laboratories capable of handling radioactive material. It has been used in performing work on fission gas release in light water reactor fuel rods. The spent nuclear fuel is in dry storage.
- The Radiochemical Engineering Development Center (Building 7920) is a multipurpose hot cell facility with the appropriate equipment, shielding, and containment provisions to safely process and store large quantities of highly radioactive fuel elements. It was specifically built to prepare and process targets for the High Flux Isotope Reactor.
- The Bulk Shielding Reactor, a pool-type research reactor, is currently shut down and its core is stored in racks. Fuel assemblies from the Oak Ridge research reactor are also stored in the pool.
- The High Flux Isotope Reactor is an 85-megawatt (MW), beryllium-reflected, light-water-moderated, flux-trap-type research reactor with associated support equipment and a storage pool. Missions include production of isotopes for medical and industrial applications, neutron-scattering experiments, and various material irradiation experiments. This is the only reactor that is still generating fuel elements that will need storage in the future.
- The Molten Salt Reactor Experiment is an 8-MW, homogeneous reactor consisting of uranium fluoride fuel in molten lithium salt. Its purpose was to test the practicality of a molten-salt reactor concept for central power station applications. The fuel is being stored in the salt storage tanks beneath the reactor.

- The Tower Shielding Reactor is a reactor facility where experiments were conducted outdoors on a remote hilltop. It is a spherically symmetric 1-MW plate-type reactor. The purpose of the facility was to conduct large-scale experiments to test shielding design methods and obtain associated data. The original core is located in the reactor. Four fuel plates are stored in the underground site, and 1,200 low-enriched fuel pins are stored in DOT shipping containers.

- Wells 7823A/7827/7829 are stainless-steel dry wells placed in the ground to provide shielded, retrievable storage facilities. They are currently closed to further storage. The wells were used to store irradiated fuel and associated fission products from 1972 to 1989.

- Waste Area Grouping 7 (Homogeneous Reactor Experiment wells) consists of seven augered holes that were drilled in 1964 to store 511 l (135 gal) of a 40-molar fuel solution. Each well was filled to ground level with soil and marked by a concrete plug and brass plaque.

- The Classified Burial Ground is now closed to operations but in the past, fuel materials were buried there. The exact quantity and location of all this material is not known.

- Solid Waste Storage Area 6 houses the suspension test reactor fuel. Seven of the underground dry-storage units are empty, although one unit has been found to contain water and another contains moist sand. These units are, therefore, not available for additional storage.

- The Building 9720-5 Vault houses the fissile components of the health physics research reactor, a DOE demonstration reactor, and the Space Nuclear Auxiliary Power-10A reactor. The building also stores HEU, which would require significant coordination with safeguards and security as well as transportation personnel.

A summary table of the inventory of reactor-irradiated nuclear material is shown in Table E.2.5–6.

High-Level Radioactive Waste. ORNL does not generate or manage HLW.

Transuranic Waste. Table E.2.5–7 presents the inventory of TRU and mixed TRU wastes at ORNL as of December 31, 1994, along with a 5-year projection. As of December, 1994, approximately 654 m^3 (857 yd^3) of contact-handled TRU waste were stored at ORNL. The amount of remote-handled TRU waste was approximately 59 m^3 (78 yd^3) (DOE 1995gg). Approximately 748 m^3 (973 yd^3) and 1,656 m^3 (2,153 yd^3) is contact and remote-handled mixed TRU, respectively. The bulk of ORNL's mixed TRU waste is in three liquid/sludge waste streams that are currently stored in tanks. Each tank's wastes must be remotely handled because of the high radioactivity. ORNL's underground storage tank management program includes implementation of leak detection, corrosion protection, spill and overflow protection, annual tightness testing, operational controls, record keeping, reporting, and replacement of those systems that cannot be upgraded by 1998. The program also addresses the immediate removal from service and remediation of sites with tanks found to be leaking, and it implements any required closures, corrective actions, and any upgrading and/or replacement of affected tanks in accordance with the regulatory requirements. Status of the tanks managed under the *Underground Storage Tank Program* is as follows:

- Twenty-six tanks have been excavated or permanently taken out of service (20 have been approved by Tennessee as closed; 6 require additional investigation and/or corrective action before final closure approval).

- Twenty-four tanks are deferred from 40 CFR 280. These will be taken out of service or upgraded.

- Two tanks were upgraded in 1990 to meet the current leak-detection requirements.

- Two tanks contain heating oil and are excluded from regulation under 40 CFR 280.
- Five tanks contain waste oil contaminated with radionuclides and are excluded under 40 CFR 280.

Solid TRU waste consisting of filters, paper, metals, and other items is generated at ORNL through laboratory, pilot plant, and reactor operations. This includes both contact-handled and remote-handled waste contaminated with lead and, in some cases, mercury. Since there is no TRU waste treatment facility at ORNL, generated TRU waste is being placed in retrievable storage. Contact-handled TRU waste is predominantly packaged in drums, while remote-handled waste is packaged in concrete casks. In 1994, approximately 105 m^3 (138 yd^3) of contact-handled and 63 m^3 (83 yd^3) of remote-handled TRU waste were placed in storage (OR LMES 1996a:4-4a). Current activities center around certification of contact-handled waste, planning and designing of a repackaging and certification facility for remote-handled wastes, and planning for shipment of wastes to WIPP or another suitable repository should WIPP prove to be unsatisfactory. The repackaging facility, located in Building 7880, is called the waste handling and packaging plant and is planned for 2001. Tables E.2.5–8 and E.2.5-9 summarize the storage and treatment facilities for TRU and mixed TRU wastes at ORNL.

The ORNL Waste Examination and Assay Facility, Building 7824, is used primarily for nondestructive examination and assay of the contents of waste containers of TRU wastes and LLW to verify compliance with the receiving (storage or disposal) facility waste acceptance criteria. The facility is also used for the nondestructive assay of nonwaste materials. It is located within the confines of SWSA-5 in the Melton Valley area of ORNL.

Low-Level Waste. Isotope production and research activities generate a variety of liquid LLW, including low-level wastewater. Sources of solid LLW include contaminated equipment, filters, paper, rags, plastic, and glass and sludge from the process waste treatment plant. Table E.2.5–9 shows the LLW treatment facilities that are operating at ORNL. In 1994, 143 m^3 (187 yd^3) of solid LLW were received prior to compaction and 189,000 l (49,800 gal) of liquid LLW were solidified at ORNL (OR LMES 1996a:5-7). Approximately 462 m^3 (605 yd^3) were sent offsite to be compacted and/or incinerated (OR LMES 1996a:5-8).

Solid LLW, including scrap metal, is placed in storage prior to disposal. As of June 1995, approximately 1,690 m^3 (2,210 yd^3) of solid LLW and 2,970 m^3 (3,890 yd^3) of radioactive scrap metal were in storage awaiting disposal at ORNL (OR LMES 1996a:5-13). Table E.2.5–10 lists the LLW and mixed LLW storage facilities currently operating at ORNL.

The SWSA-6 area at ORNL is the only active onsite disposal unit at ORR. It receives solid LLW from ORNL only, including radioactively contaminated asbestos. As of the end of 1995, approximately 340 m^3 (445 yd^3) of solid LLW were buried at SWSA-6 (OR LMES 1996a:5-16). This does not include 355 m^3 (465 yd^3) buried at three silos and a trench that was closed at the end of 1993 (OR MMES 1995c:5-29). Table E.2.5–11 lists the LLW disposal facilities at SWSA-6.

Mixed Low-Level Waste. Mixed wastes are generated by research projects and some facility operations. Isotope production and research activities generate a variety of mixed low-level and mixed TRU wastes. Table E.2.5–12 presents the inventory of mixed LLW at ORNL as of December 31, 1994, along with a 5-year projection.

As shown in Table E.2.5–9, three facilities are currently treating mixed waste at ORNL: the Process Waste Treatment Plant, the Liquid LLW Evaporation Facility, and the Melton Valley LLW Immobilization Facility (DOE 1995gg). One other treatment facility, the Nonradiological Wastewater Treatment Plant, is operating and could be used to treat mixed waste.

The Process Waste Treatment Plant is designed to treat process wastewaters, groundwater, and evaporator condensate wastewaters that contain low levels of radioactivity. Small concentrations of radioactive materials have occasionally been processed. Process wastewaters may contain small quantities of radionuclides, metals, anions, and organic chemicals. Under normal operating conditions, the process waste treatment plant can process wastewater at a rate of 492 l/minute (min) (130 gal/min). The design capacity is 757 l/min (200 gal/min) (DOE 1993h:26.2-5). Wastewaters can contain organic materials and low levels of radioactivity. The facility can treat waste streams with some heavy metals but not streams containing PCBs.

The Liquid LLW Evaporation Facility treats liquid LLW and mixed LLW using evaporation. It operates in a semicontinuous mode; waste is accumulated in collection tanks and transferred through underground piping to an evaporator system. The design capacity is 106,000 l/day (28,000 gal/day). The facility processes an average of 1,140 l (301 gal) of liquid wastes per day under normal operating conditions (OR DOE 1993a:9-22). The facility can treat waste streams containing organic contaminants.

Table E.2.5–10 summarizes the mixed LLW storage facilities at ORNL and estimates the capacity of these facilities. As of June 30, 1995, approximately 1,600 m^3 (2,100 yd^3) of mixed waste was projected to be in storage at ORNL (OR LMES 1996a:7-21).

The only disposal of mixed waste done at ORNL is the burial of radioactive asbestos at SWSA-6. Asbestos contaminated with low levels of radioactivity is placed in silos. In 1992, approximately 23 m^3 (30 yd^3) of contaminated asbestos were buried (OR DOE 1993b:9-4). Low-level contaminated biological waste has also been buried at SWSA-6.

Hazardous Waste. Hazardous wastes are generated in laboratory research, electroplating operations, painting and maintenance operations, descaling, demineralizer regeneration, and photographic processes. Few hazardous wastes are treated in onsite facilities. Onsite treatment at ORNL includes elementary neutralization and detonation facilities. Tables E.2.5–10 and E.2.5–13 summarize the hazardous waste storage and treatment facilities at ORNL. [Text deleted.]

The Chemical Detonation Facility treats small amounts of wastes that would be dangerous to transport offsite. Explosives such as aged picric acid are detonated in the detonation facility. Certain other wastes (for example, spent photographic processing solutions) are processed onsite into a nonhazardous state. Those wastes that are safe to transport are shipped to offsite RCRA-permitted commercial treatment/disposal facilities.

The Nonradiological Wastewater Treatment Plant is designed to reduce hazardous pollutant concentrations in nonradiological wastewaters to levels acceptable for effluent discharge. The plant operates in a continuous mode and carries out physical and chemical processing steps. The facility contains a heavy-metal removal system, where the pH of the wastewater is raised to 10.5 in a clarifier. Polymers are added to induce flocculation and settling of the metal precipitates. The wastewater is passed through a filtration system to remove particulates. An air stripper then removes volatile organics and activated carbon columns remove mercury. In 1993, approximately 23,800,000 l (6,300,000 gal) of liquid hazardous wastes were treated at the Nonradiological Wastewater Treatment Plant (OR MMES 1995c:6-6).

As of June 1995, approximately 29 m^3 (38 yd^3) of hazardous waste was stored at ORNL (OR LMES 1996a:6-6). PCB wastes are managed in storage facilities until they can be shipped offsite for treatment and/or disposal. PCB-contaminated and hazardous wastes are temporarily stored at Building 7507, and PCB-contaminated wastes are stored on the 7507W storage pad. Due to the "No Rad Added" policy, hazardous wastes are being stored as mixed waste. A listing of the hazardous waste storage facilities at ORNL is shown in Table E.2.5–14. In 1992, approximately 10 m^3 (13 yd^3) of asbestos wastes were sent to Y–12 Sanitary and Industrial Landfill II. About 12 m^3 (16 yd^3) of hazardous and PCB wastes were sent to K–25 for storage and incineration in the TSCA incinerator (OR DOE 1993b:9-5).

Nonhazardous Waste. Nonhazardous wastes result from ORNL maintenance and utilities. The steam plant and the sanitary waste treatment plant produce a sludge which is sampled to demonstrate that it is nonhazardous and meets the Y–12 Industrial and Sanitary Landfill II waste acceptance criteria. The sewage treatment facility treats sanitary and laundry wastewater. It is an extended aeration-activated sludge unit followed by mixed-media tertiary filtration of secondary effluent dewatering. The sludge is dried onsite in open-air drying beds. In 1994, approximately 360 million l (95 million gal) of industrial and sanitary liquid waste were treated at the sewage treatment plant (OR LMES 1996a:8-4).

The Melton Valley LLW Immobilization Facility is currently treating nonhazardous liquid waste (OR DOE 1994a:A-20). The facility can be used to solidify liquid mixed LLW that has a pH greater than 12.5 and that contains some heavy metals. This liquid mixed LLW is transferred from tanks by interconnecting pipelines. Batches of waste are pumped from a liquid decantation system to a solidification system as required to provide adequate storage-tank capacity. The facility operates on a campaign basis in order to provide adequate storage capacity. Solidification is currently performed using cementation. Design capacity is 62,500 l (16,500 gal) of liquid waste per month. Under normal operating conditions, the facility can process 7,570 l/month (2,000 gal/month) as required to provide adequate storage-tank capacity (DOE 1993h:26.2-5). The facility cannot treat HLW, alpha-contaminated waste with TRU activity levels greater than 100 nanocuries per gram (nCi/g), organic wastes, or PCBs.

Scrap metals are discarded from maintenance and renovation activities and are recycled when appropriate. Construction and demolition projects also produce nonhazardous industrial wastes. All solid nonhazardous wastes and medical wastes (after they are autoclaved to render them noninfectious), except scrap metal, are sent to Y–12 Industrial and Sanitary Landfill II. Approximately 16 m^3 (21 yd^3) of scrap metal were placed in storage at ORNL in 1992. This waste will remain at ORNL until it is characterized as nonradioactive per the "No Rad Added" policy (OR DOE 1993b:9-7).

Rainfall runoff from the ORNL Steam Plant coal yard storage area, plus additional wastewater from the sulfuric acid tank diked area runoff, Steam Plant boiler blowdown, and water softener regenerate, are collocated in a basin. This waste is treated at the Coal Yard Runoff Treatment Facility.

K–25 Site

Enrichment, maintenance, decontamination, and research and development activities have generated a wide variety of waste at K–25. Because of its past uranium enrichment mission, uranium is the predominant radionuclide found in K–25 waste streams. Waste management activities are increasing. Low-level radioactive wastes from other DOE sites are placed in building vaults until a final disposition strategy is identified. Also, PCB wastes and RCRA wastes contaminated with uranium began arriving from other DOE sites in 1987 for incineration in the K-1435 TSCA incinerator. Tables E.2.5–15 and E.2.5–16 summarize the treatment and storage facilities at K–25 that are capable of treating and storing multiple categories of waste.

Pollution Prevention. K–25 policy mandates minimization of waste generated while achieving compliance with applicable environmental regulations. Five waste reduction options are used at K–25: segregation, material substitution, process innovation, mechanical volume reduction, and recycling/reuse. In recent years, some aluminum cans, worker clothing, and office furniture have been recycled for use at K–25. As of 1991, this recycling had saved approximately 1,150,000 kg (2,520,00 lbs) of materials. K–25 management supports the waste reduction program. An example of this program is the conversion to gas-fired boilers to reduce capacity excursions and, in effect, reduce or eliminate fly ash production.

Spent Nuclear Fuel. K–25 does not generate or manage spent nuclear fuel.

High-Level Radioactive Waste. K–25 does not generate or manage HLW.

Transuranic Waste. K–25 does not generate or manage TRU waste.

Low-Level Waste. Solid LLW is generated by discarding radioactively contaminated construction debris, wood, paper, asbestos and trapping media. Solid LLW is also generated by process equipment and by removing radionuclides from liquid and airborne discharges. Currently, solid LLW is being stored for future disposal. Table E.2.5–17 shows the storage facilities that deal only with LLW. [Text deleted.] Treatment of the current inventory of contaminated scrap metal at K–25 (as well as at Portsmouth, Paducah, and Fernald facilities) is expected to occur over the next 3 to 5 years as part of a comprehensive DOE scrap metal program to be managed through K–25. All contaminated scrap metal is stored aboveground at the K-770 scrap metal facility until further disposal methods are evaluated.

The Uranium Hexafluoride (UF_6) Cylinder Program is directed toward improving the safety and reliability of long-term storage for 7,000 cylinders currently at K–25. These cylinders remain from the now-terminated gaseous diffusion mission. In storage at the site are approximately 5,000 9-t (10-ton) and 13-t (14-ton) cylinders of depleted UF_6; 1,000 cylinders of normal-assay feed UF_6; 400 cylinders containing more than 23 kg (50 lb) of "enriched" material; and 600 miscellaneous empty cylinders. The UF_6 Cylinder Program is being designed to develop a clear understanding of the current conditions of the cylinders and define any near-term and long-term actions for safe storage of the cylinders pending decisions on ultimate disposition of the UF_6 material. Some of the initial actions in the program are a baseline inspection, a corrosion coupon program, and an ultrasonic thickness measurement program. The baseline inspection identified a variety of cylinder defects that will require special attention and also identified four breached cylinders. Immediate corrective actions have been taken to handle the breached cylinders, and a schedule of activities has been developed for moving and repairing the cylinders.

The cylinders containing normal-assay feed UF_6 are currently being shipped to the Paducah Gaseous Diffusion Plant. The current DOE direction for the 5,000 cylinders with depleted UF_6 is to store them until at least the year 2020, at which time conversion to oxide will be performed if no other uses have been determined. A plan for cleaning the empty cylinders and those containing more than 110 kg (50 lb) of enriched material has not yet been approved (this may be performed at K–25 or at one of the operating gaseous diffusion plants).

Currently, there are no onsite disposal facilities being operated at K–25. An ORR centralized waste management organization has been established at K–25 and assigned the responsibility of designing, constructing, and operating all new LLW disposal facilities for the ORR.

Mixed Low-Level Waste. Mixed LLW primarily consists of contaminated waste oils, solvents, sludges, soils, and acid wastes. Table E.2.5–18 presents the inventory of mixed LLW as of December, 1994, along with a 5-year projection. Sludges contaminated with low-level radioactivity were generated by settling and scrubbing operations and were stored in K-1407B and K-1407C ponds. Sludges have been removed from these ponds, and a portion has been fixed in concrete at the K-1419 sludge treatment facility and stored at the K-33 Building. These materials are considered mixed LLW and will be shipped offsite for disposal at a permitted commercial facility.

Most of the treatment of mixed waste is at the TSCA incinerator and the central neutralization facility. The majority of waste treated at the TSCA incinerator cannot be treated by commercial incinerators because of radioactive contamination. All waste sent to this facility must be fully characterized and identified. DOE has an approved chain-of-custody system for all waste received from offsite. The K-1435 TSCA incinerator is capable of incinerating waste that is mixed or contains PCBs. In 1990, a limited amount of waste was incinerated as a part of the startup testing. The incinerator began full operations in early 1991 and met all regulatory requirements in processing 1,000 m^3 (1,310 yd^3) of mixed waste. Mixed TSCA waste is being generated in the ash residue at the TSCA incinerator. Compliance issues regarding the management of the mixed PCB and radioactive waste generated in the ash are being pursued with EPA by DOE.

Most of the radioactively contaminated wastewater treated at the central neutralization facility is generated at the TSCA incinerator from the wet scrubber blowdown. Treated effluents are discharged through a designated release point. The contaminated sludges that precipitate in the sludge-thickener tank are stored in an approved above ground storage area at K–25.

RCRA mixed, radioactive land disposal restricted waste (including some nonradiological classified land disposal restricted waste) has been stored in some areas for longer than 1 year. These wastes are currently subject to the land disposal restriction that permits storage only for accumulation of sufficient quantities to facilitate proper treatment, recycling, or disposal. This waste is being stored because of the nationwide shortage of treatment and disposal facilities for this type of waste. Private-sector technology demonstrations are being conducted that involve uranium extractions from sludge.

Uranium-contaminated PCB wastes (that is, mixed wastes) are being stored in excess of the 1-year limit imposed by TSCA because of the lack of treatment and disposal capacities. DOE and EPA have signed an FFCA, effective February 20, 1992, to bring the facility into compliance with TSCA regulations for use, storage, and disposal of PCBs. It also addressed the approximately 10,000 pieces of nonradioactive PCB-containing dielectric equipment associated with the shutdown of diffusion plant operations.

In 1989, during routine inspections of the drums of stabilized K-1407 pond sludge at the K-1417 storage facility, it was discovered that many of the drums had begun to corrode. Free liquid (waste with a pH of 12) on top of the concrete in the drums was found to be causing the corrosion (OR DOE 1993a:9-16). An action plan has been implemented to decant and/or dewater the mixed waste contained in the drums. A total of 45,000 drums of stabilized material and 32,000 drums of raw sludge must be processed and moved to storage facilities that meet regulations governing mixed wastes. All containers will be transferred to and stored in new and existing facilities at the K-1065, K-31, and K-33 buildings.

Hazardous Waste. Hazardous wastes generated at K–25 include PCB articles and items, waste oils and items, and uncontaminated asbestos waste. All hazardous wastes are managed according to applicable State and Federal regulations and DOE Orders. Several waste management facilities are already in place. Changing laws and regulations have made it necessary to upgrade several facilities and to design and construct new facilities that reflect the most recent environmental technology. The Central Neutralization Facility and the TSCA incinerator are the two major facilities that treat hazardous waste.

The Central Neutralization Facility provides pH adjustment and chemical precipitation for several aqueous streams throughout K–25. The main purpose of the facility is to treat wastewater to ensure compliance with the requirements of NPDES discharge limits on pH, heavy metal concentrations, and suspended solids. The treatment system consists of two 94,600-l (25,000-gal) reaction tanks and a 227,000-l (60,000-gal) sludge-thickener tank. Acidic wastes are neutralized with a hydrated-lime slurry, and basic wastes are neutralized with sulfuric or hydrochloric acid. The hydrated-lime bin and acid tanks are located at the facility. The treatment facility is physically divided into separate sections for treating hazardous and nonhazardous waste streams.

The TSCA Incinerator consists of storage tanks, dikes, and the incinerator. The incinerator system consists of a liquid, solid, and sludge feed system; a rotary kiln incinerator; and a secondary combustion chamber. The wastes treated at this facility include oils, solvents, chemicals, sludges, and aqueous waste.

As of June 30, 1995 approximately 76 m^3 (100 yd^3) of hazardous waste was stored at K-25 (OR LMES 1996a:6-6). In general, most of the waste stored at K–25 is designated as hazardous waste that has been contaminated with PCBs. Recyclable materials, such as mercury and silver-bearing photographic wastes, are stored before recycling, while other hazardous wastes are stored until sufficient quantity is accumulated for an offsite shipment. All offsite disposals of hazardous wastes, were halted in 1991 until procedures addressing a DOE performance objective of "No Rad Added" were developed by the sites and approved by DOE. Incineration is the preferred method for offsite treatment or disposal of wastes, particularly PCB wastes; however, landfills and other types of disposal are used as needed. On the K–25 site all hazardous waste is treated as mixed LLW.

Nonhazardous Waste. Computer paper is being recycled from the K–25 computer technology center. The paper recycling program is being reviewed for expansion into nonradiological areas. Product substitutions at the paint shop and photography lab have resulted in a decrease of waste generation. No percentage of reduction has been calculated due to the lack of baseline data.

Waste assay monitors have been purchased and are being used to screen solid, potentially radioactive waste to determine the potential to manage it as nonhazardous waste. The K-770 clean scrap yard provides storage for nonradioactive scrap metal. The scrap metal is stockpiled before being sold to the public. The solid nonhazardous waste from K–25 is sent to Y–12 Industrial Landfill V. Some materials, such as furniture, file cabinets, and paper, are disposed of through property sales.

The only nonhazardous treatment facility at K–25 is the sanitary waste treatment plant (Building K-1203). The system consists of an extended aeration treatment plant with a rate capacity of approximately 2,270,000 l/day (600,000 gal/day). The current demand is about 1,140,000 l/day (300,000 gal/day) (OR LMES 1996a:8-5). The sanitary sludge is disposed of in the Y–12 landfill. The Central Neutralization Facility does treat some nonhazardous liquid waste streams.

E.2.6 SAVANNAH RIVER SITE

The process of manufacturing useful nuclear materials has produced radioactive, mixed, and hazardous wastes that are treated, stored, or disposed of at the SRS. The *Savannah River Site Waste Management Final Environmental Impact Statement* (DOE/EIS-0217) addresses the tasks to be completed in the next 10 years to clean up existing waste units and bring current operations into compliance with applicable regulations. It deals in detail with the current conditions and provides the preferred alternatives for processing current and future waste streams. It also addresses the development and funding of processes to minimize waste generation and to safely process and dispose of future waste generation.

Pollution Prevention. Pollution prevention, previously driven by best management practices and economics, is now mandated by statutes, regulations, and agency directives. The SRS Waste Minimization and Pollution Prevention Program is designed to achieve continuous reduction of wastes and pollutant releases to the maximum extent feasible and in accord with regulatory requirements while fulfilling national security missions. The *SRS Waste Minimization and Pollution Prevention Awareness Plan* addresses wastes and potential pollutants of all types and establishes priorities for accomplishing waste minimization and pollution prevention through source reduction, recycling, treatment, and environmentally safe disposal.

Spent Nuclear Fuel. [Text deleted.] DOE will make detailed decisions for SRS concerning the treatment and stabilization of its current and future inventory of spent nuclear fuel after the completion of site-specific analysis pursuant to NEPA. SRS has been one of the receiving sites for returned domestic and foreign research reactor spent fuel, and will manage all of DOE's aluminum-clad spent fuel. The stabilization and storage of spent nuclear fuel at SRS has been addressed programmatically in the ROD (60 FR 28680), as amended (61 FR 9441), for the *Department of Energy Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs Final Environmental Impact Statement* (Spent Nuclear Fuel EIS) (DOE/EIS-0203-F) and the ROD (61 FR 25092) for the *Final Environmental Impact Statement on a Proposed Nuclear Weapons Nonproliferation Policy Concerning Foreign Research Reactor Spent Nuclear Fuel* (DOE/EIS-0218F). There are about 206 t (227 tons) of spent reactor fuel in storage at SRS (60 FR 28680). As a result of the ROD from the programmatic Spent Nuclear Fuel EIS, SRS will increase its inventory of aluminum-clad spent nuclear fuel to 213 t (234 tons). As a result of the *Final Environmental Impact Statement on a Proposed Nuclear Weapons Nonproliferation Policy Concerning Foreign Research Reactor Spent Nuclear Fuel*, SRS will receive an additional 18.2 t (20.1 tons) of research reactor spent fuel and 0.6 t (0.7 tons) of target material.

High-Level Waste. Liquid HLW containing actinides and hazardous chemicals were generated from recovery and purification of TRU products and from spent fuel processing. These wastes were retreivably stored in 51 underground tanks. One of these tanks is out of service. The tanks are managed in compliance with Federal laws, State of South Carolina regulations, and DOE Orders. The waste is segregated by heat generation rate, neutralized to excess alkalinity, and stored to permit the decay of short-lived radionuclides before its volume is reduced by evaporation. Twenty-nine of the tanks are located in the H-Area Tank Farm, and 22 are located in the F-Area Tank Farm. The tanks are of four different designs, but all are of carbon steel. Wastes are transferred to and processed in the newer tanks, which have full-height secondary containment and forced-water cooling. Some older tanks contain old salt and sludge awaiting waste removal. Other old tanks have had waste removed, except for residue, and are used to store low-activity waste. The older tanks will be taken out of service when the contents of other tanks are transferred to the Defense Waste Processing Facility (DWPF).

High-heat liquid waste is stored for 1 to 2 years to allow decay of radionuclides before being processed through evaporators. Low-heat waste is sent directly to the evaporator feed tanks. Each tank farm has one evaporator that is used to reduce water volume and concentrate the solids. A replacement higher-capacity evaporator is planned and may be used in conjunction with the current evaporators. Liquids can be reduced to 25 to 33 percent of original volume and stored as salts or sludges. Cesium removal columns can operate in conjunction with the evaporators. The evaporators obtain decontamination factors of 10,000 to 100,000, and the cesium removal columns can obtain another 10 to 200 decontamination factors. Decontaminated liquids (overheads) are sent to the ETF for processing before being released to Upper Three Runs Creek. The concentrated salt solution is processed to remove radionuclides, and the decontaminated solution is sent to the DWPF Saltstone Facility for solidification and storage in the saltstone vaults.

The remaining sludges and salts contain the majority of the radionuclides, and are stored separately, awaiting vitrification. Prior to vitrification, salt is precipitated in the in-tank precipitation process. The precipitate and sludge is fed into the vitrification process in the DWPF. The waste is mixed with borosilicate glass and immobilized by melting the mixture, then pouring it into stainless steel cylinders. These cylinders are stored in a shielded facility at the DWPF until a repository is available. Figure E.2.6–1 illustrates HLW management at SRS. Tables E.2.6–1, E.2.6–2, and E.2.6–3 list HLW inventories, treatment, and storage facilities at SRS.

Transuranic Waste. All TRU waste currently being generated is stored in containers on aboveground storage pads in compliance with state regulations and DOE Orders. Older TRU wastes (prior to 1965) were buried in plastic bags and cardboard boxes in earthen trenches. Wastes containing more than 0.1 Curies (Ci) per package were placed in concrete containers and buried. Wastes containing less than 0.1 Ci per package were buried unencapsulated in earthen trenches. Since 1974, TRU wastes containing more than 10 nCi/g have been stored in retrievable containers free of external contamination. Polyethylene-lined galvanized drums containing more than 0.5 Ci are additionally protected by closure in concrete culverts.

Approximately 85 percent of the TRU waste currently in storage is suspected of being contaminated with hazardous constituents. Presently, waste is characterized by onsite generators and is being stored prior to final disposal. TRU waste containing less than 100 nCi/g may be disposed of as LLW at SRS. Waste containing greater than 100 nCi/g, and meeting the final WIPP waste acceptance criteria, will be sent to WIPP, if WIPP is determined to be a suitable repository pursuant to the requirements of 40 CFR 191 and 40 CFR 268. Waste not meeting the acceptance criteria as currently packaged will be repackaged as necessary to meet the WIPP waste acceptance criteria. Should additional treatment be necessary for disposal at WIPP, SRS would develop the appropriate treatment technology, or ship this waste to another facility for treatment. Studies are under way to solve the problem of high-heat TRU waste, which is unique to SRS. Wastes with high Pu-238 fractions generate too much heat to be shipped in the TRUPACT-II. TRU waste is currently stored on 17 pads at the solid waste disposal facility in the E-Area. Figure E.2.6–2 illustrates the TRU waste management plan. Table E.2.6–4 lists the mixed TRU waste inventories, and Tables E.2.6–5 and E.2.6–6 list the TRU and mixed TRU waste treatment and storage facilities.

Low-Level Waste. Both liquid and solid LLW are treated at SRS. Liquids are managed and processed to remove and solidify the radioactive constituents and to release the balance of the liquids to permitted discharge points in compliance with state regulations. The bulk of liquid LLW is process wastewater consisting of effluent cooling water, purge water from storage basins for irradiated reactor fuel or target elements, distillate from the evaporation of process waste streams, and surface water runoff from areas where there is a potential for radioactive contamination.

Aqueous LLW streams are sent to the ETF and treated by filtration, reverse osmosis, and ion exchange to remove the radionuclide contaminants. After treatment, the effluent is discharged to Upper Three Runs Creek. The resultant wastes are concentrated by evaporation and stored in the H-Area tank farm for eventual treatment in the DWPF Saltstone Facility. In that facility, they will be processed with grout for onsite disposal. Figure E.2.6–3 illustrates the LLW processing at SRS. Treatment and storage facilities for LLW are listed in Tables E.2.6–7 and E.2.6–8.

Disposal of solid LLW at the SRS traditionally has been accomplished using engineered trenches in accordance with the guidelines and technology existing at the time of disposal. Currently, packaged LLW is deposited in the E-area vaults. These are concrete structures that meet the requirements of DOE Orders, incorporate technological advances, and address more stringent Federal regulation and heightened environmental awareness. Four basic types of vaults/buildings are used for the different waste categories: low-activity waste vault, intermediate-level nontritium vault, intermediate-level tritium vault, and long-lived waste storage building.

The vaults are below-grade concrete structures and the storage building is a metal building on a concrete pad. Long-lived waste is being stored until a final disposition can be determined. Additional information on these facilities is given in Table E.2.6–9.

Solid LLW is segregated into several categories to facilitate proper treatment, storage, and disposal. Solid LLW that radiates less than 200 thousandths of one roentgen equivalent man (rem), also called 200 mrem, per hour at 5 cm from the unshielded container is considered low-activity waste. If it radiates greater than 200 mrem/hr at 5 cm, it is considered intermediate-activity waste. This waste is typically contaminated equipment from separations, reactors, or waste management facilities. Intermediate activity tritium waste is intermediate-activity waste with more than 10 Ci of tritium per container. Residuals from tritium operations equipment are included in this waste. Long-lived waste is contaminated with long-lived isotopes that exceed the waste acceptance criteria for disposal. Resin contaminated with carbon-14 from reactor operations is an example. Excavated soil from radiological materials areas that is potentially contaminated, and cannot be economically demonstrated to be uncontaminated, is managed as suspect soil. Solid LLW typically consists of protective clothing, contaminated equipment, irradiated hardware, residuals from tritium extraction operations, and spent deionizer resins. All LLW is disposed of in the solid waste disposal facility in the E-Area between the F- and H-Areas. Wastes are compacted and packaged for burial. Monitoring wells are located near each disposed waste area to verify performance and to monitor groundwater in the vicinity of the vaults. As of December 1994, the total inventory of LLW disposed of at SRS was 676,400 m^3 (884,700 yd^3) (DOE 1995kk).

Mixed Low-Level Waste. Management of mixed wastes includes safe storage until treatment is available. Mixed LLW is stored in the A-, E-, M-, N-, and S- Areas in various tanks and buildings. These facilities include burial-ground solvent tanks, the M-Area Process Waste Interim Treatment/Storage Facility, the Savannah River Technology Center mixed waste storage tanks, and the organic waste storage tanks. These South Carolina Department of Health and Environmental Control-permitted facilities will remain in use until appropriate treatment and disposal is performed on the waste.

The Hazardous/Mixed Waste Treatment and Disposal Facility and the Consolidated Incineration Facility will process both mixed and hazardous wastes. The mixed waste management plan for SRS, illustrated in Figure E.2.6–4, has been reevaluated through the development of a site treatment plan in accordance with the *Federal Facility Compliance Act*. Mixed waste inventories are listed in Table E.2.6–10. Treatment facilities and processes are listed in Table E.2.6–7. Storage facilities capacity and status are listed in Table E.2.6–8.

Hazardous Waste. Typical hazardous wastes at SRS are lead, mercury, cadmium, 1,1,1-trichloroethane, leaded oil, trichlorotrifluoroethane, benzene, and paint solvents. Figure E.2.6–5 illustrates hazardous wastes management at SRS. Table E.2.6–11 lists hazardous waste storage facilities at SRS.

This waste is stored in RCRA-permitted buildings in the B- and N-Areas. Although hazardous waste was previously sent offsite for treatment and disposal, DOE imposed a moratorium on shipments of hazardous materials from radiological areas. Now, waste that is confirmed as not subject to the moratorium is shipped to an offsite vendor for processing and disposal. SRS annually publishes the tier two emergency and hazardous chemical inventory report, which lists hazardous chemicals that are present above their minimum threshold level or are extremely hazardous substances under the emergency planning community *Right-to-Know Act of 1986*. The annual reports filed under the *Superfund Amendments and Reauthorization Act for the SRS* facilities include year-to-year inventories of these chemicals.

Nonhazardous Waste. SRS-generated municipal solid waste is currently being sent to a permitted offsite disposal facility. DOE is evaluating a proposal to participate in an interagency effort to establish a regional solid waste management center at SRS (DOE/EA-0989, DOE/EA-1079). SRS disposes of other nonhazardous wastes consisting of scrap metal, powerhouse ash, domestic sewage, scrap wood, construction debris, and used railroad ties, in a variety of ways.

Scrap metal is sold to salvage vendors for reclamation. Powerhouse ash and domestic sewage sludge is used for land reclamation. Scrap wood is burned onsite or chipped for mulch. Construction debris is used for erosion control. Railroad ties are shipped offsite for disposal. Nonhazardous waste management is illustrated in Figure E.2.6–6.

E.3 PROJECT-SPECIFIC WASTE MANAGEMENT ACTIVITIES

This section describes in detail the waste management activities at the facilities being evaluated in this PEIS for the proposed long-term storage and disposition of weapons-usable fissile materials. All facilities that would support the storage and disposition program would be designed to be fully compliant with DOE orders and all applicable Federal and State environmental regulations and statutes. Facility designs incorporate waste minimization and pollution prevention. To facilitate waste minimization, where possible, nonhazardous materials would be substituted for those materials that contribute to the generation of hazardous or mixed waste. Material from the waste streams would be treated, where possible, to facilitate disposal as nonhazardous wastes. Future D&D considerations have also been incorporated into the designs. The estimated waste quantities generated in the proposed facilities are conservative so as to provide an upper bound. Once a facility is built and operational, a significant decrease in waste generation would occur by incorporating future technologies.

Solid and liquid nonhazardous wastes generated during construction would include concrete and steel construction waste materials and sanitary wastewater. The steel construction waste would be recycled as scrap material before completing construction. The remaining nonhazardous wastes generated during construction would be disposed of as part of the construction project by the contractor. Uncontaminated wastewater would be used for soil compaction and dust control, and excavated soil would be used for grading and site preparation. Wood, paper, and metal wastes would be shipped offsite to a commercial contractor for recycling. Hazardous wastes such as adhesives, motor oil, and lubricants would be packaged in DOT-approved containers and shipped offsite to commercial RCRA-permitted treatment, storage, and disposal facilities. Except for the HEU storage upgrade at Y–12, no radioactive waste would be generated during construction. No soil contaminated with hazardous or radioactive constituents is expected to be generated during construction. However, if any contaminated soil is generated it would be managed in accordance with site practice and all applicable Federal and State regulations.

E.3.1 FISSILE MATERIAL LONG-TERM STORAGE FACILITIES

The Preferred Alternative for the long-term storage of surplus Pu involves a combination of upgrade (SRS, ORR, and Pantex), No Action (Hanford, NTS, INEL, and LANL), and phaseout (RFETS).

This section describes the waste management activities at facilities that would provide long-term (50 years) storage for weapons-usable fissile material. Table E.3.1–1 lists the types of wastes expected to be generated from the long-term storage of Pu. There is no generation of spent nuclear fuel or HLW associated with the storage of Pu.

Table E.3.1–2 lists the types of wastes expected to be generated from the long-term storage of uranium. There is no generation of spent nuclear fuel, HLW, or TRU waste associated with the storage of uranium.

E.3.1.1 Upgrade Alternative

This section contains the construction and operational waste volumes (Tables E.3.1.1–1 through E.3.1.1–4), and waste management block diagrams (Figures E.3.1.1–1 through E.3.1.1–3) for the facilities that would provide long-term (50 years) storage for weapons-usable fissile materials through the upgrading of existing storage facilities. Tables E.3.1.1–5 through E.3.1.1–9 reflect the incorporation of all or some of the material from the RFETS or Los Alamos National Laboratory in upgraded facilities.

Table E.3.1.1–1. Estimated Waste Volumes for the Upgrade Without Rocky Flats Environmental Technology Site Plutonium or Los Alamos National Laboratory Plutonium Subalternative at Hanford Site

Category	Annual Average Volume Generated From Construction (m^3)	Annual Volume Generated From Operations (m^3)	Annual Volume Effluent From Operations (m^3)
Transuranic			
Liquid	None	None	None
Solid	None	20	20
Mixed Transuranic			
Liquid	None	None	None
Solid	None	None	None
Low-Level			
Liquid	None	0.08[a]	None
Solid	None	85	42[b]
Mixed Low-Level			
Liquid	None	None	None
Solid	None	5	5
Hazardous			
Liquid	Included in solid	0.57	0.57
Solid	0.38	4	4
Nonhazardous (Sanitary)			
Liquid	3,880[c]	8,330	None
Solid	21[d]	917	459[b]
Nonhazardous (Other)			
Liquid	Included in sanitary	Included in sanitary	None
Solid	Included in sanitary	None	None

[a] Liquid LLW would be treated and solidified prior to disposal.
[b] Assumes compaction of 4:1 for compactible solid LLW and nonhazardous waste.
[c] Does not include groundwater dewatering, if required.
[d] Includes concrete and 2.7 t of steel construction waste material that would be recycled as scrap metal.
Source: HF DOE 1996a.

Table E.3.1.1–2. Estimated Waste Volumes for the Upgrade Without Rocky Flats Environmental Technology Site Plutonium or Los Alamos National Laboratory Plutonium Subalternative at Idaho National Engineering Laboratory, Argonne National Laboratory-West

Category	Annual Average Volume Generated From Construction (m^3)	Annual Volume Generated From Operations (m^3)	Annual Volume Effluent From Operations (m^3)
Transuranic			
Liquid	None	0.004[a]	None
Solid	None	2	1[b]
Mixed Transuranic			
Liquid	None	None	None
Solid	None	1	1
Low-Level			
Liquid	None	0.79[a]	None
Solid	None	500	250[b]
Mixed Low-Level			
Liquid	None	0.015	0.015
Solid	None	27	27
Hazardous			
Liquid	5.7	0.15	0.15
Solid	23	1	1
Nonhazardous (Sanitary)			
Liquid	4,000[c]	7,600	None
Solid	34[d]	240	120[b]
Nonhazardous (Other)			
Liquid	Included in sanitary	Included in sanitary	None
Solid	Included in sanitary	310[e]	None

[a] Liquid TRU waste and LLW would be treated with the remaining sludge being solidified.
[b] Assumes compaction factor of 4:1 for compactible solid TRU waste,low-level , and nonhazardous waste.
[c] Does not include groundwater dewatering, if required.
[d] Includes concrete and 6.3 t of steel construction waste material that would be recycled as scrap metal.
[e] Recyclable wastes.
Source: IN DOE 1996a.

Table E.3.1.1–3. Estimated Waste Volumes for the Upgrade Without Rocky Flats Environmental Technology Site Plutonium or Los Alamos National Laboratory Plutonium Subalternative at Pantex Plant

Category	Annual Average Volume Generated From Construction (m^3)	Annual Volume Generated From Operations (m^3)	Annual Volume Effluent From Operations (m^3)
Transuranic			
Liquid	None	None	None
Solid	None	0.8	0.8
Mixed Transuranic			
Liquid	None	None	None
Solid	None	None	None
Low-Level			
Liquid	None	0.08[a]	None
Solid	None	138	69[b]
Mixed Low-Level			
Liquid	None	0.2	0.2
Solid	None	8	8
Hazardous			
Liquid	Included in solid	1	1
Solid	0.05	1.5	1.5
Nonhazardous (Sanitary)			
Liquid	3,130[c]	12,900	12,900
Solid	1.3[d]	275	138[c]
Nonhazardous (Other)			
Liquid	Included in sanitary	Included in sanitary	Included in sanitary
Solid	Included in sanitary	344[e]	None

[a] Liquid LLW would be treated with the remaining sludge being solidified.
[b] [Text deleted.] Assumes compaction factor of 4:1 for compactible solid LLW and nonhazardous waste.
[c] [Text deleted.] Does not include groundwater dewatering, if required.
[d] Includes concrete and 0.18 t of steel construction waste material that would be recycled as scrap metal.
[e] Recyclable wastes.
[Text deleted.]
Source: PX MH 1994a.

Table E.3.1.1–4. Estimated Waste Volumes for the Upgrade Alternative at Y–12 Plant

Category	Annual Average Volume Generated From Construction (m^3)	Annual Volume Generated From Operations (m^3)	Annual Volume Effluent From Operations (m^3)
Transuranic			
Liquid	None	None	None
Solid	None	None	None
Mixed Transuranic			
Liquid	None	None	None
Solid	None	None	None
Low-Level			
Liquid	None	0.04[a]	None
Solid	8[b]	3	2[c]
Mixed Low-Level			
Liquid	None	0.02	0.02
Solid	None	0.8	0.8
Hazardous			
Liquid	None	Included in mixed LLW	Included in mixed LLW
Solid	None	Included in mixed LLW	Included in mixed LLW
Nonhazardous (Sanitary)			
Liquid	1,010	0.8	0.8
Solid	5[d]	31	15[c]
Nonhazardous (Other)			
Liquid	Included in sanitary	0.8	0.8
Solid	Included in sanitary	0.8	0.8

[a] Liquid LLW would be treated with the remaining sludge being solidified.
[b] Includes concrete and 3 t of steel which is contaminated.
[c] [Text deleted.] Assumes compaction factor of 4:1 for compactible solid LLW and nonhazardous waste.
[d] Includes concrete and 1.5 t of steel construction waste material that would be recycled as scrap metal.
Source: OR MMES 1996a.

Table E.3.1.1–5. Estimated Waste Volumes for the Upgrade With All or Some Rocky Flats Environmental Technology Site Plutonium or Los Alamos National Laboratory Plutonium Subalternative at Hanford Site

Category	Annual Average Volume Generated From Construction (m^3)	Annual Volume Generated From Operations (m^3)	Annual Volume Effluent From Operations (m^3)
Transuranic			
Liquid	None	None	None
Solid	None	21	21
Mixed Transuranic			
Liquid	None	None	None
Solid	None	None	None
Low-Level			
Liquid	None	0.08[a]	None
Solid	None	89	45[b]
Mixed Low-Level			
Liquid	None	None	None
Solid	None	5	5
Hazardous			
Liquid	0.2	0.57	0.57
Solid	1.4	4	4
Nonhazardous (Sanitary)			
Liquid	5,880[c]	8,780	None
Solid	37[d]	967	483
Nonhazardous (Other)			
Liquid	Included in sanitary	Included in sanitary	None
Solid	Included in sanitary	None	None

[a] Liquid LLW would be treated and solidified prior to disposal.
[b] Assumes compaction factor of 4:1 for compactible solid LLW and nonhazardous waste.
[c] Does not include groundwater dewatering, if required.
[d] Includes concrete and 4.4 t of steel construction waste material that would be recycled as scrap metal.
[Text deleted.]
Source: HF DOE 1996a.

Table E.3.1.1–6. Estimated Waste Volumes for the Upgrade With All or Some Rocky Flats Environmental Technology Site Plutonium and Los Alamos National Laboratory Plutonium Subalternative at Idaho National Engineering Laboratory, Argonne National Laboratory-West

Category	Annual Average Volume Generated From Construction (m^3)	Annual Volume Generated From Operations (m^3)	Annual Volume Effluent From Operations (m^3)
Transuranic			
Liquid	None	0.004[a]	None
Solid	None	2	1[b]
Mixed Transuranic			
Liquid	None	None	None
Solid	None	1	1
Low-Level			
Liquid	None	0.79[a]	None
Solid	None	500	250[b]
Mixed Low-Level			
Liquid	None	0.14	0.14
Solid	None	27	27
Hazardous			
Liquid	6.3	1.3	1.3
Solid	26	1	1
Nonhazardous (Sanitary)			
Liquid	6,100[c]	10,300	None
Solid	49[d]	346	173[b]
Nonhazardous (Other)			
Liquid	Included in sanitary	Included in sanitary	None
Solid	Included in sanitary	440[e]	None

[a] Liquid TRU waste and LLW would be treated with the remaining sludge being solidified.
[b] [Text deleted.] Assumes compaction factor of 4:1 for compactible solid TRU, low-level, and nonhazardous waste.
[c] Does not include groundwater dewatering, if required.
[d] Includes concrete and 8 t of steel construction waste material that would be recycled as scrap metal.
[Text deleted.]
[e] Recyclable wastes.
Source: IN DOE 1996a.

Table E.3.1.1–7. Estimated Waste Volumes for the Upgrade With Rocky Flats Environmental Technology Site Plutonium Pit Subalternative at Pantex Plant

Category	Annual Average Volume Generated From Construction (m^3)	Annual Volume Generated From Operations (m^3)	Annual Volume Effluent From Operations (m^3)
Transuranic			
Liquid	None	None	None
Solid	None	0.8	0.8
Mixed Transuranic			
Liquid	None	None	None
Solid	None	None	None
Low-Level			
Liquid	None	0.08[a]	None
Solid	None	138	69[b]
Mixed Low-Level			
Liquid	None	0.2	0.2
Solid	None	8	8
Hazardous			
Liquid	Included in solid	1	1
Solid	0.05	1.5	1.5
Nonhazardous (Sanitary)			
Liquid	3,130[c]	12,900	12,900
Solid	1.3[d]	275	138[e]
Nonhazardous (Other)			
Liquid	Included in sanitary	Included in sanitary	Included in sanitary
Solid	Included in sanitary	344[f]	None

[a] Liquid LLW would be treated with the remaining sludge being solidified.
[b] [Text deleted.] Assumes compaction factor of 4:1 for compactible solid LLW.
[c] [Text deleted.] Does not include groundwater dewatering, if required.
[d] Includes concrete and 0.18 t of steel construction waste material that would be recycled as scrap metal.
[e] Assumes a compaction factor of 4:1 for compactible solids.
[f] Recyclable wastes.
[Text deleted.]
Note: Waste volumes for the Upgrade with All or Some RFETS and LANL Pu material are bounded by the Consolidation Alternative Modifying Existing and Constructing a New Facility in Zone 12 South at Pantex Plant (Table E.3.1.2–5).
Source: PX MH 1994a.

Table E.3.1.1–8. Estimated Waste Volumes for the Upgrade With Rocky Flats Environmental Technology Site Non-Pit Plutonium Subalternative at Savannah River Site

Category	Annual Average Volume Generated From Construction (m^3)	Annual Volume Generated From Operations (m^3)	Annual Volume Effluent From Operations (m^3)
Transuranic			
Liquid	None	None	None
Solid	None	None	None
Mixed Transuranic			
Liquid	None	None	None
Solid	None	None	None
Low-Level			
Liquid	None	None	None
Solid	None	None	None
Mixed Low-Level			
Liquid	None	None	None
Solid	None	None	None
Hazardous			
Liquid	Included in Solid	None	None
Solid	0.33	0.56	0.56
Nonhazardous (Sanitary)	1,680[a]	1,490[b]	1,480
Liquid	4.5[c]	13	11[d]
Solid			
Nonhazardous (Other)			
Liquid	Included in sanitary	Included in sanitary	Included in sanitary
Solid	Included in sanitary	13[e]	None

[a] [Text deleted.] Does not include groundwater dewatering, if required.
[b] Assumes a 350:1 wastewater/sludge ratio in the treatment of liquid sanitary waste.
[c] Includes concrete and 2.3 t of steel construction waste material that would be recycled as scrap metal.
[d] Includes sludge (5 m^3) from sanitary treatment which goes to land applicator. Compactible solids compacted by a factor of 4:1.
[e] Recyclable wastes.
Source: SR DOE 1994e; SRS 1996a:4.

Table E.3.1.1–9. Estimated Waste Volumes for the Upgrade With All or Some Rocky Flats Environmental Technology Site Plutonium and Los Alamos National Laboratory Plutonium Subalternative at Savannah River Site

Category	Annual Average Volume Generated From Construction (m^3)	Annual Volume Generated From Operations (m^3)	Annual Volume Effluent From Operations (m^3)
Transuranic			
Liquid	None	None	None
Solid	None	None	None
Mixed Transuranic			
Liquid	None	None	None
Solid	None	None	None
Low-Level			
Liquid	None	None	None
Solid	None	None	None
Mixed Low-Level			
Liquid	None	None	None
Solid	None	None	None
Hazardous			
Liquid	Included in solid	None	None
Solid	0.5	0.8	0.8
Nonhazardous (Sanitary)			
Liquid	2,370[a]	1,806[b]	1,800
Solid	19[c]	18	14[d]
Nonhazardous (Other)			
Liquid	Included in sanitary	Included in sanitary	Included in sanitary
Solid	Included in sanitary	18[e]	None

[a] [Text deleted.] Does not include groundwater dewatering, if required.
[b] Assumes a 350:1 wastewater/sludge ratio in the treatment of liquid sanitary waste.
[c] Includes concrete and 2.3 t of steel construction waste material that would be recycled as scrap metal.
[d] Includes sludge (5 m^3) from sanitary treatment which goes to land applicator. Compactible solids compacted by a factor of 4:1.
[e] Recyclable wastes.
Source: SR DOE 1994e; SRS 1996a:4.

E.3.1.2 Consolidation Alternative

This section contains the construction and operational waste volumes (Tables E.3.1.2–1 through E.3.1.2–7) and waste management block diagrams (Figures E.3.1.2–1 through E.3.1.2–4) associated with the storage facilities for the consolidation alternative.

Table E.3.1.2–1. Estimated Waste Volumes for the Consolidation Alternative—Constructing a New Facility at Hanford Site

Category	Annual Average Volume Generated From Construction (m^3)	Annual Volume Generated From Operations (m^3)	Annual Volume Effluent From Operations (m^3)
Transuranic			
Liquid	None	0.02[a]	None
Solid	None	10	5[b]
Mixed Transuranic			
Liquid	None	None	None
Solid	None	4	4
Low-Level			
Liquid	None	2[a]	None
Solid	None	1,260	630[b]
Mixed Low-Level			
Liquid	None	0.2	0.2
Solid	None	65	65
Hazardous			
Liquid	22	2	2
Solid	90	2	2
Nonhazardous (Sanitary)			
Liquid	7,670[c]	110,000	None
Solid	271[d]	1,140	570[b]
Nonhazardous (Other)			
Liquid	Included in sanitary	Included in sanitary	None
Solid	Included in sanitary	1,400[e]	None

[a] Liquid TRU waste and LLW would be treated with the remaining sludge being vitrified.
[Text deleted.]
[b] Assumes compaction factor of 4:1 for compactible solid TRU, low-level, and nonhazardous waste.
[c] Does not include groundwater dewatering, if required.
[Text deleted.]
[d] Includes concrete and 32 t of steel construction waste material which would be recycled as scrap metal.
[e] Recyclable wastes.
Source: DOE 1996e.

Table E.3.1.2–2. Estimated Waste Volumes for the Consolidation Alternative—Modifying P-Tunnel and Constructing New Material Handling Building at Nevada Test Site

Category	Annual Average Volume Generated From Construction (m^3)	Annual Volume Generated From Operations (m^3)	Annual Volume Effluent From Operations (m^3)
Transuranic			
Liquid	None	0.02[a]	None
Solid	None	10	5[b]
Mixed Transuranic			
Liquid	None	None	None
Solid	None	4	4
Low-Level			
Liquid	None	2[a]	None
Solid	None	1,260	630[b]
Mixed Low-Level			
Liquid	None	0.2	0.2
Solid	None	65	65
Hazardous			
Liquid	23	2	2
Solid	92	2	2
Nonhazardous (Sanitary)			
Liquid	7,830[c]	135,000	None
Solid	271[d]	1,620	810[b]
Nonhazardous (Other)			
Liquid	Included in sanitary	Included in sanitary	None
Solid	Included in sanitary	2,000[e]	None

[a] Liquid TRU waste and LLW would be treated with the remaining sludge being vitrified.
[Text deleted.]
[b] Assumes compaction factor of 4:1 for compactible solid TRU, low-level, and nonhazardous waste.
[c] Does not include groundwater dewatering, if required.
[d] Includes concrete and 35 t of steel construction waste material which would be recycled as scrap metal.
[Text deleted.]
[e] Recyclable wastes.
Source: NT DOE 1996a.

Table E.3.1.2–3. Estimated Waste Volumes for the Consolidation Alternative—Constructing a New Facility at Nevada Test Site

Category	Annual Average Volume Generated From Construction (m^3)	Annual Volume Generated From Operations (m^3)	Annual Volume Effluent From Operations (m^3)
Transuranic			
Liquid	None	0.02[a]	None
Solid	None	10	5[b]
Mixed Transuranic			
Liquid	None	None	None
Solid	None	4	4
Low-Level			
Liquid	None	2[a]	None
Solid	None	1,260	630[b]
Mixed Low-Level			
Liquid	None	0.2	0.2
Solid	None	65	65
Hazardous			
Liquid	23	2	2
Solid	92	2	2
Nonhazardous (Sanitary)			
Liquid	7,830[c]	114,000	None
Solid	288[d]	1,500	750[b]
Nonhazardous (Other)			
Liquid	Included in sanitary	Included in sanitary	None
Solid	Included in sanitary	1,900[e]	None

[a] Liquid TRU waste and LLW would be treated with the remaining sludge being vitrified.
[Text deleted.]
[b] Assumes compaction factor of 4:1 for compactible solid TRU, low-level, and nonhazardous waste.
[c] Does not include groundwater dewatering, if required.
[d] Includes concrete and 35 t of steel construction waste material which would be recycled as scrap metal.
[Text deleted.]
[e] Recyclable wastes.
Source: DOE 1996e.

Table E.3.1.2–4. Estimated Waste Volumes for the Consolidation Alternative—Constructing a New Facility at Idaho National Engineering Laboratory

Category	Annual Average Volume Generated From Construction (m^3)	Annual Volume Generated From Operations (m^3)	Annual Volume Effluent From Operations (m^3)
Transuranic			
Liquid	None	0.02[a]	None
Solid	None	10	5[b]
Mixed Transuranic			
Liquid	None	None	None
Solid	None	4	4
Low-Level			
Liquid	None	2[a]	None
Solid	None	1,260	630[b]
Mixed Low-Level			
Liquid	None	0.2	0.2
Solid	None	65	65
Hazardous			
Liquid	23	2	2
Solid	92	2	2
Nonhazardous (Sanitary)			
Liquid	7,830[c]	65,900	None
Solid	271[d]	1,320	660[b]
Nonhazardous (Other)			
Liquid	Included in sanitary	Included in sanitary	None
Solid	Included in sanitary	1,600[e]	None

[a] Liquid TRU waste and LLW would be treated with the remaining sludge being vitrified.
[Text deleted.]
[b] Assumes compaction factor of 4:1 for compactible solid TRU, low-level, and nonhazardous waste.
[c] Does not include groundwater dewatering, if required.
[d] Includes concrete and 37 t of steel construction waste material which would be recycled as scrap metal.
[Text deleted.]
[e] Recyclable wastes.
Source: DOE 1996e.

Table E.3.1.2–5. Estimated Waste Volumes for the Consolidation Alternative—Modifying Existing and Constructing a New Facility in Zone 12 South at Pantex Plant

Category	Annual Average Volume Generated From Construction (m^3)	Annual Volume Generated From Operations (m^3)	Annual Volume Effluent From Operations (m^3)
Transuranic			
Liquid	None	0.02[a]	None
Solid	None	10	5[b]
Mixed Transuranic			
Liquid	None	None	None
Solid	None	4	4
Low-Level			
Liquid	None	2[a]	None
Solid	None	1,260	630[b]
Mixed Low-Level			
Liquid	None	0.2	0.2
Solid	None	65	65
Hazardous			
Liquid	23	2	2
Solid	102	2	2
Nonhazardous (Sanitary)			
Liquid	8,000[c]	109,500	None
Solid	289[d]	1,560	780[b]
Nonhazardous (Other)			
Liquid	Included in sanitary	Included in sanitary	None
Solid	Included in sanitary	1,900[e]	None

[a] Liquid TRU waste and LLW would be treated with the remaining sludge being vitrified.
[Text deleted.]
[b] Assumes compaction factor of 4:1 for compactible solid TRU, low-level, and nonhazardous waste.
[c] Does not include groundwater dewatering, if required.
[d] Includes concrete and 42 t of steel construction waste material which would be recycled as scrap metal.
[Text deleted.]
[e] Recyclable wastes.
Source: PX DOE 1996a.

Table E.3.1.2–6. Estimated Waste Volumes for the Consolidation Alternative—Constructing a New Facility at Pantex Plant

Category	Annual Average Volume Generated From Construction (m^3)	Annual Volume Generated From Operations (m^3)	Annual Volume Effluent From Operations (m^3)
Transuranic			
Liquid	None	0.02[a]	None
Solid	None	10	5[b]
Mixed Transuranic			
Liquid	None	None	None
Solid	None	4	4
Low-Level			
Liquid	None	2[a]	None
Solid	None	1,260	630[b]
Mixed Low-Level			
Liquid	None	0.2	0.2
Solid	None	65	65
Hazardous			
Liquid	23	2	2
Solid	97	2	2
Nonhazardous (Sanitary)			
Liquid	8,000[c]	97,800	None
Solid	305[d]	1,440	720[b]
Nonhazardous (Other)			
Liquid	Included in sanitary	Included in sanitary	None
Solid	Included in sanitary	1,800[e]	None

[a] Liquid TRU waste and LLW would be treated with the remaining sludge being vitrified.
[Text deleted.]
[b] Assumes compaction factor of 4:1 for compactible solid TRU, low-level, and nonhazardous waste.
[c] Does not include groundwater dewatering, if required.
[d] Includes concrete and 38 t of steel construction waste material which would be recycled as scrap metal.
[Text deleted.]
[e] Recyclable wastes.
Source: DOE 1996e.

Table E.3.1.2–7. Estimated Waste Volumes for the Consolidation Alternative—Constructing a New Facility at Savannah River Site

Category	Annual Average Volume Generated From Construction (m^3)	Annual Volume Generated From Operations (m^3)	Annual Volume Effluent From Operations (m^3)
Transuranic			
Liquid	None	0.02[a]	None
Solid	None	10	5[b]
Mixed Transuranic			
Liquid	None	None	None
Solid	None	4	4
Low-Level			
Liquid	None	2[a]	None
Solid	None	1,260	630[b]
Mixed Low-Level			
Liquid	None	0.2	0.2
Solid	None	65	65
Hazardous			
Liquid	23	2	2
Solid	95	2	2
Nonhazardous (Sanitary)			
Liquid	8,000[c]	168,830	168,770
Solid	305[d]	1,480	740[b]
Nonhazardous (Other)			
Liquid	Included in sanitary	Included in sanitary	Included in sanitary
Solid	Included in sanitary	1,800[e]	None

[a] Liquid TRU waste and LLW would be treated with the remaining sludge being vitrified.
[Text deleted.]
[b] Assumes compaction factor of 4:1 for compactible solid TRU, low-level, and nonhazardous waste.
[c] Does not include groundwater dewatering, if required.
[d] Includes concrete and 38.3 t of steel construction waste material which would be recycled as scrap metal.
[Text deleted.]
[e] Recyclable wastes.
Source: DOE 1996e.

E.3.1.3 Collocation Alternative

This section contains the construction and operational waste volumes (Tables E.3.1.3–1 through E.3.1.3–8) and waste management block diagrams (Figures E.3.1.3–1 through E.3.1.3–4) associated with the storage facilities for the collocation alternative. At ORR, a new Pu storage facility (Table E.3.1.3–6 and Figure E.3.1.3–2) would be constructed in conjunction with maintaining or upgrading HEU storage at Y–12; whereas, Table E.3.1.3–7 and Figure E.3.1.3–3 reflect a new facility for the storage of both Pu and HEU.

Table E.3.1.3–1. Estimated Waste Volumes for the Collocation Alternative—Constructing a New Facility at Hanford Site

Category	Annual Average Volume Generated From Construction (m^3)	Annual Volume Generated From Operations (m^3)	Annual Volume Effluent From Operations (m^3)
Transuranic			
Liquid	None	0.02[a]	None
Solid	None	10	5[b]
Mixed Transuranic			
Liquid	None	None	None
Solid	None	4	4
Low-Level			
Liquid	None	2.1[a]	None
Solid	None	1,300	650[b]
Mixed Low-Level			
Liquid	None	0.2	0.2
Solid	None	66	66
Hazardous			
Liquid	31	2	2
Solid	122	2	2
Nonhazardous (Sanitary)			
Liquid	12,500[c]	146,000	None
Solid	366[d]	1,760	880[b]
Nonhazardous (Other)			
Liquid	Included in sanitary	Included in sanitary	None
Solid	Included in sanitary	2,200[e]	None

[a] Liquid TRU waste and LLW would be treated with the remaining sludge being vitrified.
[Text deleted.]
[b] Assumes compaction factor of 4:1 for compactible solid TRU, low-level, and nonhazardous waste.
[c] Does not include groundwater dewatering, if required.
[d] Includes concrete and 42.5 t of steel construction waste material which would be recycled as scrap metal.
[Text deleted.]
[e] Recyclable wastes.
Source: DOE 1996f.

Table E.3.1.3–2. Estimated Waste Volumes for the Collocation Alternative—Modifying P-Tunnel and Constructing New Material Handling Building at Nevada Test Site

Category	Annual Average Volume Generated From Construction (m^3)	Annual Volume Generated From Operations (m^3)	Annual Volume Effluent From Operations (m^3)
Transuranic			
Liquid	None	0.02[a]	None
Solid	None	10	5[b]
Mixed Transuranic			
Liquid	None	None	None
Solid	None	4	4
Low-Level			
Liquid	None	2.1[a]	None
Solid	None	1,300	650[b]
Mixed Low-Level			
Liquid	None	0.2	0.2
Solid	None	66	66
Hazardous			
Liquid	27	2	2
Solid	108	2	2
Nonhazardous (Sanitary)			
Liquid	8,670[c]	189,000	None
Solid	339[d]	1,960	980[b]
Nonhazardous (Other)			
Liquid	Included in sanitary	Included in sanitary	None
Solid	Included in sanitary	2,500[e]	None

[a] Liquid TRU waste and LLW would be treated with the remaining sludge being vitrified.
[Text deleted.]
[b] Assumes compaction factor of 4:1 for compactible solid TRU, low-level, and nonhazardous waste.
[c] Does not include groundwater dewatering, if required.
[d] Includes concrete and 48 t of steel construction waste material which would be recycled as scrap metal.
[Text deleted.]
[e] Recyclable wastes.
Source: NT DOE 1996a.

Table E.3.1.3–3. Estimated Waste Volumes for the Collocation Alternative—Constructing a New Facility at Nevada Test Site

Category	Annual Average Volume Generated From Construction (m^3)	Annual Volume Generated From Operations (m^3)	Annual Volume Effluent From Operations (m^3)
Transuranic			
Liquid	None	0.02[a]	None
Solid	None	10	5[b]
Mixed Transuranic			
Liquid	None	None	None
Solid	None	4	4
Low-Level			
Liquid	None	2.1[a]	None
Solid	None	1,300	650[b]
Mixed Low-Level			
Liquid	None	0.2	0.2
Solid	None	66	66
Hazardous			
Liquid	31	2	2
Solid	125	2	2
Nonhazardous (Sanitary)			
Liquid	12,600[c]	153,000	None
Solid	383[d]	1,900	950[b]
Nonhazardous (Other)			
Liquid	Included in sanitary	Included in sanitary	None
Solid	Included in sanitary	2,400[e]	None

[a] Liquid TRU waste and LLW would be treated with the remaining sludge being vitrified.
[Text deleted.]
[b] Assumes compaction factor of 4:1 for compactible solid TRU, low-level, and nonhazardous waste.
[c] Does not include groundwater dewatering, if required.
[d] Includes concrete and 47.5 t of steel construction waste material which would be recycled as scrap metal.
[Text deleted.]
[e] Recyclable wastes.
Source: DOE 1996f.

Table E.3.1.3–4. Estimated Waste Volumes for the Collocation Alternative—Constructing a New Facility at Idaho National Engineering Laboratory

Category	Annual Average Volume Generated From Construction (m^3)	Annual Volume Generated From Operations (m^3)	Annual Volume Effluent From Operations (m^3)
Transuranic			
Liquid	None	0.02[a]	None
Solid	None	10	5[b]
Mixed Transuranic			
Liquid	None	None	None
Solid	None	4	4
Low-Level			
Liquid	None	2.1[a]	None
Solid	None	1,300	650[b]
Mixed Low-Level			
Liquid	None	0.2	0.2
Solid	None	66	66
Hazardous			
Liquid	33	2	2
Solid	129	2	2
Nonhazardous (Sanitary)			
Liquid	12,800[c]	86,800	None
Solid	402[d]	1,720	860[b]
Nonhazardous (Other)			
Liquid	Included in sanitary	Included in sanitary	None
Solid	Included in sanitary	2,100[e]	None

[a] Liquid TRU waste and LLW would be treated with the remaining sludge being vitrified.
[Text deleted.]
[b] Assumes compaction factor of 4:1 for compactible solid TRU, low-level, and nonhazardous waste.
[c] Does not include groundwater dewatering, if required.
[d] Includes concrete and 51 t of steel construction waste material which would be recycled as scrap metal.
[Text deleted.]
[e] Recyclable wastes.
Source: DOE 1996f.

Table E.3.1.3–5. Estimated Waste Volumes for the Collocation Alternative—Constructing a New Facility at Pantex Plant

Category	Annual Average Volume Generated From Construction (m^3)	Annual Volume Generated From Operations (m^3)	Annual Volume Effluent From Operations (m^3)
Transuranic			
Liquid	None	0.02[a]	None
Solid	None	10	5[b]
Mixed Transuranic			
Liquid	None	None	None
Solid	None	4	4
Low-Level			
Liquid	None	2.1[a]	None
Solid	None	1,300	650[b]
Mixed Low-Level			
Liquid	None	0.2	0.2
Solid	None	66	66
Hazardous			
Liquid	33	2	2
Solid	130	2	2
Nonhazardous (Sanitary)			
Liquid	13,000[c]	129,500	None
Solid	401[d]	1,840	920[b]
Nonhazardous (Other)			
Liquid	Included in sanitary	Included in sanitary	None
Solid	Included in sanitary	2,300[e]	None

[a] Liquid TRU waste and LLW would be treated with the remaining sludge being vitrified.
[Text deleted.]
[b] Assumes compaction factor of 4:1 for compactible solid TRU, low-level, and nonhazardous waste.
[c] Does not include groundwater dewatering, if required.
[d] Includes concrete and 52.5 t of steel construction waste material which would be recycled as scrap metal.
[Text deleted.]
[e] Recyclable wastes.
Source: DOE 1996f.

Table E.3.1.3–6. Estimated Waste Volumes for the Collocation Alternative—Constructing a New Plutonium Storage Facility; Maintaining or Upgrading Y–12 Plant

Category	Annual Average Volume Generated From Construction (m^3)	Annual Volume Generated From Operations (m^3)	Annual Volume Effluent From Operations (m^3)
Transuranic			
Liquid	None	0.02[a]	None
Solid	None	10	5[b]
Mixed Transuranic			
Liquid	None	None	None
Solid	None	4	4
Low-Level			
Liquid	None	2[a]	None
Solid	None	1,260	630[b]
Mixed Low-Level			
Liquid	None	0.2	0.2
Solid	None	65	65
Hazardous			
Liquid	23	2	2
Solid	93	2	2
Nonhazardous (Sanitary)			
Liquid	7,830[c]	136,630	136,570
Solid	305[d]	1,340	670[b]
Nonhazardous (Other)			
Liquid	Included in sanitary	Included in sanitary	Included in sanitary
Solid	Included in sanitary	1,700[e]	None

[a] Liquid TRU waste and LLW would be treated with the remaining sludge being vitrified.
[Text deleted.]
[b] Assumes compaction factor of 4:1 for compactible solid TRU, low-level, and nonhazardous waste.
[c] Does not include groundwater dewatering, if required.
[d] Includes concrete and 36.7 t of steel construction waste material which would be recycled as scrap metal.
[Text deleted.]
[e] Recyclable wastes.
Source: DOE 1996e.

Table E.3.1.3–7. Estimated Waste Volumes for the Collocation Alternative—Constructing a New Plutonium and Highly Enriched Uranium Storage Facility at Oak Ridge Reservation

Category	Annual Average Volume Generated From Construction (m^3)	Annual Volume Generated From Operations (m^3)	Annual Volume Effluent From Operations (m^3)
Transuranic			
Liquid	None	0.02[a]	None
Solid	None	10	5[b]
Mixed Transuranic			
Liquid	None	None	None
Solid	None	4	4
Low-Level			
Liquid	None	2.1[a]	None
Solid	None	1,300	650[b]
Mixed Low-Level			
Liquid	None	0.2	0.2
Solid	None	66	66
Hazardous			
Liquid	31	2	2
Solid	127	2	2
Nonhazardous (Sanitary)			
Liquid	13,000[c]	171,840	171,770[d]
Solid	406[e]	1,740	870[b]
Nonhazardous (Other)			
Liquid	Included in sanitary	Included in sanitary	Included in sanitary
Solid	Included in sanitary	2,200[f]	None

[a] Liquid TRU waste and LLW would be treated with the remaining sludge being vitrified.
[Text deleted.]
[b] Assumes compaction factor of 4:1 for compactible solid TRU, low-level, and nonhazardous waste.
[c] Does not include groundwater dewatering, if required.
[d] Assumes a 350:1 wastewater/sludge ratio in the treatment of liquid sanitary waste.
[e] Includes concrete and 49.5 t of steel construction waste material which would be recycled as scrap metal.
[Text deleted.]
[f] Recyclable wastes.
Source: DOE 1996f.

Table E.3.1.3–8. Estimated Waste Volumes for the Collocation Alternative—Constructing a New Facility at Savannah River Site

Category	Annual Average Volume Generated From Construction (m^3)	Annual Volume Generated From Operations (m^3)	Annual Volume Effluent From Operations (m^3)
Transuranic			
Liquid	None	0.02[a]	None
Solid	None	10	5[b]
Mixed Transuranic			
Liquid	None	None	None
Solid	None	4	4
Low-Level			
Liquid	None	2.1[a]	None
Solid	None	1,300	650[b]
Mixed Low-Level			
Liquid	None	0.2	0.2
Solid	None	66	66
Hazardous			
Liquid	33	2	2
Solid	130	2	2
Nonhazardous (Sanitary)			
Liquid	13,000[c]	214,890	214,820[d]
Solid	401[e]	1,880	940[b]
Nonhazardous (Other)			
Liquid	Included in sanitary	Included in sanitary	Included in sanitary
Solid	Included in sanitary	2,300[f]	None

[a] Liquid TRU waste and LLW would be treated with the remaining sludge being vitrified.
[Text deleted.]
[b] Assumes compaction factor of 4:1 for compactible solid TRU, low-level, and nonhazardous waste.
[c] Does not include groundwater dewatering, if required.
[d] Assumes a 350:1 wastewater/sludge ratio in the treatment of liquid sanitary waste.
[e] Includes concrete and 52.5 t of steel construction waste material which would be recycled as scrap metal.
[Text deleted.]
[f] Recyclable wastes.
Source: DOE 1996f.

E.3.2 FACILITIES COMMON TO MULTIPLE PLUTONIUM DISPOSITION ALTERNATIVES

Under the Preferred Alternative for surplus Pu disposition, the pit disassembly/conversion facility and the mixed oxide (MOX) fuel fabrication facility could each be located at either Hanford, INEL, Pantex, or SRS and the Pu conversion facility could be located at Hanford or SRS. The amount of waste generated from the construction of these alternatives could be reduced by using existing facilities for portions of the operations. The next tier of NEPA review will examine locations for the selected alternatives including the use of existing facilities.

E.3.2.1 Pit Disassembly/Conversion Facility

The design of the pit disassembly/conversion facility would place great emphasis on the minimization of both liquid and solid wastes. Where generation of a waste could not be avoided, methods would be pursued to recycle the waste. In general terms, waste management of the pit disassembly/conversion facility would include waste handling and treatment operations for processing the various wastes in aqueous, organic liquid, or solid form generated directly from pit conversion/disassembly operations or from related site activities.

Table E.3.2.1–1 presents the estimated annual waste volumes during construction and operation of the pit disassembly/conversion facility. Waste management capabilities would be provided to monitor, treat, and handle radiological wastes, industrial and chemical wastes, as well as sanitary and stormwater wastes. The treated effluent from utility, process, and sanitary wastewater treatment would be reclaimed and used as cooling system makeup water. The radioactive and nonradioactive waste management facilities would be located in the Pu processing building. This building would have space for the following: unloading and disassembly of retired Pu pits, separating of the Pu and other components, and the required processing of wastes for ultimate disposal. The waste treatment processes would include assay examination, sorting, separation, concentration, size reduction, special treatment, and thermal treatment. The wastes would be converted to either water meeting effluent standards, grouted cement, or compacted solid waste as final form products for disposal. Waste treatment processing would also perform equipment and waste container decontamination operations.

Following receipt of the retired pits, the initial phase of the processing would be disassembly and conversion. The pits would be parted and the Pu extracted and converted into metal or oxide using hydriding technology. If metal product was required, then the hydride would be converted back to metal by dehydriding. If oxide product was required, the hydride would be converted to oxide. A passivation furnace would be used in this phase to convert glovebox sweepings and residues into a stable oxide. A packaging station would be provided to package product metal or oxide and remove it from the glovebox line. The next phase would be residue recovery. Pu-contaminated components, equipment, and residues would be processed to remove the Pu. In addition, Pu residues such as passivated sweepings, crucibles, and some turnings would be processed to recover Pu. Product oxide from the residue recovery would be transferred to the disassembly/conversion area for packaging.

The wastes generated from pit disassembly/conversion and residue recovery operations would consist of low-level, mixed low-level, TRU, and mixed TRU wastes. The LLW would consist of paper and surgeon's gloves that would be discarded inside the radioactive materials area but external to gloveboxes. The TRU waste would be waste generated internal to the gloveboxes and would consist of failed equipment, stainless steel hemishells, combustibles, HEPA filters, and used vacuum pump oil. The mixed TRU waste would be principally leaded gloves.

Waste management involves the collection, assaying, sorting, treatment, packaging, storing, and shipping of radioactive, hazardous, and mixed wastes from Pu operations, and hazardous and nonhazardous waste from the support facilities. Two main subsystems, solid waste treatment and liquid waste treatment, would handle TRU, low-level, hazardous, and mixed wastes. Initial sorting of wastes would be performed at the source of generation. Wastes would be processed to ensure compliance with all applicable Federal and State statutes and regulations, as well as DOE Orders.

For solid waste treatment, as illustrated in Figure E.3.2.1–1, nonnuclear material, such as stainless steel, would be processed to form unclassified shapes and then be packaged for disposal. In addition, wastes from facility glovebox operations would be sorted, processed, and packaged for disposal. This subsystem contains nondestructive assay systems to assay waste material for Pu content and certify it as low-level or TRU waste. Following appropriate treatment, solid nonhazardous waste would be either disposed of at a permitted sanitary landfill or sent to a commercial recycling center. For liquid waste treatment, as illustrated in Figure E.3.2.1–2, solutions from the residue recovery subsystem would be treated to produce a disposable waste form. Typical processing would include: neutralization, filtration, immobilization, and certification for disposal. This subsystem would also contain the effluent and wastes from laundry facilities. Following appropriate treatment to below permitted levels, aqueous wastes would be discharged to natural drainage channels or permitted outfalls.

Any nonradiological wastes generated from operation would be monitored, collected, and treated, if necessary, before discharge to the environment. Facilities would be provided to treat chemically-contaminated wastewaters to below regulatory requirements before discharge to the environment. Holding tanks would be provided for the wastes. Nonradioactive solid wastes would be recycled where possible or transferred to approved disposal sites in accordance with accepted industrial practices and regulatory requirements.

All fire sprinkler water discharged in process areas during and after a fire would be contained, monitored, sampled, and if required, retained until disposal. Utility wastewater discharges (including cooling system and boiler blowdown) would be treated in an industrial wastewater treatment plant prior to discharge in accordance with applicable environmental standards. The facility design does not include a sanitary treatment plant to treat liquid sanitary waste; rather, the design assumes that such support infrastructure would already be in place.

High-Level Waste. The pit disassembly/conversion facility would not generate any HLW.

Transuranic Waste. TRU waste would be generated from process and facility operations, equipment decontamination, failed equipment, and used tools. Numerous processes, including those directly supporting pit disassembly and conversion, residue recovery, and analytical laboratory operation, and those managing the various waste streams, would produce used HEPA filters, retired gloveboxes, glovebox sweepings, failed equipment, declassified components, contaminated wipes and rags, combustibles, used vacuum pump oil, and other process equipment. Following characterization, these wastes would be handled, treated, and disposed of according to their level of contamination. If characterized as TRU waste, they would be appropriately treated and stored until final disposal (assumed to be WIPP).

Transuranic waste would be treated in a waste handling facility to form grout or a compact solid waste. Should any liquid TRU waste be generated, it would be treated with the remaining TRU sludge being solidified. Treated TRU waste products would be packaged, assayed, and certified to meet the waste acceptance criteria of WIPP or alternative treatment level. Assuming WIPP is determined to be a suitable repository for these wastes, pursuant to the requirements of 40 CFR 191 and 40 CFR 268 and depending on decisions made in the ROD associated with the supplemental EIS being prepared for the proposed continued phased development of WIPP for disposal of TRU waste, these wastes would be transported to WIPP for disposal.

Mixed Transuranic Waste. A very small quantity of solid mixed TRU waste, mainly protective clothing and radiological survey waste from the waste handling facility, would be generated annually during operations. This mixed TRU waste would be primarily generated from activities at the waste handling/management facilities. Mixed TRU waste would be packaged and shipped to another DOE waste management facility for temporary storage, pending final treatment and disposal in accordance with the site-specific treatment plan that was developed to comply with the *Federal Facility Compliance Act*. Current plans call for disposal at WIPP.

Low-Level Waste. [Text deleted.] Numerous processes, including those directly supporting pit disassembly and conversion, residue recovery, and analytical laboratory operation, and those managing the various waste streams, would produce contaminated operator clothing, gloves, wipes, shoe covers, and process equipment. Following characterization, these wastes would be handled, treated, and disposed of according to their level of contamination. If characterized as LLW, they would be treated by sorting, separation, concentration, and size reduction processes. Should any liquid LLW be generated, it would be treated with the remaining LLW sludge being solidified. Final LLW products would be surveyed and disposed of onsite or offsite in a shallow burial site.

Mixed Low-Level Waste. A very small quantity of liquid and solid mixed LLW, mainly protective clothing and radiological survey waste from the waste handling facility, would be generated annually during operations. This mixed LLW would be primarily generated from activities at the waste handling/management facilities. Any mixed LLW would be stored onsite on an interim basis until treatment, disposal, or offsite shipment in accordance with the site-specific treatment plan.

Hazardous Waste. Many of the pit disassembly/conversion facility processes would generate hazardous waste. This would include chemical makeup and reagents for support activities, lubricants and oils for process and support equipment, and used solvent rags. The liquid and solid hazardous waste would be collected and stored onsite on an interim basis. The hazardous waste would be recycled, or stored and packaged for offsite treatment or disposal at offsite commercial RCRA-permitted facilities.

Nonhazardous (Sanitary) Waste. Liquid nonhazardous sanitary waste generated in the facility would be transferred to the sanitary waste system for treatment. Solid nonhazardous waste, such as domestic trash, office waste, cafeteria wastes, clean non-Pu wastes, and industrial wastes from utility and maintenance operations, would be transported to a permitted sanitary landfill for disposal.

Nonhazardous (Other) Waste. Other liquid nonhazardous waste generated from facilities support operations (for example, cooling system blowdown and evaporator condensate) would be collected in a catch tank and sampled before being reclaimed for other recycle use or release to the environment. The facility design includes stormwater retention ponds with the necessary NPDES monitoring equipment. Runoff within the main facility area would be collected separately, routed to the stormwater collection ponds, then sampled and analyzed before discharge to the natural drainage channels (dry site) or river (wet site). If the runoff was contaminated, it would be treated in the process wastewater treatment system. Runoff outside of the main facility area would be discharged directly into the natural drainage channel or river.

E.3.2.2 Plutonium Conversion Facility

The design of the Pu conversion facility would place great emphasis on the minimization of both liquid and solid wastes. Where generation of a waste could not be avoided, methods would be pursued to recycle the waste, as well as any process reagents. In general terms, waste management of the Pu conversion facility would include waste handling and treatment operations for processing the various wastes in aqueous, organic liquid, or solid form generated directly from Pu conversion operations or from related site activities.

Table E.3.2.2–1 presents the estimated annual waste volumes during construction and operation of the Pu conversion facility. As illustrated in Figure E.3.2.2–1, waste management capabilities would be provided to monitor, treat, and handle radioactive wastes, industrial and chemical wastes, and sanitary and stormwater wastes. The treated effluent from utility, process and sanitary wastewater treatment would be reclaimed to be used as cooling system makeup water.

The radioactive and nonradioactive waste management capabilities that would be provided to handle the generated wastes would consist of the Process Building, Liquid Waste Treatment Facility, Long-Term Waste Storage Building, and a Sanitary Wastewater Treatment Plant. The Process Building would have space for handling and processing surplus fissile material into the accepted long- term storage form. It would also have space for support operations, including material control and accountability, safety systems, waste handling and management, repackaging, and assay and analysis. Liquid wastes collected from processing areas would be treated by the Liquid Waste Treatment Facility through neutralization, precipitation, and volume reduction via evaporation. Any sludge produced would be immobilized and packaged for disposal, while evaporated water would be recycled for use in the utility systems. The Long-Term Waste Storage Building would provide interim storage/staging for hazardous and low-level wastes. Hazardous waste would be transported from there to an approved offsite RCRA-permitted treatment and disposal facility. LLW would be transported to a DOE LLW disposal facility. In general, the wastes would be converted to either water meeting effluent standards, grouted cement, or compacted solid waste as final form products for disposal. The waste treatment processing would also perform equipment and waste container decontamination operations.

Following receipt and unpackaging of the surplus non-pit Pu, the initial phase of the processing would be material management, which would provide the interface between receiving and processing, and repackaging and storage. Material management would include sampling, nondestructive assay, feed segregation, and feed and product preparation. The wastes generated from the shipping and receiving function and the materials management function would consist of decontamination solutions, damaged primary containers, lubricants, hydraulic fluids, and process wastewater.

The direct processing steps within the Pu conversion facility would include separation, oxidation/wash and calcination, and repackaging of the oxide products in their final form prior to disposition. The separation function would use aqueous processing, including dissolution, extraction or ion exchange, precipitation, and calcination operations. The oxidation/wash function would consist of oxidizing carbonaceous components in scrap feeds, providing additional size reduction, and leaching Pu from the insoluble residue. The calcination function would convert impure feeds by oxidizing reactive metals and carbonaceous material and stabilizing the material to a uniform size and composition that would meet long-term storage criteria. The repackaging function would entail containerization and interim storage for the oxide products from the recovery processes, as well as for the surplus metal and oxides from existing facilities, in accordance with safe storage criteria.

Waste management involves the collection, assaying, sorting, treating, packaging, storing, and shipping of radioactive, hazardous, and mixed wastes generated by Pu conversion operations, and hazardous and nonhazardous waste from the support facilities. Wastes would be processed to ensure compliance with all applicable Federal and State statutes and regulations and DOE Orders.

For solid waste treatment, initial sorting of wastes would be performed at the source of generation and would involve treatment by a variety of processes to ensure regulatory compliance. Nondestructive assay systems would be provided to assay waste materials for Pu content and certify the waste as low-level or TRU. For liquid waste treatment, solutions from the various process functions would be treated to produce a disposable waste form. Processing capabilities would include: neutralization, filtration, precipitation, concentration by evaporation, immobilization, and packaging/certification for disposal. The radioactive liquid waste would be processed and recycled to the maximum extent possible at the point of generation. Following appropriate treatment to below permitted levels, aqueous wastes would be discharged to natural drainage channels or permitted outfalls.

Any nonradiological wastes generated from operation would be monitored, collected, and treated, if necessary, before discharge to the environment. Facilities would be provided to treat chemically contaminated wastewaters to below regulatory requirements before discharge to the environment. Holding tanks would be provided for the wastes. Nonradioactive solid wastes would be recycled where possible or transferred to approved disposal sites in accordance with accepted industrial practices and regulatory requirements.

All fire sprinkler water discharged in process areas during and after a fire would be contained, monitored, sampled, and if required, retained until disposal. Utility wastewater discharges, including cooling system and boiler blowdown, would be treated in an industrial wastewater treatment plant prior to discharge in accordance with applicable environmental standards. The facility design includes a sanitary treatment plant to treat liquid sanitary wastes.

High-Level Waste. The Pu conversion facility would not generate any HLW.

Transuranic Waste. TRU wastes would be generated from process and facility operations, equipment decontamination, failed equipment, and used tools. Numerous processes, including those directly supporting surplus Pu conversion and final waste form production, and those managing the various waste streams, would produce used HEPA filters, retired gloveboxes and leaded gloves, glovebox sweepings, failed equipment, contaminated wipes and rags, combustibles, used hydraulic fluids, and other process equipment. Following characterization, these wastes would be handled, treated, and disposed of according to their level of contamination. If characterized as TRU waste, they would be appropriately treated and stored until final disposal.

Transuranic wastes would be treated in a waste handling facility to form grout or a compact solid waste. Treated TRU waste products would be packaged, assayed, and certified to meet the waste acceptance criteria of the WIPP or alternative treatment level. Assuming WIPP is determined to be a suitable repository for these wastes, pursuant to the requirements of 40 CFR 191 and 40 CFR 268 and depending on decisions made in the ROD associated with the supplemental EIS being prepared for the proposed continued phased development of WIPP for disposal of TRU waste, these wastes would be transported to WIPP for disposal.

Mixed Transuranic Waste. A small quantity of solid mixed TRU waste, mainly protective clothing and radiological survey waste, would be generated annually during operations. This mixed TRU waste would be primarily generated from activities at the waste handling/management facilities. Mixed TRU would be packaged and shipped to another DOE waste management facility for temporary storage, pending final treatment and disposal in accordance with the site-specific treatment plan that was developed to comply with the *Federal Facility Compliance Act* of 1992. Current plans call for disposal at WIPP.

Low-Level Waste. [Text deleted.] Numerous processes, including those directly supporting surplus Pu conversion and final waste form production, and those managing the various waste streams, would produce contaminated operator clothing, gloves, wipes, shoe covers, and process equipment. Following characterization, these wastes would be handled, treated, and disposed of according to their level of contamination. If characterized as LLW, they would be treated by sorting, separation, concentration and size reduction processes.

Any liquid LLW would be treated and the remaining LLW sludge would be solidified. Final LLW products would be surveyed and disposed of in an onsite or offsite DOE LLW disposal facility.

Mixed Low-Level Waste. A very small quantity of liquid and solid mixed LLW would be generated annually during operations. Liquid mixed LLW could originate from potentially contaminated lubricants and hydraulic fluids used for material handling equipment. Solid mixed LLW would be made up of wipes laden with contaminated oils and hydraulic fluids. Any mixed LLW would be stored onsite on an interim basis until treatment, disposal, or offsite shipment in accordance with the site-specific treatment plan that was developed to comply with the *Federal Facility Compliance Act* of 1992.

Hazardous Waste. Many of the Pu conversion facility processes would generate hazardous waste. This waste would include chemical makeup and reagents for support activities, lubricants and oils for process and support equipment, and used solvent rags. The liquid and solid hazardous waste would be collected at the facility and stored on an interim basis. The hazardous wastes would be recycled, or stored and packaged for offsite treatment or disposal at commercial RCRA-permitted facilities.

Nonhazardous (Sanitary) Waste. Nonhazardous sanitary liquid wastes generated in the facility would be transferred to the sanitary waste treatment plant for processing. Nonhazardous solid wastes, such as domestic trash, office waste, cafeteria wastes, clean non-Pu wastes, and industrial wastes from utility and maintenance operations, would be hauled to a permitted sanitary landfill for disposal.

Nonhazardous (Other) Waste. Other nonhazardous liquid wastes generated from facilities support operations (for example, cooling system blowdown and evaporator condensate) would be collected in a catch tank and sampled before being reclaimed for other recycle use or release to the environment. The facility design includes stormwater retention ponds with the necessary NPDES monitoring equipment. Runoff within the main facility area would be collected separately, routed to the stormwater collection ponds, and then sampled and analyzed before discharge to the natural drainage channels (dry site) or river (wet site). If the runoff was contaminated, it would be treated in the process wastewater treatment system. Runoff outside of the main facility area would be discharged directly into the natural drainage channel or river.

E.3.2.3 Generic Mixed Oxide Fuel Fabrication Facility

The design of the generic MOX fuel fabrication facility would place great emphasis on the minimization of both liquid and solid wastes. Where generation of a waste could not be avoided, methods would be pursued to recycle the waste. In general terms, the waste management of the generic MOX fuel fabrication facility would include waste handling and treatment operations for processing the various wastes in aqueous, organic liquid, or solid form generated directly from MOX fuel fabrication operations or from related site activities.

Table E.3.2.3–1 presents the estimated annual waste volumes during construction and operation of the generic MOX fuel fabrication facility. Waste management capabilities would be provided to monitor, treat, and handle radioactive, industrial and chemical, and sanitary and stormwater wastes. The treated effluent from utility, process, and sanitary wastewater treatment would be reclaimed to be used as cooling system makeup water.

The fuel fabrication process would consist of the purification and conditioning of plutonium dioxide (PuO_2) that does not meet specifications; blending of PuO_2 and uranium dioxide; fabrication of fuel pellets; fabrication of fuel rods; assembly of fuel bundles; recycling of Pu-bearing scrap and materials from pellets, rods, and bundles that do not meet requirements; and management of wastes generated throughout the fuel fabrication process. The wastes would include TRU, low-level, mixed, hazardous, and nonhazardous wastes. The radioactive and nonradioactive waste management capabilities provided to handle these wastes would be located in the Waste Management Building adjacent to the Receiving and Storage Building and the Fuel Fabrication Building. The waste treatment processes would include assay examination, sorting, separation, concentration, size reduction, special treatment, and thermal treatment. The waste would be converted to either water meeting effluent standards, grouted cement, or compacted solid waste as final form products for disposal. The waste treatment processing would also perform equipment and waste container decontamination operations.

Waste would be generated during each step of the MOX fuel fabrication. As illustrated in Figures E.3.2.3–1 and E.3.2.3–2, the waste management process would involve the collection, assaying, sorting, treating, packaging, storing, and shipping of radioactive, hazardous, and mixed wastes from the Pu operations, and hazardous and nonhazardous wastes from the support facilities. Initial sorting of solid waste would be performed at the generation source. Solid waste would be treated by a variety of processes to ensure compliance with all applicable requirements. The treatment processes include passivation for reactive metals. Waste products would be immobilized and packaged to meet DOT and DOE requirements. Liquid organic waste would be separated and dispositioned, as would solid organic waste. In addition, radioactive liquid waste would be neutralized, filtered, precipitated, concentrated by evaporation, immobilized, and packaged for appropriate disposal, while mixed LLW would be stored until a decision is made to allow disposal as LLW following appropriate treatment. Mixed TRU waste would be handled like other TRU wastes. Finally, solid, nonhazardous, and aqueous and gaseous wastes would be treated in conformance with standard industrial practice and regulatory requirements. Solid nonhazardous waste would either be disposed of in a permitted sanitary landfill or sent to a commercial recycle center. Aqueous waste that was below regulatory limits would be discharged through permitted outfalls. Gaseous waste that was below regulatory limits following treatment would be released to the atmosphere.

All of the nonradioactive waste generated from operation would be strictly monitored, completely collected, and appropriately treated, if necessary, before discharge to the environment. Facilities would be provided to treat chemically-contaminated wastewaters before discharge to the environment. Holding tanks would be provided for the waste. Solid nonradioactive waste would be recycled, where possible, or transferred to approved disposal sites in accordance with accepted industrial practices.

All fire sprinkler water discharged in process areas during and after a fire would be contained, monitored, sampled, and if required, retained until disposal. Utility wastewater (including cooling system and boiler blowdown) would be treated in an industrial wastewater treatment plant prior to discharge in accordance with applicable environmental standards. The facility design includes a sanitary treatment plant to treat liquid sanitary waste.

High-Level Waste. The generic MOX fuel fabrication facility would not generate any HLW.

Transuranic Waste. TRU waste would be generated from process and facility operations, equipment decontamination, failed equipment, and used tools. Numerous processes, including those directly supporting the Pu oxide purification, MOX fuel fabrication, fuel pellet/rod/bundle handling, material recycle, and those managing the various waste streams, would produce used ventilation air filters, resins, and Pu oxide sweepings, as well as contaminated operator clothing, gloves, glove boxes, tools, wipes and rags, shoe covers, and other process equipment. Following characterization, these wastes would be handled, treated, and disposed of according to their level of contamination. If characterized as TRU waste, they would be appropriately treated and stored until final disposal.

The TRU waste would be treated in a waste handling facility to form grout or a compact solid waste. Treated TRU waste products would be packaged, assayed, and certified to meet the waste acceptance criteria of the WIPP or alternative treatment level. Assuming WIPP is determined to be a suitable repository for these wastes, pursuant to the requirements of 40 CFR 191 and 40 CFR 268 and depending on decisions made in the ROD associated with the supplemental EIS being prepared for the proposed continued phased development of WIPP for disposal of TRU waste, these wastes would be transported to WIPP for disposal.

Mixed Transuranic Waste. A very small quantity of solid mixed TRU waste, mainly protective clothing and radiological survey water, would be generated annually during operations. This solid mixed TRU waste would be primarily generated from activities at the Waste Management Building. Mixed TRU waste would be packaged and shipped to another DOE waste management facility for temporary storage, pending final treatment and disposal in accordance with the site treatment plan that was developed to comply with the *Federal Facility Compliance Act*. Current plans call for disposal at WIPP.

Low-Level Waste. [Text deleted.] Numerous processes, including those directly supporting the Pu oxide purification, MOX fuel fabrication, fuel pellet/rod/bundle handling, and material recycling, and those managing the various waste streams, would produce contaminated operator clothing, gloves, tools, wipes and rags, shoe covers, and process equipment. Following characterization, these wastes would be handled, treated, and disposed of according to their level of contamination. If characterized as LLW, they would be treated by sorting, separation, concentration, and size-reduction processes. Any liquid LLW would be treated with the remaining LLW sludge being solidified. Final LLW products would be surveyed and disposed of in a DOE or commercial LLW disposal facility.

Mixed Low-Level Waste. A very small quantity of solid mixed LLW, mainly protective clothing and radiological survey waste, would be generated annually during operations. This mixed LLW would be primarily generated from activities at the Waste Management Building. Any mixed LLW would be stored onsite on an interim basis until treatment, disposal, or offsite shipment in accordance with the site treatment plan that was developed to comply with the *Federal Facility Compliance Act*.

Hazardous Waste. Many of the generic MOX fuel fabrication facility processes would generate hazardous waste. This waste would include chemical makeup and reagents for support activities, and lubricants and oils for process and support equipment. Liquid waste would include cleaning solvents, vacuum pump oils, film processing fluids, hydraulic fluids from mechanical equipment, antifreeze solutions, and paint. Solid waste would include lead packing, used wipes and rags contaminated with oils, lubricants, and cleaning solvents. The liquid and solid hazardous wastes would be collected at the facility and stored on an interim basis. The hazardous waste would be recycled, or stored and packaged for offsite treatment and disposal at commercial RCRA-permitted facilities.

Nonhazardous (Sanitary) Waste. Liquid nonhazardous sanitary waste generated in the facility would be transferred to the sanitary waste system for treatment. Solid nonhazardous waste, such as domestic trash and office waste, would be hauled to a permitted sanitary landfill for disposal.

Nonhazardous (Other) Waste. Liquid nonhazardous waste generated from support operations (for example, cooling system blowdown and evaporated condensate) would be collected in a catch tank and sampled before being reclaimed for other recycle use or release to the environment. The facility design includes stormwater retention ponds with the necessary NPDES monitoring equipment. Runoff within the main facility area would be collected separately, routed to the stormwater collection ponds, and then sampled and analyzed before discharge to the natural drainage channels (dry site) or river (wet site). If the runoff was contaminated, it would be treated in the process wastewater treating system. Runoff outside of the main facility area would be discharged directly into the natural drainage channel or river.

E.3.3 FACILITIES TO SUPPORT FINAL DISPOSITION OF PLUTONIUM

Under the Preferred Alternative for surplus Pu disposition, the ceramic immobilization facility or the vitrification facility could be located at Hanford or SRS. The volume of waste generated from the construction of these alternatives could be reduced by existing facilities for portions of the operations. The next tier of NEPA review will examine locations for the second alternatives including the use of existing facilities.

E.3.3.1 Direct Disposition Alternative—Deep Borehole Complex

The design of the deep borehole disposal facility for direct disposition would place great emphasis on the minimization of both liquid and solid wastes. Where generation of waste could not be avoided, methods would be pursued to recycle the waste. In general terms, the waste management of the borehole facility would include waste handling and treatment operations for processing the various wastes (in aqueous, organic liquid, or solid form) generated directly from borehole disposition operations or from related site activities.

Table E.3.3.1–1 presents the estimated annual waste generation volumes during construction and operation of the deep borehole disposal facility. As illustrated in Figure E.3.3.1–1, waste management capabilities would be provided to monitor, treat, and handle radioactive, industrial, and chemical wastes, as well as sanitary and stormwater wastes. The treated effluent from utility, process, and sanitary wastewater treatment would be reclaimed to be used as cooling system makeup water. Generated wastes would include TRU, low-level, mixed, hazardous, and nonhazardous wastes. The management facilities provided to handle radioactive wastes would be located in the Process Waste Management Facility adjacent to the receiving and processing building. The waste treatment processes would include assay examination, sorting, separation, concentration, size reduction, special treatment, and thermal treatment. The wastes would be converted to water meeting effluent standards, grouted cement, or compacted solid waste as final form products for disposal. The waste treatment processing would also perform equipment and waste container decontamination operations.

Any wastes generated by the surface processing facility would be sampled for radioactivity and, if free of contamination, would be stored, pending disposal, in a permitted sanitary/industrial disposal facility. If contaminated, they would be considered low-level/TRU waste and treated accordingly. Solid waste generated from process operations at the surface facilities would include packing materials, deformed Pu shipping containers, wipes and rags, gloves, paper clothing, and HEPA filters. Liquid waste would include wash water from canister decontamination, spent pump oils, and trichloroethane cleaning solvent.

Wastes generated from the drilling facility would include a mixture of solid rock cuttings brought out of the borehole by the drilling mud and drilling mud additives. This conglomeration would be allowed to settle out in the drilling mud pit. The exact makeup of the additives and rock cuttings will not be known until the geology of the site has been ascertained. Once characterized, this cutting mixture would be disposed of by appropriate means. Any wastewater generated by the drilling process would be tested and treated, as needed, through evaporation ponds and the residual solids would be buried in the mud pits.

The Process Waste Management Facility would contain equipment and processes for the treatment of nonhazardous process, hazardous, radioactive, and mixed liquid wastes. The facility would allow treatment of any wastewater generated by the various facilities. The wastewater originating in the borehole array area would be pumped through underground pipes to the Process Waste Treatment Facility. This wastewater would primarily consist of mop waters and cleaning solutions, emplacement canister sealants and additives, drilling mud additives, grout additives, and machine coolant wastes. The drilling facility would generate a substantial amount of wastewater as overflow from drilling mud settlement ponds. In addition, water pumped out of the borehole during drilling, emplacing, and sealing operations would require appropriate treatment.

Any nonradiological wastes generated from operation would be monitored, collected, and treated, if necessary, before being designated as reclaimed water recycle and used as makeup to the cooling system. Facilities would be provided to treat chemically-contaminated wastewaters before discharge to the environment. Holding tanks would be provided for the wastes. Nonradioactive solid wastes would be recycled, where possible, or transferred to approved disposal sites in accordance with accepted industrial practices.

All fire-sprinkler water discharged in process areas during and after a fire would be contained, monitored, sampled, and if required, retained until disposal. Utility wastewater (including cooling system and boiler blowdown) would be treated in an industrial wastewater treatment plant prior to being designated as reclaimed water recycle. The facility design includes a sanitary treatment plant to treat liquid sanitary wastes.

High-Level Waste. The deep borehole disposal facility for direct disposition would not generate any HLW.

Transuranic Waste. TRU wastes would be generated from process and facility operations, equipment decontamination, failed equipment, and used tools. Numerous processes (including those directly supporting the borehole drilling, radioactive Pu handling, and direct canister emplacement and those managing the various waste streams) would produce used ventilation air filters, resins, and sludges, as well as contaminated operator clothing, gloves, wipes, shoe covers, and other process equipment. Following characterization, these wastes would be handled, treated, and disposed of according to their level of contamination. If characterized as TRU waste, they would be appropriately treated and stored until final disposal.

Transuranic wastes would be treated in a waste handling facility to form grout or a compact solid waste. The small amount of liquid TRU waste would be treated with the remaining TRU sludge being solidified. Treated TRU waste products would be packaged, assayed, and certified to meet the waste acceptance criteria of the WIPP or alternative treatment level. Assuming WIPP is determined to be a suitable repository for these wastes and depending on decisions made in the ROD associated with the supplemental EIS being prepared for the proposed continued phased development of WIPP for disposal of TRU waste, these wastes would be transported to WIPP for disposal pursuant to the requirements of 40 CFR 191 and 40 CFR 268.

Mixed Transuranic Waste. A very small quantity of solid mixed TRU waste (mainly protective clothing and radiological survey waste from the waste handling facility) would be generated annually during operations. Mixed TRU would be packaged and shipped to another DOE waste management facility for temporary storage, pending final treatment and disposal in accordance with the site-specific treatment plan that was developed to comply with the *Federal Facility Compliance Act*. Current plans call for disposal at WIPP.

Low-Level Waste. [Text deleted.] Numerous processes (including those directly supporting the borehole drilling, radioactive Pu handling, and direct canister emplacement, and those managing the various waste streams) would produce contaminated operator clothing, gloves, wipes, shoe covers, and process equipment. Following characterization, these wastes would be handled, treated, and disposed of according to their level of contamination. If characterized as LLW, they would be treated by sorting, separation, concentration, and size-reduction processes. Any liquid LLW would be treated with the remaining LLW sludge being solidified. Final LLW products would be surveyed and disposed of in a shallow land burial site.

Mixed Low-Level Waste. A very small quantity of solid mixed LLW (mainly protective clothing and radiological survey waste from the waste handling facility) would be generated annually during operations. Any mixed LLW would be stored onsite on an interim basis until treatment, disposal, or offsite shipment in accordance with the site-specific treatment plan that was developed to comply with the *Federal Facility Compliance Act*.

Hazardous Waste. Many of the Deep Borehole Disposal Facility processes would generate hazardous waste. This waste would include chemical makeup and reagents for support activities, lubricants and oils for process and support equipment, and used solvent rags contaminated with trichloroethane. The liquid and solid hazardous waste would be collected at the facility and stored on an interim basis. The hazardous waste would be recycled, or stored and packaged for offsite treatment or disposal at RCRA-permitted facilities.

Nonhazardous (Sanitary) Waste. Liquid nonhazardous sanitary waste generated in the facility would be transferred to the sanitary waste system for treatment. Treated wastewater would be designated as reclaimed water recycle and would be used as makeup to the cooling system. Solid nonhazardous waste (such as domestic trash and office waste) would be hauled to a permitted sanitary landfill for disposal.

Nonhazardous (Other) Waste. Other liquid nonhazardous wastes generated from facilities support operations (for example, cooling system and boiler blowdown) would be collected in a catch tank and sampled before being reclaimed for recycle use, such as makeup to the cooling system. The facility design includes stormwater retention ponds with the necessary NPDES monitoring equipment. Runoff within the main facility area would be collected separately, routed to the stormwater collection ponds, and then sampled and analyzed before discharge to the natural drainage channels (dry site) or river (wet site). If the runoff was contaminated, it would be treated in the process wastewater treatment system. Runoff outside of the main facility area would be discharged directly into the natural drainage channel or river.

Table E.3.3.1–1. Estimated Waste Volumes for the Direct Disposition Alternative—Deep Borehole Complex

Category	Annual Average Volume Generated From Construction (m^3)	Annual Volume Generated From Operations (m^3)	Annual Volume Effluent From Operations (m^3)
Transuranic			
Liquid	None	0.2[a]	None
Solid	None	0.2	0.2
Mixed Transuranic			
Liquid	None	None	None
Solid	None	0.04	0.04
Low-Level			
Liquid	None	2[a]	None
Solid	None	5	5
Mixed Low-Level			
Liquid	None	None	None
Solid	None	None	None
Hazardous			
Liquid	4	110[b]	110[b]
Solid	26	17[c]	17[c]
Nonhazardous (Sanitary)			
Liquid	10,100	10,600	None[d]
Solid	331	306	306
Nonhazardous (Other)			
Liquid	1,890[e]	6,800[f]	None[d]
Solid	179[g]	1,250[h]	1,250[h]

[a] Liquid TRU waste and LLW would be treated with the remaining TRU and low-level sludge being solidified.
[b] Includes 108 m^3 of oil, antifreeze, and hydraulic fluid.
[c] Includes 1,814 kg (assuming 1,500 kg/m^3) of rags and other materials generated by the Drilling and Emplacing-Borehole Sealing Facilities.
[d] Treated wastewater would be designated as reclaimed water recycle and would be used as makeup to the cooling system.
[e] Includes service water and concrete batch plant water.
[f] Includes cooling water blowdown and evaporator condensate.
[g] Includes 60 t of steel (assuming 0.127 m^3/t).
[h] Includes 38,600 kg (assuming 1,500 kg/m^3) of bentonite and polymers, and 1,220 m^3 of rock cuttings generated by the Drilling and Emplacing-Borehole Sealing Facilities.
Source: LLNL 1996a.

E.3.3.2 Immobilized Disposition Alternative—Deep Borehole Complex

The design of the deep borehole disposal facility for immobilized disposition would place great emphasis on the minimization of both liquid and solid wastes. Where generation of a waste could not be avoided, methods would be pursued to recycle the waste. In general terms, the waste management of the borehole facility would include waste handling and treatment operations for processing the various wastes in aqueous, organic liquid or solid form generated directly from borehole disposition operations or from related site activities.

Table E.3.3.2–1 presents the estimated annual waste volumes during construction and operation of the deep borehole disposal facility. As illustrated in Figure E.3.3.2–1, waste management capabilities would be provided to monitor, treat, and handle radioactive wastes, industrial, and chemical wastes, as well as sanitary and stormwater wastes. The treated effluent from utility, process and sanitary wastewater treatment would be reclaimed to be used as cooling system makeup water. The wastes would include TRU, low-level, mixed, hazardous and nonhazardous wastes. The management facilities provided to handle radioactive wastes would be located in the Process Waste Management Facility adjacent to the receiving and process building. The waste treatment processes would include assay examination, sorting, separation, concentration, size reduction, special treatment, and thermal treatment. The wastes would be converted to either water meeting effluent standards, grouted cement, or compacted solid waste as final form products for disposal. The waste treatment processing would also perform equipment and waste container decontamination operations.

Any wastes generated by the Surface Processing Facility would be sampled for radioactivity and, if free of contamination, would be stored for disposal in a permitted sanitary/industrial disposal facility. If contaminated, they would be considered low-level/TRU waste and treated accordingly. Solid waste generated from process operations at the surface facilities would include packing materials, deformed Pu-loaded ceramic pellet shipping containers, wipes and rags, gloves, paper clothing, and HEPA filters. Liquid waste would include washwater from canister decontamination, spent pump oils, and trichloroethane cleaning solvent.

Wastes generated from the drilling facility would include a mixture of solid rock cuttings brought out of the borehole by the drilling mud and drilling mud additives. This conglomeration would be allowed to settle out in the drilling mud pit. The exact makeup of the additives and rock cuttings will not be known until the geology of the site has been ascertained. Once characterized, this cutting mixture would be disposed of by appropriate means. Any wastewater generated by the drilling process would be tested and treated, as needed, through evaporation ponds and the residual solids would be buried in the mud pits.

The Process Waste Management Facility would contain equipment and processes for the treatment of nonhazardous process, hazardous, radioactive, and mixed liquid wastes. The facility would allow treatment of any wastewater generated by the Surface Processing Facility and Pellet-Grout Mix Preparation Subfacility, as well as the Emplacing-Borehole Sealing Facility processes. The wastewater originating in the borehole array area would be pumped through underground pipes to the Process Waste Treatment Facility. This wastewater would primarily consist of mopwaters and cleaning solutions, emplacement canister sealants and additives, drilling mud additives, grout additives, and machine coolant wastes. The drilling facility would generate a substantial amount of wastewater as overflow from drilling mud settlement ponds. In addition, water pumped out of the borehole during drilling, emplacing, and sealing operations would require appropriate treatment.

Any nonradiological wastes generated from operation would be monitored, collected, and treated, if necessary, before being designated as reclaimed water recycle and used as makeup to the cooling system. Facilities would be provided to treat chemically-contaminated wastewaters before discharge to the environment. Holding tanks would be provided for the wastes. Nonradioactive solid wastes would be recycled, where possible, or transferred to approved disposal sites in accordance with accepted industrial practices.

All fire sprinkler water discharged in process areas during and after a fire would be contained, monitored, sampled and if required, retained until disposal. Utility wastewater discharges (including cooling system and boiler blowdown) would be treated in an industrial wastewater treatment plant prior to being designated reclaimed water recycle. The facility design includes a sanitary treatment plant to treat liquid sanitary wastes.

High-Level Waste. The deep borehole disposal facility would not generate any HLW.

Transuranic Waste. TRU wastes would be generated from process and facility operations, equipment decontamination, failed equipment, and used tools. Numerous processes, including those directly supporting the borehole drilling, radioactive Pu handling, and direct canister emplacement, and those managing the various waste streams, would produce used ventilation air filters, resins, and sludges, as well as contaminated operator clothing, gloves, wipes, shoe covers, and other process equipment. Following characterization, these wastes would be handled, treated, and disposed of according to their level of contamination. If characterized as TRU waste, they would be appropriately treated and stored until final disposal.

The TRU wastes would be treated in a waste handling facility to form grout or a compact solid waste. The small amount of liquid TRU waste would be treated with the remaining TRU sludge being solidified. Treated TRU waste products would be packaged, assayed, and certified to meet the waste acceptance criteria of the WIPP or alternative treatment level. Assuming WIPP is determined to be a suitable repository for these wastes and depending on decisions made in the ROD associated with the supplemental EIS being prepared for the proposed continued phased development of WIPP for disposal of TRU waste, pursuant to the requirements of 40 CFR 191 and 40 CFR 268, these wastes would be transported to WIPP for disposal.

Mixed Transuranic Waste. A very small quantity of solid mixed TRU waste, mainly protective clothing and radiological survey waste from the waste handling facility, would be generated annually during operations. Mixed TRU would be packaged and shipped to another DOE waste management facility for temporary storage, pending final treatment and disposal in accordance with the site-specific treatment plan that was developed to comply with the *Federal Facility Compliance Act*. Current plans call for disposal at WIPP.

Low-Level Waste. [Text deleted.] Numerous processes, including those directly supporting the borehole drilling, radioactive Pu handling, and direct canister emplacement, and those managing the various waste streams, would produce contaminated operator clothing, gloves, wipes, shoe covers, and process equipment. Following characterization, these wastes would be handled, treated and disposed of according to their level of contamination. If characterized as LLW, they would be treated by sorting, separation, concentration and size-reduction processes. Any liquid LLW would be treated with the remaining LLW sludge being solidified. Final LLW products would be surveyed and disposed of in a shallow land burial site.

Mixed Low-Level Waste. A very small quantity of solid mixed LLW, mainly protective clothing and radiological survey waste from the waste handling facility, would be generated annually during operations. Any mixed LLW would be stored onsite on an interim basis until treatment, disposal, or offsite shipment in accordance with the site-specific treatment plan that was developed to comply with the *Federal Facility Compliance Act*.

Hazardous Waste. Many of the deep borehole disposal facility processes would generate hazardous waste. This waste would include chemical makeup and reagents for support activities, lubricants and oils for process and support equipment, and used solvent rags contaminated with trichloroethane. The liquid and solid hazardous waste would be collected at the facility and stored on an interim basis. The hazardous wastes would be recycled, or stored and packaged for offsite treatment or disposal at commercial RCRA-permitted facilities.

Nonhazardous (Sanitary) Waste. Nonhazardous sanitary liquid wastes generated in the facility would be transferred to the sanitary waste system for treatment. Treated wastewater would be designated as reclaimed water recycle and would be used as makeup to the cooling system. Nonhazardous solid wastes, such as domestic trash and office waste, would be hauled to a permitted sanitary landfill for disposal.

Nonhazardous (Other) Waste. Other nonhazardous liquid wastes generated from facility support operations (for example, cooling system and evaporator condensate) would be collected in a catch tank and sampled before being reclaimed for recycle use such as make up water to the cooling system. Solid wastes would include rock cuttings from the boreholes and bentonite and polymers generated by the Drilling and Emplacing-Borehole Sealing Facilities. The facility design includes stormwater retention ponds with the necessary NPDES monitoring equipment. Runoff within the main facility area would be collected separately, routed to the stormwater collection ponds, and then sampled and analyzed before discharge to the natural drainage channels (dry site) or river (wet site). If the runoff was contaminated, it would be treated in the process wastewater treatment system. Runoff outside of the main facility area would be discharged directly into the natural drainage channel or river.

Table E.3.3.2–1. Estimated Waste Volumes for the Immobilized Disposition Alternative—Deep Borehole Complex

Category	Annual Average Volume Generated From Construction (m^3)	Annual Volume Generated From Operations (m^3)	Annual Volume Effluent From Operations (m^3)
Transuranic			
Liquid	None	0.5[a]	None
Solid	None	0.5	0.5
Mixed Transuranic			
Liquid	None	None	None
Solid	None	0.1	0.1
Low-Level			
Liquid	None	3[a]	None
Solid	None	6	5
Mixed Low-Level			
Liquid	None	None	None
Solid	None	None	None
Hazardous			
Liquid	4	141[b]	141[b]
Solid	24	15[c]	15[c]
Nonhazardous (Sanitary)			
Liquid	10,700	9,460	None[d]
Solid	306	291	291
Nonhazardous (Other)			
Liquid	1,770[e]	6,060[f]	None[d]
Solid	162[g]	1,250[h]	1,250[h]

[a] Liquid TRU waste and LLW would be treated with the remaining TRU and low-level sludge being solidified.
[b] Includes 69.6 m^3 of decontamination water and 69.6 m^3 of oil, antifreeze, and hydraulic fluid.
[c] Includes 1,090 kg (assuming 1,500 kg/m^3) of rags and other materials generated by the Drilling and Emplacing-Borehole Sealing Facilities.
[d] Treated wastewater would be designated as reclaimed water recycle and would be used as makeup to the cooling system.
[e] Includes service water and concrete batch plant water.
[f] Includes cooling water blowdown and evaporator condensate.
[g] Includes 54 t of steel (assuming 0.127 m^3/t).
[h] Includes 38,550 kg (assuming 1,500 kg/m^3) of bentonite and polymers, and 1,220 m^3 of rock cuttings generated by the Drilling and Emplacing-Borehole Sealing Facilities.
Source: LLNL 1996h.

E.3.3.3 Immobilized Disposition Alternative—Ceramic Immobilization Facility

The ceramic immobilization facility using coated pellets without radionuclides includes a scrap treatment cell to allow treatment of off-specification process materials, contaminated equipment, and components to recover Pu and recycle it back into the calcination and pellet press process. The cell would be equipped with equipment suitable for size reduction and process feed makeup of off-specification ceramic material from the pellet pressing and coating operations. Decontamination and leaching equipment also would be provided to allow recovery of Pu from process equipment and to return the solutions to the calciner feed makeup process. Other off-specification materials from the process upstream of the pellet presses would be recycled to the appropriate equipment in the Pu process. The ceramic immobilization operations would be configured with minimization of waste products given high priority.

Table E.3.3.3–1 presents the estimated annual waste volumes during construction and operation of the ceramic immobilization facility. As illustrated in Figure E.3.3.3–1, waste management facilities would be provided to monitor, treat, and handle radioactive wastes, including LLW, TRU waste, and mixed waste. These management facilities would be located in the Radwaste Management Building immediately adjacent to the Plutonium Processing Building. The waste treatment processes include assay examination, sorting, separation, concentration, size reduction, organic destruction, and thermal treatment.

Process liquid radioactive waste treatment facilities include the nitric acid recovery system and the LLW/TRU radwaste solidification systems. Since these systems would handle relatively low-activity waste streams, they generally would be located in processing areas outside the main Pu processing areas. The nitric acid and water would be recovered and recycled wherever appropriate for reuse in the facility. Low-level liquid radwaste treatment systems generally would be located in nonshielded processing rooms equipped with room ventilation confinement zoning appropriate to the expected levels of contamination within the room. Mixed waste would be segregated from other waste forms, and stored for onsite or offsite treatment treatment in accordance with the site treatment plan.

Process solid radioactive waste treatment would also be performed in the Radwaste Management Building. Solid waste generated from glovebox operations for the Pu processing head end generally would be handled and processed in glovebox enclosures. Where fume or dust generation is anticipated, equipment would be installed in glovebox enclosures supplied with local filters, mist eliminators, condensers, and so forth, as required to minimize the spread of contamination to the glovebox ventilation system. Solid waste generated within the process cells would be segregated remotely into low-level contact-handled, low-level remote-handled, TRU, and mixed waste. Solid waste assay, segregation, decontamination, and volume-reduction facilities would be used to minimize the volume of waste shipped from the facility. Waste packaging and shipping facilities for both LLW and TRU waste would be provided.

Gaseous waste would be filtered, condensed, scrubbed, absorbed, and so forth, as required to meet DOE and other applicable regulatory requirements. Local condensers, mist eliminators, and sintered-metal filters with blowback to the process are intended for Pu oxidation, calcination, hot pressing, and other operations where particulate generation is expected. HEPA filters would be provided at both inlets and outlets of glovebox enclosures handling Pu.

All fire sprinkler water discharged in process areas during and after a fire would be contained, monitored, sampled, and if required, retained until disposal. Utility wastewater discharges (including cooling system and boiler blowdown, cold chemical area liquid effluents, and nonradioactive liquid ceramic additive liquid wastes) would be treated in an industrial wastewater treatment plant prior to discharge in accordance with applicable environmental standards. The facility design includes a sanitary treatment plant to treat liquid sanitary wastes.

High-Level Waste. The ceramic immobilization facility would not generate a HLW stream from processing Pu. However, the facility would produce an immobilized ceramic product. The Pu disposition mission would produce 980 drums annually (LLNL 1996e:9-2). This immobilized ceramic product would require interim storage with final disposal at the deep borehole complex.

Transuranic Waste. TRU wastes would be generated from process and facility operations, equipment decontamination, failed equipment, and used tools. The granulation, pellet pressing, pellet sintering, and drum handling functions would generate both liquid and solid TRU waste. The contaminated water from the drum decontamination would be collected and transferred to the recycle waste evaporator.

Numerous other processes, including those directly supporting the production of radioactive ceramic and those managing the various waste streams, would produce used ventilation air filters, as well as contaminated operator clothing, gloves, wipes, shoe covers, and other process equipment. The original containers and packaging associated with the Pu feed would be considered waste and would be subject to characterization. Following characterization, these wastes would be handled, treated, and disposed of according to their level of contamination. If characterized as TRU waste, they would be appropriately treated and stored until final disposal.

The TRU wastes would be treated in a waste handling facility to form grout or compact solid waste. Any liquid TRU waste would be treated with the remaining TRU sludge being solidified. Treated waste products would be packaged, assayed, and certified to meet the WIPP waste acceptance criteria or alternative treatment level. Assuming WIPP is determined to be a suitable repository for these wastes and depending on decisions made in the ROD associated with the supplemental EIS being prepared for the proposed continued phased development of WIPP for disposal of TRU waste, pursuant to the requirements of 40 CFR 191 and 40 CFR 268, these wastes would be transported to WIPP for disposal.

Mixed Transuranic Waste. A very small quantity of solid mixed TRU waste, mainly rubber gloves and leaded glovebox gloves from the waste handling facility, would be generated annually during operations. This mixed TRU waste would be placed in temporary storage, pending final treatment and disposal in accordance with the site-specific treatment plan that was developed to comply with the *Federal Facility Compliance Act*. This mixed TRU waste would need eventual treatment to meet the WIPP waste acceptance criteria.

Low-Level Waste. [Text deleted.] Processes directly supporting the radioactive coated ceramic pellet production, as well as those managing the various waste streams, would produce contaminated operator clothing, gloves, wipes, shoe covers, and process equipment. The original containers and packaging associated with the Pu feed would be considered waste and would be subject to characterization. Following characterization, these wastes would be handled, treated, and disposed of according to their level of contamination. If characterized as LLW, they would be treated by sorting, separation, concentration, and size reduction processes. Any liquid LLW would be treated with the remaining LLW sludge being solidified. Final LLW products would be surveyed and disposed of in a shallow land burial site.

Mixed Low-Level Waste. A very small quantity of solid mixed LLW, mainly rubber gloves and leaded glovebox gloves from the waste handling facility, would be generated annually during operation of the ceramic immobilization facility. Any mixed LLW would be stored onsite on an interim basis until treatment, disposal, or offsite shipment to another DOE facility for treatment in accordance with the site-specific treatment plan that was developed to comply with the *Federal Facility Compliance Act*.

Hazardous Waste. Many of the ceramic immobilization facility processes would generate hazardous waste. This waste would include chemical makeup and reagents for support activities, and lubricants and oils for process and support equipment. The liquid and solid hazardous waste would be collected at the facility and stored on an interim basis. The hazardous wastes would be recycled, or stored and packaged for offsite treatment and disposal at commercial RCRA-permitted facilities.

Nonhazardous (Sanitary) Waste. Nonhazardous sanitary liquid wastes generated in the facility would be transferred to a sanitary waste system for treatment. Nonhazardous solid wastes, such as domestic trash and office waste, would be hauled to a permitted sanitary landfill for disposal.

Nonhazardous (Other) Waste. Other nonhazardous liquid wastes generated from facilities support operations (for example, cooling system blowdown and evaporator condensate) would be collected in a catch tank and sampled before being reclaimed for recycle use or release to the environment. The facility design includes stormwater retention ponds with the necessary NPDES monitoring equipment. Runoff within the main facility area would be collected separately, routed to the stormwater collection ponds, and then sampled and analyzed before discharge to the natural drainage channels (dry site) or river (wet site). If the runoff was contaminated, it would be treated in the process wastewater treatment system. Runoff outside of the main facility area would be discharged directly into the natural drainage channels or river.

Table E.3.3.3–1. Estimated Waste Volumes for the Immobilized Disposition Alternative—Ceramic Immobilization Facility

Category	Annual Average Volume Generated From Construction (m^3)	Annual Average Volume Generated From Operations (m^3)	Annual Volume Effluent From Operations (m^3)
Transuranic			
Liquid	None	110[a]	None
Solid	None	150	150
Mixed Transuranic			
Liquid	None	None	None
Solid	None	1.5	1.5
Low-Level			
Liquid	None	10[a]	None
Solid	None	23	15
Mixed Low-Level			
Liquid	None	None	None
Solid	None	0.3	0.3
Hazardous			
Liquid	17	45	45
Solid	24	23	23
Nonhazardous (Sanitary)			
Liquid	22,000[b]	43,000[b]	43,000[b]
Solid	Included in liquid	910	910
Nonhazardous (Other)			
Liquid	227,600[c]	186,900[d]	186,900[d]
Solid	147[e]	15[f]	None

[a] Liquid TRU waste and LLW would be treated with the remaining TRU and low-level sludge being solidified.
[b] Includes sewage and industrial wastewater.
[c] Includes service water, concrete batch plant water, and stormwater runoff.
[d] Includes cooling water blowdown, process wastewater, and stormwater runoff.
[e] Includes 220 t of construction material (assuming 1,500 kg/m^3).
[f] Recyclable wastes.
Source: LLNL 1996e.

E.3.3.4 Vitrification Alternative

The design of the vitrification facility with radionuclides would place great emphasis on the minimization of both liquid and solid wastes. Where generation of a waste could not be avoided, methods would be pursued to recycle the waste. The facility would have a remote decontamination and equipment maintenance facility that would generate contaminated liquid waste. Small amounts of liquid waste would also be generated in the vitrification process from offgas condensate and canister decontamination. These liquid wastes would be evaporated, calcined, and recycled to the melter feed in the form of calcine. Generally, failed contaminated equipment would be decontaminated, then disposed of through appropriate means. Equipment that fails during the life of the facility and could not be decontaminated, repaired, or disposed of would be stored in a failed equipment storage vault beneath the process cells. Because Pu oxide residues may become embedded in the equipment sent to the failed equipment storage vault, all equipment would have a critical safety evaluation prior to storage. The vault would be appropriately shielded to comply with radiological safety criteria. The failed equipment would be disposed of through appropriate means following the end of the operating mission.

Table E.3.3.4–1 presents the estimated annual waste volumes during construction and operation of the vitrification facility. As illustrated in Figure E.3.3.4–1, waste management capabilities would be provided to monitor, treat, and handle radioactive wastes, industrial and chemical wastes, as well as sanitary and stormwater wastes. The wastes would include TRU, low-level, mixed, hazardous, and nonhazardous. The management facilities provided to handle the radioactive wastes would be located in the Radwaste Management Building adjacent to the Vitrification Building. The waste treatment processes include assay examination, sorting, separation, concentration, size reduction, organic destruction, and thermal treatment.

Process liquid radioactive wastes generated by the vitrification facility would be collected in a drain waste collection tank. Most of this waste would be rinsewater streams, process cell sumps, flushing wastes, and condensate from the preparation of Pu-glass frit, cesium nitrate salt, and final vitrification processes. Some radioactive wastes would also be generated from chemical solutions and rinses used in the decontamination of process and maintenance equipment in the decontamination cell or Analytical Laboratory. There would be no discharge of radioactive liquid wastes to the environment. Contents of the drain waste collection tank would be recovered through reprocessing or would be treated in the Radwaste Management Building. Contaminated water would be used to make concrete for the disposal of chlorides from the CsCl process. Any mixed waste would be segregated from other waste forms and stored for offsite or onsite treatment in accordance with the site treatment plan.

Process solid radioactive waste treatment would also be performed in the Radwaste Management Building. Solid wastes generated would include spent canisters and hulls from shipment of Cs-137, chloride-containing cement from the processing of CsCl, contamination control waste, maintenance residues, dust-stop and HEPA filters, and stainless steel Pu-glass frit transfer cans. The solid waste would be controlled at the source of generation to reduce or eliminate this waste whenever possible. The waste would be handled and treated according to the type and concentration of the contamination. Solid waste would be decontaminated to the extent practical in or near the work area and would then be packaged in sealable carbon steel or cardboard containers in the Radwaste Management Building and prepared for disposal. Waste packaging and shipping facilities for both LLW and TRU waste would be provided.

Gaseous wastes generated by operations would include process vessel offgases and heating, ventilation, and air conditioning exhausts. Prior to release to the stack, these gaseous wastes would be filtered, condensed, scrubbed, absorbed, neutralized, and so forth, as required to meet DOE and other applicable regulatory requirements. Local condensers, mist eliminators, and sintered-metal filters with blowback to the process would be provided to ensure no uncontrolled release to the environment. Ventilation air and gaseous effluents from the process cells, process vessels, and melters would be contaminated with process radioactivity. These gases would be treated before discharge to the atmosphere through stacks to ensure that the concentration of radionuclides is at acceptable levels.

Any nonradiological waste generated from operation would be monitored, collected, and treated, if necessary, before discharge to the environment. Facilities would be provided to treat chemically-contaminated wastewaters before discharge to the environment. Holding tanks would be provided for the waste. Solid nonradioactive waste would be recycled, where possible, or transferred to approved disposal sites in accordance with accepted industrial practices.

All fire sprinkler water discharged in process areas during and after a fire would be contained, monitored, sampled, and if required, retained until disposal. Utility wastewater (including cooling system and boiler blowdown) would be treated in an industrial wastewater treatment plant prior to discharge in accordance with applicable environmental standards. The facility design includes a sanitary treatment plant to treat liquid sanitary waste.

High-Level Waste. The vitrification facility would not generate a HLW stream from processing Pu. However, the facility would produce a glass log. The Pu disposition would produce 60 canisters annually (LLNL 1996c:9-3). The glass logs would require interim storage until a final disposal option becomes available.

Transuranic Waste. TRU waste would be generated from process and facility operations, equipment decontamination, failed equipment, and used tools. Numerous processes, including those directly supporting the radioactive Pu-glass frit production, and those managing the various waste streams, would produce used ventilation air filters, resins, and sludges, as well as contaminated operator clothing, gloves, wipes, shoe covers, and other process equipment. Following characterization, these wastes would be handled, treated, and disposed of according to their level of contamination. If characterized as TRU waste, they would be appropriately treated and stored until final disposal.

The TRU waste would be treated in a waste handling facility to form grout or a compact solid waste. The small amount of liquid TRU waste would be treated with the remaining TRU sludge being solidified. Treated TRU waste products would be packaged, assayed, and certified to meet WIPP waste acceptance criteria or alternative treatment level. Assuming WIPP is determined to be a suitable repository for these wastes and depending on decisions made in the ROD associated with the supplemental EIS being prepared for the proposed continued phased development of WIPP for disposal of TRU waste, pursuant to the requirements of 40 CFR 191 and 40 CFR 268, these wastes would be transported to WIPP for disposal.

Mixed Transuranic Waste. A very small quantity of solid mixed TRU waste, mainly protective clothing and radiological survey waste from the waste handling facility, would be generated annually during operations. This mixed TRU waste would be generated primarily from activities at the waste handling facilities. Mixed TRU waste would be packaged and shipped to another DOE waste management facility for temporary storage, pending final treatment and disposal in accordance with the site-specific treatment plan that was developed to comply with the *Federal Facility Compliance Act*. Current plans call for disposal at WIPP.

Low-Level Waste. [Text deleted.] Cesium capsule processing would produce both liquid and solid LLW. Conducted in a shielded cell with manipulators, the cesium processing involves one capsule at a time. The outer capsule is cut open, decontaminated, and discarded as solid LLW. The inner capsule is sheared to expose the cesium and barium chloride solids. The sheared pieces would be leached in hot water and agitated to dissolve the solid salts. The solution would then be transferred to the ion exchange feed tank, and the capsule hull would be decontaminated and disposed of as LLW. The chloride solution would then be processed using a cation exchange column to isolate the radioactive cesium. The effluent from the exchange column would be recycled to the column as necessary to remove residual cesium. The effluent would then be neutralized and sent to waste treatment for solidification as LLW.

Numerous processes, including those directly supporting the radioactive Pu-glass frit production and those managing the various waste streams, would produce contaminated operator clothing, gloves, wipes, shoe covers, and process equipment. A substantial source of LLW would be the stainless steel cans used to transfer the Pu-glass frit to the blend cell, as they would be decontaminated and discarded as LLW. Following characterization, these wastes would be handled, treated, and disposed of according to their level of contamination. If characterized as LLW, they would be treated by sorting, separation, concentration, and size reduction processes. Any liquid LLW would be treated with the remaining LLW sludge being solidified. Final LLW products would be surveyed and disposed of in a shallow land burial site.

Mixed Low-Level Waste. A very small quantity of solid mixed LLW, mainly protective clothing and radiological survey waste from the waste handling facility, would be generated annually during operations. Any mixed LLW would be stored onsite on an interim basis until treatment, disposal, or offsite shipment in accordance with the site-specific treatment plan that was developed to comply with the *Federal Facility Compliance Act*.

Hazardous Waste. Many of the vitrification facility processes would generate hazardous waste. This waste would include chemical makeup and reagents for support activities; lubricants and oils for process and support equipment; and used solvent rags contaminated with methylene chloride, acetonitrile, and acetone. The liquid and solid hazardous wastes would be collected at the facility and stored on an interim basis. The hazardous waste would be recycled or stored and packaged for offsite treatment or disposal at an RCRA-permitted facility.

Nonhazardous (Sanitary) Waste. Liquid nonhazardous sanitary waste generated in the facility would be transferred to a sanitary waste system for treatment. Solid nonhazardous waste, such as domestic trash and office waste, would be transported to a permitted sanitary landfill for disposal.

Nonhazardous (Other) Waste. Other liquid nonhazardous waste generated from facility support operations (for example, cooling system blowdown and evaporator condensate) would be collected in a catch tank and sampled before being reclaimed for recycle use or release to the environment. The facility design includes stormwater retention ponds with the necessary NPDES monitoring equipment. Runoff within the main facility area would be collected separately, routed to the stormwater collection ponds, and then sampled and analyzed before discharge to the natural drainage channels (dry site) or river (wet site). If the runoff was contaminated, it would be treated in the process wastewater treating system. Runoff outside of the main facility area would be discharged directly into the natural drainage channels or river.

E.3.3.5 Ceramic Immobilization Alternative

The ceramic immobilization facility with radionuclides includes a scrap treatment cell to allow treatment of off-specification process materials, contaminated equipment, and components to recover Pu and recycle it back into the process. The cell would be equipped with equipment suitable for size reduction and process feed makeup of off-specification ceramic material from the hot-pressing operations. Decontamination and leaching equipment also would be provided to allow recovery of Pu from process equipment and to return the solutions to the calciner feed makeup process. Other off-specification materials from the process upstream of the hot presses would be recycled to the appropriate equipment in the Pu process. The ceramic immobilization operations would be configured with a minimization of waste products given high priority.

Table E.3.3.5–1 presents the estimated annual waste volumes during construction and operation of the ceramic immobilization facility. As illustrated in Figure E.3.3.5–1, waste management facilities would be provided to monitor, treat, and handle radioactive wastes, including low-level, TRU, and mixed waste. These management facilities would be located in the Radwaste Management Building immediately adjacent to the Plutonium Processing Building. The waste treatment processes include assay examination, sorting, separation, concentration, size reduction, organic destruction, and thermal treatment.

Process liquid waste treatment facilities include the nitric acid recovery system and the LLW/TRU radwaste solidification systems. Since these systems would handle relatively low-activity waste streams, they generally would be located in processing areas outside the main processing canyons. Low-level liquid radwaste treatment systems generally would be located in nonshielded processing rooms equipped with room ventilation confinement zoning appropriate to the expected levels of contamination within the room. Mixed waste would be segregated from other waste forms, and stored for offsite or onsite treatment in accordance with the site treatment plan.

Process solid radioactive waste treatment would also be performed in the Radwaste Management Building. Solid waste generated from glovebox operations for the Pu processing head end (upstream of the addition of cesium) would generally be handled and processed in glovebox enclosures. Where fume or dust generation is anticipated, equipment would be installed in glovebox enclosures supplied with local filters, mist eliminators, condensers, and so forth, as required to minimize the spread of contamination to the glove box ventilation system. Solid waste generated within the process cells would be segregated remotely into low-level contact-handled, low-level remote-handled, TRU, and mixed waste. Solid waste assay, segregation, decontamination, and volume-reduction facilities would be used to minimize the volume of waste shipped from the facility. Waste packaging and shipping facilities for both LLW and TRU waste would be provided.

Gaseous waste would be filtered, condensed, scrubbed, absorbed, and so forth, as required to meet DOE and other applicable regulatory requirements. Local condensers, mist eliminators, and sintered-metal filters with blowback to the process are intended for Pu oxidation, calcination, hot pressing, and other operations where particulate generation would be expected. HEPA filters would be provided at both inlets and outlets of glovebox enclosures handling Pu.

All fire sprinkler water discharged in process areas during and after a fire would be contained, monitored, sampled, and if required, retained until disposal. Utility wastewater discharges (including cooling system and boiler blowdown, cold chemical area liquid effluents, and nonradioactive liquid ceramic additive liquid wastes) would be treated in an industrial wastewater treatment plant prior to discharge in accordance with applicable environmental standards. The facility design includes a sanitary treatment plant to treat liquid sanitary wastes.

High-Level Waste. The ceramic immobilization facility would not generate a HLW stream from processing Pu. However, the facility would produce an immobilized ceramic product spiked with cesium radionuclides. The Pu disposition mission would produce 64 canisters annually (LLNL 1996d:9-2). This immobilized product would require interim storage until a final disposition option becomes available.

Transuranic Waste. TRU wastes would be generated from process and facility operations, equipment decontamination, failed equipment, and used tools. The bellows filling and closure function, as the ceramic calciner powder is assembled and prepared for compression, would generate both liquid and solid TRU waste. The contaminated water from the bellows decontamination would be collected and treated as TRU waste.

Numerous other processes, including those directly supporting the radioactive ceramic production and those managing the various waste streams, would produce used ventilation air filters, as well as contaminated operator clothing, gloves, wipes, shoe covers, and other process equipment. Following characterization, these wastes would be handled, treated, and disposed of according to their level of contamination. If characterized as TRU waste, they would be appropriately treated and stored until final disposal.

Transuranic wastes would be treated in a waste handling facility to form grout or compact solid waste. Any liquid TRU waste would be treated with the remaining TRU sludge being solidified. Treated TRU waste products would be packaged, assayed, and certified to meet the waste acceptance criteria of the WIPP or alternative treatment level. Assuming WIPP is determined to be a suitable repository for these wastes and depending on decisions made in the ROD associated with the supplemental EIS being prepared for the proposed continued phased development of WIPP for disposal of TRU waste, pursuant to the requirements of 40 CFR 191 and 40 CFR 268, these wastes would be transported to WIPP for disposal.

Mixed Transuranic Waste. A very small quantity of solid mixed TRU waste, mainly rubber gloves and leaded glovebox gloves from the waste handling facility, would be generated annually during operations. Mixed TRU would be packaged and shipped to another DOE waste management facility for temporary storage, pending final treatment and disposal in accordance with the site-specific treatment plan that was developed to comply with the *Federal Facility Compliance Act*. This mixed TRU waste would need eventual treatment to meet the WIPP waste acceptance criteria or alternative treatment level.

Low-Level Waste. [Text deleted.] Cesium capsule processing would produce both liquid and solid LLW. Conducted in a shielded cell with manipulators, the cesium processing involves one capsule at a time. The outer capsule is cut open, decontaminated, and discarded as solid LLW. The inner capsule is sheared to expose the cesium and barium chloride solids. The sheared pieces would be leached in hot water and agitated to dissolve the solid salts. The solution would then be transferred to the ion exchange feed tank, and the capsule hull would be decontaminated and disposed of as LLW. The chloride solution would then be processed using a cation exchange column to isolate the radioactive cesium. The effluent from the exchange column would be recycled to the column as necessary to remove residual cesium. The effluent would then be neutralized and sent to waste treatment for solidification as LLW.

Numerous processes, including those directly supporting the radioactive ceramic production and those managing the various waste streams, would produce contaminated operator clothing, gloves, wipes, shoe covers, and process equipment. Following characterization, these wastes would be handled, treated, and disposed of according to their level of contamination. If characterized as LLW, they would be treated by sorting, separation, concentration, and size-reduction processes. Any liquid LLW would be treated with the remaining LLW sludge being solidified.

Mixed Low-Level Waste. A very small quantity of solid mixed LLW, mainly rubber gloves and leaded glovebox gloves from the waste handling facility, would be generated annually during operations. Any mixed LLW would be stored onsite on an interim basis until treatment, disposal, or offsite shipment in accordance with the site-specific treatment plan that was developed to comply with the *Federal Facility Compliance Act*.

Hazardous Waste. Many of the ceramic immobilization facility processes would generate hazardous waste. This waste would include chemical makeup and reagents for support activities and lubricants and oils for process and support equipment. The liquid and solid hazardous waste would be collected at the facility and stored on an interim basis. The hazardous wastes would be recycled or stored and packaged for offsite treatment or disposal at commercial RCRA-permitted facilities.

Nonhazardous (Sanitary) Waste. Nonhazardous sanitary liquid wastes generated in the facility would be transferred to a sanitary waste system for treatment. Nonhazardous solid wastes, such as domestic trash and office waste, would be hauled to a permitted sanitary landfill for disposal.

Nonhazardous (Other) Waste. Other nonhazardous liquid wastes generated from facilities support operations (for example, cooling system blowdown and evaporator condensate) would be collected in a catch tank and sampled before being reclaimed for recycle use or release to the environment. The facility design includes stormwater retention ponds with the necessary NPDES monitoring equipment. Runoff within the main facility area would be collected separately, and routed to the stormwater collection ponds, and then sampled and analyzed before discharge to the natural drainage channels (dry site) or river (wet site). If the runoff was contaminated, it would be treated in the process wastewater treatment system. Runoff outside of the main facility area would be discharged directly into the natural drainage channels or river.

Table E.3.3.5–1. Estimated Waste Volumes for the Ceramic Immobilization Alternative

Category	Annual Average Volume Generated From Construction (m^3)	Annual Volume Generated From Operations (m^3)	Annual Volume Effluent From Operations (m^3)
Transuranic			
Liquid	None	75[a]	None
Solid	None	99	99
Mixed Transuranic			
Liquid	None	None	None
Solid	None	0.7	0.7
Low-Level			
Liquid	None	7[a]	None
Solid	None	14	11
Mixed Low-Level			
Liquid	None	None	None
Solid	None	0.15	0.15
Hazardous			
Liquid	13	38	38
Solid	15	19	19
Nonhazardous (Sanitary)			
Liquid	22,000	34,000[b]	34,000[b]
Solid	Included in liquid	920	920
Nonhazardous (Other)			
Liquid	157,000[c]	170,000[d]	170,000[d]
Solid	108[e]	15[f]	None

[a] Liquid TRU waste and LLW would be treated with the remaining TRU and low-level sludge being solidified.
[b] Includes sewage and industrial wastewater.
[c] Includes service water, concrete batch plant water, and stormwater runoff.
[d] Includes industrial wastewater, cooling water blowdown, process wastewater, and stormwater runoff.
[e] Includes 162 t of construction material (assuming 1500 kg/m^3).
[f] Recyclable wastes.
Source: LLNL 1996d.

E.3.3.6 Electrometallurgical Treatment Alternative (Glass-Bonded Zeolite)

The design of the electrometallurgical treatment facility would place great emphasis on the minimization of both solid and liquid wastes. Where generation of a waste could not be avoided, methods would be pursued to recycle the waste. In general terms, waste management at the electrometallurgical treatment facility would include waste handling and treatment operations for processing the wastes generated by electrometallurgical treatment in aqueous, organic liquid, or solid form operations or by related site activities.

Table E.3.3.6–1 presents the estimated incremental annual waste volumes for the Pu disposition mission during construction and operation of the electrometallurgical treatment facility. Waste management capabilities would be provided to monitor, treat, and handle radioactive, industrial, and chemical wastes, as well as sanitary and stormwater wastes. The treated effluent from utility, process, and sanitary wastewater treatment would be reclaimed to be used as makeup to the cooling system. Other wastes generated by operations would include TRU, low-level, mixed, hazardous, and nonhazardous wastes. Management facilities for radioactive and nonradioactive waste would be located onsite.

The electrometallurgical treatment facility would utilize the waste treatment and management capabilities at INEL outlined in Appendix E.2.3. The waste treatment processes would include assay examination, sorting, separation, concentration, size reduction, special treatment, and thermal treatment. The wastes would be converted to water meeting effluent standards, grouted cement, or compacted solid waste as final form products for disposal. The waste treatment processing would also perform equipment and waste container decontamination operations.

Wastes would be generated during each step of the electrometallurgical treatment process and would be addressed under existing INEL waste operations requirements. The waste management process would involve the collecting, assaying, sorting, treating, packaging, storing, and shipping of radioactive, hazardous, and mixed wastes from Pu disposition operations, and hazardous and nonhazardous wastes from the support facilities.

Initial sorting of solid wastes would be performed at the generation source. Solid wastes would be treated by a variety of processes to ensure compliance with all applicable requirements. Solid LLW would be treated/ disposed of onsite at the Waste Experimental Reduction Facility and the RWMC. Waste products would be immobilized and packaged to meet DOT and DOE requirements. Liquid and solid organic wastes would be separated and dispositioned. The small quantity of mixed LLW would be managed in accordance with the *INEL Site Treatment Plan* that was developed to comply with the *Federal Facility Compliance Act* until a decision is made to allow disposal as radioactive waste following appropriate treatment. Mixed TRU wastes would be handled like other TRU wastes. Finally, nonhazardous, nonradioactive solid waste, and aqueous and gaseous wastes would be treated in conformance with standard industrial practice and regulatory requirements. Solid nonhazardous wastes would either be disposed of at a sanitary landfill or sent to a commercial recycle center.

Nonradioactive liquid wastes would be monitored, collected, and appropriately treated, if necessary, before discharge to the environment. Facilities would be provided to treat chemically contaminated wastewaters before discharge to the environment. Holding tanks would be provided for the wastes. Nonradioactive solid wastes would be recycled, where possible or transferred to approved disposal sites in accordance with accepted industrial practices.

All fire sprinkler water discharged in process areas during and after a fire would be contained, monitored, sampled, and if required, treated prior to disposal. Utility wastewater discharges (including cooling system and boiler blowdown) would be treated in an industrial waste pond.The facility would use the ANL-W onsite sanitary treatment system (sewage lagoons) to treat liquid sanitary wastes.

High-Level Waste. The electrometallurgical treatment facility would not generate an HLW waste stream from processing plutonium. However, the facility would produce an immobilized glass-bonded zeolite (GBZ) product. The Pu disposition mission would produce 37 m^3 (49 yd^3) of immobilized GBZ product annually (LLNL 1996b:7-3). This immobilized glass-bonded zeolite product would require interim storage until a final disposal option becomes available.

Transuranic Waste. TRU wastes would be generated from process and facility operations, equipment decontamination, failed equipment, and used tools. Numerous processes, including those directly supporting the electrometallurgical treatment operations and those managing the various waste streams, would produce used ventilation air filters and Pu oxide sweepings, as well as contaminated operator clothing, gloves, gloveboxes, tools, wipes and rags, shoe covers, and other process equipment. Following characterization, these wastes would be handled, treated, and disposed of according to their level of contamination. If characterized as TRU waste, they would be appropriately treated and stored until final disposal (assumed to be WIPP).

Transuranic wastes would be treated, as appropriate, at the INEL Radioactive Scrap and Waste Facility to form grout or a compact solid waste. Treated TRU waste products would be packaged, assayed, and certified to meet the waste acceptance criteria of the WIPP or alternative treatment level. Assuming WIPP is determined to be a suitable repository for these wastes and depending on decisions made in the ROD associated with the supplemental EIS being prepared for the proposed continued phased development of WIPP for disposal of TRU waste, pursuant to the requirements of 40 CFR 191 and 40 CFR 268, these wastes would be transported to WIPP for disposal.

Mixed Transuranic Waste. A very small quantity of solid mixed TRU waste, mainly protective clothing and radiological survey waste, would be generated annually during operations. This mixed TRU waste primarily would be generated from activities at the waste handling/management facilities. Mixed TRU would be packaged for temporary storage, pending final treatment and disposal in accordance with the *INEL Site Treatment Plan* that was developed to comply with the *Federal Facility Compliance Act*. Current plans call for disposal at WIPP.

Low-Level Waste. LLW would be generated from numerous operations at the facility and would be treated by sorting, separation, concentration, and size-reduction processes. The Waste Experimental Reduction Facility could be utilized. Numerous processes, including those directly supporting the electrometallurgical treatment operations and those managing the various waste streams, would produce contaminated operator clothing, gloves, tools, wipes and rags, shoe covers, and process equipment. Following characterization, these wastes would be handled, treated, and disposed of according to their level of contamination. Final LLW products would be surveyed and transported within the INEL site for shallow land burial at the LLW disposal pits at the RWMC. Any contaminated washdown water would be treated and solidified in the Radioactive Liquid Waste Treatment Facility.

Mixed Low-Level Waste. A very small quantity of solid mixed LLW, mainly protective clothing and radiological survey waste, would be generated annually during operations. This mixed LLW primarily would be generated from activities at the waste handling/management facilities. Any mixed LLW would be stored onsite on an interim basis until treatment, disposal, or offsite shipment in accordance with the *INEL Site Treatment Plan* that was developed to comply with the *Federal Facility Compliance Act*.

Hazardous Waste. Hazardous wastes would consist of chemical makeup and reagents for support activities, and lubricants and oils for process and support equipment. Solid hazardous wastes would include lead packing, and used wipes and rags contaminated with oils, lubricants, and cleaning solvents. Liquid hazardous wastes generated from the facility would include cleaning solvents, vacuum pump oils, film processing fluids, hydraulic fluids from mechanical equipment, antifreeze solutions, and paint. The liquid and solid hazardous waste would be collected at the facility and stored on an interim basis. The hazardous wastes would be recycled, where appropriate, or stored and packaged for offsite treatment or disposal at an RCRA-permitted facility in accordance with ongoing waste management procedures at INEL.

Nonhazardous (Sanitary) Waste. Nonhazardous sanitary liquid wastes generated in the facility would be treated in the existing ANL-W sanitary waste system. Nonhazardous solid wastes, such as domestic trash and office waste, would be hauled to a permitted sanitary landfill for disposal.

Nonhazardous (Other) Waste. Other nonhazardous liquid wastes generated from facilities support operations (for example, cooling system blowdown and evaporator condensate) would be collected in a catch tank and sampled before being reclaimed for recycle use or release to the environment. The facility design includes stormwater retention ponds with the necessary monitoring equipment. Runoff within the main facility area would be collected separately, routed to the stormwater collection ponds, and then sampled and analyzed before discharge to the natural drainage channels. If the runoff was contaminated, it would be treated in the process wastewater treating system. Runoff outside of the main facility area would be discharged directly into the natural drainage channel.

E.3.3.7 Evolutionary Light Water Reactor Alternative

The solid and liquid nonhazardous wastes generated during construction would include concrete and steel waste materials and sanitary wastewater. The steel waste would be recycled as scrap before completing construction. The remaining nonhazardous wastes would be disposed of as part of the construction project by the contractor. Uncontaminated wastewater would be used for soil compaction and dust control, and excavated soil would be used for grading and site preparation. Wood, paper, and metal wastes would be shipped offsite to a commercial contractor for recycling. Hazardous construction wastes would consist of adhesives, oils, cleaning fluids, solvents, and coatings. This waste would be packaged in DOT-approved containers and shipped offsite to commercial RCRA-permitted treatment, storage, and disposal facilities. No radioactive waste would be generated during construction.

The reactor design considers and incorporates waste minimization and pollution prevention. Activities that generate radioactive and hazardous wastes would be segregated, where possible, to avoid the generation of mixed wastes. Where applicable, treatment to separate radioactive and nonradioactive components would reduce the volume of mixed wastes and permit for cost-effective disposal or recycle. To facilitate waste minimization, where possible, nonhazardous materials would be substituted for those materials that contribute to the generation of hazardous or mixed waste. Production processes would be configured with minimization of waste production given high priority. Where possible, material from the waste streams would be treated to facilitate disposal as nonhazardous wastes. Future D&D considerations have also been incorporated into the design.

Tables E.3.3.7–1 and E.3.3.7–2 present the estimated annual spent nuclear fuel and waste volumes during construction and operation of large and small evolutionary light water reactors (LWRs). Liquid and solid waste streams are routed to the waste management system. Figures E.3.3.7–1 and E.3.3.7–2 depict the waste management systems. Solid wastes would be characterized and segregated into LLW, hazardous, and mixed wastes, then treated to a form suitable for disposal or storage within the facility. Liquid wastes would be treated onsite to reduce hazardous/toxic and radioactive elements before discharge or transport. All fire sprinkler water discharged in process areas would be contained and treated as process wastewater, when required.

Spent Nuclear Fuel. Spent nuclear fuel would not be reprocessed. Fuel elements containing spent fuel would be stored for 3 to 10 years in water-cooled storage basins. The spent fuel storage pool must be able to accommodate fuel assemblies for 10 years after reactor discharge. The spent fuel pool would be equipped with an underwater canister loading system. Twelve spent fuel assemblies would be placed in fixed positions in a borated aluminum or stainless-steel basket for criticality safety. The basket would be contained in a canister with seal-welded lids. After the 10-year cooling period, the canisters would be drained, vacuum dried, and backfilled with helium through lid penetrations in preparation for dry storage. The canisters would be transferred in a cask to the interim spent fuel storage facility. At the storage facility each canister would be transferred to its final storage cask, which would be made of precast concrete. Casks would be placed on a concrete basemat. Periodic visual inspections of the canisters and the cask vents would be required. Periodic testing for helium leaks might also be required. The facility design would have sufficient capacity to store the spent nuclear fuel for the life of the facility, pending the availability of a geologic repository.

High-Level Waste. Under the assumption of no fuel reprocessing, the evolutionary LWR would not generate any HLW.

Transuranic Waste. Under the assumption of no fuel reprocessing, the evolutionary LWR would not generate any TRU waste.

Low-Level Waste. LLW would be generated by the operation of the reactor and support facilities and would include concentrated waste from the condensate demineralizer system. Process effluents would be temporarily stored in tanks before conversion into a solid LLW that is suitable for disposal. The liquid effluent would be discharged through a permitted NPDES outfall. The bulk of the solid LLW, consisting of contaminated equipment pieces, plastic sheeting, and protective clothing, would be generated from reactor operations. Solid LLW would be compacted, if appropriate, and then disposed of at a DOE-approved onsite or offsite disposal facility.

Mixed Low-Level Waste. Very small amounts of liquid mixed LLW would be generated by reactor operations. Solid mixed LLW could consist of wipes laden with contaminated oils, lubricants, and solvents used to decontaminate surfaces. Mixed LLW would be stored in an onsite RCRA-permitted storage facility until treatment in accordance with the site-specific site treatment plan that was developed to comply with the *Federal Facility Compliance Act*.

Hazardous Waste. Liquid hazardous wastes would consist of cleaning solvents, cutting oils, vacuum pump oils, film processing fluids, hydraulic fluids from mechanical equipment, antifreeze solutions, and paint. A cleaning solvent would be selected from a list of nonhalogenated solvents. Liquid hazardous wastes would be collected in DOT-approved containers and sent to an onsite hazardous waste accumulation area. The accumulation area would provide a 90-day staging capacity prior to shipment in DOT-certified transportation to an offsite commercial RCRA-permitted treatment, storage, and disposal facility. Solid hazardous wastes would be generated from nonradioactive materials such as wipes contaminated with oils, lubricants, and cleaning solvents that would be used for equipment outside the main processing units. After compaction, if appropriate, the solid hazardous wastes would be packaged in DOT-approved containers and sent to a hazardous waste accumulation area for staging prior to shipment in DOT-certified transporters to an offsite commercial RCRA-permitted treatment, storage, and disposal facility.

Nonhazardous (Sanitary) Waste. Sewage wastewater would be treated in the sanitary wastewater treatment plant, site septic systems, or pretreated prior to discharge to existing municipal systems. Sewage wastewater would be kept separate from all industrial and process wastewaters and normally would contain no radioactive wastes from the reactor facility. The sewage wastewater would be routinely monitored for radioactive contaminants. The sludge would be disposed of in a permitted landfill. The treated effluent would be discharged through a permitted NPDES outfall (wet site) or recycled for cooling water makeup and other services (dry site). The treated effluent from the process wastewater treatment would be discharged to the river through an NPDES outfall (wet site) or a natural drainage channel (dry site). Other nonrecyclable, nonhazardous solid sanitary and industrial wastes would be compacted and disposed of in a permitted landfill.

Nonhazardous (Other) Waste. The reactor design includes stormwater retention facilities with the necessary NPDES monitoring equipment. Runoff within the Limited Area and Protected Area would be collected separately, routed to the stormwater collection ponds and then sampled and analyzed before discharge to the natural drainage channels (dry site) or river (wet site). If the runoff was contaminated, it would be treated in the radioactive waste treatment system. Runoff from the Property Protection Area would be discharged directly into the natural drainage channels or river. Cooling tower blowdown would be treated and discharged to the river (wet site) or recycled for reuse (dry site). The treated effluent from the utility wastewater treatment would be discharged to the river through an NPDES outfall (wet site) or a natural drainage channel (dry site). All sludges would be disposed of in a permitted landfill.

Appendix F
Air Quality and Noise

F.1 AIR QUALITY

This appendix provides detailed data that support air quality impact assessments addressed in Chapter 3, Affected Environment-Air Quality and Chapter 4, Environmental Consequences-Air Quality. The data presented include emission inventories for site-related activities and facility emissions for various alternatives. Section F.1.1 presents the methodology and models used in the air quality assessment. Section F.1.2 presents supporting data applicable to each site. Sections F.1.2.2 through F.1.2.9 contain tables of site-specific information applicable to the air quality assessments at each site and figures showing wind rose data specific to each site. Section F.1.3 presents the emission rates for the facilities considered for each alternative. Section F.2 presents sound level monitoring data for each site and summarizes relevant local noise regulations.

F.1.1 METHODOLOGY AND MODELS

The assessment of potential impacts to air quality is based upon comparison of proposed project effects with applicable standards and guidelines. The Industrial Source Complex Short-Term Model Version 2 (ISCST2) is used to estimate concentrations of pollutants from emission sources at each site. The screening model (SCREEN2) is used to estimate concentrations of pollutants at the site boundary for the generic sites, assuming a distance to the site boundary of 800 meters (m) (0.5 miles [mi]).

The air quality modeling analysis performed for the candidate sites is considered a "screening level" analysis. It applies conservative assumptions to each site to permit comparison among the sites of the impacts associated with the respective alternatives. These conservative assumptions will tend to overestimate pollutant concentrations at each site.

The assumptions applied to the air quality analysis at each site are as follows: where available, existing modeling analyses of criteria pollutant and toxic/hazardous pollutant emissions were used to determine No Action concentrations and are based on actual source locations and stack parameters; criteria pollutant and toxic/hazardous pollutant emissions were modeled for other sites and each alternative from a single source centrally located within the complex of facilities on each site assuming a 10-m (32.8-foot [ft]) stack height, a 0.3-m (1-ft) stack diameter, stack exit temperature equal to ambient temperature, and a stack exit velocity equal to 0.03 m/second (s) (0.1 ft/s) unless otherwise specified. These assumptions will tend to overestimate pollutant concentrations because they do not account for spacial and temporal variations of emission sources.

Emission sources at each facility or site and for each alternative were assumed to be in the same location as existing toxic/hazardous pollutant emission sources and assumed the modeling parameters used for those emissions.

The ISCST2 model is a revision of the ISCST model. The modeling algorithms have not been changed and the revised model will give nearly identical results to the original ISCST model for most applications. The performance of the ISCST model has not been validated with field data. However, it is an extended version of a single-stack model, CRSTER, that has been examined using field data from four large power plants. The performance of the ISCST model has been evaluated with field data for its point source submodel and for its special features, such as the gravitational settling/dry deposition option and building downwash option. From the validation studies for the single source CRSTER model, based on field data measured at four large power plants, it was concluded that the model acceptably predicts the upper percentile of the corresponding distributions of 1-hour concentrations and of the corresponding distributions of 24-hour concentrations. The highest-second-highest (a term within the model to represent the second highest concentration) 1-hour concentrations were predicted within a factor of two at two-thirds of the field sampling sites for elevated power plant plumes. The ratio of highest-second-highest 24-hour concentration to measured concentration ranged from about 0.2 to 2.7 at about 90 percent of the sampling sites.

In other validation studies for the point source model, the CRSTER model predicted peak short-term (1-, 3-, and 24-hour) concentration values within 30 to 70 percent at a plain site (EPRI 1983a:7-1–7-7). The CRSTER model predicted peak 1-hour concentrations within 2 percent and underpredicted peak 3-hour concentrations by about 30 percent at a moderately complex terrain site (EPRI 1985a:7-1). The ISCST model overpredicts 1-hour concentrations by about 60 percent with better predictions for longer time periods at an urban site (EPRI 1988a:5-2). Uses of gravitational settling/dry deposition and building downwash options were found to improve the model performance significantly over that of the model without such features (APCA 1986a:258-264; EPA 1981a:5-1,5-2; EPA 1982a:151,152).

F.1.2 SUPPORTING DATA

F.1.2.1 Overview

This section presents supporting information for each of the eight existing DOE sites considered under the No Action Alternative, and the various storage and disposition alternatives, as appropriate. Table F.1.2.1–1 presents the air quality standards applicable to each site. Subsequent sections present supporting information used in the air quality analysis at the Hanford Site (Hanford), Nevada Test Site (NTS), Idaho National Engineering Laboratory (INEL), Pantex Plant (Pantex), Oak Ridge Reservation (ORR), Savannah River Site (SRS), Rocky Flats Environmental Technology Site (RFETS), and Los Alamos National Laboratory (LANL).

F.1.2.2 Hanford Site

This section provides information on climatology and meteorology, modeling assumptions, atmospheric dispersion characteristics, and annual mean windspeeds and direction frequencies at Hanford.

Climatology and Meteorology. Figure F.1.2.2–1 shows annual mean windspeeds and wind direction frequencies for July 1989 through June 1990 measured at the 10-m (32.8-ft) level of the Hanford Meteorology Station. The wind rose shows that the maximum wind direction frequency for 1989-1990 is from the west-northwest. The mean windspeed from the west-northwest is 4.3 m/s (9.6 miles per hour [mph]); the maximum mean windspeed is 5 m/s (11.2 mph) from the west-southwest. The historical wind data from the site indicate that the prevailing wind direction is from the west-northwest. The average annual windspeed is 3.4 m/s (7.6 mph) (HF PNL 1994b:83-84).

The average annual temperature is 11.8 degrees Celsius (°C) (53.3 degrees Fahrenheit [°F]); average monthly temperatures vary from a minimum of -1.5 °C (29.3 °F) in January to a maximum of 24.7 °C (76.5 °F) in July (HF PNL 1994b:83-84).

The average annual precipitation at Hanford is 16.0 centimeters (cm) (6.3 inches (in) (HF PNL 1994b:83-84).

Topographic features have a significant impact on the climate of Hanford. All air masses that reach the region undergo some modification resulting from their passage over the complex topography of the Pacific Northwest. The climate of the region is strongly influenced by the Pacific Ocean and the Cascade Range to the west and by the Rocky Mountains to the east and the north. The Rocky Mountains play a key role in protecting the region from the severe winter storms and extremely low temperatures associated with modified arctic air masses that move southward through Canada.

The Hanford Meteorological Station's climatological summary and the National Severe Storms Forecast Center's database list only 24 tornado occurrences within 161 kilometers (km) (100 mi) of Hanford from 1916 to 1994.

Table F.1.2.1–1. Ambient Air Quality Standards Applicable to Existing Department of Energy Sites

Pollutant	Averaging Time	Primary NAAQS[a] (μg/m³)	Secondary NAAQS[a] (μg/m³)	Washington (Hanford) (μg/m³)	Nevada (NTS) (μg/m³)	Idaho (INEL) (μg/m³)	Texas (Pantex) (μg/m³)	Tennessee (ORR) (μg/m³)	Georgia and South Carolina (SRS) (μg/m³)	Colorado (RFETS) (μg/m³)	New Mexico (LANL) (μg/m³)
Criteria Pollutants											
Carbon monoxide	8-hour	10,000	b	10,000	10,000	10,000	10,000	10,000	10,000	10,000	7,689[c]
	1-hour	40,000	b	40,000	40,000	40,000	40,000	40,000	40,000	40,000	11,578[c]
Lead	Calendar quarter	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
	24-hour	b	b	0.5	b	b	b	b	b	b	b
Nitrogen dioxide	Annual	100	100	100	100	100	100	100	100	100	73[c]
	24-hour	b	b	b	b	b	b	b	b	b	145[c]
Ozone	1-hour	235	235	235	235	235	235	235	235	235	235
Particulate matter less than or equal to 10 microns in diameter	Annual	50	50	50	50	50	50	50	50	50	50
	24-hour	150	150	150	150	150	150	150	150	150	150
Sulfur dioxide	Annual	80	b	52	80	80	80	80	80	80	40[c]
	24-hour	365	b	260	365	365	365	365	365	365	202[c]
	3-hour	b	1,300	1,300	1,300	1,300	1,300	1,300	1,300	1,300	1,300
	3-hour	b	b	b	b	b	b	b	b	700[d]	b
	1-hour	b	b	1,018	b	b	b	b	b	b	b
	1-hour	b	b	655[e]	b	b	b	b	b	b	b
	30-minute	b	b	b	b	b	1,045	b	b	b	b

Table F.1.2.1–1. Ambient Air Quality Standards Applicable to Existing Department of Energy Sites—Continued

Pollutant	Averaging Time	Primary NAAQS[a] (μg/m³)	Secondary NAAQS[a] (μg/m³)	Washington (Hanford) (μg/m³)	Nevada (NTS) (μg/m³)	Idaho (INEL) (μg/m³)	Texas (Pantex) (μg/m³)	Tennessee (ORR) (μg/m³)	Georgia and South Carolina (SRS) (μg/m³)	Colorado (RFETS) (μg/m³)	New Mexico (LANL) (μg/m³)
State and County Mandated Pollutants											
Beryllium	24-hour	b	b	b	b	b	0.01	b	b	b	b
Gaseous fluoride	30-day	b	b	0.8	b	b	0.8	1.2	0.8	b	b
	7-day	b	b	1.7	b	b	1.6	1.6	1.6	b	b
	24-hour	b	b	2.9	b	b	2.9	2.9	2.9	b	b
	12-hour	b	b	3.7	b	b	3.7	3.7	3.7	b	b
	8-hour	b	b	b	b	b	b	250	b	b	b
Hydrogen sulfide	1-hour	b	b	b	112	b	b	b	b	142	11[c]
	30-minute	b	b	b	b	b	111	b	b	b	b
Sulfuric acid	24-hour	b	b	b	b	b	15	b	b	b	b
	1-hour	b	b	b	b	b	50	b	b	b	b
Total reduced sulfur		b	b	b	b	b	b	b	b	b	3
Total suspended particulates	Annual	b	b	60	b	60	b	b	75	75	60[c]
	30-day	b	b	b	b	b	b	b	b	b	90[c]
	7-day	b	b	b	b	b	b	b	b	b	110[c]
	24-hour	b	b	150	b	150	b	150	b	150	150[c]
	3-hour	b	b	b	b	b	200	b	b	b	b
	1-hour	b	b	b	b	b	400	b	b	b	b

[a] The NAAQS (40 CFR 50), other than those for ozone, particulate matter, lead, and those based on annual averages, are not to be exceeded more than once per year. The ozone standard is attained when the expected number of days per year with maximum hourly average concentrations above the standard is ≤ 1. The 24-hour particulate matter standard is attained when the expected number of days with a 24-hour average concentration above the standard is ≤ 1. The annual arithmetic mean particulate matter standard is attained when the expected annual arithmetic mean concentration is less than or equal to the standard. The calendar quarter lead standard is not to be exceeded.

[b] There is no standard.

[c] State standard. The conversion from ppm to μg/m³ for the ambient air quality standard is calculated with the corrections for temperature (21 °C) and pressure (elevation) (7,400 ft mean sea level).

[d] State of Colorado also has an incremental standard for sulfur dioxide.

[e] The standard is not to be exceeded more than twice in any seven consecutive days.

Note: NAAQS=National Ambient Air Quality Standards; μg-microgram.

Source: 40 CFR 50; CO DPHE 1994a; ID DHW 1995a; ID DHW 1995b; ID DHW 1995c; NM EIB 1995a; NM EIB 1996a; NV DCNR 1995a; SC DHEC 1992b; TN DEC 1994a; TX NRCC 1992a; WA Ecology 1994a.

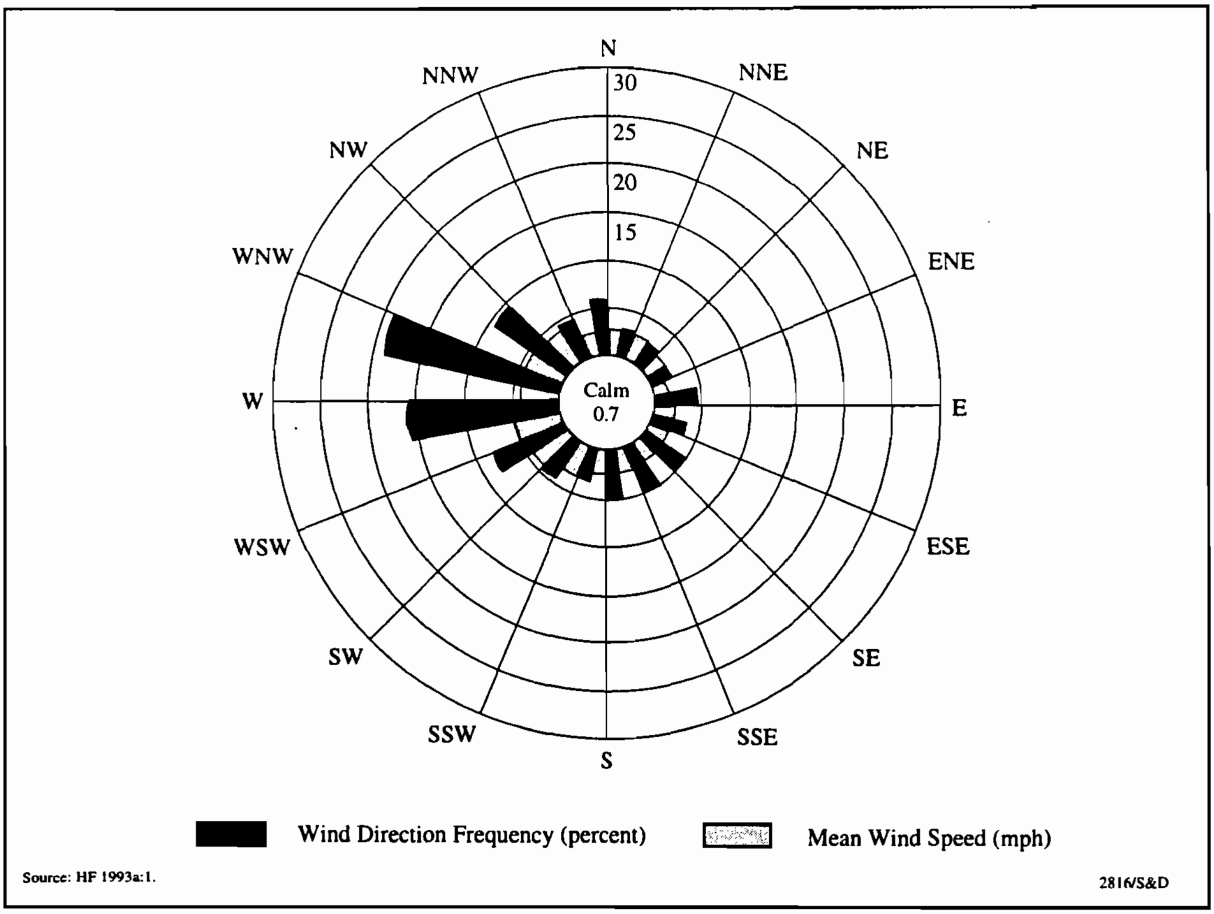


Figure F.1.2.2–1. Wind Distribution at Hanford Site, 1989-1990 (10-meter level).

Only one of these tornadoes was observed within the boundaries of Hanford (on its extreme western edge), and no damage resulted. The estimated probability of a tornado striking a point at Hanford is $9.6x10^{-6}$/year (yr) (HF PNL 1994a:4.10). Because tornadoes are infrequent and generally small in the Pacific Northwest (and hurricanes do not reach this area), risks from severe winds are generally associated with thunderstorms or the passage of strong cold fronts. The greatest peak wind gust recorded at 15.2 m (50 ft) above ground level at the Hanford Meteorology Station was 36 m/s (80 mph). Observations indicate a return period of about 200 years for a peak gust in excess of 40 m/s (90 mph) at 15.2 m (50 ft) above ground level (HF PNL 1983a:V-2,V-13, XI-1).

Emission Rates. Table F.1.2.2–1 presents the emission rates for criteria and toxic/hazardous pollutants at Hanford. These emission rates were used as input into the ISCST2 model to estimate No Action pollutant concentrations.

Modeling Assumptions. In order to estimate maximum pollutant concentrations at or beyond the Hanford boundary, criteria pollutant emissions and toxic/hazardous pollutant emissions were modeled from a centrally located stack at a height of 10 m (32.8 ft), with a stack diameter of 0.3 m (1 ft), an exit velocity of 0.03 m/s (0.1 ft/s), and an exit temperature equal to ambient temperature.

Atmospheric Dispersion Characteristics. Data collected at Hanford meteorological monitoring station indicate that unstable conditions occur approximately 25 percent of the time, neutral conditions approximately 31 percent, and stable conditions approximately 44 percent, on an annual basis (HF 1993a:1).

Table F.1.2.2–1. Emission Rates of Criteria and Toxic/Hazardous Pollutants at Hanford Site[a]

Pollutant	Emission Rate (kg/yr)
Criteria Pollutants	
Carbon monoxide	11,660
Nitrogen dioxide	46,660
Particulate matter less than or equal to 10 microns in diameter[b]	4,566
Sulfur dioxide	200
Total suspended particulates[b]	4,566
Volatile organic compounds	927.8
Toxic/Hazardous Pollutants	
Ammonia	2.26

[a] For stationary sources within Hanford Site projected for 2005.

[b] Total suspended particulates emissions are assessed as particulate matter less than or equal to 10 microns in diameter.

Note: yr=year.

Source: HF 1995a:1.

F.1.2.3 Nevada Test Site

This section provides information on climatology and meteorology, modeling assumptions, atmospheric dispersion characteristics, and annual mean windspeeds and direction frequencies at NTS.

Climatology and Meteorology. Figure F.1.2.3–1 shows annual mean windspeeds and wind direction frequencies for 1991 measured at the 10-m (32.8-ft) level of the Desert Rock National Weather Service station. The wind rose shows that the maximum wind direction frequency for 1991 is from the northeast with a secondary maximum from the north-northeast. The mean windspeed from the northeast is 4.2 m/s (9.4 mph) and from the north-northeast it is 4.7 m/s (10.5 mph); the maximum mean windspeed is 6.3 m/s (14.1 mph) from the south-southwest.

Historical data indicate that predominating winds are southerly during summer and northerly during winter. The general downward slope in the terrain from north to south results in an intermediate scenario that is reflected in the characteristic diurnal wind reversal from southerly winds during the day to northerly winds at night. This north-to-south reversal is strongest in the summer and, on occasion, becomes intense enough to override the wind regime associated with large-scale pressure systems. Average annual windspeeds and direction vary with location. At higher elevations on Pahute Mesa, the average annual windspeed is 4.7 m/s (10.5 mph). The prevailing wind direction during winter months is north-northeasterly, and during summer months, winds are southerly. In Yucca Flat, the average annual windspeed is 3.1 m/s (7 mph). The prevailing wind direction during winter months is north-northwesterly and during summer months is south-southwesterly. At Mercury, Nevada, the average annual windspeed is 3.6 m/s (8 mph), with northwesterly prevailing winds during the winter months and southwesterly winds during the summer months (NT DOE 1993e:2-17,2-19).

Elevation influences temperatures on NTS. At an elevation of 2,000 m (6,560 ft) above mean sea level (MSL) on Pahute Mesa, the average daily maximum/minimum temperatures are 4.4/-2.2 °C (40/28 °F) in January and 26.7/16.7 °C (80/62 °F) in July. In Yucca Flat, 1,195 m (3,920 ft) above MSL, the average daily maximum/minimum temperatures are 10.6/-6.1 °C (51/21 °F) in January and 35.6/13.9 °C (96/57 °F) in July (NT DOE 1993e:2-17,2-19).

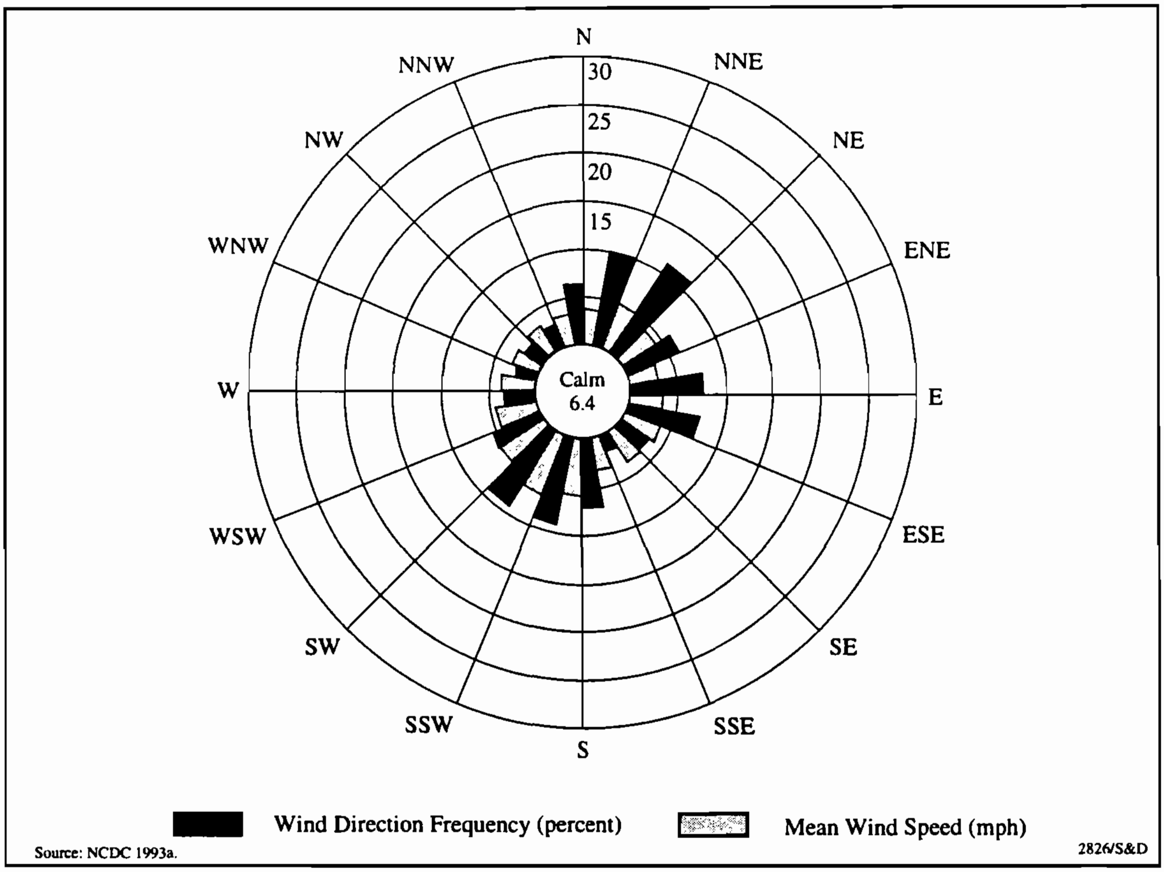


Figure F.1.2.3–1. Wind Distribution at Nevada Test Site, 1991 (10-meter level).

The average annual temperature at NTS is 19.5 °C (67.1 °F); temperatures vary from an average daily minimum of 0.9 °C (33.6 °F) in January to an average daily maximum of 41.1 °C (105.9 °F) in July. The average annual precipitation at NTS is 10.5 cm (4.13 in) (NOAA 1994d:3).

Annual precipitation in southern Nevada is very light and depends largely upon elevation. On NTS, the mesas receive an average annual precipitation of 23 cm (9 in), which includes winter snow accumulations. The lower elevations receive approximately 15 cm (6 in) of precipitation annually, with occasional snow accumulations lasting only a few days (NT DOE 1993e:2-17,2-19).

Precipitation usually falls in isolated showers with large variations in precipitation amounts within a shower area. Summer precipitation occurs mainly in July and August when intense heating of the ground below moist air masses triggers thunderstorm development. On rare occasions, a tropical storm will move northeastward from the coast of Mexico, bringing heavy precipitation during September and October.

Other than temperature extremes, severe weather in the region includes occasional thunderstorms, lightning, tornadoes, and sandstorms. Severe thunderstorms may produce high precipitation with durations of approximately 1 hour and may create a potential for flash flooding (NT DOE 1983a:26). Tornadoes have been observed in the region but are infrequent. The estimated probability of a tornado striking a point at NTS is 3.0×10^{-7}/yr (NRC 1986a:32).

Emission Rates. Table F.1.2.3–1 presents the emission rates for criteria and toxic/hazardous pollutants at NTS. These emission rates were used as input into the ISCST2 model to estimate pollutant concentrations.

Table F.1.2.3–1. Emission Rates of Criteria and Toxic/Hazardous Pollutants at Nevada Test Site[a]

Pollutant	Emission Rate (kg/yr)
Criteria Pollutants	
Carbon monoxide	b
Nitrogen dioxide	b
Particulate matter less than or equal to 10 microns in diameter[c]	86,820
Sulfur dioxide	71,125
Total suspended particulates[c]	86,820
Toxic/Hazardous Pollutants (no toxic sources indicated)	

[a] Based on permitted sources (1990-1992).
[b] No pollutant sources indicated.
[c] It is assumed that PM_{10} emissions are TSP emissions.
Note: yr=year.
Source: NV DCNR 1992a.

Modeling Assumptions. In order to estimate maximum pollutant concentrations at or beyond the NTS boundary for No Action, criteria pollutant emissions were modeled from actual stack locations using operating permit data on stack height, stack diameter, exit velocity, and exit temperature (NV DCNR 1992a).

Atmospheric Dispersion Characteristics. Data collected at the NTS meteorological monitoring station for 1991 indicate that unstable conditions occur approximately 26 percent of the time, neutral conditions approximately 37 percent, and stable conditions approximately 37 percent, on an annual basis.

F.1.2.4 Idaho National Engineering Laboratory

This section provides information on climatology and meteorology, modeling assumptions, atmospheric dispersion characteristics, and annual mean windspeeds and direction frequencies at INEL.

Climatology and Meteorology. Figure F.1.2.4–1 shows annual mean windspeeds and wind direction frequencies for 1992 measured at the 10-m (32.8-ft) level of the INEL meteorological tower. The wind rose shows that the maximum wind direction frequency is from the southwest with a secondary maximum from the north-northeast. The mean windspeed from the southwest is 5.2 m/s (11.6 mph) and from the north-northeast it is 2.8 m/s (6.3 mph); the maximum mean windspeed is 5.5 m/s (12.3 mph) from the west-southwest.

The historical wind data from the site indicate that prevailing wind directions are from the southwest to west-southwest with a secondary maximum from the north-northeast to northeast. The annual average windspeed is 3.4 m/s (7.5 mph) (IN DOE 1989b:28,30,55,77).

The average annual temperature at INEL is 5.6 °C (42.0 °F); average monthly temperatures vary from a minimum of -8.8 °C (16.1 °F) in January to a maximum of 20 °C (68 °F) in July. The average annual precipitation at INEL is 22.1 cm (8.71 in) (IN DOE 1989b:28,30,55,77).

The maximum instantaneous wind gust recorded at the Central Facilities Area Weather Station (6.1-m [20-ft] level) was 34.9 m/s (78 mph) from the west-southwest, and the maximum hourly average windspeed, also from the west-southwest, was 22.8 m/s (51 mph) (IN DOE 1989b:28,30,55,77).

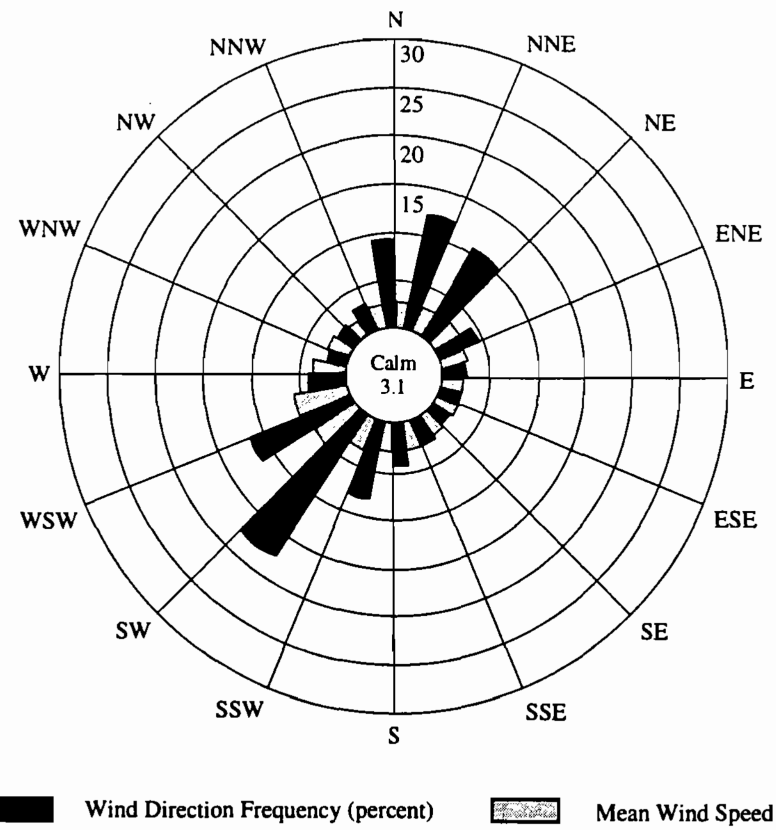


Figure F.1.2.4–1. Wind Distribution at Idaho National Engineering Laboratory, 1992 (10-meter level).

Other than thunderstorms, severe weather is uncommon. The months of June, July, and August each average two to three thunderstorm days. Hail storms occur occasionally, with the hail usually smaller than 0.64-cm (0.25-in) diameter. Tornadoes are very infrequent in the area. Between 1950 and 1989, a total of five funnel clouds and no tornadoes were sighted within the boundary of INEL (IN DOE 1989b:100-102). The estimated probability of a tornado striking a point at INEL is 6.0×10^{-7} per year (NRC 1986a:32).

Emission Rates. Table F.1.2.4–1 presents the emission rates for criteria and toxic/hazardous pollutants at INEL. These emission rates were used as input into the ISCST2 model to estimate pollutant concentrations. INEL exceeds the applicable 227,000 kilograms (kg)/yr (250 short tons (tons)/yr) emissions criterion for carbon monoxide (CO), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), and particulate matter less than or equal to 10 microns in diameter (PM_{10}), and is therefore classified as an existing major source for these pollutants. The classification of INEL as a major source may require further prevention of significant deterioration review than sites not classified as a major source.

Modeling Assumptions. In order to estimate maximum pollutant concentrations at or beyond the INEL site boundary, criteria pollutant emissions were modeled from actual stack locations using operating permit data on stack height, stack diameter, exit velocity, and exit temperature (INEL 1995a:1). Toxic/hazardous pollutant emissions were modeled from a centrally located stack at a height of 10 m (32.8 ft), with a stack diameter of 0.3 m (1 ft), an exit velocity of 0.03 m/s (0.1 ft/s), and an exit temperature equal to ambient temperature.

Table F.1.2.4–1. Emission Rates of Criteria and Toxic/Hazardous Pollutants at Idaho National Engineering Laboratory[a]

Pollutant	Emission Rate (kg/yr)
Criteria Pollutants	
CO	2,200,000
Lead	68
NO_2	3,000,000
PM_{10}[b]	900,000
SO_2	1,700,000
Total suspended particulates[b]	900,000
[Text deleted]	
Toxic/Hazardous Pollutants[c]	
1,3-Butadiene	390
[Text deleted]	
Acetaldehyde	180
Ammonia	6,500
Arsenic	24
Benzene	530
Carbon tetrachloride	28
[Text deleted.]	
Chromium-hexavalent	26
Cyclopentane	350
[Text deleted.]	
Formaldehyde	3,300
Hydrazine	8.3
[Text deleted]	
Hydrogen chloride	1,500
[Text deleted]	
Mercury	200
Methylene chloride	1,100
Naphthalene	16
Nickel	1,000
Nitric acid	97,000
Perchloroethylene	980
Phosphorous	210
Potassium hydroxide	2,100
Propionaldehyde	110
Styrene	4.7
Toluene	580
Trichloroethylene	4.5
Trimethylbenzene	87
Trivalent chromium	38

[a] Emissions from historical data (1990) are assumed for No Action (2005).

[b] It is assumed that PM_{10} emissions are TSP emissions.

[c] Hazardous/toxic air pollutants that are listed in State of Idaho regulations and are emitted in quantities that exceed screening criteria.

Source: DOE 1995v; INEL 1995a:1.

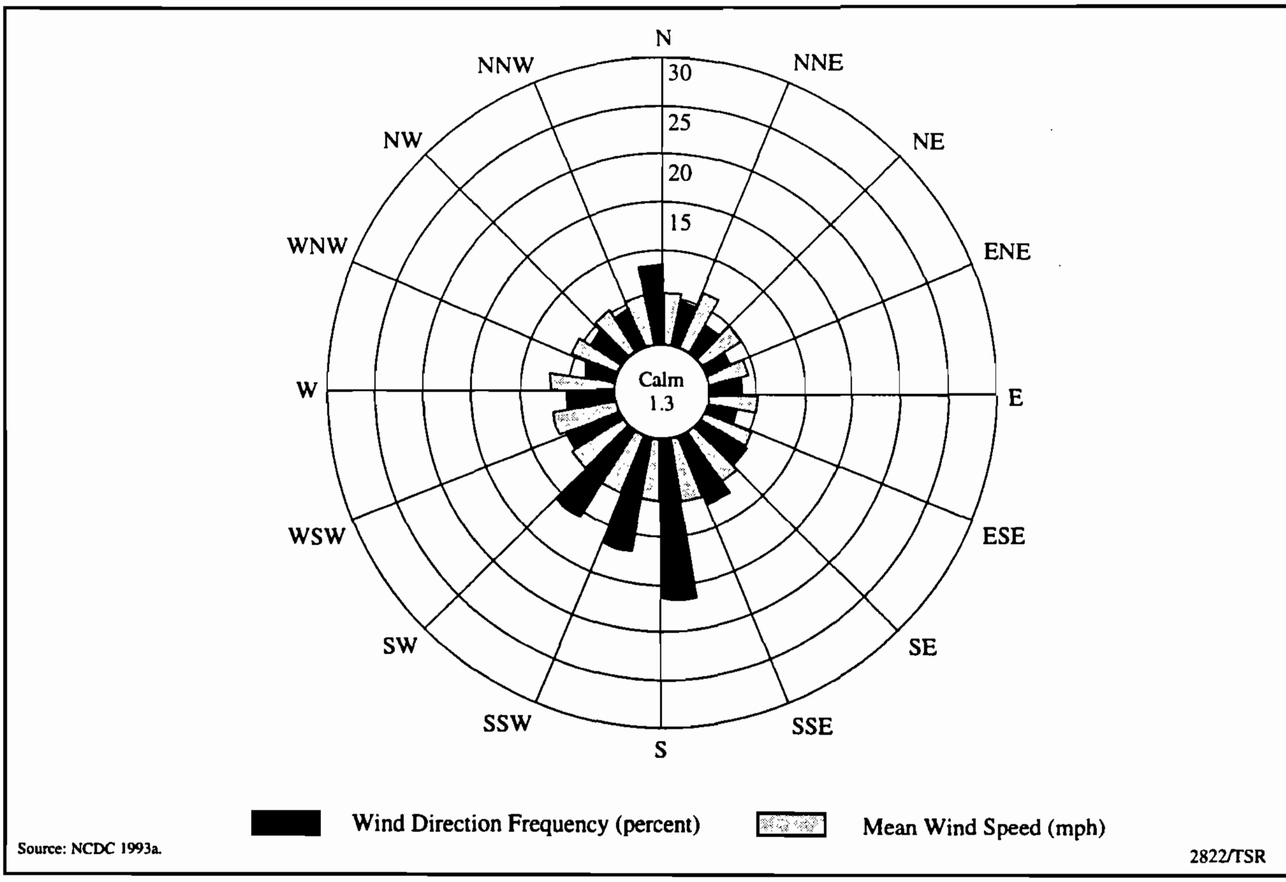


Figure F.1.2.5–1. Wind Distribution at Amarillo, 1991 (10-meter level).

Atmospheric Dispersion Characteristics. Data collected at INEL meteorological monitoring stations for 1992 indicate that unstable conditions occur approximately 22 percent of the time, neutral conditions approximately 26 percent, and stable conditions approximately 52 percent, on an annual basis.

F.1.2.5 Pantex Plant

This section provides information on climatology and meteorology, modeling assumptions, atmospheric dispersion characteristics, and annual mean windspeeds and direction frequencies at Pantex.

Climatology and Meteorology. Figure F.1.2.5–1 shows annual mean windspeeds and wind direction frequencies for 1991 measured at the 10-m (32.8-ft) level of the Amarillo National Weather Service station. The wind rose shows that the maximum wind direction frequency is from the south with a secondary maximum from the south-southwest. The mean windspeed from the south is 6.3 m/s (14.1 mph) and from the south-southwest it is 6.3 m/s (14.1 mph); the maximum mean windspeed is 6.6 m/s (14.8 mph) from the west.

Historical data indicate that prevailing wind directions are from the south to southwest. The annual average windspeed is 6.0 m/s (13.5 mph) (NOAA 1994c:3).

The average annual temperature at Pantex is 13.8 °C (56.9 °F); temperatures vary from an average daily minimum of -5.7 °C (21.8 °F) in January to an average daily maximum of 32.8 °C (91.1 °F) in July (NOAA 1994c:3).

The average annual precipitation at Pantex is 49.7 cm (19.6 in). Most of the annual precipitation falls between April and October and usually occurs from thunderstorm activity and the intrusion of warm, moist tropical air from the Gulf of Mexico. Snowfall has occurred in the area from October to April and averages nearly 42.9 cm (16.9 in) annually. The maximum 24-hour rainfall with a 100-year recurrence interval is approximately 16.5 cm (6.5 in). On average, the area can expect thunderstorms about 50 days/yr, hail 4 days/yr, and freezing rain 8 days/yr. During the 30-year period between 1954 and 1983, a total of 108 tornadoes were reported within a 1-degree latitude and longitude square area that includes Pantex. On average, fewer than four tornadoes occur in an area of 10,096 square kilometers (km^2) (3,898 square miles [mi^2]) surrounding Pantex per year. The estimated probability of a tornado striking a point at Pantex is $2.3x10^{-4}$/yr (NRC 1986a:32).

Emission Rates. Table F.1.2.5–1 presents the emission rates for criteria and toxic/hazardous pollutants at Pantex.

Table F.1.2.5–1. Emission Rates of Criteria and Toxic/Hazardous Pollutants at Pantex Plant

Pollutant	Emission Rate (kg/yr)
Criteria Pollutants	
CO	22,493
NO_2	54,056
Lead	185
PM_{10}	8,439
SO_2	0.1
Total suspended particulates	[a]
Hydrogen fluoride	1,176
Toxic/Hazardous Pollutants	
1,1,1-Chloroethane	22.74
[Text deleted]	
1,1,2-Trichloroethane	3.78
2-Nitropropane	1.71
[Text deleted]	
Alcohols	1,184
[Text deleted]	
Benzene	91.38
Carbon disulfide	27.05
Carbon tetrachloride	15.59
Chlorobenzene	1.79
Chromium	2.14
Cresol	0.05
Cresylic acid	0.05
[Text deleted]	
Dibenzofuran	0.07
[Text deleted]	
Ester glycol ethers	0.86
Ethyl benzene	1.51
Ethylene dichloride	1.33
Formaldehyde	57.89
Hydrogen chloride	1,106.11

Table F.1.2.5–1. Emission Rates of Criteria and Toxic/Hazardous Pollutants at Pantex Plant—Continued

Pollutant	Emission Rate (kg/yr)
Toxic/Hazardous Pollutants (continued)	
[Text deleted]	
Ketones	0.28
Mercury	0
Methanol	1,095.57
Methyl ethyl ketone	7,067.62
Methyl isobutyl ketone	0.62
Methylene chloride	182.07
Naphthalene	0.41
Nickel	0.16
Nitrobenzene	0.05
Phenol	2.23
[Text deleted]	
Tetrachloroethylene	6.44
Toluene	465.29
Trichloroethene	1.56
Trichloroethylene	19.50
Triethylamine	0
Xylene	222.15

[Text deleted.]

[a] Not available.
Source: PX DOE 1996b.

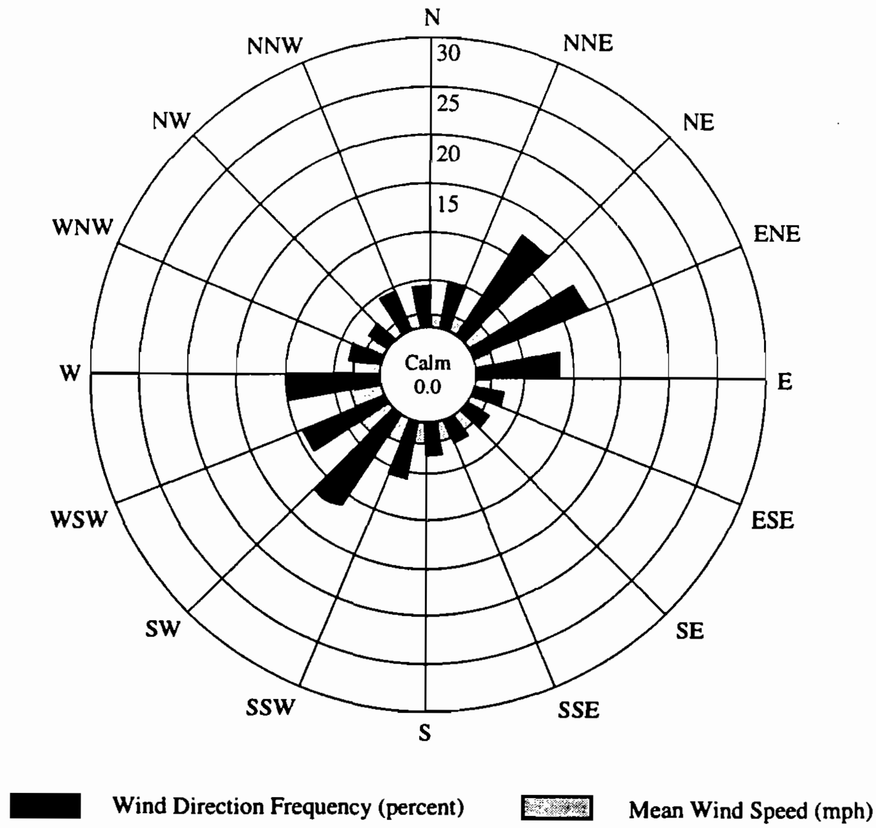
Modeling Assumptions. Baseline and No Action concentrations were based on actual source locations and stack parameters. In order to estimate maximum pollutant concentrations for alternatives at or beyond the Pantex boundary, criteria pollutant emissions and toxic/hazardous pollutant emissions were modeled from a centrally located stack in the Pantex complex at a height of 10 m (32.8 ft), with a stack diameter of 0.3 m (1.0 ft), an exit velocity of 0.03 m/s (0.1 ft/s), and an exit temperature equal to ambient temperature.

Atmospheric Dispersion Characteristics. Data collected at the Amarillo meteorological monitoring station for 1991 indicate that unstable conditions occur approximately 14 percent of the time, neutral conditions approximately 64 percent, and stable conditions approximately 22 percent, on an annual basis.

F.1.2.6 Oak Ridge Reservation

This section provides information on climatology and meteorology, modeling assumptions, atmospheric dispersion characteristics, and annual mean windspeeds and direction frequencies at ORR.

Meteorology and Climatology. The wind direction above the ridge tops and within the valley at ORR tends to follow the orientation of the valley. On an annual basis, the prevailing winds at the National Weather Service (NWS) station in the city of Oak Ridge are either up-valley, from west to southwest, or down-valley, from east to northeast. Figure F.1.2.6–1 shows mean windspeeds and direction frequencies for 1990 measured at the 30-m (100-ft) level of the ORR meteorology tower. The wind rose shows that the maximum wind direction frequency is from the east-northeast with a secondary maximum from the northeast. The mean windspeed from the east-northeast is 1.7 m/s (3.8 mph) and from the northeast it is 2.3 m/s (5.1 mph); the maximum mean windspeed is 3.3 m/s (7.4 mph) from the southwest.



Source: ORR 1991a:8.

2823/S&D

Figure F.1.2.6–1. Wind Distribution at Oak Ridge Reservation, 1990 (30-meter level).

The historical data indicate that prevailing wind directions are from the southwest and northeast quadrants. Mean annual windspeeds measured in the region are relatively low, averaging 2.0 m/s (4.4 mph) at the Oak Ridge NWS station at the 14-m (46-ft) level and 2.1 m/s (4.7 mph) at the 10-m (32.8-ft) level at the ORR Bethel Valley monitoring station (ORNL 1982a:2-95 – 2-113).

The average annual temperature at ORR is 13.7 °C (56.6 °F); temperatures vary from an average daily minimum of -3.8 °C (25.1 °F) in January to an average daily maximum of 30.4 °C (86.7 °F) in July. Relative humidity readings taken four times per day range from 51 percent in April to 92 percent in August and September (NOAA 1994c:3).

The average annual precipitation measured at ORR in Bethel Valley is 130.8 cm (51.5 in), while the average annual precipitation for the Oak Ridge NWS station is 136.6 cm (53.8 in). The maximum monthly precipitation recorded at the Oak Ridge NWS station was 48.95 cm (19.27 in) in July 1967, while the maximum rainfall in a 24-hour period was 19.0 cm (7.48 in) in August 1960. The average annual snowfall as measured at the Oak Ridge NWS station is 24.9 cm (9.8 in).

Damaging winds are uncommon in the region. Peak gusts recorded in the area range from 26.8 m/s (60 mph) to 30.8 m/s (69 mph) for the months of January through July; from 21.9 to 26.8 m/s (49 to 60 mph) for August, September, and December; and 16.1 to 20.1 m/s (36 to 45 mph) in October and November (ORNL 1982a:2-72). The fastest mile windspeed (the 1 mi [1.6 km] passage of wind with the highest speed for the day) recorded at the Oak Ridge NWS station for the period of 1958 through 1979 was 26.4 m/s (59 mph) in January 1959 (NOAA 1994c:3).

The extreme mile windspeed at a height of 9.1 m (30 ft) that is predicted to occur near ORR once in 100 years is approximately 39.8 m/s (89 mph). The approximate values for occurrence intervals of 10, 25, and 50 years are 28.6, 33.1, and 34.0 m/s (64, 74, and 76 mph), respectively (ORNL 1981a:3.3-7).

Between 1916 and 1972, 25 tornadoes were reported in the counties of Tennessee having borders within about 64 km (40 mi) of ORR (ORNL 1981a:3.3-7). The probability of a tornado striking a particular point in the vicinity of ORR is estimated to be 3.6×10^{-4} per year (ORNL 1982a:2-125).

On February 21, 1993, a tornado passed through the northeastern edge of ORR and caused considerable damage to a large number of structures in the nearby Union Valley Industrial Park. Damage to ORR from this tornado was relatively light. The windspeeds associated with this tornado ranged from 17.9 m/s (40 mph) to nearly 58 m/s (130 mph) (OR DOE 1993c:iii).

Emission Rates. Table F.1.2.6–1 presents the emission rates for criteria and toxic/hazardous pollutants at ORR. The emission rates were used as input into the ISCST2 model to estimate pollutant concentrations. ORR exceeds the applicable 227,000 kg/yr (250 tons/yr) emissions criterion for NO_2 and SO_2 and is therefore classified as an existing major source for these pollutants. The classification of ORR as a major source may require further prevention of significant deterioration review than sites not classified as a major source.

Table F.1.2.6–1. Emission Rates of Criteria and Toxic/Hazardous Pollutants at Oak Ridge Reservation[a]

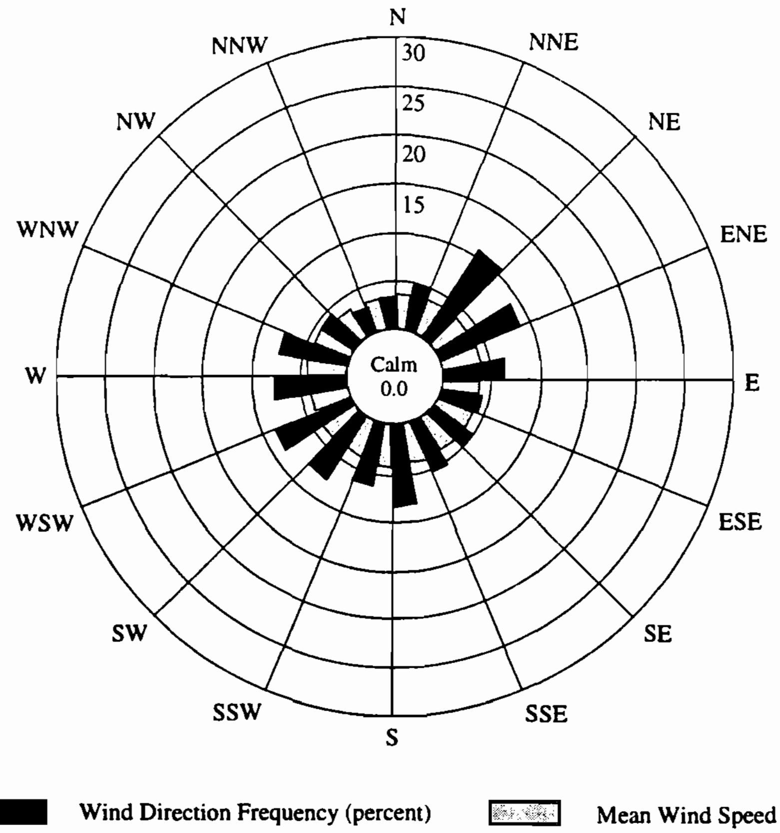
Pollutant	Emission Rate (kg/yr)
Criteria Pollutants	
CO	95,000
NO_2	870,000
PM_{10}	8,300
SO_2	972,000
Total suspended particulates	1,125,000
Toxic/Hazardous Pollutants	
1,1,1-Trichloroethane	220
Acetic acid	1
Chlorine	1,750
Hydrogen chloride	6,420
Hydrogen fluoride	70
Hydrogen sulfide	[b]
Methyl alcohol	26,400
Nitric acid	9,500
Sulfuric acid	2,500

[a] Emissions from historical data (1992) are assumed for No Action (2005).

[b] No sources of this pollutant have been identified.

Source: OR LMES 1996i.

Modeling Assumptions. In order to estimate maximum pollutant alternatives for concentrations at or beyond the ORR site boundary, criteria pollutant emissions and toxic/hazardous pollutant emissions were modeled from a centrally located stack in the Y–12 complex at a height of 10 m (32.8 ft), with a stack diameter of 0.3 m (1 ft), exit velocity of 0.03 m/s (0.1 ft/s), and exit temperature equal to ambient temperature.



Source: SRS 1995a:2.

2824/TSR

Figure F.1.2.7–1. Wind Distribution at Savannah River Site, 1991 (61-meter level).

Atmospheric Dispersion Characteristics. Data collected at the ORR meteorological monitoring station (Y–12 Plant east tower) for calendar year 1990 indicate that unstable conditions occur approximately 23 percent of the time, neutral conditions approximately 31 percent, and stable conditions approximately 46 percent, on an annual basis.

F.1.2.7 Savannah River Site

This section provides information on climatology and meteorology, modeling assumptions, atmospheric dispersion characteristics, and annual mean windspeeds and direction frequencies at SRS.

Climatology and Meteorology. Figure F.1.2.7–1 shows annual mean windspeeds and wind direction frequencies for 1991 measured at the 61-m (200-ft) level of the SRS H-Area Weather Station. The wind rose shows that the maximum wind direction frequency is from the northeast with a secondary maximum from the east-northeast. The mean windspeed from the northeast is 3.8 m/s (8.5 mph) and from the east-northeast it is 3.8 m/s (8.5 mph); the maximum mean windspeed is 4.1 m/s (9.2 mph) from the west-northwest.

The historical wind data from the site indicate that there is no predominant wind direction at SRS. The highest directional frequency is from the northeast. The average annual windspeed is 3.75 m/s (8.4 mph).

The average annual temperature at SRS is 17.3 °C (63.2 °F); temperatures vary from an average daily minimum of 0 °C (32 °F) in January to an average daily maximum of 33.2 °C (91.7 °F) in July. Relative humidity readings taken four times per day range from 45 percent in April to 92 percent in August and September.

The average annual precipitation at SRS is 113.4 cm (44.7 in). Precipitation is distributed fairly evenly throughout the year, with the highest precipitation in summer, 32.7 cm (12.87 in), and the lowest in autumn, 21.2 cm (8.34 in). Although snow can fall from November through April, the average annual snowfall is only 2.8 cm (1.1 in); large snowfalls are rare.

Winter storms in the SRS area occasionally bring strong, gusty surface winds with speeds as high as 22.8 m/s (51 mph). Thunderstorms can generate winds with speeds as high as 21.5 m/s (48.1 mph) and even stronger gusts. The fastest 1-minute windspeed recorded at Augusta between 1952 and 1993 was 27.7 m/s (62 mph) (NOAA 1994c:3).

The average number of thunderstorm days per year at SRS is 56. From 1954 to 1983, 37 tornadoes were reported in a 1-degree square of latitude and longitude that includes SRS. This frequency of occurrence amounts to an average of about one tornado per year. The estimated probability of a tornado striking a point at SRS is 7.1×10^{-5} per year (NRC 1986a:32). Since operations began at SRS in 1953, nine tornadoes have been confirmed on or near SRS. Nothing more than light damage was reported in any of these storms, with the exception of a tornado near SRS. Nothing more than light damage was reported in any of these storms, with the exception of a tornado in October 1989. That tornado caused considerable damage to timber resources in an undeveloped wooded area of SRS (WSRC 1990b:1).

From 1899 to 1980, 13 hurricanes occurred in Georgia and South Carolina, for an average frequency of about 1 hurricane every 6 years. Three hurricanes were classified as major. Because SRS is about 160 km (99.4 mi) inland, the winds associated with hurricanes have usually diminished below hurricane force (below a sustained speed of 33.5 m/s [75.0 mph]) before reaching the site (DOE 1992e:4-115).

Emissions Rates. Table F.1.2.7–1 presents the emission rates for criteria and toxic/hazardous pollutants at SRS. SRS exceeds the applicable 227,000 kg/yr (250 tons/yr) emissions criterion for CO, NO_2, SO_2 and PM_{10} and is therefore classified as an existing major source for these pollutants. The classification of SRS as a major source may require further prevention of significant deterioration review than sites not classified as a major source.

Modeling Assumptions. Emission rates for baseline and No Action for criteria and toxic/hazardous pollutants were based upon the latest sitewide emissions inventory data for the year 1990. Baseline and No Action concentrations were based on actual source locations and stack parameters. In order to estimate maximum criteria and toxic/hazardous pollutant concentrations at or beyond the SRS site boundary for the various storage and disposition alternatives, criteria pollutant emissions and toxic/hazardous pollutant emissions were modeled from a centrally located stack at a height of 10 m (32.8 ft), with a stack diameter of 0.3 m (1 ft), exit velocity of 0.03 m/s (0.1 ft/s), and exit temperature equal to ambient temperature.

Atmospheric Dispersion Characteristics. Data collected at SRS meteorological monitoring station for 1991 indicate that unstable conditions occur approximately 38 percent of the time, neutral conditions approximately 43 percent, and stable conditions approximately 19 percent, on an annual basis (SRS 1995a:2).

F.1.2.8 Rocky Flats Environmental Technology Site

This section provides information on climatology and meteorology, modeling assumptions, atmospheric dispersion characteristics, and annual mean windspeeds and direction frequencies at RFETS.

Climatology and Meteorology. Figure F.1.2.8–1 shows annual mean windspeeds and wind direction frequencies for 1990 measured at the 61.0-m (200-ft) level of the 61-m (200-ft) tower in the west buffer zone. The wind rose shows that the maximum wind direction frequency is west-northwest with a secondary maximum from the west. The mean windspeed from the west-northwest is 6.3 m/s (14.1 mph); the maximum mean windspeed is 5.7 m/s (12.8 mph) from the west.

Table F.1.2.7–1. Emission Rates of Criteria and Toxic/Hazardous Pollutants at Savannah River Site[a]

Pollutant	**Emission Rate (kg/yr)**	
Criteria Pollutants		
CO	404,449	
NO_2	4,278,380	
PM_{10}	1,963,180	
SO	9,454,199	
Total suspended particulates	4,430,890	
Hydrogen fluoride	16,690	
Toxic/Hazardous Pollutants	**Point & Volume Source (kg/yr)**	**Area Source[b] ($kg/yr/m^2$)**
3,3-Dichlorobenzidine	211.0	[c]
Acrolein	[c]	1.94×10^{-3}
Benzene	129,772.3	0.21
Bis (chloromethyl) ether	211.0	[c]
Cadmium oxide	243.0	[c]
Chlorine	21,146.7	10.11
Chloroform	1,035,006	13.6
Cobalt	5,970.2	4.58×10^{-4}
Formic acid	46,949.5	[c]
Manganese	27,882.1	2.61
Mercury	917.5	1.15×10^{-3}
Nickel	23,022.5	6.02
Nitric acid	1,150,525.8	[c]
Parathion	[d]	[d]
Phosphoric acid	14,859.8	[c]

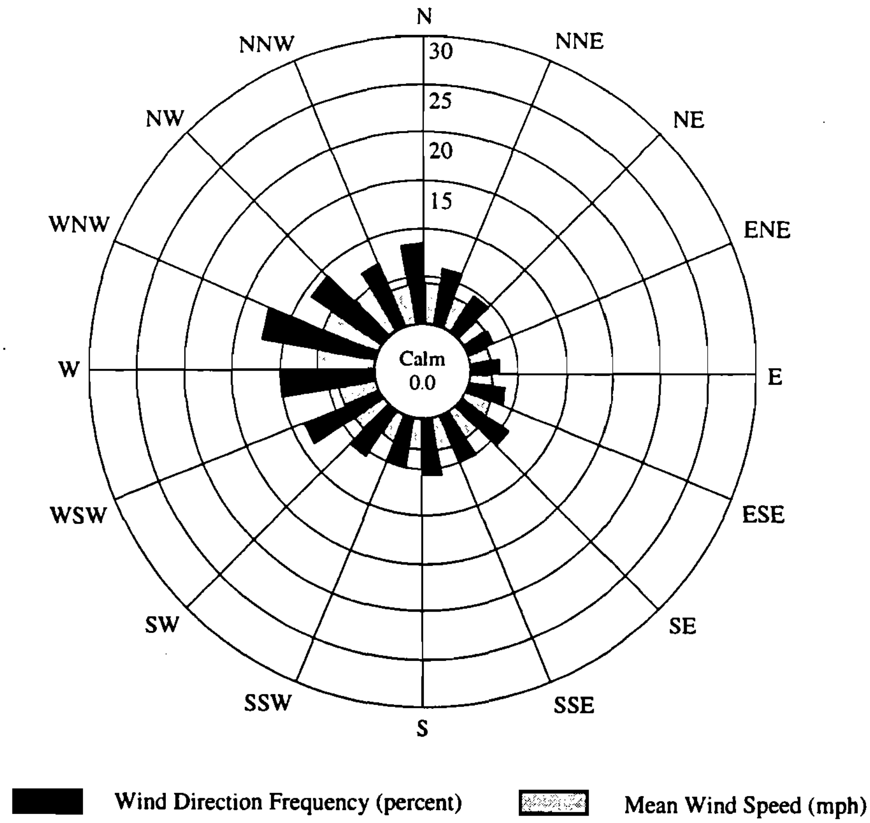
[a] Emissions from historical data (1990) are assumed for No Action (2005).
[b] Some toxic/hazardous pollutant sources were modeled as area sources, the remainder were modeled as point or volume sources.
[c] No sources of this pollutant have been identified.
[d] Data not available.
Source: SRS 1995a:10; WSRC 1993c.

The historical data indicate that the predominant wind direction is from the west-northwest. The average annual windspeed is 3.8 m/s (8.6 mph) (NOAA 1994a:3).

The average annual temperature at RFETS is 10.2 °C (50.3 °F); temperatures vary from an average daily minimum of -8.8 °C (16.1 °F) in January to an average daily maximum of 31.2 °C (88.2 °F) in July. The average annual precipitation at RFETS is 39.1 cm (15.4 in) (NOAA 1994a:3).

Winter storms in the RFETS area can generate winds with speeds as high as 21.5 m/s (48 mph) and even stronger gusts. The fastest 1-minute windspeed recorded in Denver, Colorado, was 20.6 m/s (46 mph) (NOAA 1994a:3).

The average number of thunderstorm days per year at RFETS is 42. From 1954 to 1983, 13 tornadoes were reported for a 1-degree square of latitude and longitude that includes RFETS. This frequency of occurrence amounts to an average of less than one tornado per year. The estimated probability of a tornado striking a point at RFETS is 2.0×10^{-5} per year (NRC 1986a:32).



Source: RFP 1993a:2.

2825/S&D

Figure F.1.2.8–1. Wind Distribution at Rocky Flats Environmental Technology Site, 1990 (61-meter level).

Emission Rates. Table F.1.2.8–1 presents the emission rates for criteria and toxic/hazardous pollutants at RFETS. These emission rates were used as input into the ISCST2 model to estimate pollutant concentrations.

Modeling Assumptions. In order to estimate maximum pollutant concentrations at or beyond the RFETS site boundary, criteria pollutant emissions and toxic/hazardous pollutant emissions were modeled from a centrally located stack in RFETS at a height of 10 m (32.8 ft), with a stack diameter of 0.3 m (1 ft), an exit velocity of 0.03 m/s (0.1 ft/s), and an exit temperature equal to ambient temperature.

Atmospheric Dispersion Characteristics. Data collected at RFETS meteorological monitoring station for 1990 indicate that unstable conditions occur approximately 59 percent of the time, neutral conditions approximately 26 percent, and stable conditions approximately 15 percent, on an annual basis.

F.1.2.9 Los Alamos National Laboratory

This section provides information on climatology and meteorology, modeling assumptions, atmospheric dispersion characteristics, and annual mean windspeed and direction frequencies at LANL.

Climatology and Meteorology. Figure F.1.2.9–1 shows annual mean windspeed and wind direction frequencies for 1991 measured at the 11.5-m (37-ft) level of the Technical Area (TA)-6 meteorological tower. The wind

Table F.1.2.8–1. Emission Rates of Criteria and Toxic/Hazardous Pollutants at Rocky Flats Environmental Technology Site[a]

Pollutant	Emission Rate (kg/yr)
Criteria Pollutants	
CO	39,200
NO_2	183,000
PM_{10}	10,400
SO_2	13,100
State Mandated Pollutants	
Hydrogen sulfide	0.467
Total suspended particulates	12,600
Toxic/Hazardous Pollutants[b]	
1,1,2-Trichloro-1,2,2-trifluoroethane	109
Carbon tetrachloride	53.5
Methylene chloride	53.3
Trichloroethane	136

[a] Emissions from historical data (permits 1991-1994) are assumed for No Action (2005).
[b] Only those emitted at rates greater than 45 kg/yr are listed.
Source: RFETS 1995a:1.

rose shows that the maximum wind direction frequency is from the west-northwest with a secondary maximum from the west. The mean windspeed from the west-northwest is 3.2 m/s (7.2 mph), which is also the maximum mean windspeed. The mean windspeed is 3 m/s (6.7 mph) from the west.

The historical wind data from the site indicate that the prevailing wind directions are from the south through northwest. The average annual windspeed measured is 2.8 m/s (6.3 mph) (LANL 1995s:II-11).

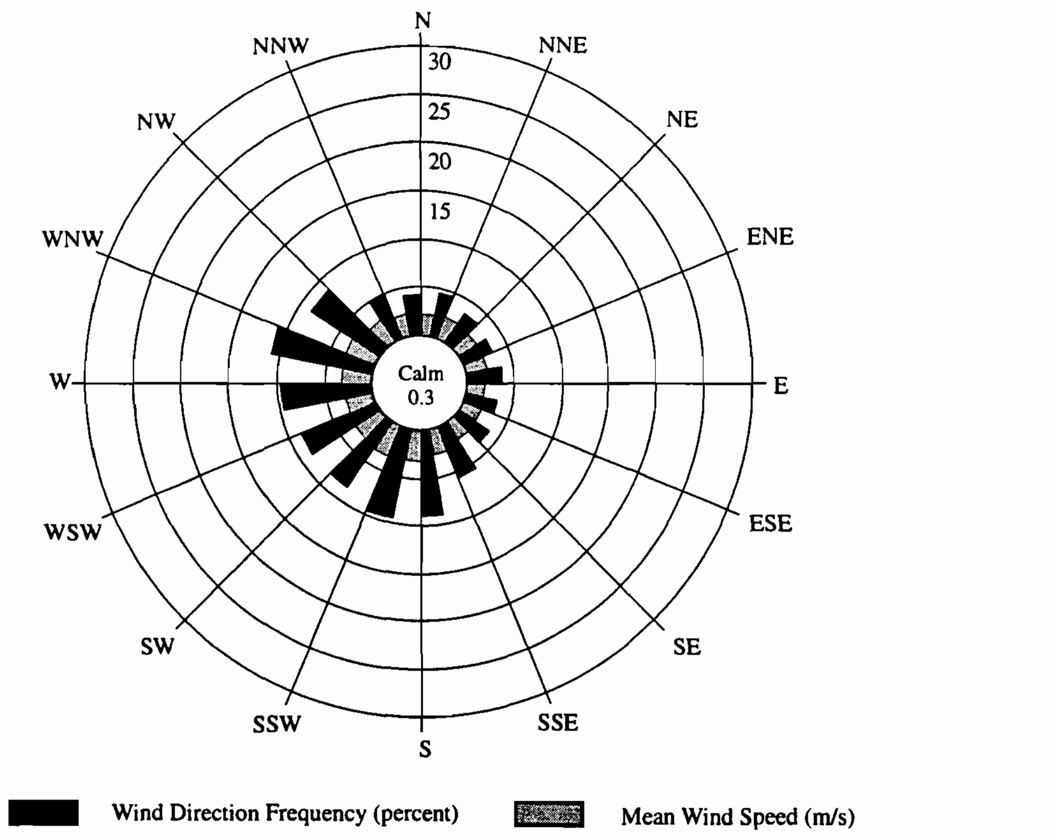
The average annual temperature at LANL is 8.8 °C (47.8 °F). In July, the average daily high temperature is 27.2 °C (81 °F), and the average nighttime low temperature is 12.8 °C (55 °F). The highest recorded temperature is 35 °C (95 °F). The average daily January high is 4.4 °C (40 °F), and the average nighttime low is -8.3 °C (17 °F). The lowest recorded temperature is -27.8 °C (-18 °F). Monthly average values of the dew point temperature range from -9.4 °C (15.0 °F) in January to 8.9 °C (48 °F) in August, when moist subtropical air invades the region. Fog is rare in Los Alamos, occurring on fewer than 5 days per year (LANL 1995s:II-8,II-11).

The average annual precipitation at LANL is 47.6 cm (18.7 in). Most of the annual precipitation falls during the months of July and August and usually occurs from convective storms. Snowfall averages nearly 150 cm (59 in). The maximum 24-hour rainfall is approximately 8.8 cm (3.5 in) (LANL 1994a:II-11).

The average number of thunderstorm days per year is 58, with most occurring during the summer. The estimated probability of a tornado striking a point at LANL is $2x10^{-5}$ per year (NRC 1986a:32). Historically, no tornadoes have been reported to have touched down in Los Alamos County (LANL 1993b:II-9).

Emission Rates. Table F.1.2.9–1 presents the emission rates for criteria and toxic/hazardous pollutants at LANL. These emission rates were used as input into the ISCST2 model, to estimate pollutant concentrations.

Modeling Assumptions. Additional model input used to estimate maximum pollutant concentrations at or beyond the LANL site boundary include the following: criteria pollutant emissions were modeled from actual



Source: LANL 1992a:6.

Figure F.1.2.9–1. Wind Distribution at Los Alamos National Laboratory, 1991 (11.5-meter level).

stack locations using actual stack heights, stack diameter, exit velocity, and exit temperature, taken from operating permits; toxic/hazardous pollutant emissions were modeled from a centrally located stack in the LANL facility at a height of 10 m (32.8 ft), stack diameter of 0.3 m (1 ft), exit velocity of 0.03 m/s (0.1 ft/s), and exit temperature equal to ambient temperature.

Atmospheric Dispersion Characteristics. Data collected at the TA-6 meteorological tower for 1991 indicate that unstable conditions occur approximately 45 percent of the time, neutral conditions approximately 21 percent of the time, and stable conditions approximately 34 percent of the time, on an annual basis.

Table F.1.2.9–1. Emission Rates of Criteria and Toxic/Hazardous Pollutants at Los Alamos National Laboratory[a]

Pollutant	Emission Rate (kg/yr)
Criteria Pollutant	
CO	21,583
Lead	26
NO_2	55,314
PM_{10}	2,983
SO_2	704.6
Total suspended particulates[b]	2,983
Hazardous and Other Toxic Compounds	
1, 1, 2-Trichloroethane	927
2-Butoxyethanol	123
Acetic acid	537
Ammonia	799
Chloroform	533
Ethyl acetate	89
Ethylene glycol	72
Formaldehyde	49
Heptane (n-heptane)	1,849
Hexane (n-hexane)	77
Hydrogen chloride	638
Hydrogen fluoride (as F)	242
Isopropyl alcohol	539
Kerosene	260
Methyl alcohol	589
Methyl ethyl ketone	1,864
Methylene chloride	1,104
Nickel	55
Nitric acid	661
Nitrogen oxide	428
Propane sultone	205
Stoddard solvent	264
Toluene	2,483
Trichloroethylene	210
Tungsten (as W) (insoluble)	109
VM&P naptha	613
Xylene (o-, m-, p-isomers)	1,762

[a] Emissions from historical data (1990) are assumed for No Action (2005).

[b] It is assumed that PM_{10} emissions are total suspended particulates emissions.

Source: LANL 1994a.

F.1.3 AIR POLLUTANT EMISSIONS

Potential ambient air quality impacts of the emissions due to operation of the various storage and disposition facilities at each site were analyzed using ISCST2 as described in Section F.1.1. The source of the facility emissions is assumed to be that which is described under the Modeling Assumptions subsection in each of the preceding descriptions of the sites. The model input data include the emission inventories for each of the facilities as presented in Tables F.1.3–1 through F.1.3–14.

Table F.1.3–1. Emission Rates of Pollutants for Upgrade of Existing Facilities

Pollutant	Hanford[b] (kg/yr)	INEL: Without RFETS or LANL Material (kg/yr)	INEL: With RFETS and LANL Material (kg/yr)	Pantex: With RFETS Pits (kg/yr)	Pantex: Without RFETS or LANL Material (kg/yr)	Pantex: With RFETS and LANL Material (kg/yr)	ORR (kg/yr)	SRS[a]: With RFETS Non-pit Material (kg/yr)	SRS[a]: With RFETS and LANL Material (kg/yr)
Criteria Pollutants									
CO	51.7	900	920	0	0	3,700	c	91	122
NO_2[d]	200	3,000	3,000	0	0	4,600	c	2,951	4,037
PM_{10}[e]	4.54	1,000	1,100	0	0	1,200	c	227	308
SO_2	3.36	4,900	5,200	0	0	85	c	8,626	11,884
Total suspended particulates[e]	4.54	1,000	1,100	0	0	1,200	c	227	308
Volatile organic compounds	50.8	84	86	0	0	550	c	23	32
Toxic/Hazardous Pollutants				0	0				
Ammonia	0	0	0	0	0	0	0	0	0
Chlorine	0	<1	<1	0	0	5	c	0	0
Hydrazine	0	<1	<1	0	0	<1	c	0	0
Hydrogen chloride	0	1	1	0	0	0	11.3	0	0
Hydrogen fluoride	0	1	1	0	0	0	11.3	0	0
Nitric acid	0	0	0	0	0	6	113.4	0	0
Phosphoric acid	0	<1	<1	0	0	<1	c	0	0
Sulfuric acid	0	<1	<1	0	0	<1	c	0	0

[a] Applies only to the incremental emissions associated with the upgrade subalternatives (RFETS non-pit subalternative and RFETS and LANL subalternative). The emissions associated with the storage of SRS plutonium in the Actinide Storage and Packaging Facility are included in the No Action emissions.
[b] Applies to both with and without RFETS and LANL Pu material.
[c] No sources of this pollutant have been identified.
[d] For some upgrades, the associated data report states the emission is NO_x. In these instances, NO_x is conservatively assumed to be NO_2.
[e] It is assumed that PM_{10} emissions are total suspended particulate emissions.
Source: DOE 1996e; FDI 1996a:1; HF DOE 1995e:1; HF DOE 1996a; IN DOE 1996a; OR MMES 1996a; PX MH 1994a; SR DOE 1994e; SRS 1996a:4.

Table F.1.3–2. Emission Rates of Pollutants for the Consolidated Plutonium Storage Facility

		NTS			Pantex		
Pollutant	**Hanford (kg/yr)**	**New Facility and Modify P-Tunnel (kg/yr)**	**New Facility (kg/yr)**	**INEL (kg/yr)**	**New Facility and Modify Zone 12 South (kg/yr)**	**New Facility (kg/yr)**	**SRS (kg/yr)**
Criteria Pollutants							
CO	520	2,500	2,300	3,400	3,700	3,300	1,600
NO_2	2,000	3,600	3,400	97,000	4,600	4,300	38,000
PM_{10}[a]	50	780	700	6,900	1,200	1,100	2,600
SO_2	34	70	62	160,000	85	79	61,000
Total suspended particulates[a]	50	780	700	6,900	1,200	1,100	2,600
Volatile organic compounds	58	370	330	400	550	500	190
Toxic/Hazardous Pollutants							
Chlorine	5	8	5	3	5	4	8
Hydrazine	<1	<1	<1	<1	<1	<1	<1
Nitric acid	6	5	6	6	6	6	6
Phosphoric acid	<1	<1	<1	<1	<1	<1	<1
Sulfuric acid	<1	<1	<1	<1	<1	<1	<1

[a] It is assumed that PM_{10} emissions are TSP emissions.

Source: DOE 1996e; NT DOE 1996a; PX DOE 1996a.

Table F.1.3–3. Emission Rates of Pollutants for the Collocated Plutonium and Highly Enriched Uranium Storage Facilities

Pollutant	Hanford (kg/yr)	NTS: New Facility and Modify P-Tunnel (kg/yr)	NTS: New Facility (kg/yr)	INEL (kg/yr)	Pantex (kg/yr)	ORR: New Pu Storage Facility Only (kg/yr)	ORR: New Pu Storage Facility and Upgrade Y–12 (kg/yr)	ORR: New Pu and HEU Facilities (kg/yr)	SRS (kg/yr)
Criteria Pollutants									
CO	520	2,800	2,500	4,000	3,800	1,900	1,900	2,100	1,700
NO_2	2,000	3,800	3,600	120,000	4,600	48,000	48,000	55,000	42,000
PM_{10}[a]	50	890	780	8,200	1,300	3,300	3,450	3,800	2,900
SO_2	34	70	66	200,000	86	79,000	79,000	90,000	69,000
Total suspended particulates[a]	50	890	780	8,200	1,300	3,300	3,300	3,800	2,900
Volatile organic compounds	58	420	370	470	570	220	220	250	200
Toxic/Hazardous Pollutants									
Chlorine	6	8	6	4	5	6	6	8	10
Nitric acid	95	5	95	95	95	6	119	95	95
Hydrazine	<1	<1	<1	<1	<1	<1	<1	<1	<1
Hydrogen chloride	9.0	9.0	9.0	9.0	9.0	[b]	11.3	9.0	9.0
Hydrogen fluoride	9.0	9.0	9.0	9.0	9.0	[b]	11.3	9.0	9.0
Phosphoric acid	<1	<1	<1	<1	<1	<1	<1	<1	<1
Sulfuric acid	<1	<1	<1	<1	<1	<1	<1	<1	<1

[a] It is assumed that PM_{10} emissions are total suspended particulates emissions.
[b] No sources of this pollutant have been identified.
Source: DOE 1996e; DOE 1996f; NT DOE 1996a; OR MMES 1996a.

Table F.1.3–4. Emission Rates of Pollutants for the Pit Disassembly/Conversion Facility

Pollutant	Hanford (kg/yr)	NTS (kg/yr)	INEL (kg/yr)	Pantex (kg/yr)	ORR (kg/yr)	SRS (kg/yr)
Criteria Pollutants						
CO	a	a	a	a	a	a
NO_2	a	a	a	a	a	a
PM_{10}	a	a	a	a	a	a
SO_2	a	a	a	a	a	a
Total suspended particulates	a	a	a	a	a	a
Volatile organic compounds	1,500	1,500	1,500	1,500	1,500	1,500
Toxic/Hazardous Pollutants						
Cleaning solvents	750	750	750	750	750	750

[a] No sources of this pollutant have been identified. The pit disassembly/conversion process involves pure Pu materials that would not require chemical processing. The emissions estimates for the facility are based on data from similar processes at LANL's TA-55 facility. The ventilation system for the pit disassembly/conversion facility would be used specifically for contamination control and would use a large volume of air to assure contamination control. Primary confinement would be provided by a glove box system and associated zone air-handling system. There would be four stages of HEPA filters on the glovebox exhaust that would eliminate (or reduce below detection limits) a minimum of 99.95 percent of nonradioactive particulates. Radioactive particulate emissions are discussed in Section 4.3.1.9. The glovebox exhaust would be mixed with room air exhaust, which also has two stages of HEPA filters. The use of HEPA filters would not reduce VOC emissions because VOCs are not in a particulate form. There would also be process-specific scrubbers, vacuum traps, and filters that reduce the chance of criteria or toxic/hazardous pollutants releases from occurring. Because of the processing technology (which does not create some of the criteria pollutants), the defense-in-depth for Pu processing systems, and the extensive HEPA filtration (which removes the remaining criteria pollutants), emissions for criteria pollutants other than VOCs are expected to be below detection limits.

Source: LANL 1996d.

Table F.1.3–5. Emission Rates of Pollutants for the Plutonium Conversion Facility

Pollutant	Hanford (kg/yr)	NTS (kg/yr)	INEL (kg/yr)	Pantex (kg/yr)	ORR (kg/yr)	SRS (kg/yr)
Criteria Pollutants						
CO	4,000	4,000	4,000	4,000	4,000	4,000
NO_2 [a]	4,500	4,500	4,500	4,500	4,500	4,500
PM_{10} [b]	12	12	12	12	12	12
SO_2	10	10	10	10	10	10
Total suspended particulates[b]	12	12	12	12	12	12
Toxic/Hazardous Pollutants						
Ammonia	10	10	10	10	10	10
Chlorine	7.5	7.5	7.5	7.5	7.5	7.5
Ethanol	20	20	20	20	20	20
Hydrogen chloride	12	12	12	12	12	12
Hydrogen fluoride	0.8	0.8	0.8	0.8	0.8	0.8
Hydrazine	<1	<1	<1	<1	<1	<1
Toxic/Hazardous Pollutants (continued)						
Nitric Acid	3	3	3	3	3	3
Phosphoric acid	<1	<1	<1	<1	<1	<1
Sulfuric acid	<1	<1	<1	<1	<1	<1
Trichloroethylene	450	450	450	450	450	450
Cleaning solvents	100	100	100	100	100	100

[a] The data report states the emission is NO_x but has been conservatively assumed to be NO_2.
[b] It is assumed that PM_{10} emissions are TSP emissions.
Source: LANL 1996c.

Table F.1.3–6. Emission Rates of Pollutants for the Generic Mixed Oxide Fuel Fabrication Facility

Pollutant	Hanford (kg/yr)	NTS (kg/yr)	INEL (kg/yr)	Pantex (kg/yr)	ORR (kg/yr)	SRS (kg/yr)	Generic (kg/yr)
Criteria Pollutants							
CO	[a]	[a]	[a]	[a]	[a]	[a]	[a]
NO_2	[a]	[a]	[a]	[a]	[a]	[a]	[a]
PM_{10}	[a]	[a]	[a]	[a]	[a]	[a]	[a]
SO_2	[a]	[a]	[a]	[a]	[a]	[a]	[a]
Total suspended particulates	[a]	[a]	[a]	[a]	[a]	[a]	[a]
Volatile organic compounds	1,000	1,000	1,000	1,000	1,000	1,000	1,000
Toxic/Hazardous Pollutants							
Cleaning solvents	<2,500	<2,500	<2,500	<2,500	<2,500	<2,500	<2,500

[a] No sources of this pollutant have been identified. The MOX fuel fabrication process involves pure Pu materials that would require minimal chemical processing. The emissions estimates for the facility are based on operational experience at European MOX facilities, the glovebox ventilation system design, and the actual process. Feed material preparation and fabrication of fuel pellets would be done in gloveboxes to control contamination for normal operations. The ventilation system for the MOX fuel fabrication facility would be used specifically for contamination control and would use a large volume of air to assure contamination control. There would be essentially four stages of HEPA filters on the glovebox exhaust that would eliminate (or reduce below detection limits) a minimum of 99.95 percent of nonradioactive particulates. Radioactive particulate emissions are discussed in Section 4.3.5.1.9. The glovebox exhaust would be mixed with room air exhaust, which also has two stages of HEPA filters for further filtration before release to the environment. The use of HEPA filters would not reduce VOC emissions because VOCs are not in a particulate form. There would be process-specific scrubbers, vacuum traps, and filters that reduce the chance of criteria or toxic/hazardous pollutant releases from occurring. Because of the processing technology (which does not create some of the criteria pollutants), the defense-in-depth for Pu processing systems, and the extensive HEPA filtration (which removes the remaining criteria pollutants), emissions for criteria pollutants other than VOCs are expected to be below detection limits.

Source: LANL 1996b.

Table F.1.3–7. Emission Rates of Pollutants for the Direct Disposition Alternative—Deep Borehole Complex

Pollutant	Generic[a] (kg/yr)
Criteria Pollutants	
CO	11,263
NO_2[b]	30,898
PM_{10}[c]	11,812
SO_2	2,822
Total suspended particulates[c]	11,812
Toxic/Hazardous Pollutants	
Hydrocarbons	2,831

[a] Includes the surface processing and the drilling and emplacing-borehole sealing facilities.
[b] The data report states the emission is NO_x but has been conservatively assumed to be NO_2.
[c] It is assumed that PM_{10} emissions are total suspended particulate emissions.
Source: LLNL 1996a.

Table F.1.3–8. Emission Rates of Pollutants for the Immobilization Disposition Alternative—Ceramic Immobilization Facility and Deep Borehole Complex

Pollutant	Hanford (kg/yr)	NTS (kg/yr)	INEL (kg/yr)	Pantex (kg/yr)	ORR (kg/yr)	SRS (kg/yr)	Generic Borehole (kg/yr)
Criteria Pollutants							
CO	32,000	32,000	32,000	32,000	32,000	32,000	11,235
NO_2[a]	9,000	9,000	9,000	9,000	9,000	9,000	31,344
PM_{10}[b]	400	400	400	400	400	400	11,340
SO_2	500	500	500	500	500	500	2,799
Total suspended particulates[b]	400	400	400	400	400	400	11,340
Volatile organic compounds	95	95	95	95	95	95	trace
Toxic/Hazardous Pollutants							
Hydrocarbons	950	950	950	950	950	950	2,806

[a] The data report states the emission is NO_x but has been conservatively assumed to be NO_2.
[b] It is assumed that PM_{10} emissions are TSP emissions.
Source: LLNL 1996e; LLNL 1996h.

Table F.1.3–9. Emission Rates of Pollutants for the Vitrification Alternative

Pollutant	Hanford (kg/yr)	NTS (kg/yr)	INEL (kg/yr)	Pantex (kg/yr)	ORR (kg/yr)	SRS (kg/yr)
CO	72,000	72,000	72,000	72,000	72,000	72,000
NO_2	72,000	72,000	72,000	72,000	72,000	72,000
PM_{10}[a]	573	573	573	573	573	573
SO_2	1,845	1,845	1,845	1,845	1,845	1,845
Total suspended particulates[a]	573	573	573	573	573	573
Volatile organic compounds	14,500	14,500	14,500	14,500	14,500	14,500

[a] It is assumed that PM_{10} emissions are TSP emissions.
Source: LLNL 1996c.

Table F.1.3–10. Emission Rates of Pollutants for the Ceramic Immobilization Alternative

Pollutant	Hanford (kg/yr)	NTS (kg/yr)	INEL (kg/yr)	Pantex (kg/yr)	ORR (kg/yr)	SRS (kg/yr)
CO	250,000	250,000	250,000	250,000	250,000	250,000
NO_2[a]	660,000	660,000	660,000	660,000	660,000	660,000
PM_{10}[b]	770	770	770	770	770	770
SO_2	68.0	68.0	68.0	68.0	68.0	68.0
Total suspended particulates[b]	770	770	770	770	770	770
Volatile organic compounds	81	81	81	81	81	81

[a] The data report states the emission is NO_x but has been conservatively assumed to be NO_2.
[b] It is assumed that PM_{10} emissions are total suspended particulate emissions.
Source: LLNL 1996d.

Table F.1.3–11. Emission Rates of Pollutants for the Electrometallurgical Treatment Alternative

Pollutant	(kg/yr)
CO	42
NO_2[a]	191
PM_{10}[b]	15
SO_2	20
Total suspended particulates[b]	15
Volatile organic compounds	45

[a] The data report states the emission is NO_x but has been conservatively assumed to be NO_2.
[b] It is assumed that PM_{10} emissions are total suspended particulate emissions.
Source: LLNL 1996b.

Table F.1.3–12. Emission Rates of Pollutants for the Existing Light Water Reactor

Pollutant	Uranium Fuel (kg/yr)[a]	MOX Fuel (kg/yr)[b]
Criteria Pollutants		
CO	40.8	40.8
NO_2	114,307	114,307
PM_{10}[c]	8,755	8,755
SO_2	85,731	85,731
Total suspended particulates[c]	8,755	8,755
Toxic/Hazardous Pollutants		
Hydrocarbons	2,223	2,223

[a] [Text deleted.] Emissions rates from the partially completed LWR are representative for existing LWRs.
[b] No increase in nonradioactive air pollutant emission is expected. During operation, concentrations of criteria and toxic/hazardous air pollutants are expected to continue to be in compliance with Federal, State, and local air quality regulations or guidelines. No additional operation or testing of diesel generators or emissions from support facilities would be expected to occur from the use of MOX fuel. Pollutant concentrations from operating an existing LWR with a MOX core rather than a uranium core would not change. The process would remain the same, because criteria and toxic/hazardous emissions are not related to the type of fuel being used (NRC 1996b:2-22).
[c] It is assumed that PM_{10} emissions are total suspended particulate emissions.
Source: ORNL 1995b; derived from TVA 1974a.

Table F.1.3–13. Emission Rates of Pollutants for the Partially Completed Light Water Reactor

Pollutant	(kg/yr)
Criteria Pollutants	
CO	40.8
NO_2	114,307
PM_{10}[a]	8,755
SO_2	85,731
Total suspended particulates[a]	8,755
Toxic/Hazardous Pollutants	
Hydrocarbons	2,223

[a] It is assumed that PM_{10} emissions are total suspended particulate emissions.

Note: Emission rates estimated for one operating unit.

Source: Derived from TVA 1974a.

Table F.1.3–14. Emission Rates of Pollutants for the Evolutionary Light Water Reactor

Pollutant	Hanford (kg/yr)	NTS (kg/yr)	INEL (kg/yr)	Pantex (kg/yr)	ORR (kg/yr)	SRS (kg/yr)
CO	<45	<45	<45	<45	<45	<45
NO_2	2,630	2,630	2,630	2,630	2,630	2,630
PM_{10}[a]	0	0	0	0	0	0
SO_2	450	450	450	450	450	450
Total suspended particulates[a]	0	0	0	0	0	0

[a] It is assumed that PM_{10} emissions are total suspended particulates emissions.

Source: LLNL 1996g.

F.2 NOISE

This section summarizes local noise regulations and presents available sound level monitoring data for the sites. A discussion of operation noise sources and the potential for noise impacts is provided in PEIS Chapter 3, Affected Environment, and Chapter 4, Environmental Consequences. Any further analysis of operation noise impacts, including traffic noise impacts and impacts from outside sources, has been deferred to the tiered, site-specific *National Environmental Policy Act* documents.

The Occupational Safety and Health Administration standards for occupational noise exposure (29 CFR 1910.95) are applicable for worker protection at each site.

F.2.1 HANFORD SITE

Studies of noise at Hanford are discussed in Chapter 3 and in detail in *Hanford Site National Environmental Policy Act Characterization* (PNL-6415 Rev. 6, August 1994).

The State of Washington Department of Ecology has adopted regulations in Washington Administrative Code 173-60 through 173-70 which limit environmental noise levels. Maximum noise levels are defined for zoning of an area in accordance with Environmental Designation for Noise Abatement (EDNA). The Hanford Site is classified as a Class C EDNA on the basis of industrial activities. Unoccupied areas are also classified as Class C areas by default because they are neither Class A (residential) nor Class B (commercial). Maximum noise levels are established based on the EDNA classification of the receiving area and the source area (Table F.2.1–1) (HF PNL 1994a:4.144).

Table F.2.1–1. Applicable State Noise Limitations for Hanford Site Based on Source and Receptor Environmental Designation for Noise Abatement (dBA)

Source Hanford Site	Receptor		
	Class A Residential	Class B Commercial	Class C Industrial
Class C - Day	60	65	70
Class C - Night	50	-	-

Source: HF PNL 1994a.

F.2.2 NEVADA TEST SITE

No environmental noise survey data are available for NTS. The State of Nevada and Nye County have not established any regulations that specify acceptable community noise levels with the exception of general prohibitions on nuisance noise.

F.2.3 IDAHO NATIONAL ENGINEERING LABORATORY

Studies of noise at INEL are limited primarily to noise measurements along roadways. These are discussed in Chapter 3 and in *NPR Environmental Impacts at the INEL: Air Quality, Cooling Towers, and Noise* (NPRD-90-059). The State of Idaho and the counties in which the INEL is located have not established any regulations that specify acceptable community noise levels, with the exception of general prohibitions on nuisance noise.

F.2.4 PANTEX PLANT

A study of sound levels near Pantex consists of data collected along roads for short periods of time during peak traffic and for specific noise events at Pantex. Neither the State of Texas nor the local government have established regulations that specify acceptable sound levels applicable to Pantex, with the exception of general prohibitions on nuisance noise.

F.2.5 OAK RIDGE RESERVATION

Sound level measurements have been recorded at various locations within and near ORR as discussed in Chapter 3 and documented by Cleaves (ORR 1991a:2) and Knazovich (ORR 1991a:6). Maximum allowable noise limits for the city of Oak Ridge are presented in Table F.2.5–1.

Table F.2.5–1. City of Oak Ridge Maximum Allowable Noise Limits Applicable to Oak Ridge Reservation

Adjacent Use	Where Measured	Maximum Sound Level (dBA)
All residential districts	Common lot line	50
Neighborhood business district	Common lot line	55
General business district	Common lot line	60
Industrial district	Common lot line	65
Major street	Street lot line	75
Secondary residential street	Street lot line	60

Note: dBA=decibel A-weighted.
Source: OR City 1985a.

F.2.6 SAVANNAH RIVER SITE

Ambient sound level data collected at SRS in 1989 and 1990 are summarized in *Sound-Level Characterization of the Savannah River Site* (NUS-5251). The States of Georgia and South Carolina, and the counties where SRS is located, have not yet established noise regulations that specify acceptable community noise levels except for a provision of the Aiken County Nuisance Ordinance that limits daytime and nighttime noise by frequency band (Table F.2.6–1).

Table F.2.6–1. Aiken County Maximum Allowable Noise Levels[a]

	Nighttime Sound Pressure Levels[b]	
Frequency Band (Hz)	**Nonresidential Lot Line (dB)**	**Residential Lot Line (dB)**
20-75	69	65
75-150	60	50
150-300	56	43
300-600	51	38
600-1,200	42	33
1,200- 2,400	40	30
2,400-4,800	38	28
4,800-10,000	35	20

[a] Daytime (7:00 a.m. - 9:00 p.m.) sound pressure levels: apply one of the following corrections (dB) to the nighttime levels above: daytime operation only, +5; source operates less than 20 percent of any 1-hour period, +5; source operates less than 5 percent of any 1-hour period, +10; source operates less than 1 percent of any 1-hour period, +15; noise of impulsive character, -5; noise of periodic character, -5.

[b] For the purpose of this ordinance, nighttime is the period 9:00 p.m. to 7:00 a.m.

Note: dB=decibel.

Source: SR County 1991a.

F.2.7 ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE

No sound level measurements have been made in the area near RFETS. Neither the State of Colorado nor the local government have established regulations that specify acceptable sound levels applicable to RFETS, with the exception of general prohibitions on nuisance noise.

F.2.8 LOS ALAMOS NATIONAL LABORATORY

No environmental noise survey data are available for LANL. The State of New Mexico has not established any regulation that specifies acceptable community noise levels with the exception of general prohibitions on nuisance noise.

Los Alamos County has adopted a noise ordinance that specifies maximum sound levels in residential areas. Sound levels at a residential property line are limited to 65 decibel A-weighted (dBA) during the hours 7 a.m. to 9 p.m., and to 53 dBA during the hours 9 p.m. to 7 a.m. The 65 dBA limit may be exceeded by up to 10 dBA for up to 10 minutes of any hour between 7 a.m. and 9 p.m.