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Fissile Materials Disposition

United States Department of Energy

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

Volume III

December 1996

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Final Programmatic Environmental Impact Statement/Volume III

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ABSTRACT: This document analyzes the potential environmental consequences of alternatives for the long-term storage (up to 50 years), including storage until disposition, and disposition of weapons-usable fissile materials from U.S. nuclear weapon dismantlements under the responsibility of the DOE. Long-term storage of nonsurplus inventories of weapons-usable plutonium (Pu) and highly enriched uranium (HEU) are required for national defense purposes, while the disposition of surplus weapons-usable Pu is necessary in order to implement our national nonproliferation policy. In addition to the No Action Alternative, this PEIS assesses three storage alternatives (that is, upgrade at multiple sites, consolidation of Pu, and collocation of Pu and HEU) at six DOE candidate sites located across the country. These sites are Hanford Site, Nevada Test Site, Idaho National Engineering Laboratory, Pantex Plant, Oak Ridge Reservation, and Savannah River Site. Although they are not candidate sites for storage, Rocky Flats Environmental Technology Site (RFETS) and Los Alamos National Laboratory are assessed for the No Action Alternative. For the disposition of surplus Pu, three alternative categories (that is, deep borehole, immobilization, and reactor) with nine primary alternatives are assessed at several DOE and representative sites for analysis purposes. Evaluations of impacts on site infrastructure, water resources, air quality and noise, socioeconomics, waste management, public and occupational health and safety, and environmental justice are included in the assessment. The intersite transportation of nuclear and hazardous materials is also assessed. DOE's Preferred Alternative is identified in this Final PEIS. The Preferred Alternative for storage is a combination of No Action and Upgrade Alternatives for the various DOE sites, and phaseout of Pu storage at RFETS. The Preferred Alternative for disposition of surplus Pu is to pursue a disposition strategy involving a combination of immobilization and reactor alternatives, including vitrification, ceramic immobilization, and existing reactors.

PUBLIC INVOLVEMENT: The DOE issued a Draft PEIS on March 8, 1996, and held a formal public comment period on the Draft through June 7, 1996. In preparing the Final PEIS, DOE considered comments received via mail, fax, electronic bulletin board (Internet), and transcripts of messages recorded by telephone. In addition, comments and concerns were recorded by notetakers during interactive public meetings held during March and April 1996 in Denver, CO, Las Vegas, NV, Oak Ridge, TN, Richland, WA, Idaho Falls, ID, Washington, DC, Amarillo, TX, and North Augusta, SC. Comments received and DOE's responses to those comments are found in Volume IV of the Final PEIS.

DOE/EIS-0229

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Volume III

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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.

TABLE OF CONTENTS

Table of Contents i
List of Figures ix
List of Tables xv
List of Acronyms and Abbreviations xlv
Chemicals and Units of Measure lii
Metric Conversion Chart and Metric Prefixes lv

Appendix A
Nonproliferation Policy and Joint Statement A–1

A.1 Nonproliferation and Export Control Policy Fact Sheet A–1
A.2 Nonproliferation of Weapons of Mass Destruction and the Means of Their Delivery A–4

Appendix B
Building and Facility Specifications B–1

B.1 Storage Facilities B–1
B.2 Facilities Common to Multiple Plutonium Disposition Alternatives B–18
B.3 Plutonium Disposition Facilities B–20

Appendix C
Materials, Resources, and Employment Requirements for Construction and Operations C–1

C.1 Construction Requirements C–1
C.1.1 Materials/Resources Required C–1
C.1.1.1 Long-Term Storage Alternatives C–1
C.1.1.2 Activities Common to Multiple Plutonium Disposition Alternatives C–6
C.1.1.3 Plutonium Disposition Alternatives C–8
C.1.2 Construction Worker Requirements C–12
C.1.2.1 Long-Term Storage Alternatives C–12
C.1.2.2 Activities Common to Multiple Plutonium Disposition Alternatives C–17
C.1.2.3 Plutonium Disposition Alternatives C–18
C.2 Requirements During Operations C–20
C.2.1 Utilities Required C–20
C.2.1.1 Long-Term Storage Alternatives C–20
C.2.1.2 Activities Common to Multiple Plutonium Disposition Alternatives C–22
C.2.1.3 Plutonium Disposition Alternatives C–23
C.2.2 Chemicals Utilized C–26
C.2.2.1 Long-Term Storage Alternatives C–26
C.2.2.2 Activities Common to Multiple Plutonium Disposition Alternatives C–34
C.2.2.3 Plutonium Disposition Alternatives C–35
C.2.3 Personnel Requirements C–39
C.2.3.1 Long-Term Storage Alternatives C–39
C.2.3.2 Activities Common to Multiple Plutonium Disposition Alternatives C–41
C.2.3.3 Plutonium Disposition Alternatives C–42

Appendix D
Water Usage D–1

D.1 Storage Alternatives D–1
D.2 Facilities Common to Multiple Plutonium Disposition Alternatives D–21
D.3 Disposition Alternatives D–24

Appendix E
Waste Management E–1

E.1 Overview E–1
E.1.1 Waste Categories E–1
E.1.2 Applicable Federal Statutes and Department of Energy Orders E–2
E.1.3 Waste Minimization and Pollution Prevention E–6
E.1.4 Waste Treatment, Storage, and Disposal E–6
E.1.5 Transportation E–10
E.1.6 Facility Transition Management E–10
E.2 Waste Management Activities E–12
E.2.1 Hanford Site E–12
E.2.2 Nevada Test Site E–29
E.2.3 Idaho National Engineering Laboratory E–33
E.2.4 Pantex Plant E–49
E.2.5 Oak Ridge Reservation E–63
E.2.6 Savannah River Site E–97
E.3 Project-Specific Waste Management Activities E–113
E.3.1 Fissile Material Long-Term Storage Facilities E–113
E.3.1.1 Upgrade Alternative E–116
E.3.1.2 Consolidation Alternative E–128
E.3.1.3 Collocation Alternative E–139
E.3.2 Facilities Common to Multiple Plutonium Disposition Alternatives E–151
E.3.2.1 Pit Disassembly/Conversion Facility E–151
E.3.2.2 Plutonium Conversion Facility E–157
E.3.2.3 Generic Mixed Oxide Fuel Fabrication Facility E–162
E.3.3 Facilities to Support Final Disposition of Plutonium E–167
E.3.3.1 Direct Disposition Alternative—Deep Borehole Complex E–167
E.3.3.2 Immobilized Disposition Alternative—Deep Borehole Complex E–171
E.3.3.3 Immobilized Disposition Alternative—Ceramic Immobilization Facility E–175
E.3.3.4 Vitrification Alternative E–179
E.3.3.5 Ceramic Immobilization Alternative E–184
E.3.3.6 Electrometallurgical Treatment Alternative (Glass-Bonded Zeolite) E–188
E.3.3.7 Evolutionary Light Water Reactor Alternative E–192

Appendix F
Air Quality and Noise F–1

F.1 Air Quality F–1
F.1.1 Methodology and Models F–1
F.1.2 Supporting Data F–2
F.1.2.1 Overview F–2
F.1.2.2 Hanford Site F–2
F.1.2.3 Nevada Test Site F–6
F.1.2.4 Idaho National Engineering Laboratory F–8
F.1.2.5 Pantex Plant F–11
F.1.2.6 Oak Ridge Reservation F–13

F.1.2.7 Savannah River Site F–16
F.1.2.8 Rocky Flats Environmental Technology Site F–17
F.1.2.9 Los Alamos National Laboratory F–19
F.1.3 Air Pollutant Emissions F–23
F.2 Noise F–31
F.2.1 Hanford Site F–31
F.2.2 Nevada Test Site F–32
F.2.3 Idaho National Engineering Laboratory F–32
F.2.4 Pantex Plant F–32
F.2.5 Oak Ridge Reservation F–32
F.2.6 Savannah River Site F–33
F.2.7 Rocky Flats Environmental Technology Site F–33
F.2.8 Los Alamos National Laboratory F–33

Appendix G
Intersite Transportation G–1

G.1 Transportation Risk Analysis Methodology G–1
G.1.1 Truck and Rail Transportation Risk G–1
G.1.2 Risk Associated With Port Handling and Global Commons for European Mixed Oxide Fuel Fabrication G–3
G.1.2.1 Port Transit and Intermodal Handling Analysis (Accident-Free Conditions) G–3
G.1.2.2 Port Transit and Intermodal Handling Analysis (Accident Conditions) G–3
G.1.2.3 Modal Considerations G–4
G.1.2.4 Port Handling Impacts G–5
G.1.2.5 Effects on the Global Commons G–6
G.1.2.6 Security Considerations in the Global Commons, and at European MOX Facilities G–7
G.2 Historical Intersite Transportation Shipment Data G–8
G.3 Highway distance G–8
G.4 Transportation Equipment G–8
G.5 6M, Type B Radioactive Material Shipment Packaging Test Sequence G–26
G.6 Safe Secure Transport G–26

Appendix H
High-Level Waste Forms Comparative Analysis H–1

H.1 Methodology H–1
H.2 Glass Form With Radionuclides H–1
H.2.1 Assumptions H–2
H.2.2 Characteristics H–2
H.2.3 Comparative Analysis H–2
H.3 Ceramic Immobilized Forms with Radionuclides H–4
H.3.1 Assumptions H–4
H.3.2 Characteristics H–6
H.3.3 Comparative Analysis H–6
H.4 Boiling Water Reactor—Mixed Oxide Burning Reactor Spent Nuclear Fuel Form H–7
H.4.1 Assumptions H–7
H.4.2 Characteristics H–8
H.4.3 Comparative Analysis H–8
H.5 Pressurized Water Reactor—Mixed Oxide Burning Reactor Spent Nuclear Fuel Form H–9

H.5.1 Assumptions H–9
H.5.2 Characteristics H–10
H.5.3 Comparative Analysis H–10
H.6 Glass-Bonded Zeolite Form H–10
H.6.1 Assumptions H–10
H.6.2 Characteristics H–11
H.6.3 Comparative Analysis H–11

Appendix I
Changes in Canadian Deuterium Uranium Reactor Operations I–1

Appendix J
Applicable Laws, Regulations, and Other Requirements J–1

Appendix K
Biological Resources K–1

Appendix L
Socioeconomics L–1
L.1 Introduction L–1

Appendix M
Health and Safety M–1
M.1 Introduction M–1
M.2 Radiological Impacts to Human Health During Normal Operations M–1
M.2.1 Background M–1
M.2.1.1 Nature of Radiation and Its Effects on Humans M–1
M.2.1.2 Health Effects M–5
M.2.2 Methodology for Estimating Radiological Impacts of Normal Operation M–8
M.2.2.1 GENII Computer Code M–8
M.2.2.2 Data and Assumptions M–9
M.2.2.3 Health Effects Calculations M–11
M.2.3 Storage and Disposition Facilities Information M–15
M.2.3.1 Radiological Releases to the Environment M–15
M.2.3.2 Radiological Impacts to In-Plant Workers M–16
M.2.4 Radiological Impacts at Hanford Site M–22
M.2.4.1 No Action M–22
M.2.4.2 Storage and Disposition M–30
M.2.5 Radiological Impacts at Nevada Test Site M–32
M.2.5.1 No Action M–38
M.2.5.2 Storage and Disposition M–38
M.2.6 Radiological Impacts at Idaho National Engineering Laboratory M–39
M.2.6.1 No Action M–47
M.2.6.2 Storage and Disposition M–51
M.2.7 Radiological Impacts at Pantex Plant M–52
M.2.7.1 No Action M–58
M.2.7.2 Storage and Disposition M–58
M.2.8 Radiological Impacts at Oak Ridge Reservation M–60
M.2.8.1 No Action M–74
M.2.8.2 Storage and Disposition M–76

M.2.9 Radiological Impacts at Savannah River Site M–78
M.2.9.1 No Action M–89
M.2.9.2 Storage and Disposition M–94
M.2.10 Radiological Impact at Rocky Flats Environmental Technology Site M–95
M.2.11 Radiological Impact at Los Alamos National Laboratory M–95
M.2.12 Deep Borehole Disposition Generic Site M–95
M.2.13 Generic Mixed Oxide Fuel Fabrication Site M–95
M.2.14 Existing Light-Water Reactor Generic Site M–95
M.2.15 Partially Completed Reactor Generic Site M–95
M.3 Hazardous Chemical Impacts to Human Health M–96
M.3.1 Background M–96
M.3.2 Chemical Toxicity Profiles M–98
M.3.3 Regulated Exposure Limits M–119
M.3.4 Hazardous Chemical Risk/Effects Calculations M–138
M.4 Human Health Studies: Epidemiology M–221
M.4.1 Background M–221
M.4.1.1 Study Designs M–221
M.4.1.2 Definitions M–222
M.4.2 Hanford Site M–224
M.4.3 Nevada Test Site M–230
M.4.4 Idaho National Engineering Laboratory M–233
M.4.5 Pantex Plant M–234
M.4.6 Oak Ridge Reservation M–235
M.4.7 Savannah River Site M–242
M.4.8 Rocky Flats Environmental Technology Site M–243
M.4.9 Los Alamos National Laboratory M–248
M.5 Facility Accidents M–251
M.5.1 Evaluation Methodologies and Assumptions M–251
M.5.1.1 Introduction M–251
M.5.1.1.1 Risk M–252
M.5.1.1.2 Uncertainties and Conservatism M–252
M.5.1.2 Safety Design Process M–253
M.5.1.3 Analysis Methodology M–254
M.5.1.3.1 Introduction M–254
M.5.1.3.2 MACCS Overview M–254
M.5.1.3.3 Methodology and Techniques M–255
M.5.1.3.4 Isotopic Spectra Used in the Storage and Disposition Accident Analyses M–256
M.5.2 Long-Term Storage Alternatives M–258
M.5.2.1 Consolidation of Plutonium Alternative M–258
M.5.2.1.1 Accident Scenarios and Source Terms M–258
M.5.2.1.2 Accident Impacts M–262
M.5.2.2 Collocation of Plutonium and Highly Enriched Uranium Alternatives M–267
M.5.2.2.1 Accident Scenarios and Source Terms M–267
M.5.2.2.2 Accident Impacts M–270
M.5.2.3 Upgrade of Existing Interim Storage Facilities at Hanford Site M–277
M.5.2.4 Upgrade of Existing Interim Storage Facilities at Idaho National Engineering Laboratory M–278
M.5.2.4.1 Accident Scenarios and Source Terms M–278
M.5.2.4.2 Accident Impacts M–283

M.5.2.5 Upgrade or Consolidation of Existing Interim Storage Facilities at Pantex Plant M–285
M.5.2.5.1 Accident Scenarios and Source Terms M–285
M.5.2.5.2 Accident Impacts M–292
M.5.2.5.3 Aircraft Crash M–292
M.5.2.6 Upgrade of Existing Interim Storage Facilities at Oak Ridge Reservation M–296
M.5.2.7 Upgrade of Existing Storage Facilities at Savannah River Site M–297
M.5.2.8 Nevada Test Site Storage Facility M–297
M.5.2.8.1 Accident Scenarios and Source Terms M–298
M.5.2.8.2 Accident Impacts M–302
M.5.3 Disposition Alternatives M–304
M.5.3.1 Pit Disassembly/Conversion Facility M–304
M.5.3.1.1 Accident Scenarios and Source Terms M–304
M.5.3.1.2 Accident Impacts M–308
M.5.3.2 Mixed Oxide Fuel Fabrication Facility M–315
M.5.3.2.1 Accident Scenarios and Source Terms M–315
M.5.3.2.2 Accident Impacts M–319
M.5.3.3 Direct Disposition Alternative for a Deep Borehole Complex M–326
M.5.3.3.1 Accident Scenarios and Source Terms M–326
M.5.3.3.2 Accident Impacts M–332
M.5.3.4 Immobilized Disposition Alternative for a Deep Borehole Complex M–334
M.5.3.4.1 Accident Scenarios and Source Terms M–334
M.5.3.4.2 Accident Impacts M–341
M.5.3.5 Vitrification Alternative M–344
M.5.3.5.1 Accident Scenarios and Source Terms M–344
M.5.3.5.2 Accident Impacts M–348
M.5.3.6 Ceramic Immobilization Alternative M–355
M.5.3.6.1 Accident Scenarios and Source Terms M–355
M.5.3.6.2 Accident Impacts M–361
M.5.3.7 Ceramic Immobilization Facility for Immobilized Disposition Alternative M–368
M.5.3.7.1 Accident Scenarios and Source Terms M–368
M.5.3.7.2 Accident Impacts M–374
M.5.3.8 Evolutionary Light Water Reactor M–381
M.5.3.8.1 Accident Scenarios and Source Terms M–381
M.5.3.8.2 Accident Impacts M–384
M.5.3.9 Plutonium Conversion M–391
M.5.3.9.1 Accident Scenarios and Source Terms M–391
M.5.3.9.2 Accident Impacts M–395
M.5.3.10 Existing Commercial and Partially Completed Light Water Reactors M–402
M.5.3.11 Contribution of Americium, Curium, and Plutonium to Reactor Accident Consequences M–407

Appendix N
Multipurpose Reactor N–1
N.1 Background N–1
N.2 New Multipurpose Reactors N–2
N.3 Advanced Light Water Reactor N–3
N.4 Modular Helium Reactor and Modular High Temperature Gas-Cooled Reactor N–3

N.5 Cost Comparisons N–4
N.5.1 Advanced Light Water Reactor Costs N–4
N.5.2 Modular Helium Reactor Costs N–6
N.6 Fast Flux Test Facility N–7
N.7 Summary N–8

Appendix O
Can-in-Canister Variants O–1

O.1 Introduction O–1
O.2 Can-in-Canister Concept at Savannah River Site O–1
O.3 Vitrification Can-in-Canister Variant O–2
O.4 Ceramic Can-in-Canister Variant O–8
O.5 Repository Acceptance O–13
O.6 Tests and Demonstrations O–14

Appendix P
Manzano Storage Facility P–1

P.1 Manzano Weapons Storage Area P–2
P.2 Affected Environment and Environmental Impacts P–2
P.2.1 Land Resources P–2
P.2.2 Site Infrastructure P–2
P.2.3 Air Quality and Noise P–5
P.2.3.1 Air Quality Affected Environment P–5
P.2.3.2 Air Quality Environmental Impacts P–5
P.2.3.3 General Conformity Determination P–6
P.2.3.4 Noise P–7
P.2.4 Water Resources P–7
P.2.5 Geology and Soils P–7
P.2.6 Biotic Resources P–7
P.2.7 Cultural Resources P–7
P.2.8 Socioeconomic Resources P–8
P.2.9 Occupational and Public Health P–8
P.2.9.1 Affected Environment P–8
P.2.9.2 Environmental Impacts P–9
P.2.9.3 Aircraft Accidents P–12
P.2.10 Waste Management P–13
P.2.11 Intrasite Transportation P–13
P.2.12 Environmental Justice P–15
P.2.12.1 Affected Environment P–15
P.2.12.2 Environmental Impacts P–17

Appendix Q
Storage of Rocky Flats Environmental Technology Site Plutonium Pits at Pantex Plant Q–1

Q.1 Introduction Q–1
Q.2 Pit Transfer and Storage Q–1
Q.3 Zone 4 West Staging Operations Q–2
Q.4 Radiological Exposure from Zone 4 Storage Q–2
Q.5 Other Impacts from Zone 4 storage Q–4

Appendix R
Aircraft Crash Accident at Pantex Plant R–1

LIST OF FIGURES

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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. D–19

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

Figure D.2–1 Typical Water Balance for the Pit Disassembly/Conversion Facility. D–22

Figure D.2–2 Typical Water Balance for the Plutonium Conversion Facility. D–22

Figure D.2–3 Typical Water Balance for the Mixed Oxide Fuel Fabrication Facility. D–23

Figure D.3–1 Typical Water Balance for the Deep Borehole Complex—Direct Disposition Alternative. D–25

Figure D.3–2 Typical Water Balance for the Deep Borehole Complex—Immobilized Disposition Alternative. D–26

Figure D.3–3 Typical Water Balance for the Ceramic Immobilization Facility—Immobilized Disposition Alternative. D–27

Figure D.3–4 Typical Water Balance for the Vitrification Alternative. D–28

Figure D.3–5 Typical Water Balance for the Ceramic Immobilization Alternative. D–29

Figure D.3–6 Typical Water Balance for the Electrometallurgical Treatment Alternative (Glass-Bonded Zeolite). D–30

Figure D.3–7 Typical Water Balance for the Evolutionary Light Water Reactor Alternative. D–31

Figure E.2.1–1 Tank Waste Management at Hanford Site. E–13

Figure E.2.3–1 Spent Nuclear Fuel Management at Idaho National Engineering Laboratory. E–34

Figure E.2.3–2 High-Level Waste Management at Idaho National Engineering Laboratory. E–36

Figure E.2.3–3 Transuranic Waste Management at Idaho National Engineering Laboratory. E–37

Figure E.2.3–4 Low-Level Waste Management at Idaho National Engineering Laboratory. E–38

Figure E.2.3–5 Mixed Waste Management at Idaho National Engineering Laboratory. E–40

Figure E.2.6–1 High-Level Waste Management at Savannah River Site. E–101

Figure E.2.6–2 Transuranic Waste Management at Savannah River Site. E–102

Figure E.2.6–3 Low-Level Waste Management at Savannah River Site. E–103

Figure E.2.6–4 Mixed Waste Management at Savannah River Site. E–104

Figure E.2.6–5 Hazardous Waste Management at Savannah River Site. E–105

Figure E.2.6–6 Nonhazardous Waste Management at Savannah River Site. E–106

Figure E.3.1.1–1 Overall Waste Management System for the Upgrade Alternative at Idaho National Engineering Laboratory, Argonne National Laboratory-West E–120

Figure E.3.1.1–2 Overall Waste Management System for the Upgrade Alternative at Pantex Plant. E–121

Figure E.3.1.1–3 Overall Waste Management System for the Upgrade Alternative at Savannah River Site. E–122

Figure E.3.1.2–1 Overall Waste Management System for the Consolidation Alternative at Hanford Site, Nevada Test Site, Idaho National Engineering Laboratory, or Pantex Plant. E–135

Figure E.3.1.2–2 Overall Waste Management System for the Consolidation Alternative at Savannah River Site. E–136

Figure E.3.1.2–3 Overall Waste Management System for the Consolidation Alternative—Modifying P-Tunnel and Constructing New Material Handling Building at Nevada Test Site. E–137

Figure E.3.1.2–4 Overall Waste Management System for the Consolidation Alternative—Modifying Existing and Constructing New Facility in Zone 12 South at Pantex Plant. E–138

Figure E.3.1.3–1 Overall Waste Management System for the Collocation Alternative at Hanford Site, Idaho National Engineering Laboratory, Nevada Test Site, or Pantex Plant. E–147

Figure E.3.1.3–2 Overall Waste Management System for the Collocation Alternative Constructing a New Plutonium Storage Facility; Maintaining or Upgrading Y–12 at Oak Ridge Reservation. E–148

Figure E.3.1.3–3 Overall Waste Management System for the Collocation Alternative—Constructing a New Plutonium and Highly Enriched Uranium Storage Facility at Oak Ridge Reservation or Savannah River Site. E–149

Figure E.3.1.3–4 Overall Waste Management System for the Collocation Alternative—Modifying P-Tunnel and Constructing New Material Handling Building at Nevada Test Site. E–150

Figure E.3.2.1–1 Pit Disassembly/Conversion Facility Solid Waste Management Process Flow Diagram. E–155

Figure E.3.2.1–2 Pit Disassembly/Conversion Facility Liquid Waste Management Process Flow Diagram. E–156

Figure E.3.2.2–1 Plutonium Conversion Facility Waste Management Process Flow Diagram E–161

Figure E.3.2.3–1 Generic Mixed Oxide Fuel Fabrication Facility Liquid Waste Management Process Flow Diagram. E–166

Figure E.3.2.3–2 Generic Mixed Oxide Fuel Fabrication Facility Solid Waste Management Process Flow Diagram. E–166

Figure E.3.3.1–1 Direct Disposition Alternative—Deep Borehole Complex Disposal Facility Waste Management Process Flow Diagram. E–170

Figure E.3.3.2–1 Immobilized Disposition Alternative—Deep Borehole Complex Disposal Facility Waste Management Process Flow Diagram. E–174

Figure E.3.3.3–1 Immobilized Disposition Alternative—Ceramic Immobilization Facility Waste Management Process Flow Diagram. E–178

Figure E.3.3.4–1 Vitrification Alternative—Vitrification Facility Waste Management Process Flow Diagram E–183

Figure E.3.3.5–1 Ceramic Immobilization Alternative—Waste Management Process Flow Diagram. E–187

Figure E.3.3.7–1 Evolutionary Light Water Reactor Alternative—Gaseous Waste Management Process Flow Diagram. E–196

Figure E.3.3.7–2 Evolutionary Light Water Reactor Alternative—Liquid Waste Management Process Flow Diagram. E–196

Figure F.1.2.2–1 Wind Distribution at Hanford Site, 1989-1990 (10-meter level). F–5

Figure F.1.2.3–1 Wind Distribution at Nevada Test Site, 1991 (10-meter level). F–7

Figure F.1.2.4–1 Wind Distribution at Idaho National Engineering Laboratory, 1992 (10-meter level). F–9

Figure F.1.2.5–1 Wind Distribution at Amarillo, 1991 (10-meter level). F–11
Figure F.1.2.6–1 Wind Distribution at Oak Ridge Reservation, 1990 (30-meter level). F–14
Figure F.1.2.7–1 Wind Distribution at Savannah River Site, 1991 (61-meter level). F–16
Figure F.1.2.8–1 Wind Distribution at Rocky Flats Environmental Technology Site, 1990 (61-meter level). F–19
Figure F.1.2.9–1 Wind Distribution at Los Alamos National Laboratory, 1991 (11.5-meter level). F–21
Figure G.4–1 Typical Assembly of 6M, Type B Packaging for Plutonium (Other Than Pits) or Highly Enriched Uranium. G–20
Figure G.4–2 Cargo Restraint Transporter Loaded With Drums. G–21
Figure G.4–3 Assembly of FL, Type B Packaging for the Transport of Plutonium Pits. G–22
Figure G.4–4 AT-400A Packaging for the Transport of Plutonium Pits. G–23
Figure G.4–5 Representation of the BUSS Cask for the Transport of Cesium Material. G–24
Figure G.4–6 Diagram of a Representative Spent Fuel Cask with Similar Characteristics to Be Employed for the Transport of Immobilized Plutonium. G–25
Figure H.2.1–1 Schematic of Waste Package Containing Canisters of Plutonium Immobilized in Glass. H–3
Figure H.2.3–1 Thermal Comparison of Plutonium-Loaded Glass Waste Package Versus Defense Waste Processing Facility Glass Waste Package. H–4
Figure H.3.1–1 Schematic of Waste Package Containing Canisters of Plutonium Immobilized in Ceramic. H–5
Figure H.3.3–1 Thermal Comparison of Plutonium-Loaded Ceramic Waste Package Versus Defense Waste Processing Facility Glass Waste Package. H–7
Figure H.4.3–1 Effective Multiplication Factor (k_{eff}) of a Boiling Water Reactor Spent Fuel Waste Package. H–8
Figure H.4.3–2 Thermal Comparison of Peak Cladding Temperature of Boiling Water Reactor Fuel Element Versus Uranium-Based Reactor Fuel Element. H–9
Figure H.5.3–1 Thermal Comparison of Peak Cladding Temperature of Pressurized Water Reactor Fuel Element Versus Uranium-Based Reactor Fuel Element. H–11
Figure I–1 Mixed Oxide Fuel Cycle. I–2
Figure M.2.4–1 Location of Release Points and Maximum Receptors at Hanford Site. M–24
Figure M.2.5–1 Location of Release Points and Maximum Receptors at Nevada Test Site. M–34
Figure M.2.6–1 Location of Release Points and Maximum Receptors at Idaho National Engineering Laboratory. M–42
Figure M.2.7–1 Location of Release Points and Maximum Receptors at Pantex Plant. M–54
Figure M.2.8–1 Location of Release Points and Maximum Receptors at Oak Ridge Reservation. M–65
Figure M.2.9–1 Location of Release Points and Maximum Receptors at Savannah River Site. M–81
Figure O.3–1 Vitrification Can-in-Canister Variant Process. O–3

Figure O.3–2 Can-in-Canister Material Flow Diagram for Operations at Savannah River Site. O–4

Figure O.3–3 Savannah River Site F-Area Layout Showing Building 221-F. O–5

Figure O.3–4 Savannah River Site S-Area Layout Showing Defense Waste Processing Facility. O–7

Figure O.4–1 Ceramic Can-in-Canister Variant Process. O–10

Figure P.1–1 The Manzano Weapons Storage Area at Kirtland Air Force Base, New Mexico. P–3

Figure P.1–2 Layout of the Manzano Weapons Storage Area at Kirtland Air Force Base. P–4

Figure P.2.9.1–1 Offsite Populations in the Vicinity of the Manzano Weapons Storage Area. P–10

Figure P.2.9.1–2 Wind Direction and Speed at Albuquerque International Airport. P–11

Figure P.2.9.3–1 Type D Storage Facility at the Manzano Weapons Storage Area. P–14

Figure P.2.12.1–1 The Manzano Weapons Storage Area Region of Influence. P–16

Figure P.2.12.1–2 Minority and Low-Income Populations in the Manzano Weapons Storage Area Region of Influence. P–18

LIST OF TABLES

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

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

Table B.1–3 Facility Requirements for the Upgrade Alternative at Pantex Plant B–2

Table B.1–4 Facility Requirements for the Upgrade Alternative at Oak Ridge Reservation, Y–12 Plant B–2

Table B.1–5 Facility Requirements for the Upgrade Alternative at Savannah River Site B–2

Table B.1–6 Facility Requirements for the Consolidation Alternative at Hanford Site B–3

Table B.1–7 Facility Requirements for the Consolidation Alternative Option to Construct a New Facility at Nevada Test Site B–4

Table B.1–8 Facility Requirements for the Consolidation Alternative Option to Modify P-Tunnel at Nevada Test Site B–5

Table B.1–9 Facility Requirements for the Consolidation Alternative at Idaho National Engineering Laboratory B–6

Table B.1–10 Facility Requirements for the Consolidation Alternative Option to Construct a New Facility at Pantex Plant B–7

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 B–8

Table B.1–12 Facility Requirements for the Consolidation Alternative at Savannah River Site B–9

Table B.1–13 Facility Requirements for the Collocation Alternative at Hanford Site B–10

Table B.1–14 Facility Requirements for the Collocation Alternative Option to Construct a New Facility at Nevada Test Site B–11

Table B.1–15 Facility Requirements for the Collocation Alternative Option to Modify P-Tunnel at Nevada Test Site B–12

Table B.1–16 Facility Requirements for the Collocation Alternative at Idaho National Engineering Laboratory B–13

Table B.1–17 Facility Requirements for the Collocation Alternative at Pantex Plant B–14

Table B.1–18 Facility Requirements for the Collocation Alternative Option to Construct a New Facility at Oak Ridge Reservation B–15

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 B–16

Table B.1–20 Facility Requirements for the Collocation Alternative at Savannah River Site B–17

Table B.2–1 Facility Requirements for the Pit Disassembly/Conversion Facility B–18

Table B.2–2 Facility Requirements for the Plutonium Conversion Facility B–18

Table B.2–3 Facility Requirements for the Mixed Oxide Fuel Fabrication Facility B–19

Table B.3–1 Facility Requirements for the Deep Borehole Complex—Direct Disposition Alternative B–20

Table B.3–2 Facility Requirements for the Deep Borehole Complex—Immobilized Disposition Alternative B–21

Table B.3–3 Facility Requirements for the Ceramic Immobilization Facility—Immobilized Disposition Alternative B–22

Table B.3–4 Facility Requirements for the Vitrification Alternative B–22

Table B.3–5 Facility Requirements for the Ceramic Immobilization Alternative B–23

Table B.3–6 Facility Requirements for the Electrometallurgical Treatment Alternative (Glass-Bonded Zeolite) B–23

Table B.3–7 Facility Requirements for the Evolutionary Light Water Reactor Alternative B–24

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 C–2

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 C–3

Table C.1.1.1–3 Materials/Resources Required During Construction of the Consolidation Alternative C–4

Table C.1.1.1–4 Materials/Resources Required During Construction of the Collocation Alternative C–5

Table C.1.1.2–1 Materials/Resources Required During Construction of the Pit Disassembly/Conversion Facility C–6

Table C.1.1.2–2 Materials/Resources Required During Construction of the Plutonium Conversion Facility C–6

Table C.1.1.2–3 Materials/Resources Required During Construction of the Mixed Oxide Fuel Fabrication Facility C–7

Table C.1.1.3–1 Materials/Resources Required During Construction of the Deep Borehole Complex—Direct Disposition Alternative C–8

Table C.1.1.3–2 Materials/Resources Required During Construction of the Deep Borehole Complex—Immobilized Disposition Alternative C–8

Table C.1.1.3–3 Materials/Resources Required During Construction of the Ceramic Immobilization Facility—Immobilized Disposition Alternative C–9

Table C.1.1.3–4 Materials/Resources Required During Construction of the Vitrification Alternative C–9

Table C.1.1.3–5 Materials/Resources Required During Construction of the Ceramic Immobilization Alternative C–10

Table C.1.1.3–6 Materials/Resources Required During Construction of the Electrometallurgical Treatment Alternative (Glass-Bonded Zeolite) C–10

Table C.1.1.3–7 Materials/Resources Required During Construction of the Partially Completed Light Water Reactor Alternative C–11

Table C.1.1.3–8 Materials/Resources Required During Construction of the Evolutionary Light Water Reactor Alternative C–11

Table C.1.2.1–1 Employment Required During Construction of the Upgrade Alternative at Hanford Site C–12

Table C.1.2.1–2 Employment Required During Construction of the Upgrade Alternative at Idaho National Engineering Laboratory, Argonne National Laboratory-West C–12

Table C.1.2.1–3 Employment Required During Construction of the Upgrade Alternative at Pantex Plant C–12

Table C.1.2.1–4 Employment Required During Construction of the Upgrade Alternative at Oak Ridge Reservation C–13

Table C.1.2.1–5 Employment Required During Construction of the Upgrade Alternative at Savannah River Site C–13

Table C.1.2.1–6 Employment Required During Construction of the Consolidation Alternative at Hanford Site C–13

Table C.1.2.1–7 Employment Required During Construction of the Consolidation Alternative Option to Construct a New Facility at Nevada Test Site C–13

Table C.1.2.1–8 Employment Required During Construction of the Consolidation Alternative Option to Modify P-Tunnel at Nevada Test Site C–14

Table C.1.2.1–9 Employment Required During Construction of the Consolidation Alternative at Idaho National Engineering Laboratory C–14

Table C.1.2.1–10 Employment Required During Construction of the Consolidation Alternative Option to Construct a New Facility at Pantex Plant C–14

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 C–14

Table C.1.2.1–12 Employment Required During Construction of the Consolidation Alternative at Savannah River Site C–15

Table C.1.2.1–13 Employment Required During Construction of the Collocation Alternative at Hanford Site C–15

Table C.1.2.1–14 Employment Required During Construction of the Collocation Alternative Option to Construct a New Facility at Nevada Test Site C–15

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

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

Table C.1.2.1–17 Employment Required During Construction of the Collocation Alternative at Pantex Plant C–16

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 C–16

Table C.1.2.1–19 Employment Required During Construction of the Collocation Alternative Option to Construct a New Facility at Oak Ridge Reservation C–16

Table C.1.2.1–20 Employment Required During Construction of the Collocation Alternative at Savannah River Site C–16

Table C.1.2.2–1 Employment Required During Construction of the Pit Disassembly/Conversion Facility C–17

Table C.1.2.2–2 Employment Required During Construction of the Plutonium Conversion Facility C–17

Table C.1.2.2–3 Employment Required During Construction of the Mixed Oxide Fuel Fabrication Facility C–17

Table C.1.2.3–1 Employment Required During Construction of the Deep Borehole Complex—Direct Disposition Alternative C–18

Table C.1.2.3–2 Employment Required During Construction of the Deep Borehole Complex—Immobilized Disposition Alternative C–18

Table C.1.2.3–3 Employment Required During Construction of the Ceramic Immobilization Facility—Immobilized Disposition Alternative C–18

Table C.1.2.3–4 Employment Required During Construction of the Vitrification Alternative C–18

Table C.1.2.3–5 Employment Required During Construction of the Ceramic Immobilization Alternative C–19

Table C.1.2.3–6 Employment Required During Construction of the Electrometallurgical Treatment Alternative (Glass-Bonded Zeolite) C–19

Table C.1.2.3–7 Employment Required During Construction of the Partially Completed Light Water Reactor Alternative C–19

Table C.1.2.3–8 Employment Required During Construction of the Evolutionary Light Water Reactor Alternative C–19

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 C–20

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 C–20

Table C.2.1.1–3 Utilities Required During Operation of the Consolidation Alternative C–21

Table C.2.1.1–4 Utilities Required During Operation of the Collocation Alternative C–21

Table C.2.1.2–1 Utilities Required During Operation of the Pit Disassembly/Conversion Facility C–22

Table C.2.1.2–2 Utilities Required During Operation of the Plutonium Conversion Facility C–22

Table C.2.1.2–3 Utilities Required During Operation of the Mixed Oxide Fuel Fabrication Facility C–22

Table C.2.1.3–1 Utilities Required During Operation of the Deep Borehole Complex—Direct Disposition Alternative C–23

Table C.2.1.3–2 Utilities Required During Operation of the Deep Borehole Complex—Immobilized Disposition Alternative C–23

Table C.2.1.3–3 Utilities Required During Operation of the Ceramic Immobilization Facility—Immobilized Disposition Alternative C–23
Table C.2.1.3–4 Utilities Required During Operation of the Vitrification Alternative C–24
Table C.2.1.3–5 Utilities Required During Operation of the Ceramic Immobilization Alternative C–24
Table C.2.1.3–6 Utilities Required During Operation of the Electrometallurgical Treatment Alternative (Glass-Bonded Zeolite) C–24
Table C.2.1.3–7 Utilities Required During Operation of the Evolutionary Light Water Reactor Alternative C–25
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 C–26
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 C–28
Table C.2.2.1–3 Chemicals Required During Operation of the Consolidation Alternative C–30
Table C.2.2.1–4 Chemicals Required During Operation of the Collocation Alternative C–32
Table C.2.2.2–1 Chemicals Required During Operation of the Mixed Oxide Fuel Fabrication Facility C–34
Table C.2.2.3–1 Chemicals Required During Operation of the Deep Borehole Complex—Direct Disposition Alternative C–35
Table C.2.2.3–2 Chemicals Required During Operation of the Deep Borehole Complex—Immobilized Disposition Alternative C–35
Table C.2.2.3–3 Chemicals Required During Operation of the Ceramic Immobilization Facility—Immobilized Disposition Alternative C–36
Table C.2.2.3–4 Chemicals Required During Operation of the Vitrification Alternative C–36
Table C.2.2.3–5 Chemicals Required During Operation of the Ceramic Immobilization Alternative C–37
Table C.2.2.3–6 Chemicals Required During Operation of the Electrometallurgical Treatment Alternative (Glass-Bonded Zeolite) C–37
Table C.2.2.3–7 Chemicals Required During Operation of the Evolutionary Light Water Reactor Alternative C–38
Table C.2.3.1–1 Employment Required During Operation of the Upgrade Alternative C–39
Table C.2.3.1–2 Employment Required During Operation of the Consolidation Alternative C–40
Table C.2.3.1–3 Employment Required During Operation of the Collocation Alternative C–40
Table C.2.3.2–1 Employment Required During Operation of the Pit Disassembly/Conversion Facility C–41
Table C.2.3.2–2 Employment Required During Operation of the Plutonium Conversion Facility C–41
Table C.2.3.2–3 Employment Required During Operation of the Mixed Oxide Fuel Fabrication Facility C–42

Table C.2.3.3–1 Employment Required During Operation of the Deep Borehole Complex—Direct Disposition Alternative C–42
Table C.2.3.3–2 Employment Required During Operation of the Deep Borehole Complex—Immobilized Disposition Alternative C–43
Table C.2.3.3–3 Employment Required During Operation of the Ceramic Immobilization Facility—Immobilized Disposition Alternative C–43
Table C.2.3.3–4 Employment Required During Operation of the Vitrification Alternative C–43
Table C.2.3.3–5 Employment Required During Operation of the Ceramic Immobilization Alternative C–44
Table C.2.3.3–6 Employment Required During Operation of the Electrometallurgical Treatment Alternative (Glass-Bonded Zeolite) C–44
Table C.2.3.3–7 Employment Required During Operation of the Evolutionary Light Water Reactor Alternative C–44
Table E.1.1–1 Waste Categories E–1
Table E.1.4–1 Low-Level Waste Disposal Land Usage Factors for Department of Energy Sites E–9
Table E.2.1–1 Spent Nuclear Fuel Inventory at Hanford Site E–20
Table E.2.1–2 High-Level Waste Inventory at Hanford Site E–20
Table E.2.1–3 High-Level Waste Treatment Facilities at Hanford Site E–21
Table E.2.1–4 High-Level Waste Storage Facilities at Hanford Site E–21
Table E.2.1–5 Transuranic and Mixed Transuranic Waste Inventory at Hanford Site E–22
Table E.2.1–6 Transuranic and Mixed Transuranic Waste Treatment Facilities at Hanford Site E–22
Table E.2.1–7 Transuranic and Mixed Transuranic Waste Storage Facilities at Hanford Site E–23
Table E.2.1–8 Mixed Low-Level Waste Inventory at Hanford Site E–23
Table E.2.1–9 Low-Level Waste and Mixed Low-Level Waste Treatment Facilities at Hanford Site E–24
Table E.2.1–10 Low-Level Waste and Mixed Low-Level Waste Disposal Facilities at Hanford Site E–25
Table E.2.1–11 Low-Level Waste and Mixed Low-Level Waste Storage Facilities at Hanford Site E–26
Table E.2.1–12 Hazardous Waste Treatment Facilities at Hanford Site E–26
Table E.2.1–13 Hazardous Waste Storage Facility at Hanford Site E–27
Table E.2.1–14 Hazardous Waste Quantities Shipped Offsite in 1994 at Hanford Site E–27
Table E.2.2–1 Mixed Transuranic Waste Storage Facility at Nevada Test Site E–31
Table E.2.2–2 Low-Level and Mixed Low-Level Waste Storage and Disposal Facilities at Nevada Test Site E–31
Table E.2.2–3 Mixed Low-Level Waste Inventories at Nevada Test Site E–32
Table E.2.3–1 High-Level Waste Inventory at Idaho National Engineering Laboratory E–41

Table E.2.3–2 High-Level Waste Treatment Facilities at Idaho National Engineering Laboratory E–41
Table E.2.3–3 High-Level Waste Storage Facilities at Idaho National Engineering Laboratory E–42
Table E.2.3–4 Transuranic and Mixed Transuranic Waste Inventory at Idaho National Engineering Laboratory E–42
Table E.2.3–5 Transuranic and Mixed Transuranic Waste Treatment Facilities at Idaho National Engineering Laboratory E–43
Table E.2.3–6 Transuranic and Mixed Transuranic Waste Storage Facilities at Idaho National Engineering Laboratory E–44
Table E.2.3–7 Mixed Low-Level Waste Inventory at Idaho National Engineering Laboratory E–44
Table E.2.3–8 Mixed Low-Level Waste and Low-Level Waste Treatment Facilities at Idaho National Engineering Laboratory E–45
Table E.2.3–9 Mixed Low-Level Waste and Low-Level Waste Storage Facilities at Idaho National Engineering Laboratory E–47
Table E.2.3–10 Hazardous Waste Quantities Shipped Offsite in 1994 at Idaho National Engineering Laboratory E–48
Table E.2.4–1 Waste Treatment Facilities and Capabilities at Pantex Plant E–52
Table E.2.4–2 Waste Storage Facilities at Pantex Plant E–53
Table E.2.4–3 Low-Level Waste Streams at Pantex Plant E–54
Table E.2.4–4 Low-Level Waste Inventory at Pantex Plant E–55
Table E.2.4–5 Mixed Low-Level Waste Streams at Pantex Plant E–56
Table E.2.4–6 Organic Liquid Waste Streams Candidates for Commercial Treatment and/or Disposal E–58
Table E.2.4–7 Mixed Low-Level Waste Inventory at Pantex Plant E–59
Table E.2.4–8 Hazardous Waste Inventory at Pantex Plant E–60
Table E.2.4–9 Hazardous Quantities Shipped Offsite in 1994 at Pantex Plant E–61
Table E.2.4–10 Class 1 Non-*Resource Conservation and Recovery Act* Hazardous Waste Inventory at Pantex Plant E–61
Table E.2.4–11 Class 2 Nonhazardous Waste Disposal in Amarillo Landfill From Pantex Plant E–62
Table E.2.5–1 Low-Level and Mixed Low-Level Waste Treatment Facilities at Y–12 Plant E–78
Table E.2.5–2 Low-Level and Mixed Low-Level Waste Storage Facilities at Y–12 Plant E–80
Table E.2.5–3 Mixed Low-Level Waste Inventory at Y–12 Plant E–82
Table E.2.5–4 Hazardous Waste Treatment Facilities at Y–12 Plant E–82
Table E.2.5–5 Hazardous Waste Storage Facilities at Y–12 Plant E–83
Table E.2.5–6 Reactor-Irradiated Nuclear Material Inventory at Oak Ridge Reservation E–84
Table E.2.5–7 Transuranic and Mixed Transuranic Waste Inventory at Oak Ridge National Laboratory E–84

Table E.2.5–8 Transuranic and Mixed Transuranic Waste Storage Facilities at Oak Ridge National Laboratory E–85
Table E.2.5–9 Low-Level, Mixed Low-Level, and Transuranic Waste Treatment Facilities at Oak Ridge National Laboratory E–86
Table E.2.5–10 Low-Level, Mixed Low-Level, and Hazardous Waste Storage Facilities at Oak Ridge National Laboratory E–87
Table E.2.5–11 Low-Level Waste Disposal Facilities at Oak Ridge National Laboratory E–88
Table E.2.5–12 Mixed Low-Level Waste Inventory at Oak Ridge National Laboratory (*Resource Conservation and Recovery Act*- and State-Regulated) E–88
Table E.2.5–13 Hazardous Waste Treatment Facilities at Oak Ridge National Laboratory E–89
Table E.2.5–14 Hazardous Waste Storage Facilities at Oak Ridge National Laboratory E–89
Table E.2.5–15 Low-Level, Mixed Low-Level, and Hazardous Waste Treatment Facilities at K–25 Site E–90
Table E.2.5–16 Low Level, Mixed Low-Level, and Hazardous Waste Storage Facilities at K–25 Site E–91
Table E.2.5–17 Low-Level Waste Storage Facilities at K–25 Site E–95
Table E.2.5–18 Mixed Low-Level Waste Inventory at K–25 Site E–96
Table E.2.6–1 High-Level Waste Inventory at Savannah River Site E–107
Table E.2.6–2 High-Level Waste Treatment Facilities at Savannah River Site E–107
Table E.2.6–3 High-Level Waste Storage Facilities at Savannah River Site E–108
Table E.2.6–4 Transuranic and Mixed Transuranic Waste Inventory at Savannah River Site E–108
Table E.2.6–5 Transuranic and Mixed Transuranic Waste Treatment Facilities at Savannah River Site E–108
Table E.2.6–6 Transuranic and Mixed Transuranic Waste Storage Facilities at Savannah River Site E–109
Table E.2.6–7 Low-Level and Mixed Low-Level Waste Treatment Facilities at Savannah River Site E–109
Table E.2.6–8 Low-Level and Mixed Low-Level Waste Storage Facilities at Savannah River Site E–110
Table E.2.6–9 Waste Disposal at Savannah River Site E–111
Table E.2.6–10 Mixed Low-Level Waste Inventory at Savannah River Site E–111
Table E.2.6–11 Hazardous Waste Storage Facilities at Savannah River Site E–112
Table E.3.1–1 Waste Types Generated From Long-Term Storage of Plutonium E–114
Table E.3.1–2 Waste Types Generated From Long-Term Storage of Uranium E–115
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 E–116

Table E.3.1.1–2 Estimated Waste Volumes for the Upgrade Without Rocky Flats Environmental Technology Site Plutonium or Los Alamos National Laboratory Subalternative at Idaho National Engineering Laboratory, Argonne National Laboratory-West E–117

Table E.3.1.1–3 Estimated Waste Volumes for the Upgrade Alternative at Pantex Plant E–118

Table E.3.1.1–4 Estimated Waste Volumes for the Upgrade Without Rocky Flats Environmental Technology Site Plutonium or Los Alamos National Laboratory Subalternative at Y–12 Plant E–119

Table E.3.1.1–5 Estimated Waste Volumes for the Upgrade With All or Some Rocky Flats Environmental Technology Site Plutonium and Los Alamos National Laboratory Plutonium Subalternative at Hanford Site E–123

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 E–124

Table E.3.1.1–7 Estimated Waste Volumes for the Upgrade With Rocky Flats Environmental Technology Site Plutonium Pit Subalternative at Pantex Plant E–125

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 E–126

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 E-127

Table E.3.1.2–1 Estimated Waste Volumes for the Consolidation Alternative—Constructing a New Facility at Hanford Site E–128

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 E–129

Table E.3.1.2–3 Estimated Waste Volumes for the Consolidation Alternative—Constructing a New Facility at Nevada Test Site E–130

Table E.3.1.2–4 Estimated Waste Volumes for the Consolidation Alternative—Constructing a New Facility at Idaho National Engineering Laboratory E–131

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 E–132

Table E.3.1.2–6 Estimated Waste Volumes for the Consolidation Alternative—Constructing a New Facility at Pantex Plant E–133

Table E.3.1.2–7 Estimated Waste Volumes for the Consolidation Alternative—Constructing a New Facility at Savannah River Site E–134

Table E.3.1.3–1 Estimated Waste Volumes for the Collocation Alternative—Constructing a New Facility at Hanford Site E–139

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 E–140

Table E.3.1.3–3 Estimated Waste Volumes for the Collocation Alternative—Constructing a New Facility at Nevada Test Site E–141

Table E.3.1.3–4 Estimated Waste Volumes for the Collocation Alternative—Constructing a New Facility at Idaho National Engineering Laboratory E–142

Table E.3.1.3–5 Estimated Waste Volumes for the Collocation Alternative—Constructing a New Facility at Pantex Plant E–143

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 E–144

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 E–145

Table E.3.1.3–8 Estimated Waste Volumes for the Collocation Alternative—Constructing a New Facility at Savannah River Site E–146

Table E.3.2.1–1 Estimated Waste Volumes for Pit Disassembly/Conversion Facility E–154

Table E.3.2.2–1 Estimated Waste Volumes for Plutonium Conversion Facility E–160

Table E.3.2.3–1 Estimated Waste Volumes for the Generic Mixed Oxide Fuel Fabrication Facility E–165

Table E.3.3.1–1 Estimated Waste Volumes for the Direct Disposition Alternative—Deep Borehole Complex E–169

Table E.3.3.2–1 Estimated Waste Volumes for the Immobilized Disposition Alternative—Deep Borehole Complex E–173

Table E.3.3.3–1 Estimated Waste Volumes for the Immobilized Disposition Alternative—Ceramic Immobilization Facility E–177

Table E.3.3.4–1 Estimated Waste Volumes for the Vitrification Alternative E–182

Table E.3.3.5–1 Estimated Waste Volumes for the Ceramic Immobilization Alternative E–186

Table E.3.3.6–1 Estimated Waste Volumes for Electrometallurgical Treatment Alternative E–191

Table E.3.3.7–1 Estimated Spent Nuclear Fuel and Waste Volumes for the Evolutionary Light Water Reactor (Large) Alternative E–194

Table E.3.3.7–2 Estimated Spent Nuclear Fuel and Waste Volumes for the Evolutionary Light Water Reactor (Small) Alternative E–195

Table F.1.2.1–1 Ambient Air Quality Standards Applicable to Existing Department of Energy Sites F–3

Table F.1.2.2–1 Emission Rates of Criteria and Toxic/Hazardous Pollutants at Hanford Site F–6

Table F.1.2.3–1 Emission Rates of Criteria and Toxic/Hazardous Pollutants at Nevada Test Site F–8

Table F.1.2.4–1 Emission Rates of Criteria and Toxic/Hazardous Pollutants at Idaho National Engineering Laboratory F–10

Table F.1.2.5–1 Emission Rates of Criteria and Toxic/Hazardous Pollutants at Pantex Plant F–12

Table F.1.2.6–1 Emission Rates of Criteria and Toxic/Hazardous Pollutants at Oak Ridge Reservation F–15

Table F.1.2.7–1 Emission Rates of Criteria and Toxic/Hazardous Pollutants at Savannah River Site F–18

Table F.1.2.8–1 Emission Rates of Criteria and Toxic/Hazardous Pollutants at Rocky Flats Environmental Technology Site F–20

Table F.1.2.9–1 Emission Rates of Criteria and Toxic/Hazardous Pollutants at Los Alamos National Laboratory F–22

Table F.1.3–1 Emission Rates of Pollutants for Upgrade of Existing Facilities F–23

Table F.1.3–2 Emission Rates of Pollutants for the Consolidated Plutonium Storage Facility F–24

Table F.1.3–3 Emission Rates of Pollutants for the Collocated Plutonium and Highly Enriched Uranium Storage Facilities F–25

Table F.1.3–4 Emission Rates of Pollutants for the Pit Disassembly/Conversion Facility F–26

Table F.1.3–5 Emission Rates of Pollutants for the Plutonium Conversion Facility F–27

Table F.1.3–6 Emission Rates of Pollutants for the Generic Mixed Oxide Fuel Fabrication Facility F–28

Table F.1.3–7 Emission Rates of Pollutants for the Direct Disposition Alternative—Deep Borehole Complex F–29

Table F.1.3–8 Emission Rates of Pollutants for the Immobilization Disposition Alternative—Ceramic Immobilization Facility and Deep Borehole Complex F–29

Table F.1.3–9 Emission Rates of Pollutants for the Vitrification Alternative F–29

Table F.1.3–10 Emission Rates of Pollutants for the Ceramic Immobilization Alternative F–30

Table F.1.3–11 Emission Rates of Pollutants for the Electrometallurgical Treatment Alternative F–30

Table F.1.3–12 Emission Rates of Pollutants for the Existing Light Water Reactor F–30

Table F.1.3–13 Emission Rates of Pollutants for the Partially Completed Light Water Reactor F–31

Table F.1.3–14 Emission Rates of Pollutants for the Evolutionary Light Water Reactor F–31

Table F.2.1–1 Applicable State Noise Limitations for Hanford Site Based on Source and Receptor Environmental Designation for Noise Abatement (dBA) F–32

Table F.2.5–1 City of Oak Ridge Maximum Allowable Noise Limits Applicable to Oak Ridge Reservation F–32

Table F.2.6–1 Aiken County Maximum Allowable Noise Levels F–33

Table G.1.2.4–1 Annual Accident Risks Due to Export of Plutonium Oxide and Import of Mixed Oxide Fuel G–6

Table G.2–1 Five-Year Summary of Cargo Shipments by Commercial Carrier To and From Department of Energy Sites G–9

Table G.2–2 Summary of Hazardous Materials Shipped To and From Department of Energy Sites–1994 ..... G–10

Table G.2–3 Summary of Hazardous Materials Shipped To and From Department of Energy Sites–1994 ..... G–15

Table G.3–1 Highway Distance Between Department of Energy Sites (kilometers) G–19
Table J–1 Federal Environmental Statutes, Regulations, and Orders J–5
Table J–2 State Environmental Statutes, Regulations, and Orders J–12
Table J–3 Selected Department of Energy Environment, Safety, and Health Orders J–19
Table J–4 Applicable Nuclear Regulatory Commission Guidelines J–20
Table K–1 Scientific Names of Nonthreatened and Nonendangered Animal and Plant Species Referred to in the Text K–2
Table L.1–1 Department of Energy Sites' Regional Economic Areas by County L–2
Table L.1–2 Distribution of Employees by Place of Residence in the Hanford Site Region of Influence, 1996 ..... L–3
Table L.1–3 Distribution of Employees by Place of Residence in the Nevada Test Site Region of Influence, 1991 ..... L–3
Table L.1–4 Distribution of Employees by Place of Residence in the Idaho National Engineering Laboratory Region of Influence, 1991 ..... L–3
Table L.1–5 Distribution of Employees by Place of Residence in the Pantex Plant Region of Influence, 1994 ..... L–4
Table L.1–6 Distribution of Employees by Place of Residence in the Oak Ridge Reservation Region of Influence, 1990 ..... L–4
Table L.1–7 Distribution of Employees by Place of Residence in the Savannah River Site Region of Influence, 1991 ..... L–4
Table L.1–8 Distribution of Employees by Place of Residence in the Rocky Flats Environmental Technology Site Region of Influence, 1995 ..... L–5
Table L.1–9 Distribution of Employees by Place of Residence in the Los Alamos National Laboratory Region of Influence, 1991 ..... L–5
Table L.1–10 Hanford Site Regional Economic Area Employment and Economy, 1995-2040 ..... L–6
Table L.1–11 Hanford Site Region of Influence Population, 1995-2040 ..... L–6
Table L.1–12 Hanford Site Region of Influence Total Number of Owner and Renter Housing Units, 1995-2040 ..... L–6
Table L.1–13 Hanford Site Region of Influence Total Student Enrollment, 1995-2040 ..... L–7
Table L.1–14 Hanford Site Region of Influence Total Number of Teachers, 1995-2040 ..... L–8
Table L.1–15 Hanford Site Region of Influence Total Number of Sworn Police Officers, 1995-2040 ..... L–9
Table L.1–16 Hanford Site Region of Influence Total Number of Firefighters, 1995-2040 ..... L–9
Table L.1–17 Hanford Site Region of Influence Hospital Occupancy Rates, 1995-2040 ..... L–10
Table L.1–18 Hanford Site Region of Influence Total Number of Doctors, 1995-2040 ..... L–10
Table L.1–19 Nevada Test Site Regional Economic Area Employment and Economy, 1995-2040 ..... L–11
Table L.1–20 Nevada Test Site Region of Influence Population, 1995-2040 ..... L–11

Table L.1–21 Nevada Test Site Region of Influence Total Number of Owner and Renter Housing Units, 1995-2040 ..... L–11

Table L.1–22 Nevada Test Site Region of Influence Total Student Enrollment, 1995-2040 ..... L–12

Table L.1–23 Nevada Test Site Region of Influence Total Number of Teachers, 1995-2040 ..... L–12

Table L.1–24 Nevada Test Site Region of Influence Total Number of Sworn Police Officers, 1995-2040 ..... L–12

Table L.1–25 Nevada Test Site Region of Influence Total Number of Firefighters, 1995-2040 ..... L–13

Table L.1–26 Nevada Test Site Region of Influence Hospital Occupancy Rates, 1995-2040 ..... L–13

Table L.1–27 Nevada Test Site Region of Influence Total Number of Doctors, 1995-2040 ..... L–13

Table L.1–28 Idaho National Engineering Laboratory Regional Economic Area Employment and Economy, 1995-2040 ..... L–14

Table L.1–29 Idaho National Engineering Laboratory Region of Influence Population, 1995-2040 ..... L–14

Table L.1–30 Idaho National Engineering Laboratory Region of Influence Total Number of Owner and Renter Housing Units, 1995-2040 ..... L–15

Table L.1–31 Idaho National Engineering Laboratory Region of Influence Total Student Enrollment, 1995-2040 ..... L–15

Table L.1–32 Idaho National Engineering Laboratory Region of Influence Total Number of Teachers, 1995-2040 ..... L–16

Table L.1–33 Idaho National Engineering Laboratory Region of Influence Total Number of Sworn Police Officers, 1995-2040 ..... L–16

Table L.1–34 Idaho National Engineering Laboratory Region of Influence Total Number of Firefighters, 1995-2040 ..... L–17

Table L.1–35 Idaho National Engineering Laboratory Region of Influence Hospital Occupancy Rates, 1995-2040 ..... L–17

Table L.1–36 Idaho National Engineering Laboratory Region of Influence Total Number of Doctors, 1995-2040 ..... L–17

Table L.1–37 Pantex Plant Regional Economic Area Employment and Economy, 1995-2040 ..... L–18

Table L.1–38 Pantex Plant Region of Influence Population, 1995-2040 ..... L–19

Table L.1–39 Pantex Plant Region of Influence Total Number of Owner and Renter Housing Units, 1995-2040 ..... L–19

Table L.1–40 Pantex Plant Region of Influence Total Student Enrollment, 1995-2040 ..... L–19

Table L.1–41 Pantex Plant Region of Influence Total Number of Teachers, 1995-2040 ..... L–20

Table L.1–42 Pantex Plant Region of Influence Total Number of Sworn Police Officers, 1995-2040 ..... L–20

Table L.1–43 Pantex Plant Region of Influence Total Number of Firefighters, 1995-2040 ..... L–20
Table L.1–44 Pantex Plant Region of Influence Hospital Occupancy Rates, 1995-2040 ..... L–21
Table L.1–45 Pantex Plant Region of Influence Total Number of Doctors, 1995-2040 ..... L–21
Table L.1–46 Oak Ridge Reservation Regional Economic Area Employment and Economy, 1995-2040 ..... L–22
Table L.1–47 Oak Ridge Reservation Region of Influence Population, 1995-2040 ..... L–23
Table L.1–48 Oak Ridge Reservation Region of Influence Total Number of Owner and Renter Housing Units, 1995-2040 ..... L–23
Table L.1–49 Oak Ridge Reservation Region of Influence Total Student Enrollment, 1995-2040 ..... L–24
Table L.1–50 Oak Ridge Reservation Region of Influence Total Number of Teachers, 1995-2040 ..... L–24
Table L.1–51 Oak Ridge Reservation Region of Influence Total Number of Sworn Police Officers, 1995-2040 ..... L–25
Table L.1–52 Oak Ridge Reservation Region of Influence Total Number of Firefighters, 1995-2040 ..... L–25
Table L.1–53 Oak Ridge Reservation Region of Influence Hospital Occupancy Rates, 1995-2040 ..... L–26
Table L.1–54 Oak Ridge Reservation Region of Influence Total Number of Doctors, 1995-2040 ..... L–26
Table L.1–55 Savannah River Site Regional Economic Area Employment and Economy, 1995-2040 ..... L–27
Table L.1–56 Savannah River Site Region of Influence Population, 1995-2040 ..... L–27
Table L.1–57 Savannah River Site Region of Influence Total Number of Owner and Renter Housing Units, 1995-2040 ..... L–28
Table L.1–58 Savannah River Site Region of Influence Total Student Enrollment, 1995-2040 ..... L–28
Table L.1–59 Savannah River Site Region of Influence Total Number of Teachers, 1995-2040 ..... L–29
Table L.1–60 Savannah River Site Region of Influence Total Number of Sworn Police Officers, 1995-2040 ..... L–29
Table L.1–61 Savannah River Site Region of Influence Total Number of Firefighters, 1995-2040 ..... L–30
Table L.1–62 Savannah River Site Region of Influence Hospital Occupancy Rates, 1995-2040 ..... L–30
Table L.1–63 Savannah River Site Region of Influence Total Number of Doctors, 1995-2040 ..... L–30
Table L.1–64 Rocky Flats Environmental Technology Site Regional Economic Area Employment and Economy, 1995-2040 ..... L–31
Table L.1–65 Rocky Flats Environmental Technology Site Region of Influence Population, 1995-2040 ..... L–31

Table L.1–66 Rocky Flats Environmental Technology Site Region of Influence Total Number of Owner and Renter Housing Units, 1995-2040 ..... L–32

Table L.1–67 Rocky Flats Environmental Technology Site Region of Influence Total Student Enrollment, 1995-2040 ..... L–32

Table L.1–68 Rocky Flats Environmental Technology Site Region of Influence Total Number of Teachers, 1995-2040 ..... L–33

Table L.1–69 Rocky Flats Environmental Technology Site Region of Influence Total Number of Sworn Police Officers, 1995-2040 ..... L–34

Table L.1–70 Rocky Flats Environmental Technology Site Region of Influence Total Number of Firefighters, 1995-2040 ..... L–34

Table L.1–71 Rocky Flats Environmental Technology Site Region of Influence Hospital Occupancy Rates, 1995-2040 ..... L–34

Table L.1–72 Rocky Flats Environmental Technology Site Region of Influence Total Number of Doctors, 1995-2040 ..... L–35

Table L.1–73 Los Alamos National Laboratory Regional Economic Area Employment and Economy, 1995-2040 ..... L–36

Table L.1–74 Los Alamos National Laboratory Region of Influence Population, 1995-2040 ..... L–36

Table L.1–75 Los Alamos National Laboratory Region of Influence Total Number of Owner and Renter Housing Units, 1995-2040 ..... L–37

Table L.1–76 Los Alamos National Laboratory Region of Influence Total Student Enrollment, 1995-2040 ..... L–37

Table L.1–77 Los Alamos National Laboratory Region of Influence Total Number of Teachers, 1995-2040 ..... L–37

Table L.1–78 Los Alamos National Laboratory Region of Influence Total Number of Sworn Police Officers, 1995-2040 ..... L–38

Table L.1–79 Los Alamos National Laboratory Region of Influence Total Number of Firefighters, 1995-2040 ..... L–38

Table L.1–80 Los Alamos National Laboratory Region of Influence Hospital Occupancy Rates, 1995-2040 ..... L–38

Table L.1–81 Los Alamos National Laboratory Region of Influence Total Number of Doctors, 1995-2040 ..... L–38

Table L.1–82 Representative Site for the Partially Completed Reactor Facility Regional Economic Area Employment and Economy, 1995-2040 ..... L–39

Table L.1–83 Representative Site for the Partially Completed Reactor Facility Region of Influence Population, 1995-2040 ..... L–39

Table L.1–84 Representative Site for the Partially Completed Reactor Region of Influence Total Number of Owner and Renter Housing Units, 1995-2040 ..... L–40

Table L.1–85 Representative Site for the Partially Completed Reactor Region of Influence Total Student Enrollment, 1995-2040 ..... L–40

Table L.1–86 Representative Site for the Partially Completed Reactor Region of Influence Total Number of Teachers, 1995-2040 ..... L–40

Table L.1–87 Representative Site for the Partially Completed Reactor Region of Influence Total Number of Sworn Police Officers, 1995-2040 ..... L–41

Table L.1–88 Representative Site for the Partially Completed Reactor Region of Influence Total Number of Firefighters, 1995-2040 ..... L–41

Table L.1–89 Representative Site for the Partially Completed Reactor Region of Influence Hospital Occupancy Rates, 1995-2040 ..... L–41

Table L.1–90 Representative Site for the Partially Completed Reactor Region of Influence Total Number of Doctors, 1995-2040 ..... L–41

Table M.2.1.2–1 Lifetime Risks per 100,000 Persons Exposed to a Single Exposure of 10 rem M–7

Table M.2.2.2–1 GENII Exposure Parameters to Plumes and Soil Contamination M–12

Table M.2.2.2–2 GENII Usage Parameters for Consumption of Terrestrial Food M–12

Table M.2.2.2–3 GENII Usage Parameters for Consumption of Animal Products M–13

Table M.2.2.2–4 GENII Usage Parameters for Aquatic Activities M–13

Table M.2.3.1–1 Annual Radioactive Releases During Normal Operation of Long-Term Storage Facilities (curies) M–15

Table M.2.3.1–2 Annual Radioactive Releases During Normal Operation of Facilities for Plutonium Disposition Used by Multiple Alternatives (curies) M–17

Table M.2.3.1–3 Annual Radioactive Releases During Normal Operation of Non-Reactor Plutonium Disposition Facilities (curies) M–18

Table M.2.3.1–4 Annual Liquid and Atmospheric Radioactive Releases From the Large Evolutionary Light Water Reactor Using a Mixed Oxide Core (curies) M–19

Table M.2.3.1–5 Annual Liquid and Atmospheric Radioactive Releases From the Small Evolutionary Light Water Reactor Using a Mixed Oxide Core (curies) M–20

Table M.2.3.2–1 Potential Radiological Impacts From Normal Operation to Involved Workers of Disposition Technology Alternatives and Common Activities M–21

Table M.2.4–1 Release Point Characteristics, Direction, Distance, and Chi/Q at the Hanford Site Boundary M–23

Table M.2.4–2 Direction, Distance, and Meteorological Dispersion to Various Maximum Individual Receptors at the Hanford Site Boundary M–25

Table M.2.4–3 Doses and Resulting Health Effects to the Maximally Exposed Individual at Hanford Site From Atmospheric Releases Associated With Annual Normal Operation M–27

Table M.2.4–4 Doses and Resulting Health Effects to the Population Within 80 Kilometers of Hanford Site From Atmospheric Releases Associated With Normal Operation in 2030 ..... M–28

Table M.2.4–5 Doses and Resulting Health Effects to the Maximally Exposed Individual at Hanford Site From Liquid Releases Associated With Annual Normal Operation .. M–29

Table M.2.4–6 Doses and Resulting Health Effects to the Population Within 80 Kilometers of Hanford Site From Liquid Releases Associated With Normal Operation in 2030 ..... M–29

Table M.2.4.1–1 Annual Atmospheric Radioactive Releases From Normal Operation of No Action at Hanford Site (curies) M–30

Table M.2.4.1–2 Annual Liquid Releases From Normal Operation of No Action at Hanford Site (curies) M–30

Table M.2.5–1 Release Point Characteristics, Direction, Distance, and Chi/Q at Nevada Test Site M–33

Table M.2.5–2 Direction, Distance, and Meteorological Dispersion to Various Maximum Individual Receptors at the Nevada Test Site Boundary M–35

Table M.2.5–3 Doses and Resulting Health Effects to the Maximally Exposed Individual at Nevada Test Site From Atmospheric Releases Associated With Annual Normal Operation M–36

Table M.2.5–4 Doses and Resulting Health Effects to the Population Within 80 Kilometers of Nevada Test Site From Atmospheric Releases Associated With Normal Operation in 2030 ..... M–37

Table M.2.5.1–1 Annual Atmospheric Radioactive Releases From Normal Operation of No Action at Nevada Test Site (curies) M–38

Table M.2.6–1 Release Point Characteristics, Direction, Distance, and Chi/Q at the Idaho National Engineering Laboratory Boundary M–40

Table M.2.6–2 Direction, Distance, and Meteorological Dispersion to Various Maximum Individual Receptors at the Idaho National Engineering Laboratory Site Boundary M–43

Table M.2.6–3 Doses and Resulting Health Effects to the Maximally Exposed Individual at Idaho National Engineering Laboratory From Atmospheric Releases Associated With Annual Normal Operation M–45

Table M.2.6–4 Doses and Resulting Health Effects to the Population Within 80 Kilometers of Idaho National Engineering Laboratory From Atmospheric Releases Associated With Normal Operation in 2030 ..... M–46

Table M.2.6.1–1 Annual Atmospheric Radioactive Releases From Normal Operation of No Action at Idaho National Engineering Laboratory (curies) M–48

Table M.2.7–1 Release Point Characteristics, Direction, Distance, and Chi/Q at the Pantex Plant Boundary M–53

Table M.2.7–2 Direction, Distance, and Meteorological Dispersion to Various Maximum Individual Receptors at the Pantex Plant Boundary M–55

Table M.2.7–3 Doses and Resulting Health Effects to the Maximally Exposed Individual at Pantex Plant From Atmospheric Releases Associated With Annual Normal Operation M–56

Table M.2.7–4 Doses and Resulting Health Effects to the Population Within 80 Kilometers of Pantex Plant From Atmospheric Releases Associated With Normal Operation in 2030 ..... M–57

Table M.2.7.1–1 Annual Atmospheric Radioactive Releases From Normal Operation of No Action at Pantex Plant (curies) M–58

Table M.2.8–1 Release Point Characteristics, Direction, Distance, and Chi/Q at the Oak Ridge Reservation Boundary (Without Presence of the Clinch River Breeder Reactor Site) M–61

Table M.2.8–2 Release Point Characteristics, Direction, Distance, and Chi/Q at the Oak Ridge Reservation Boundary (With Presence of the Clinch River Breeder Reactor Site) M–63

Table M.2.8–3 Direction, Distance, and Meteorological Dispersion to Various Maximum Individual Receptors at the Oak Ridge Reservation Site Boundary (Without Presence of the Clinch River Breeder Reactor Site) M–66

Table M.2.8–4 Direction, Distance, and Meteorological Dispersion to Various Maximum Individual Receptors at the Oak Ridge Reservation Site Boundary (With Presence of the Clinch River Breeder Reactor Site) M–68

Table M.2.8–5 Doses and Resulting Health Effects to the Maximally Exposed Individual at Oak Ridge Reservation From Atmospheric Releases Associated With Annual Normal Operation M–70

Table M.2.8–6 Doses and Resulting Health Effects to the Population Within 80 Kilometers of Oak Ridge Reservation From Atmospheric Releases Associated With Normal Operation in 2030 ..... M–71

Table M.2.8–7 Doses and Resulting Health Effects to the Maximally Exposed Individual at Oak Ridge Reservation From Liquid Releases Associated With Annual Normal Operation M–72

Table M.2.8–8 Doses and Resulting Health Effects to the Population Downstream of Oak Ridge Reservation From Liquid Releases Associated With Normal Operation in 2030 ..... M–73

Table M.2.8.1–1 Annual Atmospheric Radioactive Releases From Normal Operation of No Action at Oak Ridge Reservation (curies) M–75

Table M.2.8.1–2 Annual Liquid Releases From Normal Operation of No Action at Oak Ridge Reservation (curies) M–76

Table M.2.9–1 Release Point Characteristics, Direction, Distance, and Atmospheric Dispersion at the Savannah River Site Boundary M–79

Table M.2.9–2 Direction, Distance, and Meteorological Dispersion to Various Maximum Individual Receptors at the Savannah River Site Boundary M–82

Table M.2.9–3 Doses and Resulting Health Effects to the Maximally Exposed Individual From Atmospheric Releases Associated With Annual Normal Operation at Savannah River Site M–85

Table M.2.9–4 Doses and Resulting Health Effects to the Population Within 80 Kilometers of Savannah River Site From Atmospheric Releases Associated With Normal Operation in 2030 ..... M–86

Table M.2.9–5 Doses and Resulting Health Effects to the Maximally Exposed Individual From Liquid Releases Associated With Annual Normal Operation at Savannah River Site M–87

Table M.2.9–6 Doses and Resulting Health Effects to the Population Downstream of Savannah River Site From Liquid Releases Associated With Normal Operation in 2030 ..... M–88

Table M.2.9.1–1 Annual Atmospheric Radioactive Releases From Normal Operation of No Action at Savannah River Site (curies) M–90

Table M.2.9.1–2 Annual Liquid Releases From Normal Operation of No Action at Savannah River Site (curies) M–94

Table M.3.2–1 Chemical Toxicity Profiles M–99
Table M.3.3–1 Table of Exposure Limits M–120
Table M.3.4–1 Risk Assessments From Exposure to Hazardous Chemicals at Hanford Site—No Action M–139
Table M.3.4–2 Risk Assessments From Exposure to Hazardous Chemicals at Hanford Site—Upgrade Plutonium Storage Facility (Both Options) M–140
Table M.3.4–3 Risk Assessments From Exposure to Hazardous Chemicals at Hanford Site—Consolidate Plutonium Storage Facility M–141
Table M.3.4–4 Risk Assessments From Exposure to Hazardous Chemicals at Hanford Site—Collocate Plutonium and Highly Enriched Uranium Storage Facility M–142
Table M.3.4–5 Risk Assessments From Exposure to Hazardous Chemicals at Nevada Test Site—No Action M–143
Table M.3.4–6 Risk Assessments From Exposure to Hazardous Chemicals at Nevada Test Site—Consolidate Plutonium Storage Facility M–144
Table M.3.4–7 Risk Assessments From Exposure to Hazardous Chemicals at Nevada Test Site—Consolidate Plutonium Storage Facility at P-Tunnel M–145
Table M.3.4–8 Risk Assessments From Exposure to Hazardous Chemicals at Nevada Test Site—Collocate Plutonium and Highly Enriched Uranium Storage Facility M–146
Table M.3.4–9 Risk Assessments From Exposure to Hazardous Chemicals at Nevada Test Site—Collocate Plutonium and Highly Enriched Uranium Storage Facility at P-Tunnel M–147
Table M.3.4–10 Risk Assessments From Exposure to Hazardous Chemicals at Idaho National Engineering Laboratory—No Action M–148
Table M.3.4–11 Risk Assessments From Exposure to Hazardous Chemicals at Idaho National Engineering Laboratory—Upgrade Plutonium Storage Facility M–150
Table M.3.4–12 Risk Assessments From Exposure to Hazardous Chemicals at Idaho National Engineering Laboratory—Consolidate Plutonium Storage Facility M–151
Table M.3.4–13 Risk Assessments From Exposure to Hazardous Chemicals at Idaho National Engineering Laboratory—Collocate Plutonium and Highly Enriched Uranium Storage Facility M–152
Table M.3.4–14 Risk Assessments From Exposure to Hazardous Chemicals at Pantex Plant—No Action M–153
Table M.3.4–15 Risk Assessments From Exposure to Hazardous Chemicals at Pantex Plant—Upgrade Plutonium Storage Facility M–155
Table M.3.4–16 Risk Assessments From Exposure to Hazardous Chemicals at Pantex Plant—Consolidate Plutonium Storage Facility M–156
Table M.3.4–17 Risk Assessments From Exposure to Hazardous Chemicals at Pantex Plant—Collocate Plutonium and Highly Enriched Uranium Storage Facility M–157
Table M.3.4–18 Risk Assessments From Exposure to Hazardous Chemicals at Oak Ridge Reservation—No Action M–158
Table M.3.4–19 Risk Assessments From Exposure to Hazardous Chemicals at Oak Ridge Reservation—Upgrade Highly Enriched Uranium Storage Facility M–159

Table M.3.4–20 Risk Assessments From Exposure to Hazardous Chemicals at Oak Ridge Reservation—Collocate Plutonium Storage Facilities; Maintain Highly Enriched Uranium Facility M–160

Table M.3.4–21 Risk Assessments From Exposure to Hazardous Chemicals at Oak Ridge Reservation—Collocate Plutonium and Highly Enriched Uranium Storage Facility M–161

Table M.3.4–22 Risk Assessments From Exposure to Hazardous Chemicals at Savannah River Site—No Action M–162

Table M.3.4–23 Risk Assessments From Exposure to Hazardous Chemicals at Savannah River Site—Upgrade Plutonium Storage Facility M–163

Table M.3.4–24 Risk Assessments From Exposure to Hazardous Chemicals at Savannah River Site—Consolidate Plutonium Storage Facility M–164

Table M.3.4–25 Risk Assessments From Exposure to Hazardous Chemicals at Savannah River Site—Collocate Plutonium and Highly Enriched Uranium Storage Facility M–165

Table M.3.4–26 Risk Assessments From Exposure to Hazardous Chemicals at Rocky Flats Environmental Technology Site—No Action M–166

Table M.3.4–27 Risk Assessments From Exposure to Hazardous Chemicals at Los Alamos National Laboratory—No Action M–167

Table M.3.4–28 Risk Assessments From Exposure to Hazardous Chemicals at Hanford Site—Pit Disassembly/Conversion Facility M–169

Table M.3.4–29 Risk Assessments From Exposure to Hazardous Chemicals at Nevada Test Site—Pit Disassembly/Conversion Facility M–170

Table M.3.4–30 Risk Assessments From Exposure to Hazardous Chemicals at Idaho National Engineering Laboratory—Pit Disassembly/Conversion Facility M–171

Table M.3.4–31 Risk Assessments From Exposure to Hazardous Chemicals at Pantex Plant—Pit Disassembly/Conversion Facility M–172

Table M.3.4–32 Risk Assessments From Exposure to Hazardous Chemicals at Oak Ridge Reservation—Pit Disassembly/Conversion Facility M–173

Table M.3.4–33 Risk Assessments From Exposure to Hazardous Chemicals at Savannah River Site—Pit Disassembly/Conversion Facility M–174

Table M.3.4–34 Risk Assessments From Exposure to Hazardous Chemicals at Hanford Site—Plutonium Conversion Facility M–175

Table M.3.4–35 Risk Assessments From Exposure to Hazardous Chemicals at Nevada Test Site—Plutonium Conversion Facility M–176

Table M.3.4–36 Risk Assessments From Exposure to Hazardous Chemicals at Idaho National Engineering Laboratory—Plutonium Conversion Facility M–177

Table M.3.4–37 Risk Assessments From Exposure to Hazardous Chemicals at Pantex Plant—Plutonium Conversion Facility M–178

Table M.3.4–38 Risk Assessments From Exposure to Hazardous Chemicals at Oak Ridge Reservation—Plutonium Conversion Facility M–179

Table M.3.4–39 Risk Assessments From Exposure to Hazardous Chemicals at Savannah River Site—Plutonium Conversion Facility M–180

Table M.3.4–40 Risk Assessments From Exposure to Hazardous Chemicals at the Deep Borehole Complex—Direct Disposition Alternative M–181

Table M.3.4–41 Risk Assessments From Exposure to Hazardous Chemicals at Hanford Site—Ceramic Immobilization Facility for the Immobilized Disposition Alternative M–182

Table M.3.4–42 Risk Assessments From Exposure to Hazardous Chemicals at Nevada Test Site—Ceramic Immobilization Facility for the Immobilized Disposition Alternative M–183

Table M.3.4–43 Risk Assessments From Exposure to Hazardous Chemicals at Idaho National Engineering Laboratory—Ceramic Immobilization Facility for the Immobilized Disposition Alternative M–184

Table M.3.4–44 Risk Assessments From Exposure to Hazardous Chemicals at Pantex Plant—Ceramic Immobilization Facility for the Immobilized Disposition Alternative M–185

Table M.3.4–45 Risk Assessments From Exposure to Hazardous Chemicals at Oak Ridge Reservation—Ceramic Immobilization Facility for the Immobilized Disposition Alternative M–186

Table M.3.4–46 Risk Assessments From Exposure to Hazardous Chemicals at Savannah River Site—Ceramic Immobilization Facility for the Immobilized Disposition Alternative M–187

Table M.3.4–47 Risk Assessments From Exposure to Hazardous Chemicals at the Deep Borehole Complex—Immobilized Disposition Alternative M–188

Table M.3.4–48 Risk Assessments From Exposure to Hazardous Chemicals at Hanford Site—Vitrification Alternative M–189

Table M.3.4–49 Risk Assessments From Exposure to Hazardous Chemicals at Nevada Test Site—Vitrification Alternative M–190

Table M.3.4–50 Risk Assessments From Exposure to Hazardous Chemicals at Idaho National Engineering Laboratory—Vitrification Alternative M–191

Table M.3.4–51 Risk Assessments From Exposure to Hazardous Chemicals at Pantex Plant—Vitrification Alternative M–192

Table M.3.4–52 Risk Assessments From Exposure to Hazardous Chemicals at Oak Ridge Reservation—Vitrification Alternative M–193

Table M.3.4–53 Risk Assessments From Exposure to Hazardous Chemicals at Savannah River Site—Vitrification Alternative M–194

Table M.3.4–54 Risk Assessments From Exposure to Hazardous Chemicals at Hanford Site—Ceramic Immobilization Alternative M–195

Table M.3.4–55 Risk Assessments From Exposure to Hazardous Chemicals at Nevada Test Site—Ceramic Immobilization Alternative M–196

Table M.3.4–56 Risk Assessments From Exposure to Hazardous Chemicals at Idaho National Engineering Laboratory—Ceramic Immobilization Alternative M–197

Table M.3.4–57 Risk Assessments From Exposure to Hazardous Chemicals at Pantex Plant—Ceramic Immobilization Alternative M–198

Table M.3.4–58 Risk Assessments From Exposure to Hazardous Chemicals at Oak Ridge Reservation—Ceramic Immobilization Alternative M–199
Table M.3.4–59 Risk Assessments From Exposure to Hazardous Chemicals at Savannah River Site—Ceramic Immobilization Alternative M–200
Table M.3.4–60 Risk Assessments From Exposure to Hazardous Chemicals at Idaho National Engineering Laboratory—Electrometallurgical Treatment Alternative M–201
Table M.3.4–61 Risk Assessments From Exposure to Hazardous Chemicals at Hanford Site—Mixed Oxide Fuel Fabrication Facility M–202
Table M.3.4–62 Risk Assessments From Exposure to Hazardous Chemicals at Nevada Test Site—Mixed Oxide Fuel Fabrication Facility M–203
Table M.3.4–63 Risk Assessments From Exposure to Hazardous Chemicals at Idaho National Engineering Laboratory—Mixed Oxide Fuel Fabrication Facility M–204
Table M.3.4–64 Risk Assessments From Exposure to Hazardous Chemicals at Pantex Plant—Mixed Oxide Fuel Fabrication Facility M–205
Table M.3.4–65 Risk Assessments From Exposure to Hazardous Chemicals at Oak Ridge Reservation—Mixed Oxide Fuel Fabrication Facility M–206
Table M.3.4–66 Risk Assessments From Exposure to Hazardous Chemicals at Savannah River Site—Mixed Oxide Fuel Fabrication Facility M–207
Table M.3.4–67 Risk Assessments From Exposure to Hazardous Chemicals at Generic Site—Mixed Oxide Fuel Fabrication Facility M–208
Table M.3.4–68 Risk Assessments From Exposure to Hazardous Chemicals at Hanford Site—Large Evolutionary Light Water Reactor M–209
Table M.3.4–69 Risk Assessments From Exposure to Hazardous Chemicals at Nevada Test Site—Large Evolutionary Light Water Reactor M–210
Table M.3.4–70 Risk Assessments From Exposure to Hazardous Chemicals at Idaho National Engineering Laboratory—Large Evolutionary Light Water Reactor M–211
Table M.3.4–71 Risk Assessments From Exposure to Hazardous Chemicals at Pantex Plant—Large Evolutionary Light Water Reactor M–212
Table M.3.4–72 Risk Assessments From Exposure to Hazardous Chemicals at Oak Ridge Reservation—Large Evolutionary Light Water Reactor M–213
Table M.3.4–73 Risk Assessments From Exposure to Hazardous Chemicals at Savannah River Site—Large Evolutionary Light Water Reactor M–214
Table M.3.4–74 Risk Assessments From Exposure to Hazardous Chemicals at Hanford Site—Small Evolutionary Light Water Reactor M–215
Table M.3.4–75 Risk Assessments From Exposure to Hazardous Chemicals at Nevada Test Site—Small Evolutionary Light Water Reactor M–216
Table M.3.4–76 Risk Assessments From Exposure to Hazardous Chemicals at Idaho National Engineering Laboratory—Small Evolutionary Light Water Reactor M–217
Table M.3.4–77 Risk Assessments From Exposure to Hazardous Chemicals at Pantex Plant—Small Evolutionary Light Water Reactor M–218
Table M.3.4–78 Risk Assessments From Exposure to Hazardous Chemicals at Oak Ridge Reservation—Small Evolutionary Light Water Reactor M–219

Table M.3.4–79 Risk Assessments From Exposure to Hazardous Chemicals at Savannah River Site—Small Evolutionary Light Water Reactor M–220
Table M.5.1.3.4–1 Isotopic Distribution for a Mixed Plutonium Release M–257
Table M.5.1.3.4–2 Isotopic Distribution for a Weapons-Grade Plutonium Release M–257
Table M.5.1.3.4–3 Isotopic Distribution for a Non-Pit (Pu Conversion) Plutonium Release M–257
Table M.5.2.1.1–1 Evaluation Basis Accident Scenarios for Consolidation Alternative M–258
Table M.5.2.1.1–2 Beyond Evaluation Basis Accident Scenarios for Consolidation Alternative M–258
Table M.5.2.1.1–3 Accident Scenario Descriptions for Consolidation and Collocation Facilities M–259
Table M.5.2.1.1–4 Consolidation Alternative Evaluation Basis Accident Source Terms M–260
Table M.5.2.1.1–5 Consolidation Alternative Beyond Evaluation Basis Accident Source Terms M–261
Table M.5.2.1.2–1 Consolidation Alternative Accident Impacts at Hanford Site M–262
Table M.5.2.1.2–2 Consolidation Alternative Accident Impacts at Nevada Test Site M–263
Table M.5.2.1.2–3 Consolidation Alternative Accident Impacts at Idaho National Engineering Laboratory M–264
Table M.5.2.1.2–4 Consolidation Alternative Accident Impacts at Pantex Plant M–265
Table M.5.2.1.2–5 Consolidation Alternative Accident Impacts at Savannah River Site M–266
Table M.5.2.2.1–1 Evaluation Basis Accident Scenarios for Collocation Alternative M–267
Table M.5.2.2.1–2 Beyond Evaluation Basis Accident Scenarios for Collocation Alternative M–268
Table M.5.2.2.1–3 Collocation Alternative Evaluation Basis Accident Source Terms M–268
Table M.5.2.2.1–4 Collocation Alternative Beyond Evaluation Basis Accident Source Terms M–269
Table M.5.2.2.2–1 Collocation Alternative Accident Impacts at Hanford Site M–271
Table M.5.2.2.2–2 Collocation Alternative Accident Impacts at Nevada Test Site M–272
Table M.5.2.2.2–3 Collocation Alternative Accident Impacts at Idaho National Engineering Laboratory M–273
Table M.5.2.2.2–4 Collocation Alternative Accident Impacts at Pantex Plant M–274
Table M.5.2.2.2–5 Collocation Alternative Accident Impacts at Oak Ridge Reservation M–275
Table M.5.2.2.2–6 Collocation Alternative Accident Impacts at Savannah River Site M–276
Table M.5.2.3–1 Upgrade Without Rocky Flats Environmental Technology Site Plutonium or Los Alamos National Laboratory Plutonium Subalternative Accident Impacts at Hanford Site M–277
Table M.5.2.3–2 Upgrade With Rocky Flats Environmental Technology Site Plutonium and Los Alamos National Laboratory Plutonium Subalternative Accident Impacts at Hanford Site M–278
Table M.5.2.4–1 Upgrade With Rocky Flats Environmental Technology Site Plutonium and Los Alamos National Laboratory Plutonium Subalternative Accident Impacts at Idaho National Engineering Laboratory M–279
Table M.5.2.4.1–1 Evaluation Basis Accident Scenarios for Upgrade of Interim Storage Facilities at Idaho National Engineering Laboratory M–280

Table M.5.2.4.1–2 Beyond Evaluation Basis Accident Scenarios for Upgrade of Interim Storage Facilities at Idaho National Engineering Laboratory M–280
Table M.5.2.4.1–3 Evaluation Basis Accident Source Terms for Upgrade of Interim Storage Facilities at Idaho National Engineering Laboratory M–280
Table M.5.2.4.1–4 Beyond Evaluation Basis Accident Source Terms for Upgrade of Interim Storage Facilities at Idaho National Engineering Laboratory M–281
Table M.5.2.4.1–5 Accident Scenario Descriptions for Storage Facilities at Idaho National Engineering Laboratory M–282
Table M.5.2.4.2–1 Accident Impacts for Upgrade of Existing Storage Facilities at Idaho National Engineering Laboratory M–284
Table M.5.2.5.1–1 Evaluation Basis Accident Scenarios for Upgrade or Consolidation at Pantex Plant—Surplus Materials Storage Building M–285
Table M.5.2.5.1–2 Beyond Evaluation Basis Accident Scenarios for Upgrade or Consolidation at Pantex Plant—Surplus Materials Storage Building M–286
Table M.5.2.5.1–3 Evaluation Basis Accident Scenarios for Upgrade or Consolidation at Pantex Plant—Strategic Reserves Storage Building M–286
Table M.5.2.5.1–4 Beyond Evaluation Basis Accident Scenarios for Upgrade or Consolidation at Pantex Plant—Strategic Reserves Storage Building M–286
Table M.5.2.5.1–5 Evaluation Basis Accident Source Terms for Upgrade or Consolidation at Pantex Plant—Surplus Materials Storage Building M–287
Table M.5.2.5.1–6 Beyond Evaluation Basis Accident Source Terms for Upgrade or Consolidation at Pantex Plant—Surplus Materials Storage Building M–288
Table M.5.2.5.1–7 Evaluation Basis Accident Source Terms for Upgrade or Consolidation at Pantex Plant—Strategic Reserves Storage Building M–289
Table M.5.2.5.1–8 Beyond Evaluation Basis Accident Source Terms for Upgrade or Consolidation at Pantex Plant—Strategic Reserves Storage Building M–290
Table M.5.2.5.1–9 Accident Scenario Descriptions for Storage Facilities at Pantex Plant M–291
Table M.5.2.5.2–1 Accident Impacts for Consolidation in the Surplus Materials Storage Building at Pantex Plant M–293
Table M.5.2.5.2–2 Accident Impacts for Consolidation in the Strategic Reserves Storage Building at Pantex Plant M–294
Table M.5.2.5.2–3 Upgrade With Rocky Flats Environmental Technology Site Plutonium Pits Subalternative (Preferred Alternative) Accident Impacts at Pantex Plant M–295
Table M.5.2.7–1 Upgrade With Rocky Flats Environmental Technology Site Plutonium and Los Alamos National Laboratory Plutonium Subalternative Accident Impacts at Savannah River Site M–297
Table M.5.2.7–2 Upgrade With Rocky Flats Environmental Technology Site Non-Pit Plutonium Subalternative (Preferred Alternative) Accident Impacts at Savannah River Site... M–298
Table M.5.2.8.1–1 Evaluation Basis Accident Scenarios at Nevada Test Site for Plutonium Storage Facility—P-Tunnel M–299
Table M.5.2.8.1–2 Beyond Evaluation Basis Accident Scenarios at Nevada Test Site for Plutonium Storage Facility—P-Tunnel M–299

Table M.5.2.8.1–3 Evaluation Basis Accident Source Terms at Nevada Test Site for Plutonium and Highly Enriched Uranium Storage Facility— P-Tunnel M–299
Table M.5.2.8.1–4 Beyond Evaluation Basis Accident Source Terms at Nevada Test Site for Plutonium and Highly Enriched Uranium Storage Facility—P-Tunnel M–300
Table M.5.2.8.1–5 Accident Scenario Descriptions for Nevada Test Site for Plutonium Storage Facility—P-Tunnel M–301
Table M.5.2.8.2–1 Plutonium and Highly Enriched Uranium Storage Facility Accident Impacts at Nevada Test Site—P-Tunnel M–303
Table M.5.3.1.1–1 Evaluation Basis Accident Scenarios for the Pit Disassembly/Conversion Facility M–304
Table M.5.3.1.1–2 Beyond Evaluation Basis Accident Scenarios for the Pit Disassembly/Conversion Facility M–304
Table M.5.3.1.1–3 Pit Disassembly/Conversion Facility Criticality Source Terms M–305
Table M.5.3.1.1–4 Pit Disassembly/Conversion Facility Evaluation Basis Accident Source Terms M–305
Table M.5.3.1.1–5 Pit Disassembly/Conversion Facility Beyond Evaluation Basis Accident Source Terms M–306
Table M.5.3.1.1–6 Accident Scenario Descriptions for the Pit Disassembly/Conversion Facility M–307
Table M.5.3.1.2–1 Pit Disassembly/Conversion Facility Accident Impacts at Hanford Site M–309
Table M.5.3.1.2–2 Pit Disassembly/Conversion Facility Accident Impacts at Nevada Test Site M–310
Table M.5.3.1.2–3 Pit Disassembly/Conversion Facility Accident Impacts at Idaho National Engineering Laboratory M–311
Table M.5.3.1.2–4 Pit Disassembly/Conversion Facility Accident Impacts at Pantex Plant M–312
Table M.5.3.1.2–5 Pit Disassembly/Conversion Facility Accident Impacts at Oak Ridge Reservation M–313
Table M.5.3.1.2–6 Pit Disassembly/Conversion Facility Accident Impacts at Savannah River Site M–314
Table M.5.3.2.1–1 Evaluation Basis Accident Scenarios for the Mixed Oxide Fuel Fabrication Facility M–315
Table M.5.3.2.1–2 Beyond Evaluation Basis Accident Scenarios for the Mixed Oxide Fuel Fabrication Facility M–315
Table M.5.3.2.1–3 Mixed Oxide Fuel Fabrication Facility Criticality Source Terms M–316
Table M.5.3.2.1–4 Mixed Oxide Fuel Fabrication Facility Evaluation Basis Accident Source Terms M–316
Table M.5.3.2.1–5 Mixed Oxide Fuel Fabrication Facility Beyond Evaluation Basis Accident Source Terms M–317
Table M.5.3.2.1–6 Accident Scenario Descriptions for the Mixed Oxide Fuel Fabrication Facility M–318
Table M.5.3.2.2–1 Mixed Oxide Fuel Fabrication Facility Accident Impacts at Hanford Site M–320
Table M.5.3.2.2–2 Mixed Oxide Fuel Fabrication Facility Accident Impacts at Nevada Test Site M–321

Table M.5.3.2.2–3 Mixed Oxide Fuel Fabrication Facility Accident Impacts at Idaho National Engineering Laboratory M–322
Table M.5.3.2.2–4 Mixed Oxide Fuel Fabrication Facility Accident Impacts at Pantex Plant M–323
Table M.5.3.2.2–5 Mixed Oxide Fuel Fabrication Facility Accident Impacts at Oak Ridge Reservation M–324
Table M.5.3.2.2–6 Mixed Oxide Fuel Fabrication Facility Accident Impacts at Savannah River Site M–325
Table M.5.3.3.1–1 Evaluation Basis Accident Scenarios for Direct Disposition at the Deep Borehole Complex M–327
Table M.5.3.3.1–2 Beyond Evaluation Basis Accident Scenarios for Direct Disposition at the Deep Borehole Complex M–328
Table M.5.3.3.1–3 Direct Disposition at the Deep Borehole Complex Evaluation Basis Accident Source Terms M–329
Table M.5.3.3.1–4 Direct Disposition at the Deep Borehole Complex Beyond Evaluation Basis Accident Source Terms M–330
Table M.5.3.3.1–5 Accident Scenario Descriptions for Direct Disposition at the Deep Borehole Complex M–331
Table M.5.3.3.2–1 Direct Disposition at the Deep Borehole Complex Accident Impacts Ranges at Generic Sites M–333
Table M.5.3.4.1–1 Evaluation Basis Accident Scenarios for Immobilized Disposition at the Deep Borehole Complex M–335
Table M.5.3.4.1–2 Beyond Evaluation Basis Accident Scenarios for Immobilized Disposition at the Deep Borehole Complex M–336
Table M.5.3.4.1–3 Immobilized Disposition at the Deep Borehole Complex Evaluation Basis Accident Source Terms M–337
Table M.5.3.4.1–4 Immobilized Disposition at the Deep Borehole Complex Beyond Evaluation Basis Accident Source Terms M–339
Table M.5.3.4.1–5 Accident Scenario Descriptions for Immobilized Disposition at the Deep Borehole Complex M–340
Table M.5.3.4.2–1 Immobilized Disposition at the Deep Borehole Complex Accident Impacts Ranges at Generic Site M–342
Table M.5.3.5.1–1 Evaluation Basis Accident Scenarios for the Vitrification Alternative M–344
Table M.5.3.5.1–2 Beyond Evaluation Basis Accident Scenarios for the Vitrification Alternative M–345
Table M.5.3.5.1–3 Vitrification Alternative Evaluation Basis Accident Source Terms M–346
Table M.5.3.5.1–4 Vitrification Alternative Beyond Evaluation Basis Accident Source Terms M–347
Table M.5.3.5.1–5 Accident Scenario Descriptions for the Vitrification Alternative M–348
Table M.5.3.5.2–1 Vitrification Alternative Accident Impacts at Hanford Site M–349
Table M.5.3.5.2–2 Vitrification Alternative Accident Impacts at Nevada Test Site M–350
Table M.5.3.5.2–3 Vitrification Alternative Accident Impacts at Idaho National Engineering Laboratory M–351

Table M.5.3.5.2–4 Vitrification Alternative Accident Impacts at Pantex Plant M–352
Table M.5.3.5.2–5 Vitrification Alternative Accident Impacts at Oak Ridge Reservation M–353
Table M.5.3.5.2–6 Vitrification Alternative Accident Impacts at Savannah River Site M–354
Table M.5.3.6.1–1 Evaluation Basis Accident Scenarios for the Ceramic Immobilization Alternative M–355
Table M.5.3.6.1–2 Beyond Evaluation Basis Accident Scenarios for the Ceramic Immobilization Alternative M–356
Table M.5.3.6.1–3 Ceramic Immobilization Alternative Evaluation Basis Accident Source Terms M–357
Table M.5.3.6.1–4 Ceramic Immobilization Alternative Beyond Evaluation Basis Accident Source Terms M–359
Table M.5.3.6.1–5 Accident Scenario Descriptions for Ceramic Immobilization Alternative M–360
Table M.5.3.6.2–1 Ceramic Immobilization Alternative Accident Impacts at Hanford Site M–362
Table M.5.3.6.2–2 Ceramic Immobilization Alternative Accident Impacts at Nevada Test Site M–363
Table M.5.3.6.2–3 Ceramic Immobilization Alternative Accident Impacts at Idaho National Engineering Laboratory M–364
Table M.5.3.6.2–4 Ceramic Immobilization Alternative Accident Impacts at Pantex Plant M–365
Table M.5.3.6.2–5 Ceramic Immobilization Alternative Accident Impacts at Oak Ridge Reservation M–366
Table M.5.3.6.2–6 Ceramic Immobilization Alternative Accident Impacts at Savannah River Site M–367
Table M.5.3.7.1–1 Evaluation Basis Accident Scenarios for Immobilized Disposition at the Ceramic Immobilization Facility M–368
Table M.5.3.7.1–2 Beyond Evaluation Basis Accident Scenarios for Immobilized Disposition at the Ceramic Immobilization Facility M–369
Table M.5.3.7.1–3 Immobilized Disposition at the Ceramic Immobilization Facility Evaluation Basis Accident Source Terms M–370
Table M.5.3.7.1–4 Immobilized Disposition at the Ceramic Immobilization Facility Beyond Evaluation Basis Accident Source Terms M–372
Table M.5.3.7.1–5 Accident Scenario Descriptions for Immobilized Disposition at the Ceramic Immobilization Facility M–373
Table M.5.3.7.2–1 Immobilized Disposition at the Ceramic Immobilization Facility Accident Impacts at Hanford Site M–375
Table M.5.3.7.2–2 Immobilized Disposition at the Ceramic Immobilization Facility Accident Impacts at Nevada Test Site M–376
Table M.5.3.7.2–3 Immobilized Disposition at the Ceramic Immobilization Facility Accident Impacts at Idaho National Engineering Laboratory M–377
Table M.5.3.7.2–4 Immobilized Disposition at the Ceramic Immobilization Facility Accident Impacts at Pantex Plant M–378
Table M.5.3.7.2–5 Immobilized Disposition at the Ceramic Immobilization Facility Accident Impacts at Oak Ridge Reservation M–379

Table M.5.3.7.2–6 Immobilized Disposition at the Ceramic Immobilization Facility Accident Impacts at Savannah River Site M–380
Table M.5.3.8.1–1 Advanced Boiling Water Reactor Evaluation Basis Accident Source Terms M–382
Table M.5.3.8.1–2 Advanced Boiling Water Reactor Beyond Evaluation Basis Accident Source Terms M–384
Table M.5.3.8.2–1 Evolutionary Light Water Reactor Accident Impacts at Hanford Site M–385
Table M.5.3.8.2–2 Evolutionary Light Water Reactor Accident Impacts at Nevada Test Site M–386
Table M.5.3.8.2–3 Evolutionary Light Water Reactor Accident Impacts at Idaho National Engineering Laboratory M–387
Table M.5.3.8.2–4 Evolutionary Light Water Reactor Accident Impacts at Pantex Plant M–388
Table M.5.3.8.2–5 Evolutionary Light Water Reactor Accident Impacts at Oak Ridge Reservation M–389
Table M.5.3.8.2–6 Evolutionary Light Water Reactor Accident Impacts at Savannah River Site M–390
Table M.5.3.9.1–1 Evaluation Basis Accident Scenarios for the Plutonium Conversion Facility M–391
Table M.5.3.9.1–2 Beyond Evaluation Basis Accident Scenarios for the Plutonium Conversion Facility M–391
Table M.5.3.9.1–3 Plutonium Conversion Facility Criticality Source Terms M–392
Table M.5.3.9.1–4 Plutonium Conversion Facility Evaluation Basis Source Terms M–392
Table M.5.3.9.1–5 Plutonium Conversion Facility Beyond Evaluation Basis Accident Source Terms M–393
Table M.5.3.9.1–6 Accident Scenario Descriptions for the Plutonium Conversion Facility M–394
Table M.5.3.9.2–1 Plutonium Conversion Facility Accident Consequences at Hanford Site M–396
Table M.5.3.9.2–2 Plutonium Conversion Facility Accident Impacts at Nevada Test Site M–397
Table M.5.3.9.2–3 Plutonium Conversion Facility Accident Impacts at Idaho National Engineering Laboratory M–398
Table M.5.3.9.2–4 Plutonium Conversion Facility Accident Impacts at Pantex Plant M–399
Table M.5.3.9.2–5 Plutonium Conversion Facility Accident Impacts at Oak Ridge Reservation M–400
Table M.5.3.9.2–6 Plutonium Conversion Facility Accident Impacts at Savannah River Site M–401
Table M.5.3.10–1 Accident Impacts for Existing Light Water Reactor With Mixed Oxide Fuels M–403
Table M.5.3.10–2 Ratio of Accident Impacts for Mixed Oxide and Uranium Fueled Reactors for Typical Severe Accidents (Mixed Oxide Impacts/Uranium Impacts) M–405
Table M.5.3.10–3 Accident Impact Sensitivity Analysis for Light Water Reactors Using Mixed Oxide Fuels M–406
Table M.5.3.11–1 Ratio of Accident Dose for Americium, Curium, and Plutonium in a Mixed Oxide Fueled Reactor to Total Dose for Uranium Fueled Reactor (Americium+Curium+Plutonium Dose/Total Dose) M–407
Table N.5.1–1 Advanced Light Water Reactor Costs (1996 Dollars) N–5

Table N.5.2–1 Modular Helium Reactor Costs (1996 Dollars) N–7
Table O.3–1 Locations for Proposed Vitrification Can-in-Canister Process Equipment O–2
Table O.4–1 Locations for Proposed Ceramic Can-in-Canister Process Equipment..... O–10
Table P.2.3.2–1 Pollutant Emission Rates Related to Storage of Pits at the Manzano Weapons Storage Area P–6
Table P.2.3.3–1 Threshold Values..... P–6
Table P.2.9.1–1 Major Sources of Radiation Exposure in the Vicinity of the Manzano Weapons Storage Area at Kirtland Air Force Base..... P–9
Table P.2.9.3–1 Albuquerque International Airport Operations for 1994..... P–12
Table Q.4–1 Estimated Transportation and Staging Worker Exposures for the Proposed Action Q–3

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

^{o}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
^{o}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] (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
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]

Materials/Resources	Total Consumption			
	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

	Total Consumption							
	Hanford	NTS		INEL	Pantex	ORR		SRS
Materials/ Resources		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]

Utility	Annual Average Consumption			
	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]

Utility	Annual Average Consumption					
			Pantex		SRS	
	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						
Annual average consumption (MWh)	21,150	4,500	1,375	48,000	4,900	3,600
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

Utility	Average Annual Consumption	
	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

Chemical	Annual Quantity (kg)						
	Hanford	NTS		INEL	Pantex		SRS
		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

Chemical	Annual Quantity (kg)						
	Hanford	NTS		INEL	Pantex		SRS
		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

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]	
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

	Number of Employees						
	Hanford	NTS		INEL	Pantex		SRS
Labor Category		New Pu Storage Facility	Modify P-Tunnel		New Pu Storage Facility	New and Modified Zone 12 South Facilities	
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

	Number of Employees							
	Hanford	NTS		INEL	Pantex	ORR		SRS
Labor Category		New Pu and HEU Storage Facility	Modify P-Tunnel			New Pu and HEU Storage Facility	New Pu Storage Facility Only[a]	
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

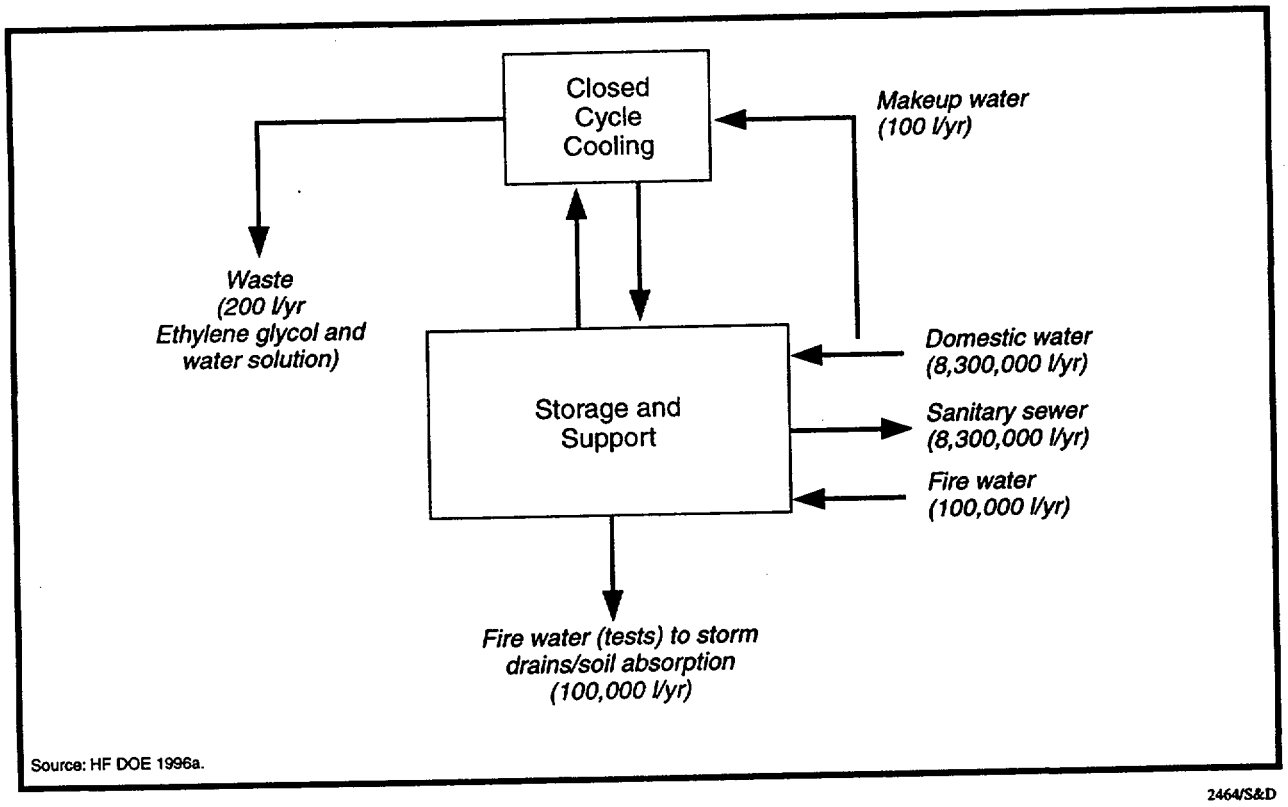
Source: LLNL 1996g.

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

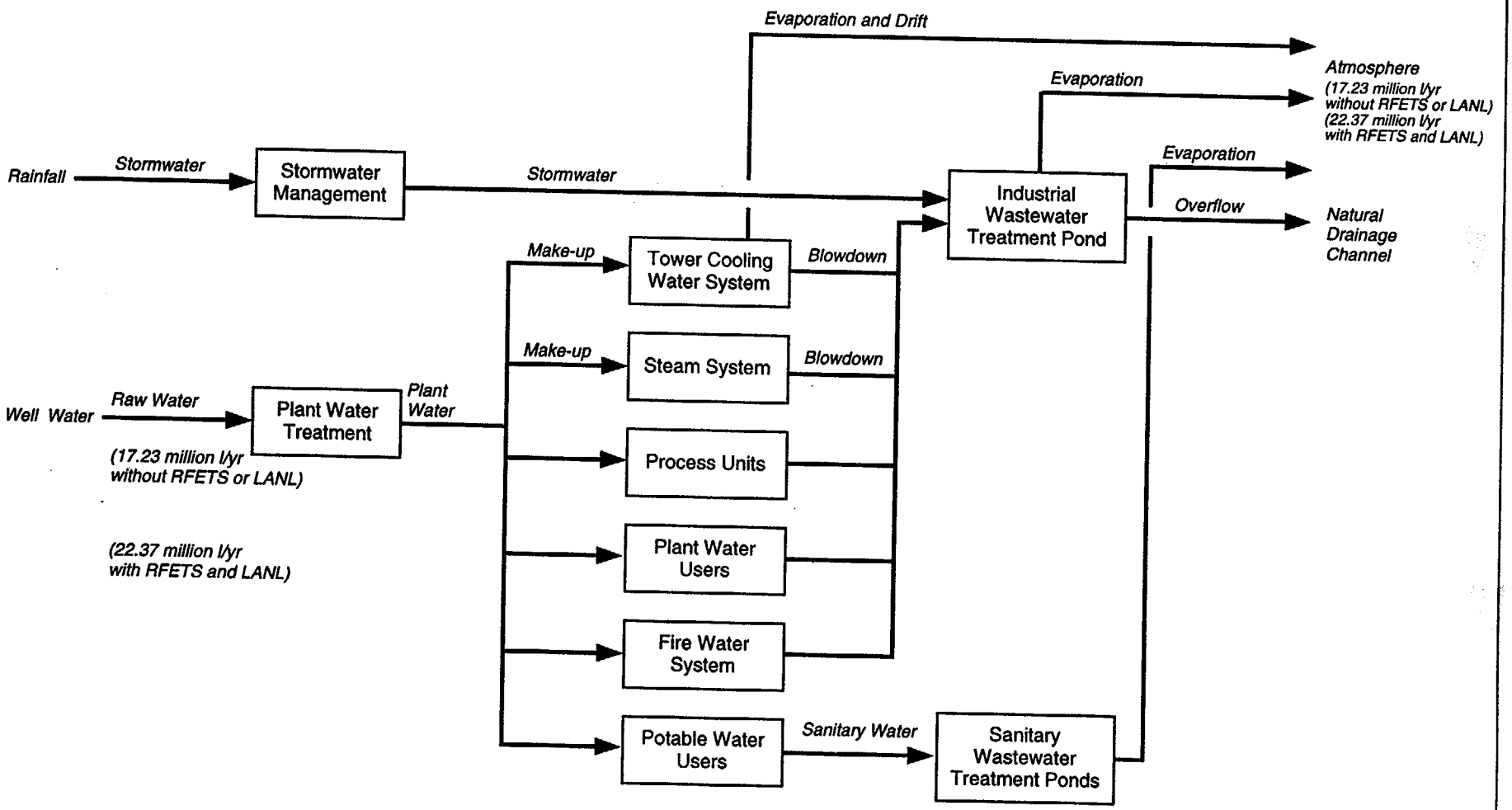
The water balance diagrams with flow rates in liter/year (l/yr) in Figure D.1–1 to D.1–20 for the plutonium (Pu) and highly enriched uranium (HEU) storage alternatives are organized into three groups: modification of existing and/or construction of new storage facilities, consolidated Pu storage facilities, 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).



Source: HF DOE 1996a.

2464/S&D

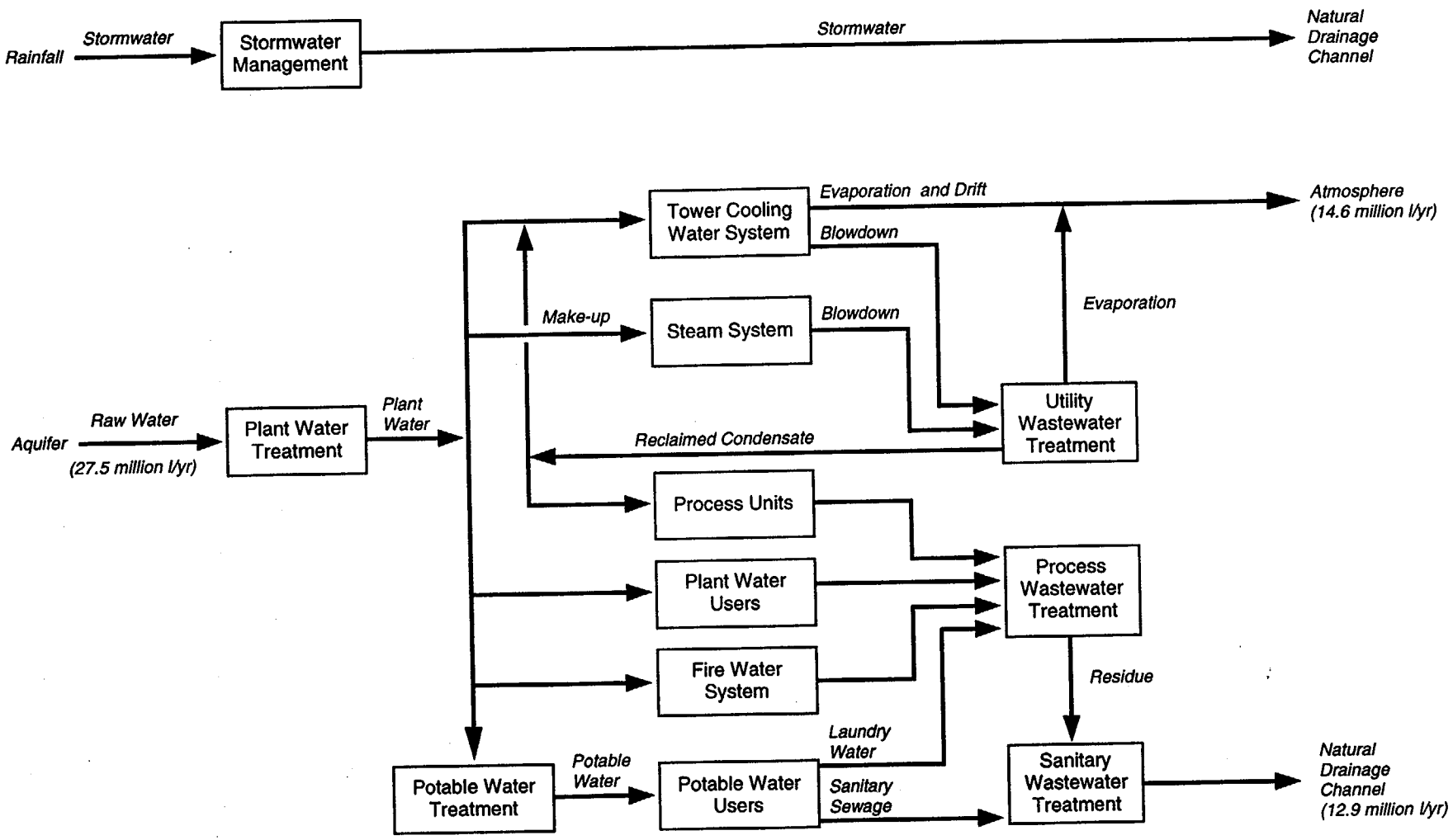
Figure D.1–1. Annual Water Balance for the Upgrade Alternative at Hanford Site.



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.

2523/S&D

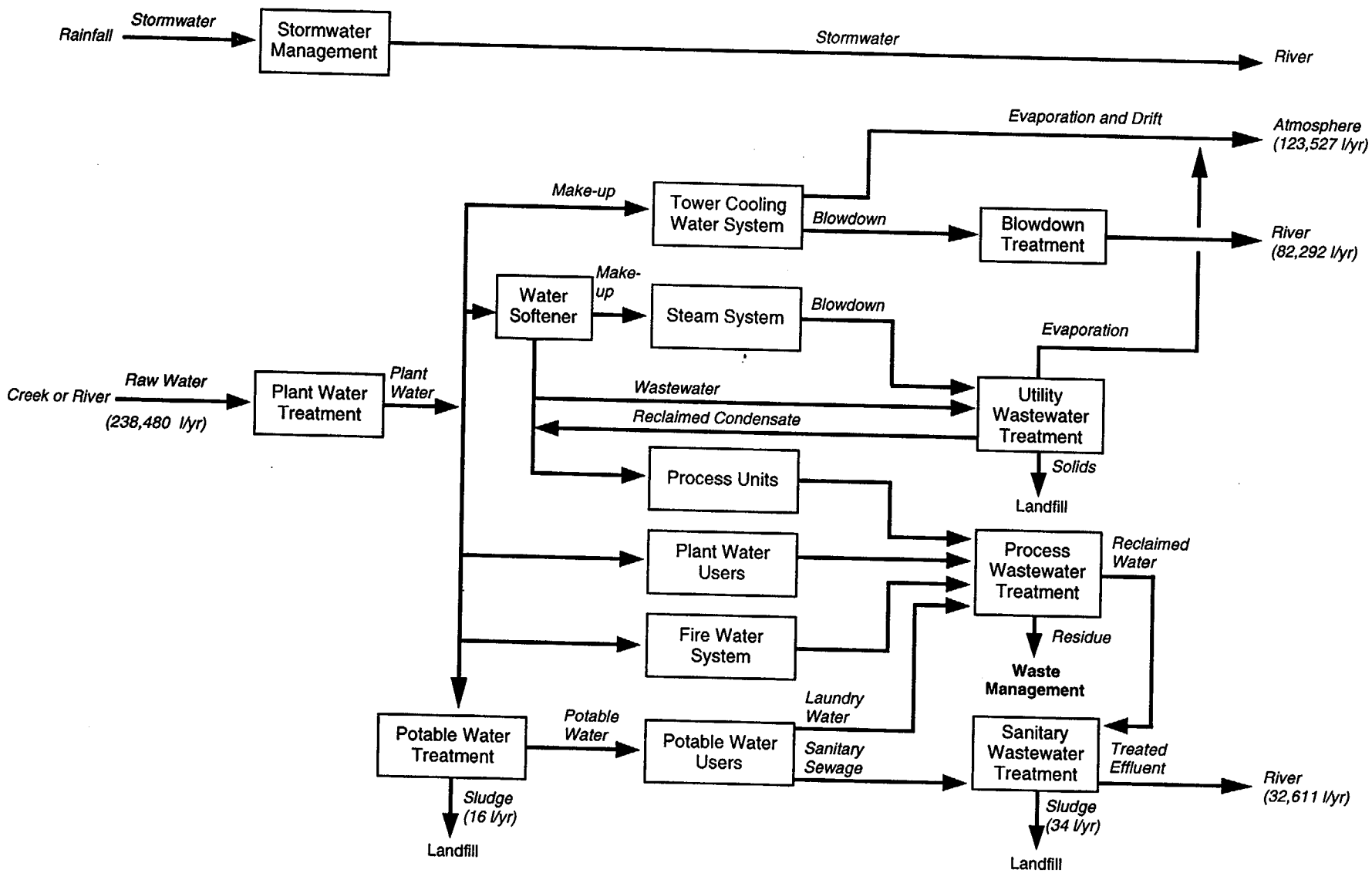
Figure D.1–2. Annual Water Balance for the Upgrade Alternative at Idaho National Engineering Laboratory, Argonne National Laboratory–West.



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

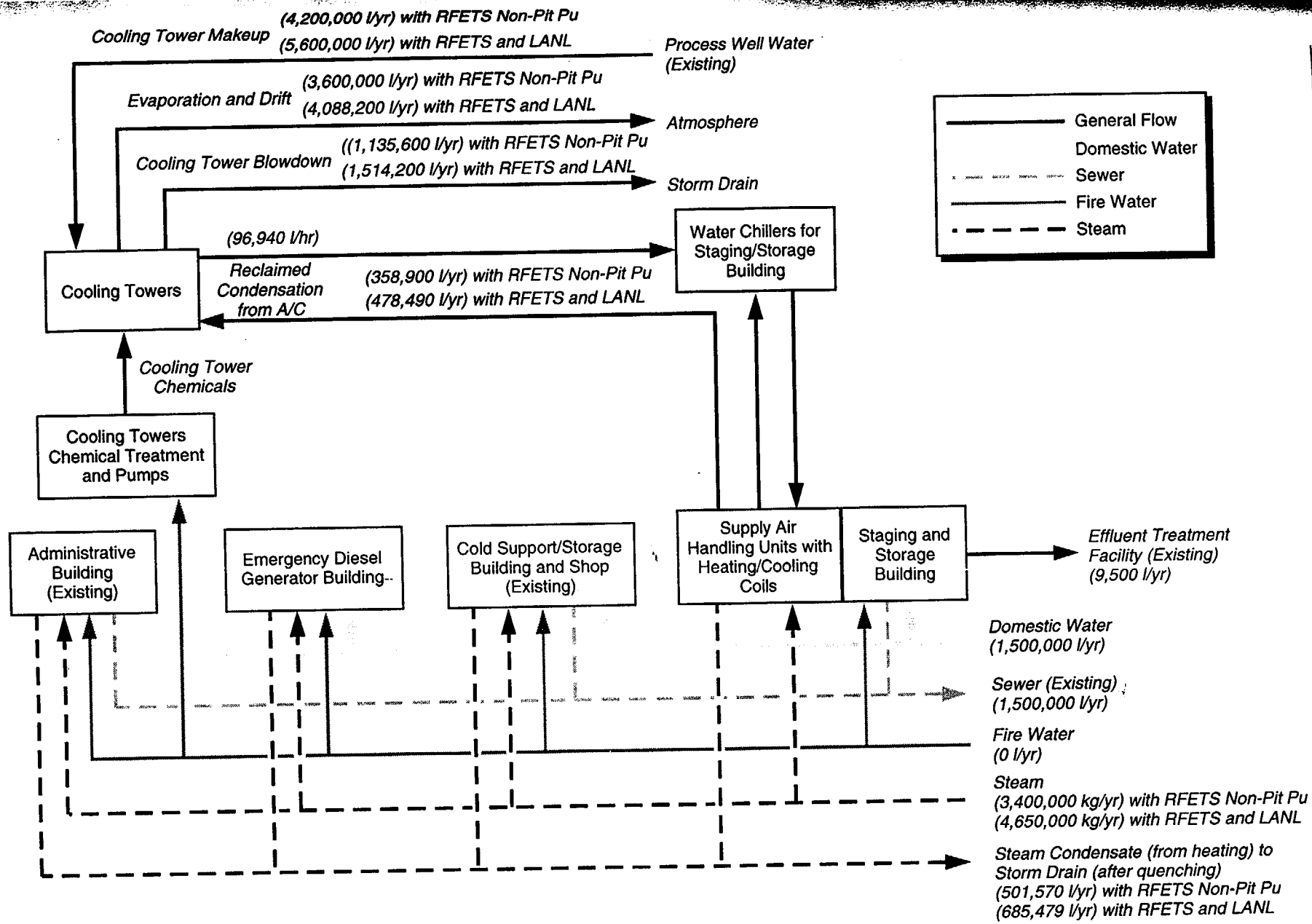
Figure D.1–3. Annual Water Balance for the Upgrade Alternative at Pantex Plant.



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.

2966/S&D

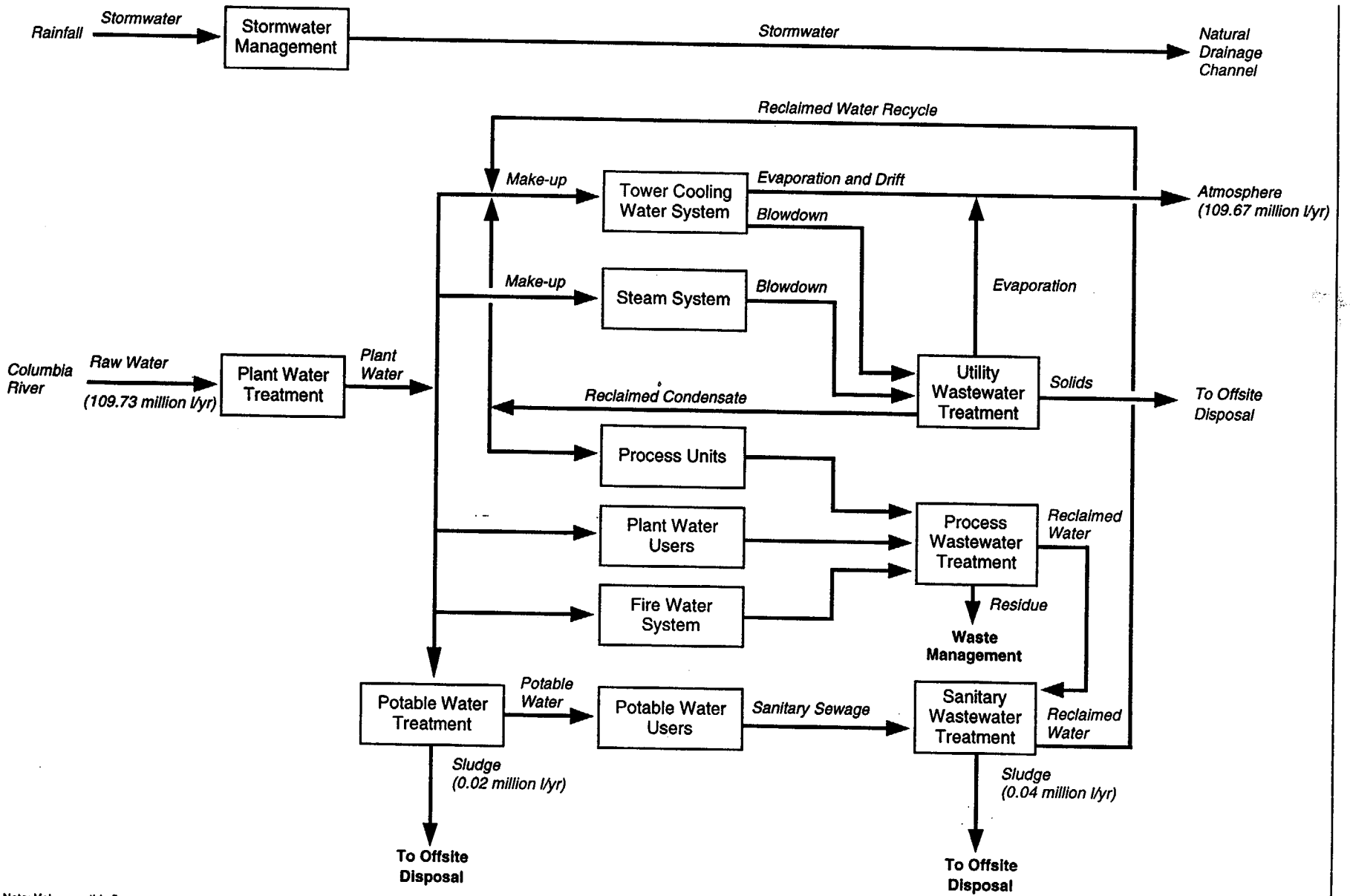
Figure D.1–4. Annual Water Balance for the Upgrade Alternative at Oak Ridge Reservation, Y–12 Plant.



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

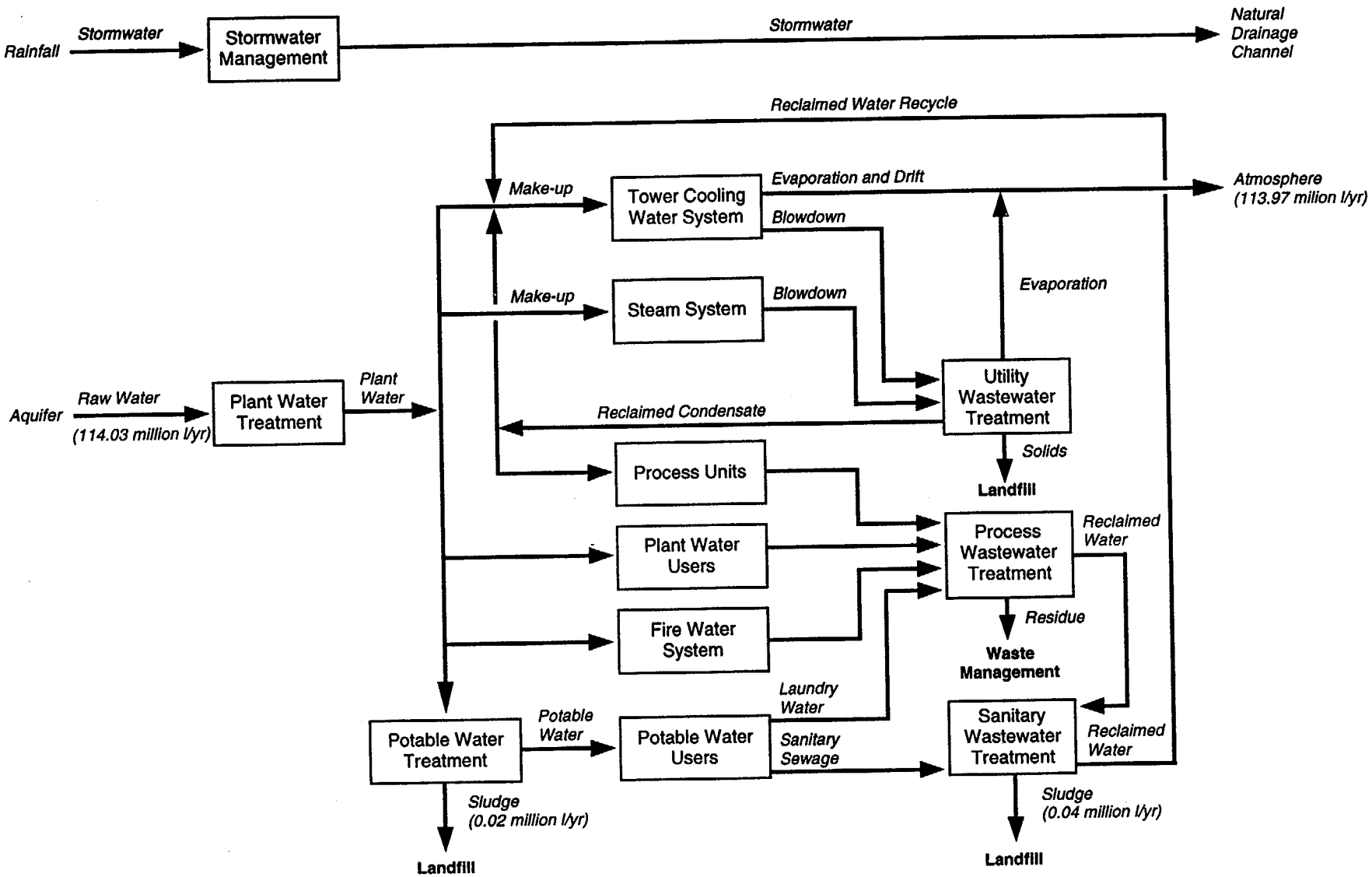
Figure D.1–5. Annual Water Balance for the Upgrade Alternatives at Savannah River Site.



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.

3264/S&D

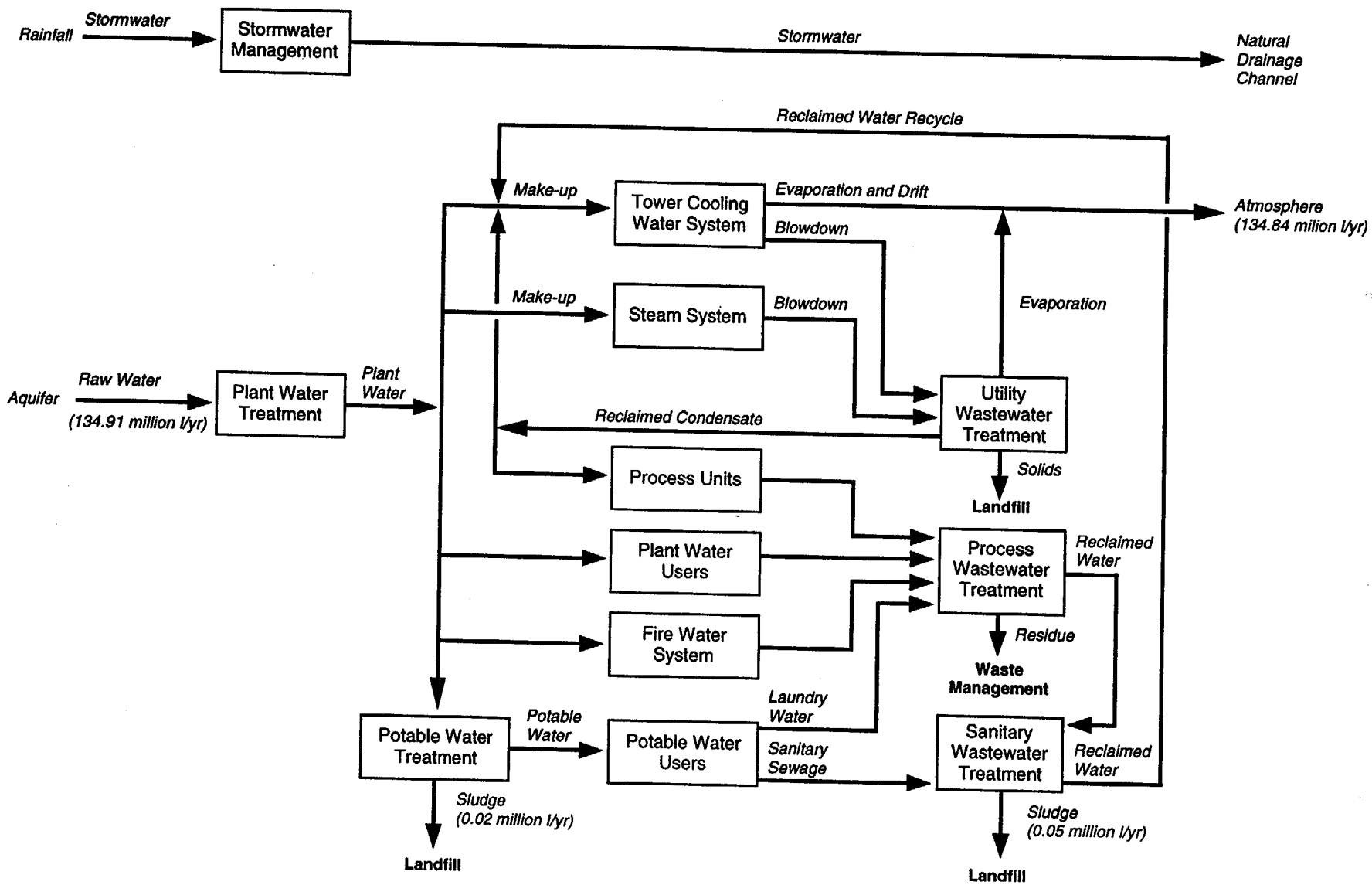
Figure D.1–6. Annual Water Balance for the Consolidation Alternative at Hanford Site.



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

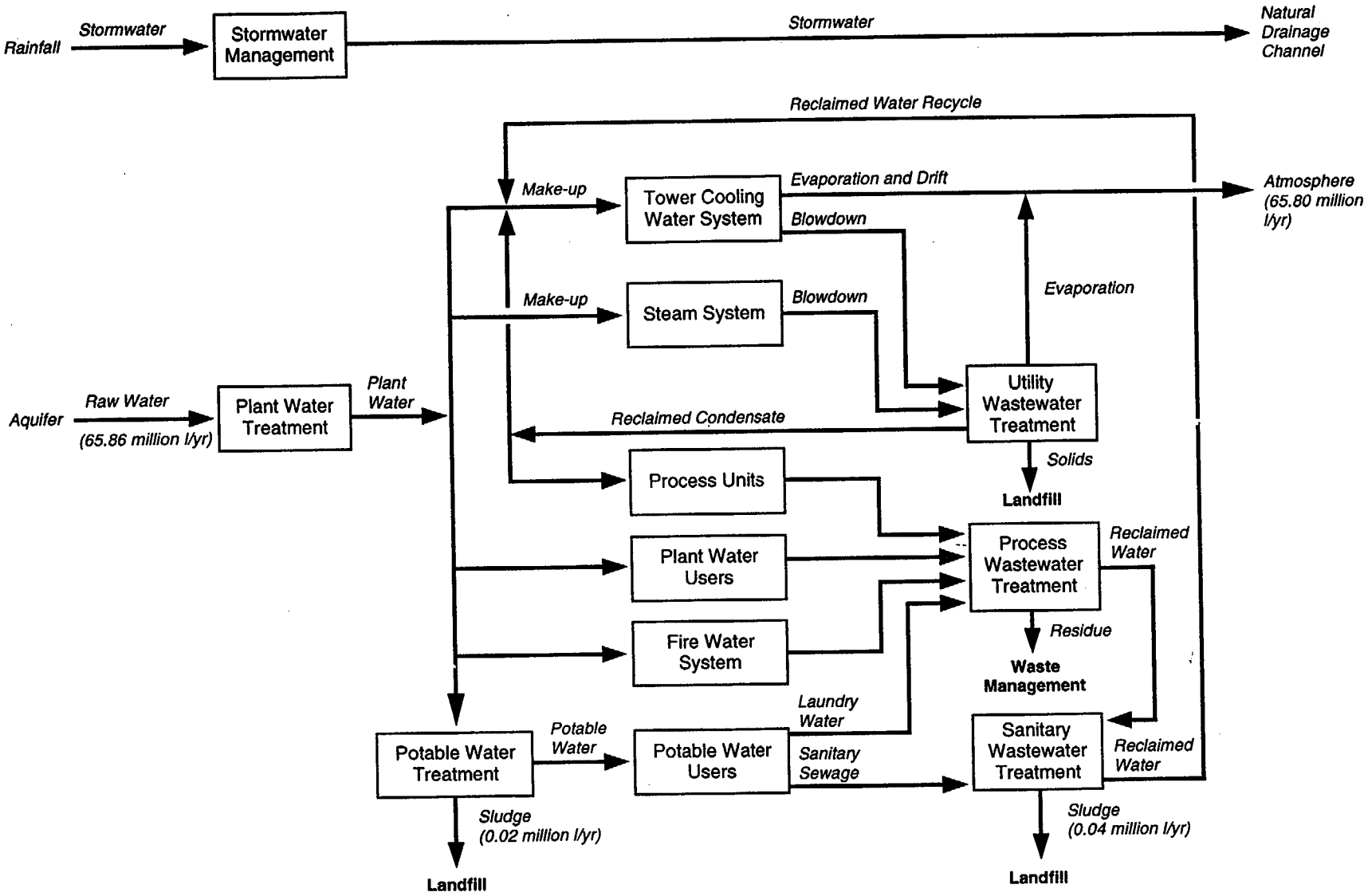
Figure D.1–7. Annual Water Balance for the Consolidation Alternative Constructing a New Facility at Nevada Test Site.



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.

3089/S&D

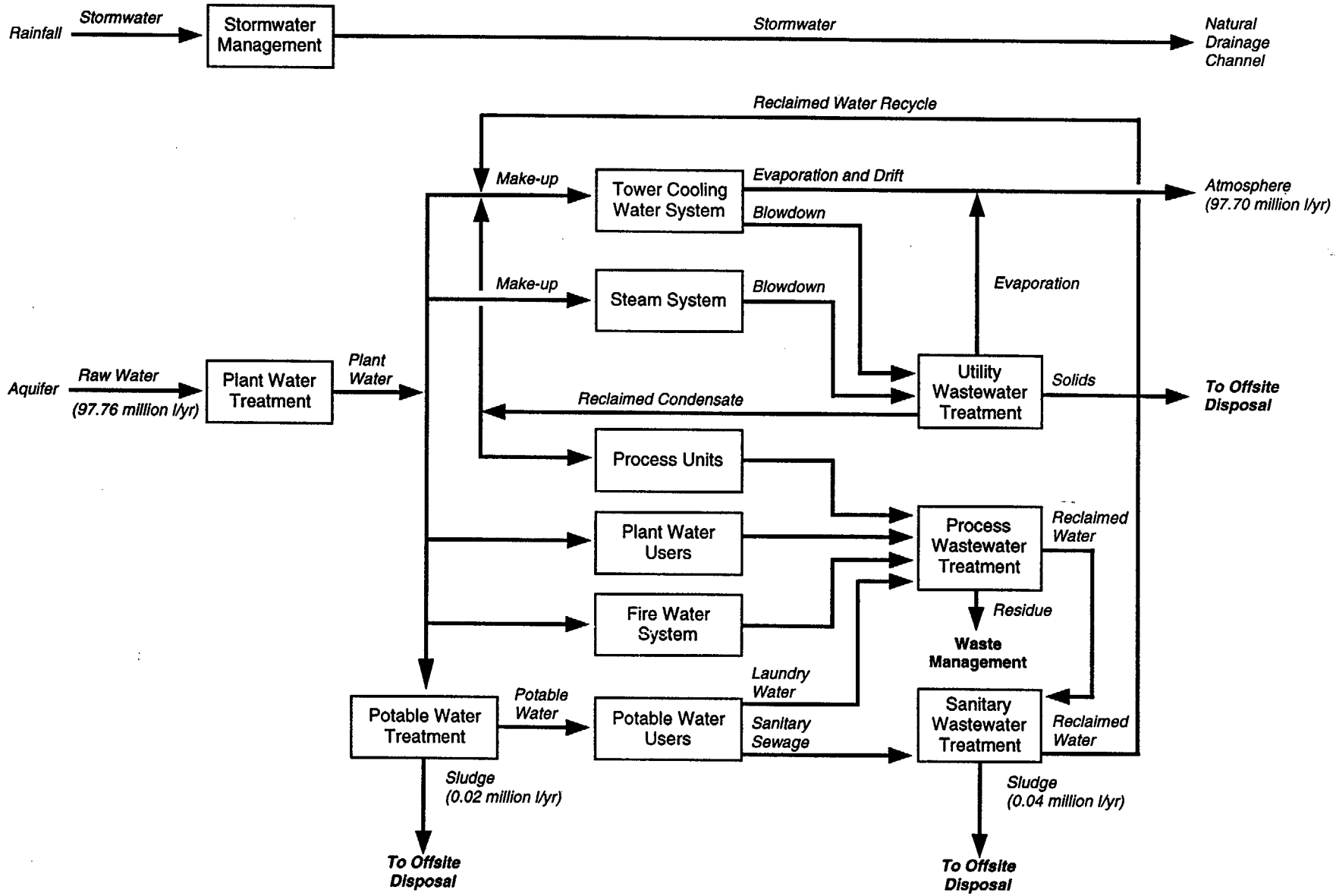
Figure D.1–8. Annual Water Balance for the Consolidation Alternative Modifying P-Tunnel at Nevada Test Site.



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

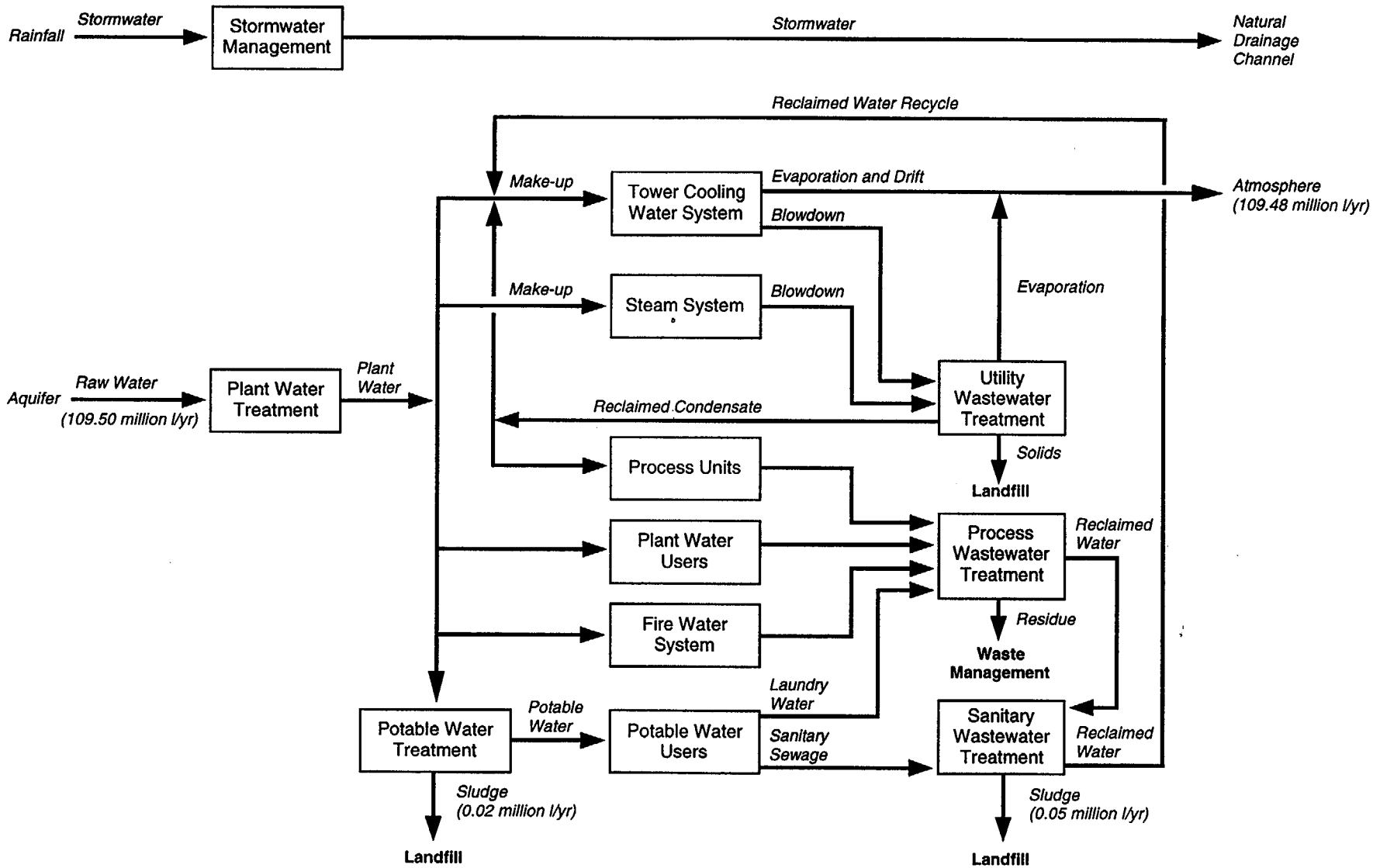
Figure D.1–9. Annual Water Balance for the Consolidation Alternative at Idaho National Engineering Laboratory.



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.

2498/S&D

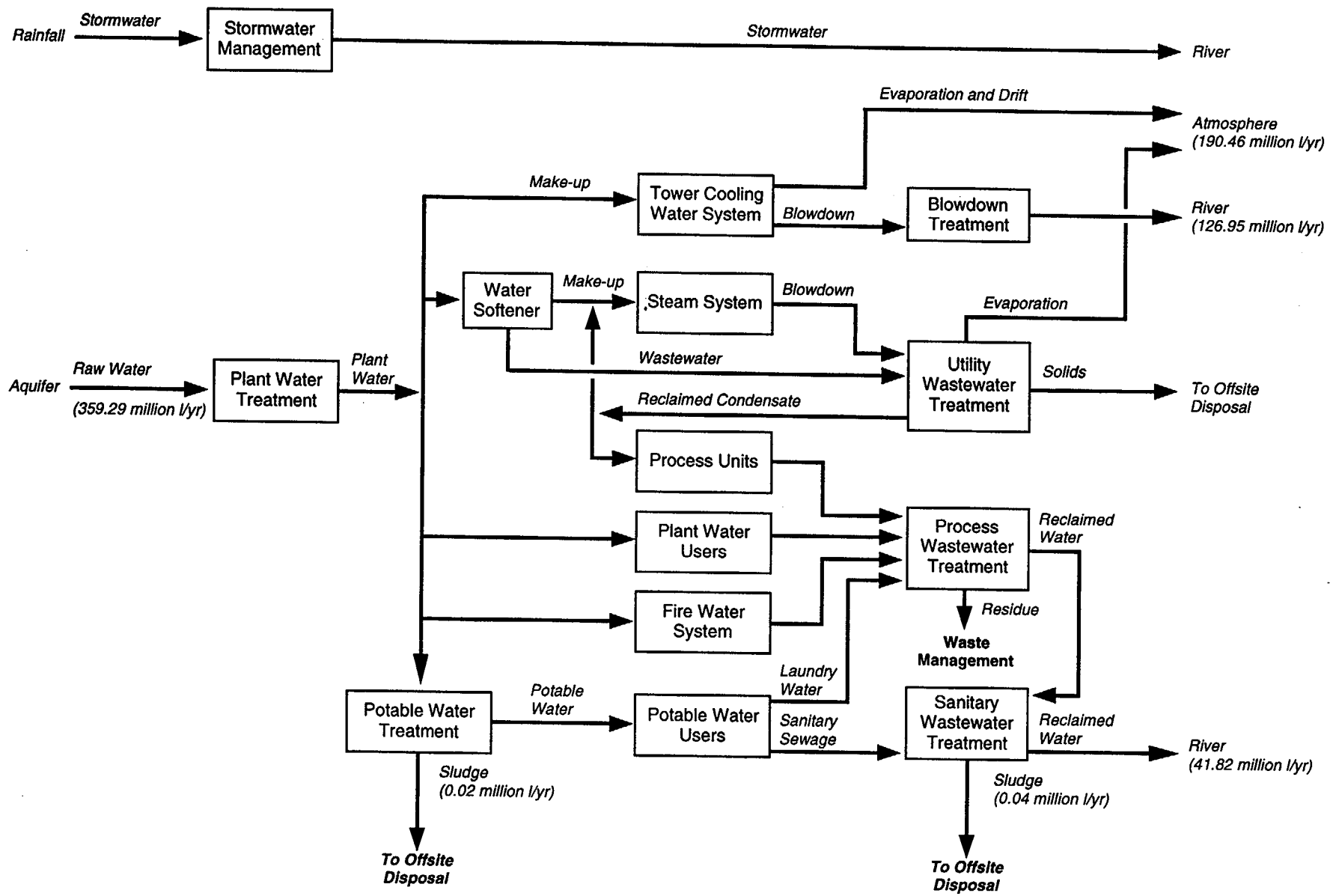
Figure D.1–10. Annual Water Balance for the Consolidation Alternative Constructing a New Facility at Pantex Plant.



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.

2519/S&D

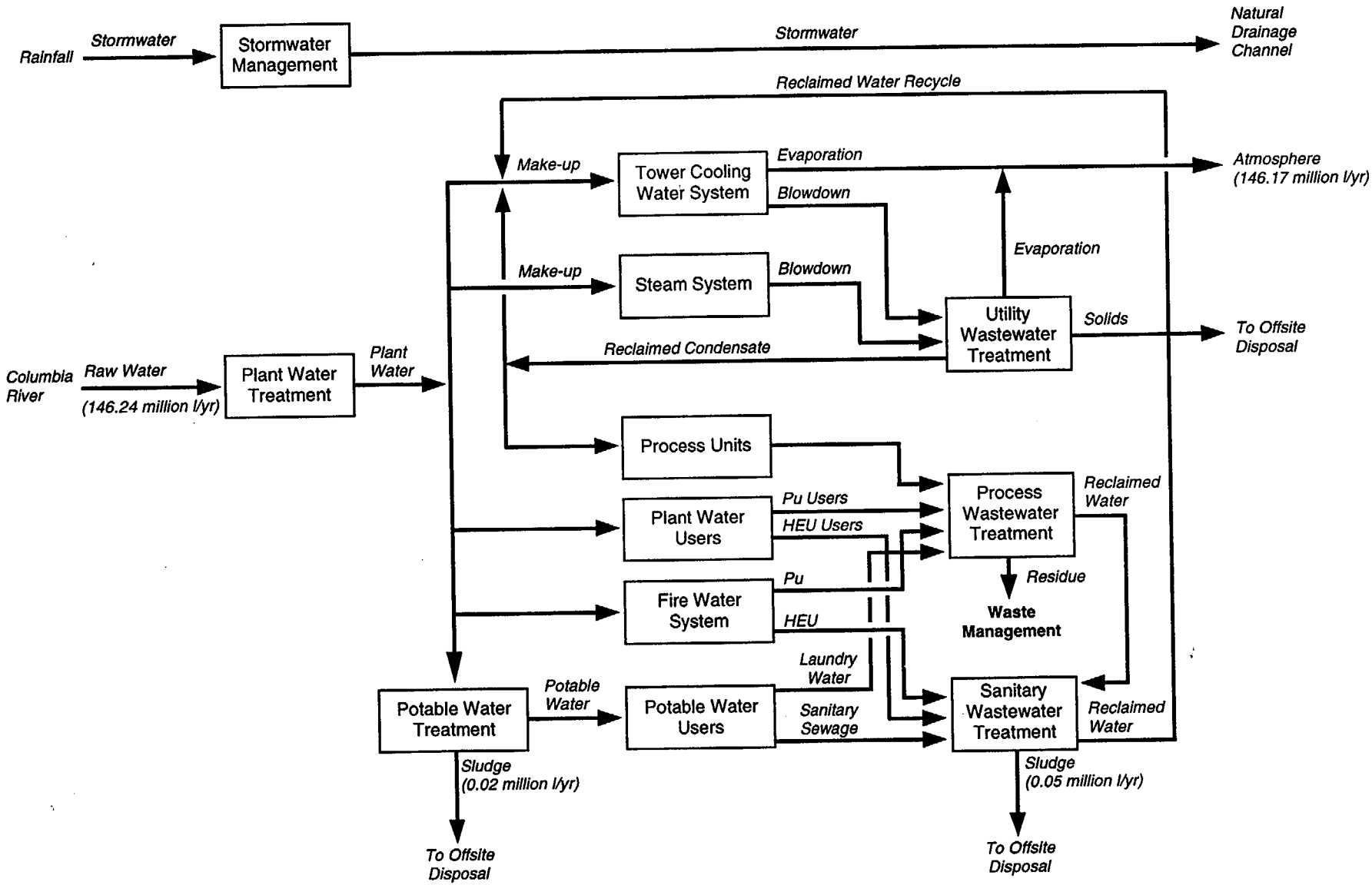
Figure D.1–11. Annual Water Balance for the Consolidation Alternative Modifying Zone 12 South at Pantex Plant.



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.

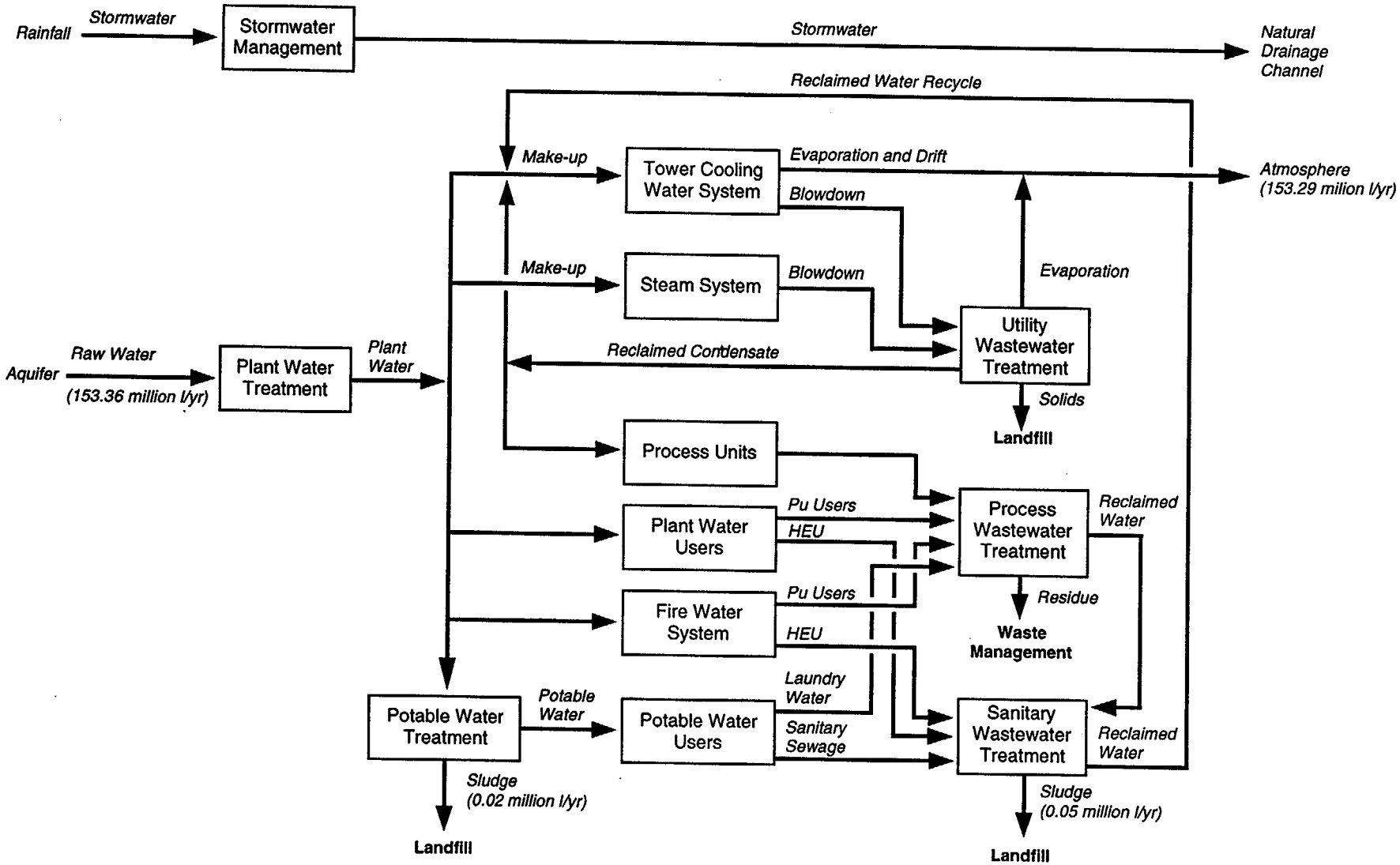
2499/S&D

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.

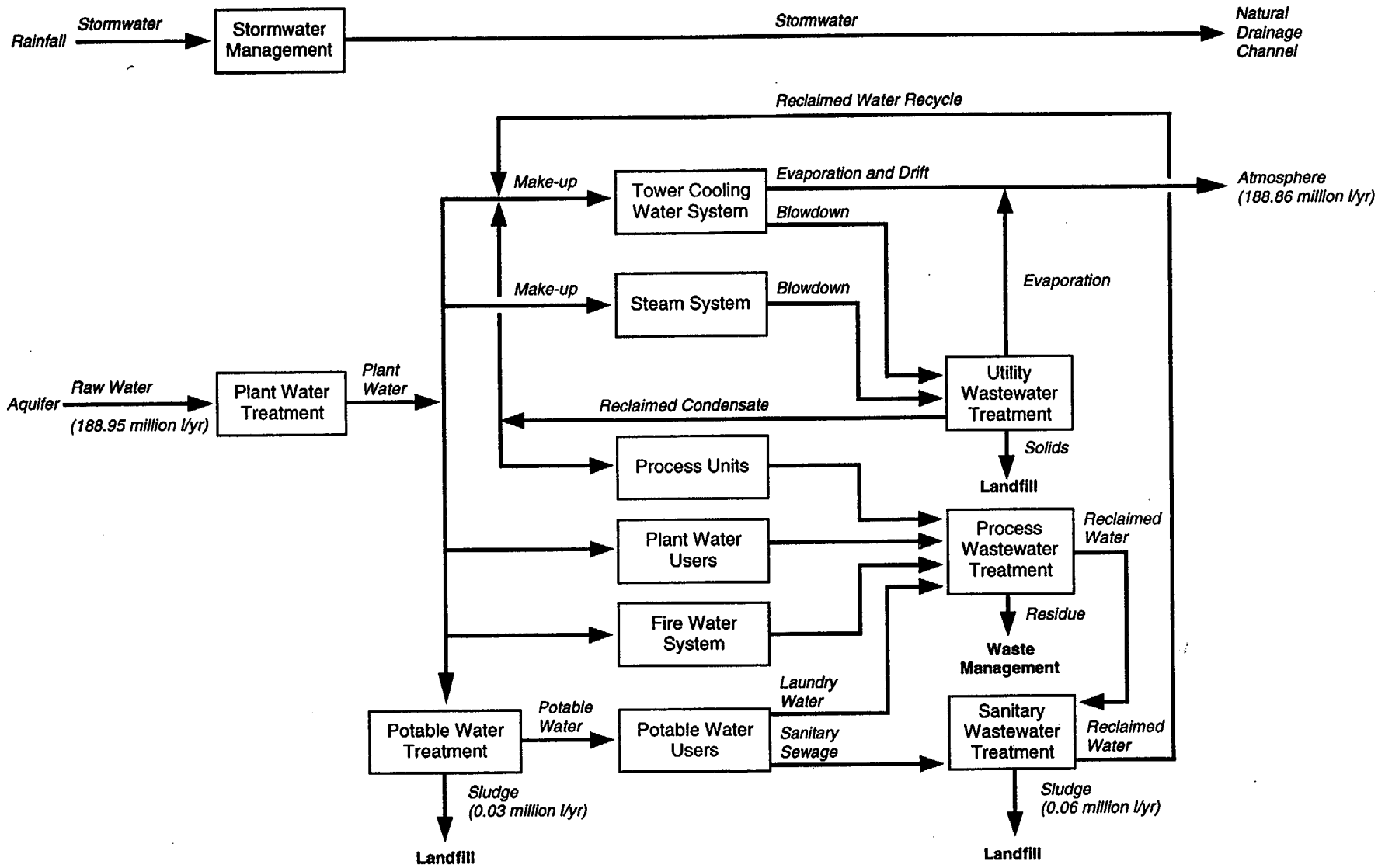
Figure D.1–13. Annual Water Balance for the Collocation Alternative at Hanford Site.



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.

2482/S&D

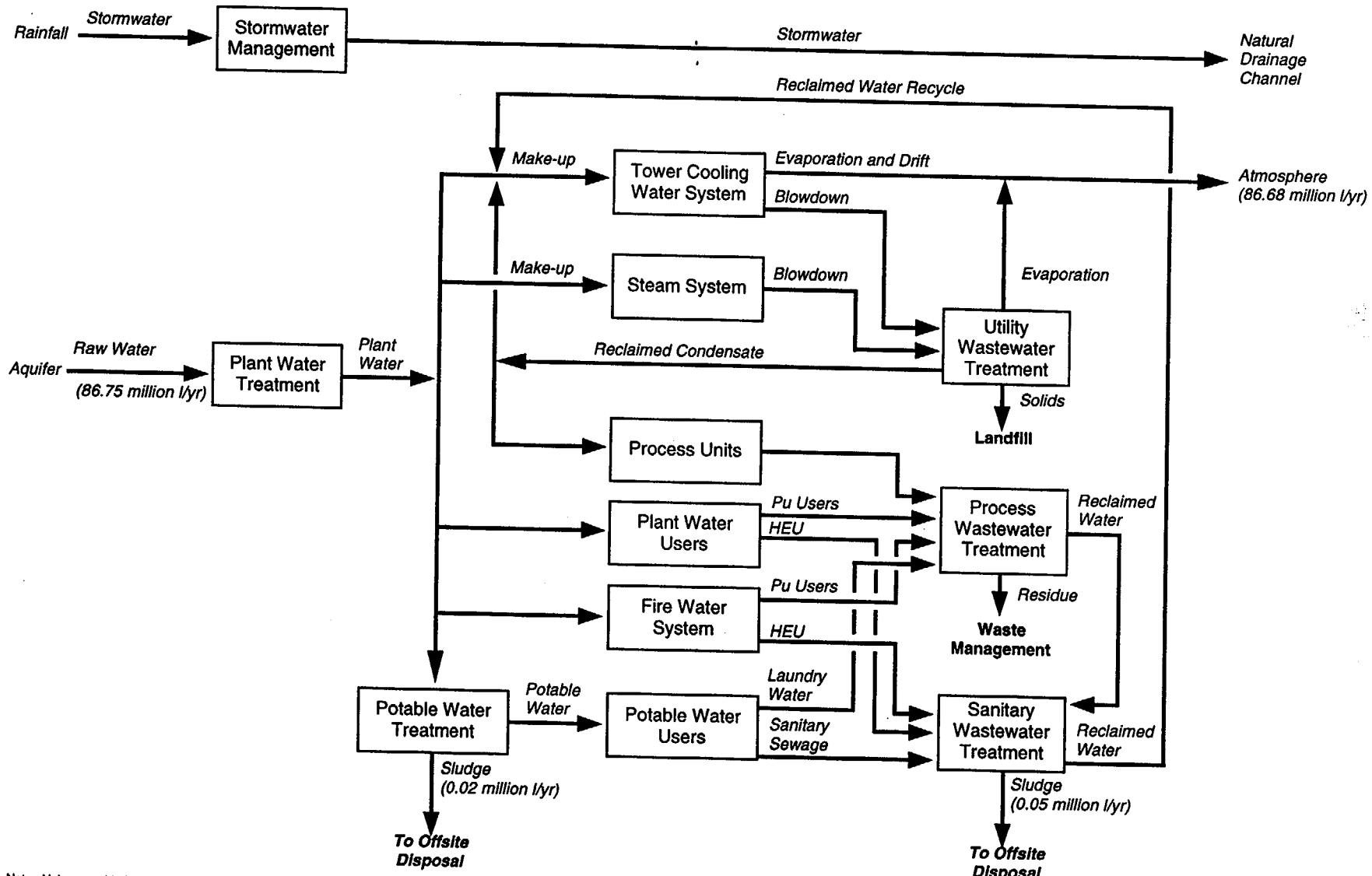
Figure D.1–14. Annual Water Balance for the Collocation Alternative Constructing a New Facility at Nevada Test Site.



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.

2486/S&D

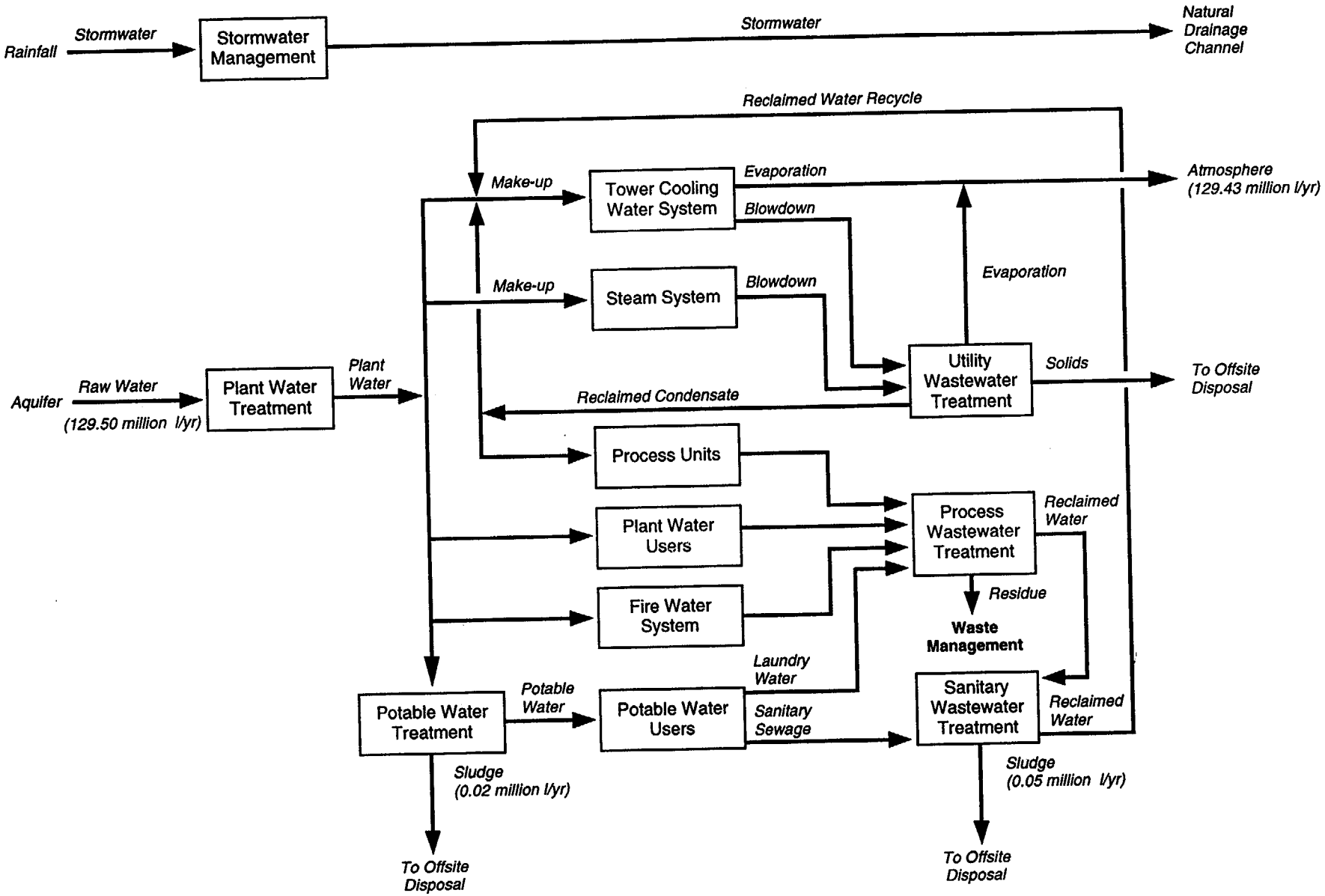
Figure D.1–15. Annual Water Balance for the Collocation Alternative Modifying P-Tunnel at Nevada Test Site.



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.

2481/S&D

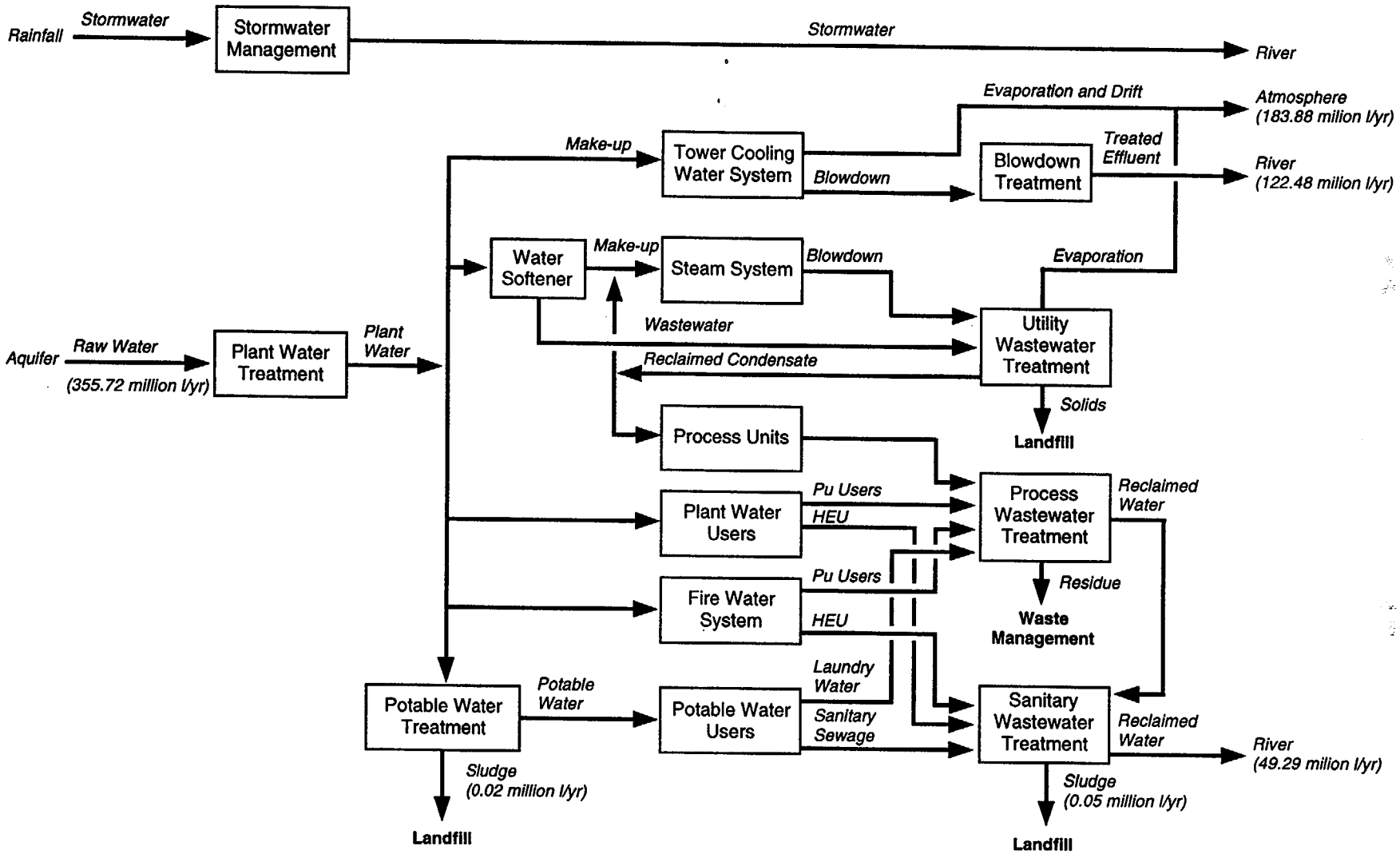
Figure D.1–16. Annual Water Balance for the Collocation Alternative at Idaho National Engineering Laboratory.



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.

2968/S&D

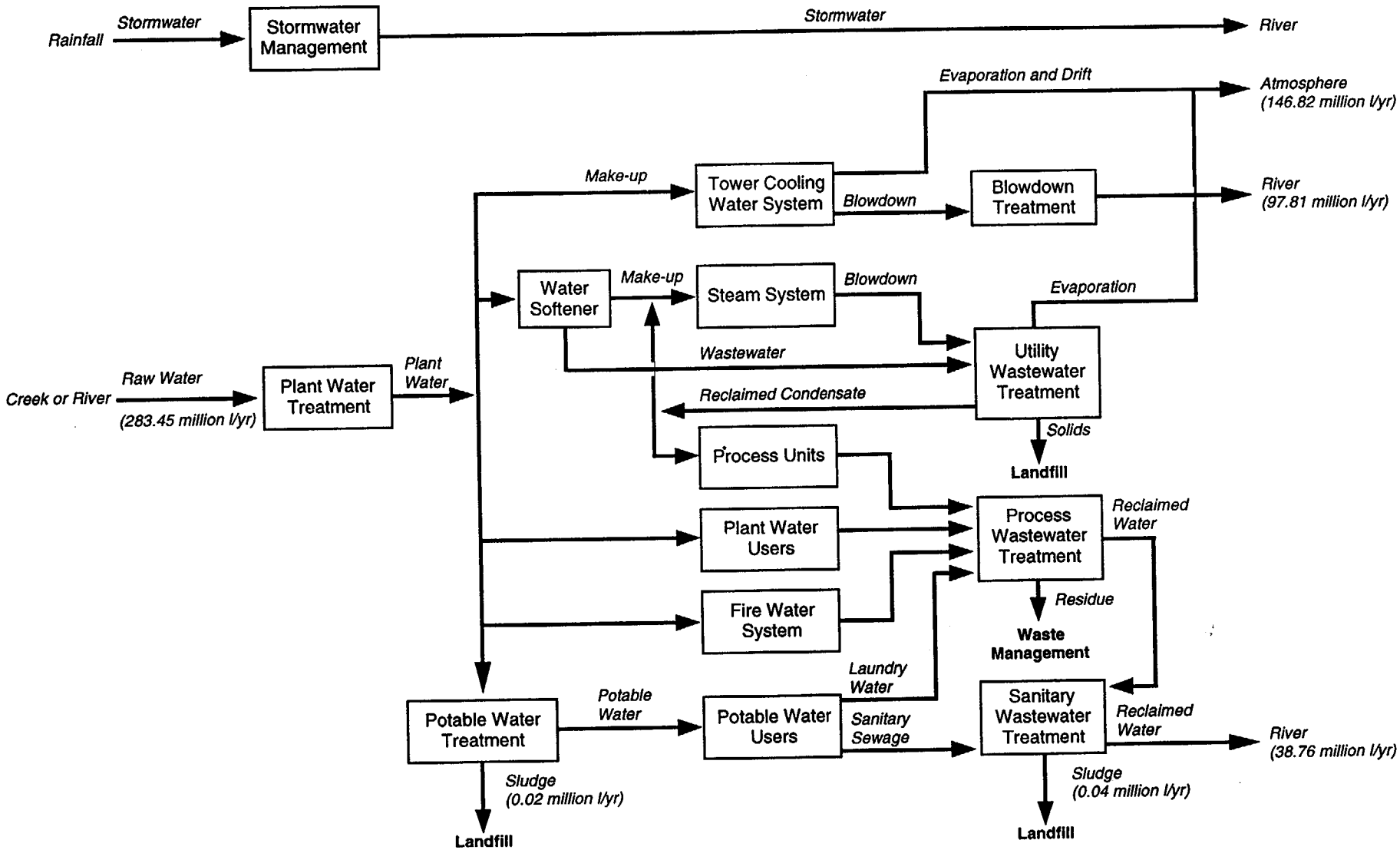
Figure D.1–17. Annual Water Balance for the Collocation Alternative at Pantex Plant.



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.

2483/S&D

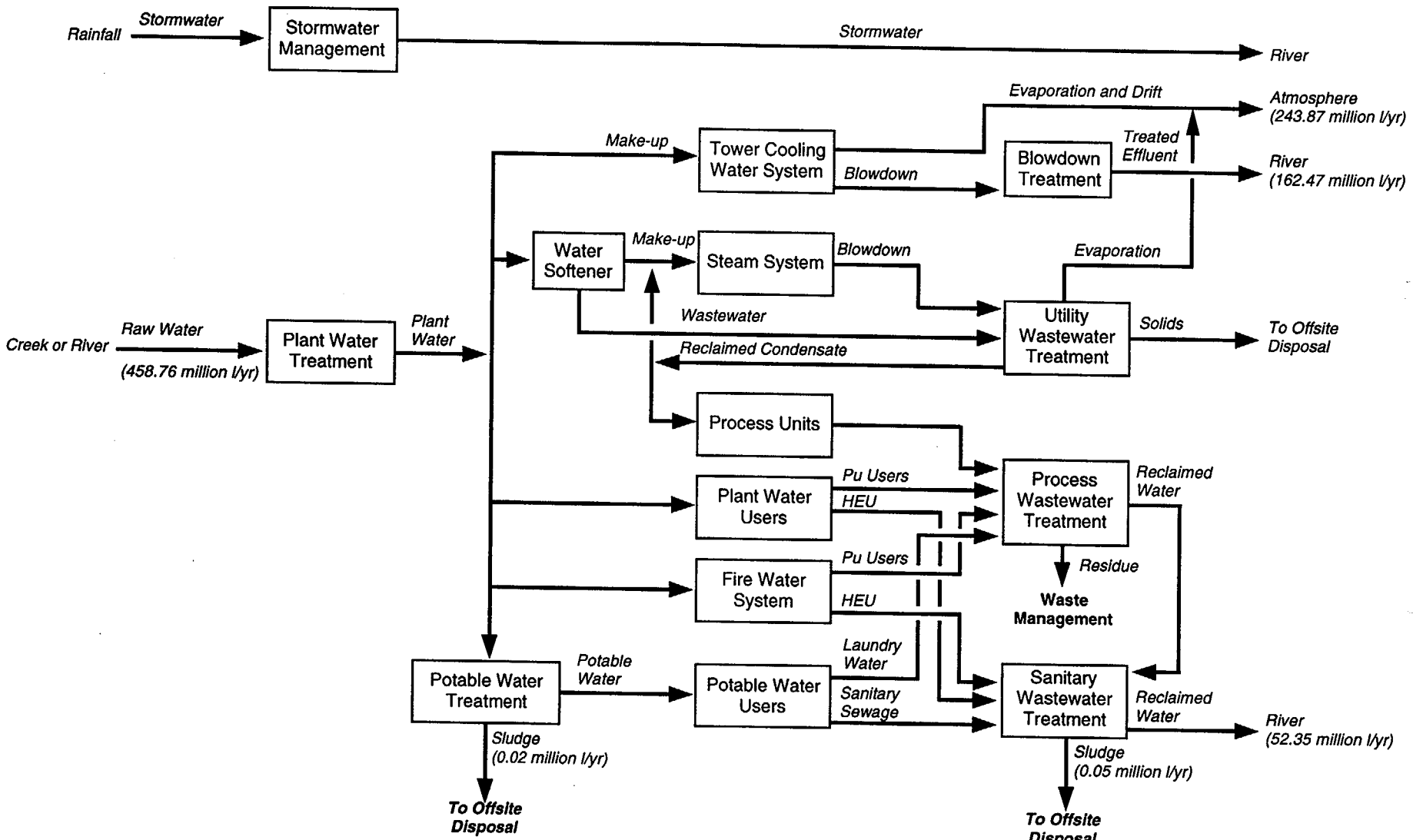
Figure D.1–18. Annual Water Balance for the Collocation Alternative Constructing a New Facility at Oak Ridge Reservation.



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.

2485/S&D

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.

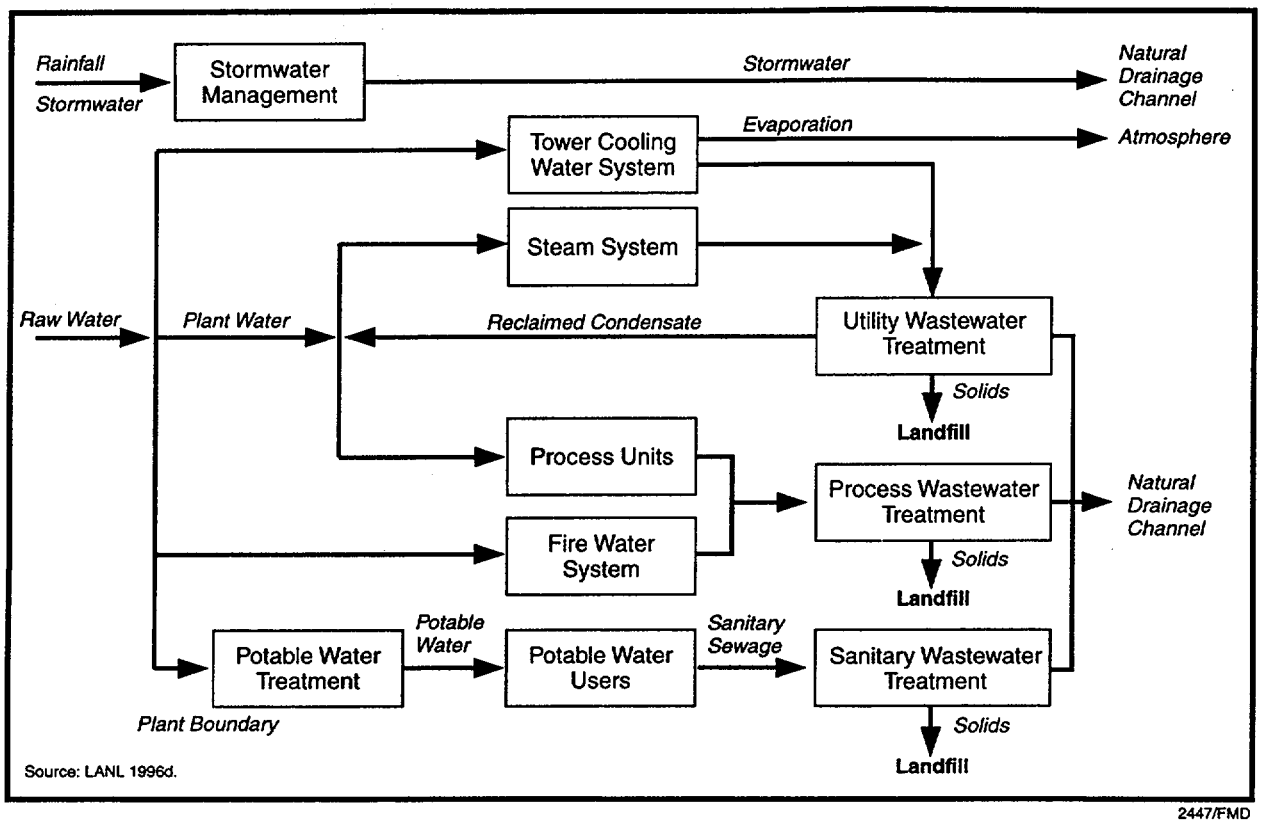


Figure D.2–1. Typical Water Balance for the Pit Disassembly/Conversion Facility.

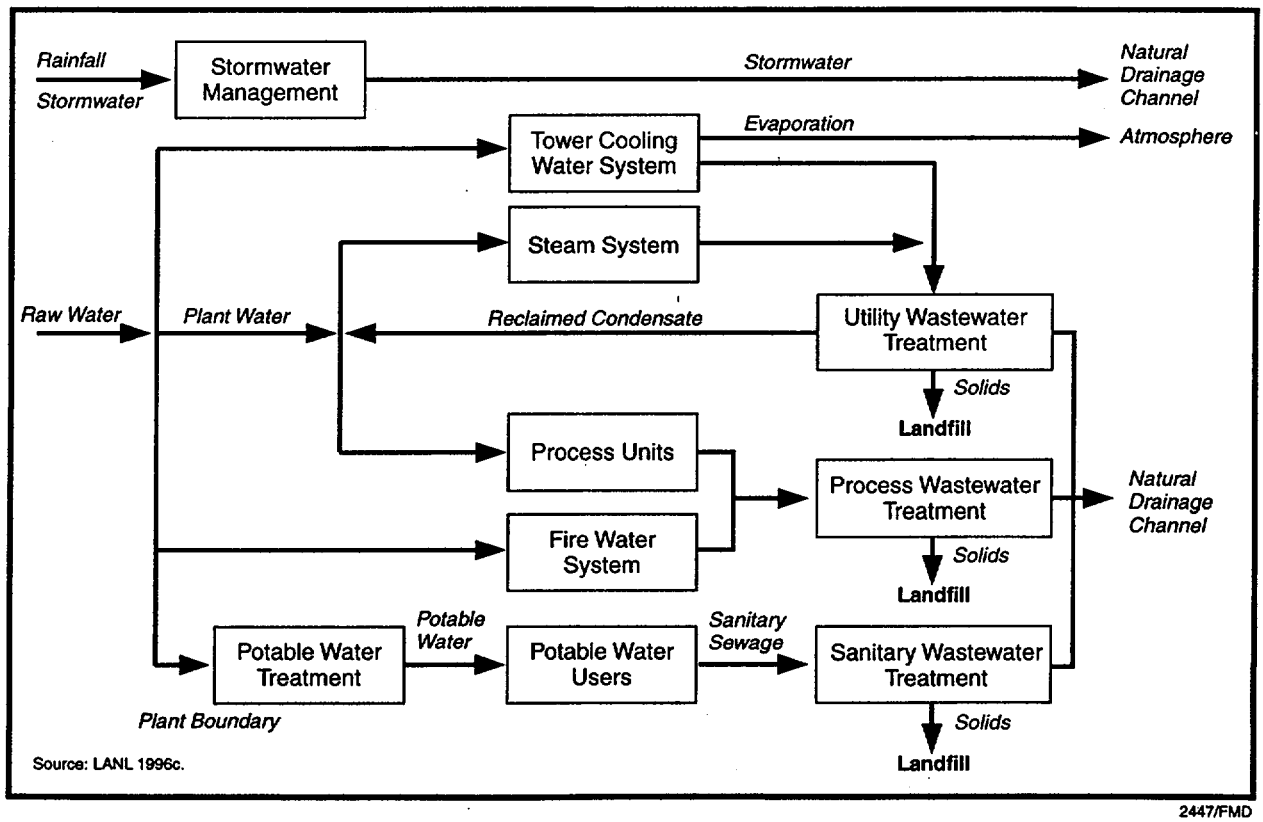
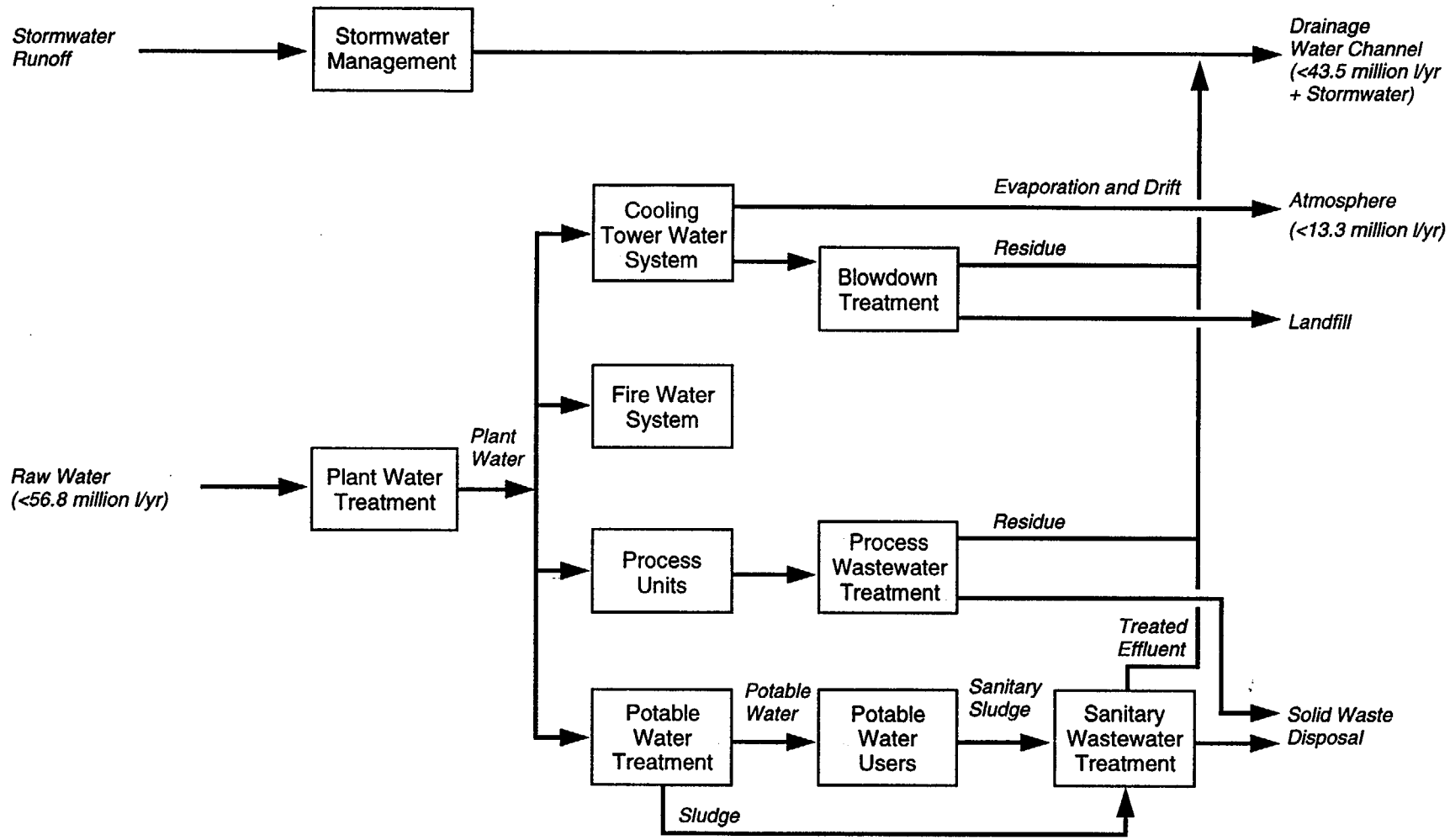


Figure D.2–2. Typical Water Balance for the Plutonium Conversion Facility.



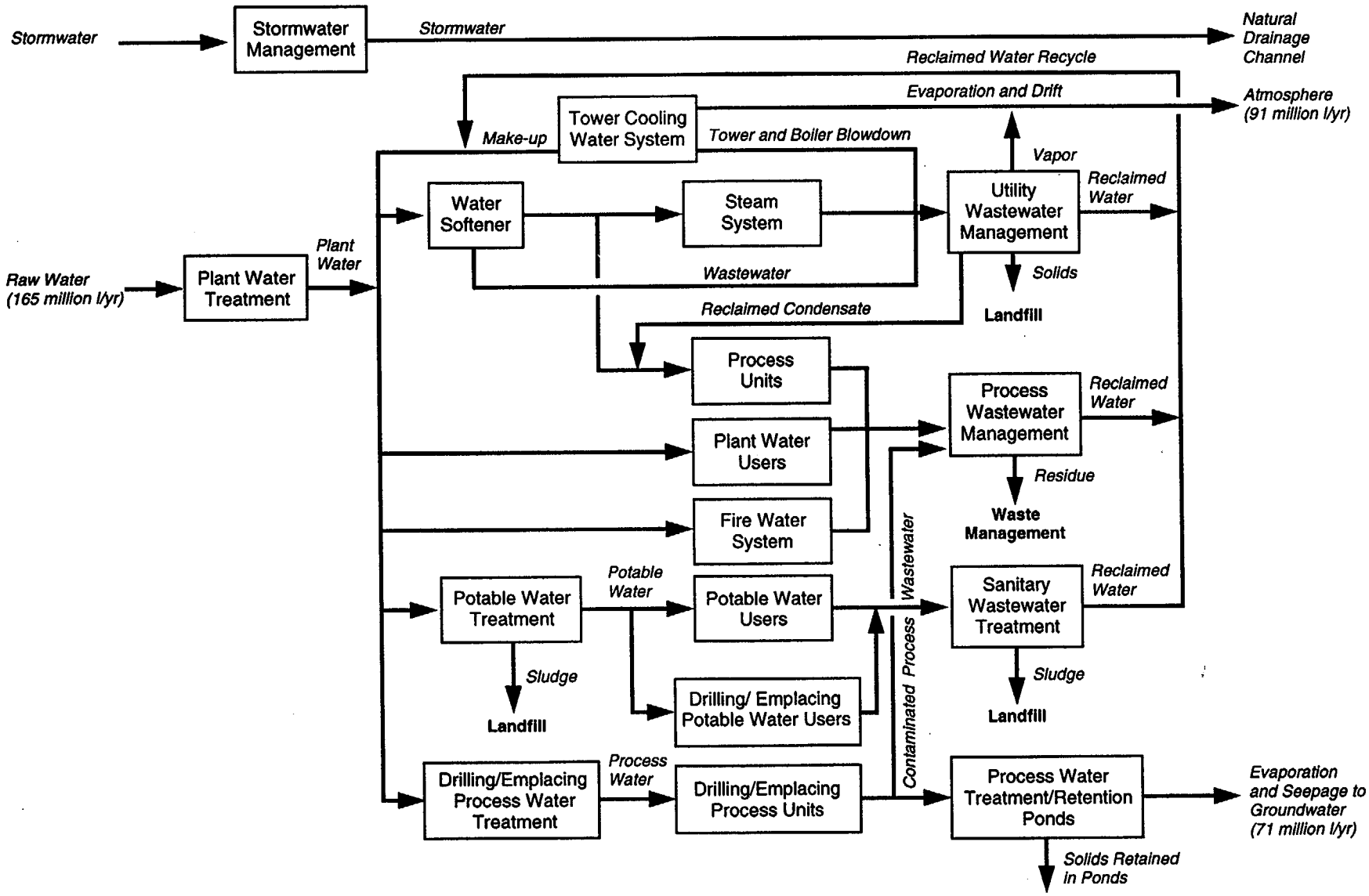
Source: LANL 1996b.

2437/FMD

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

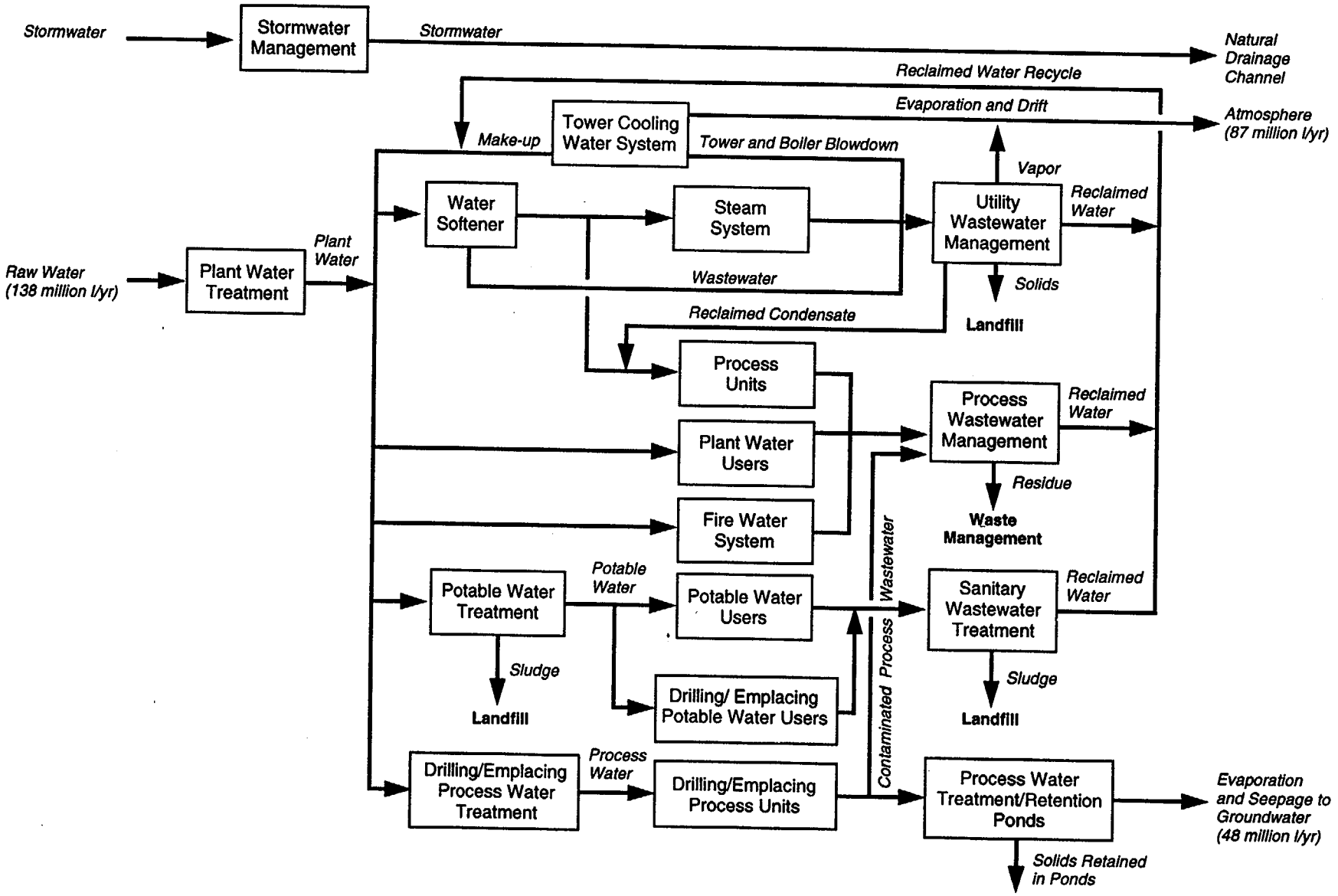
D.3 DISPOSITION ALTERNATIVES

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.

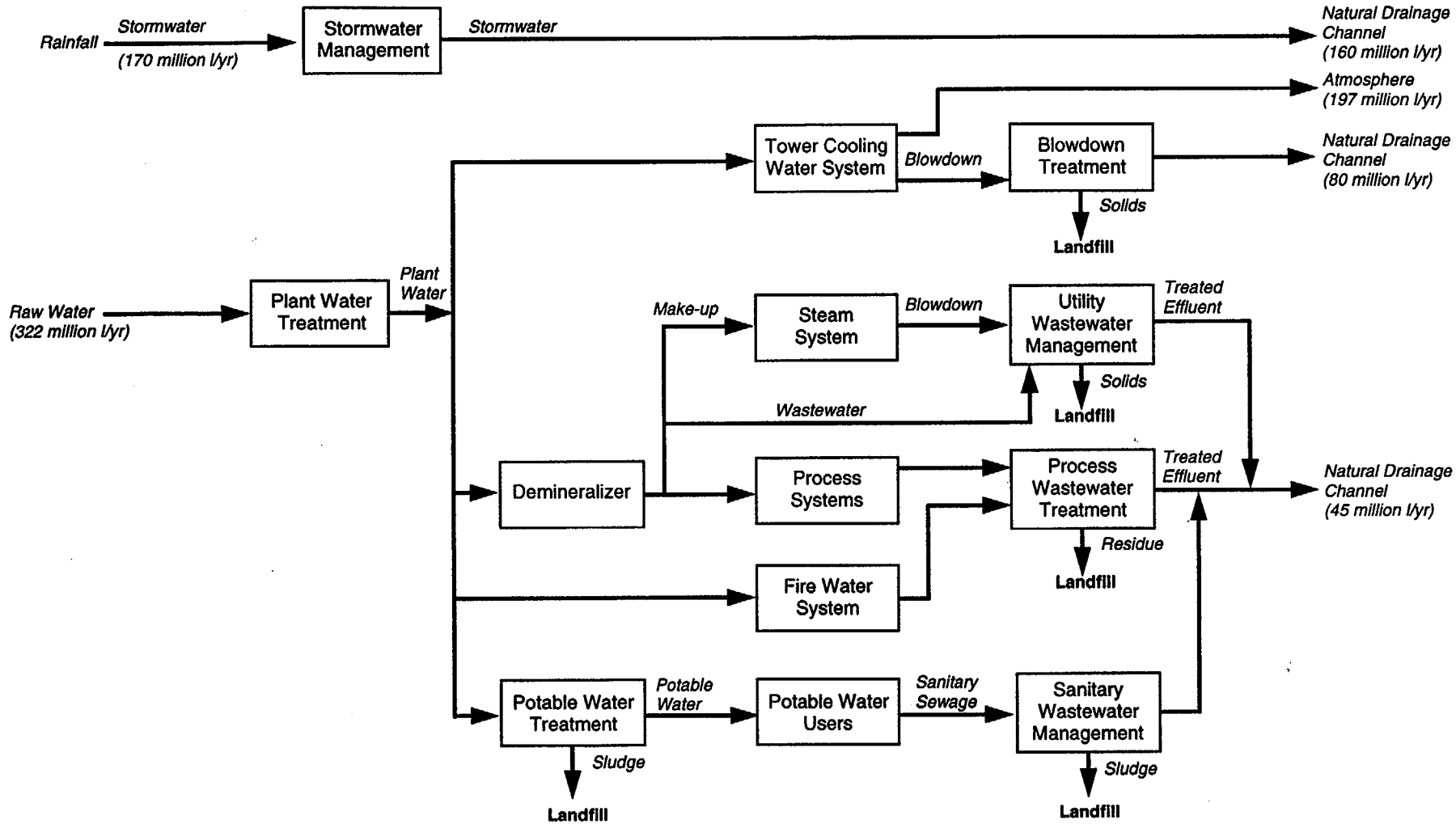
Figure D.3–1. Typical Water Balance for the Deep Borehole Complex—Direct Disposition Alternative.



Source: LLNL 1996h.

2697/FMD

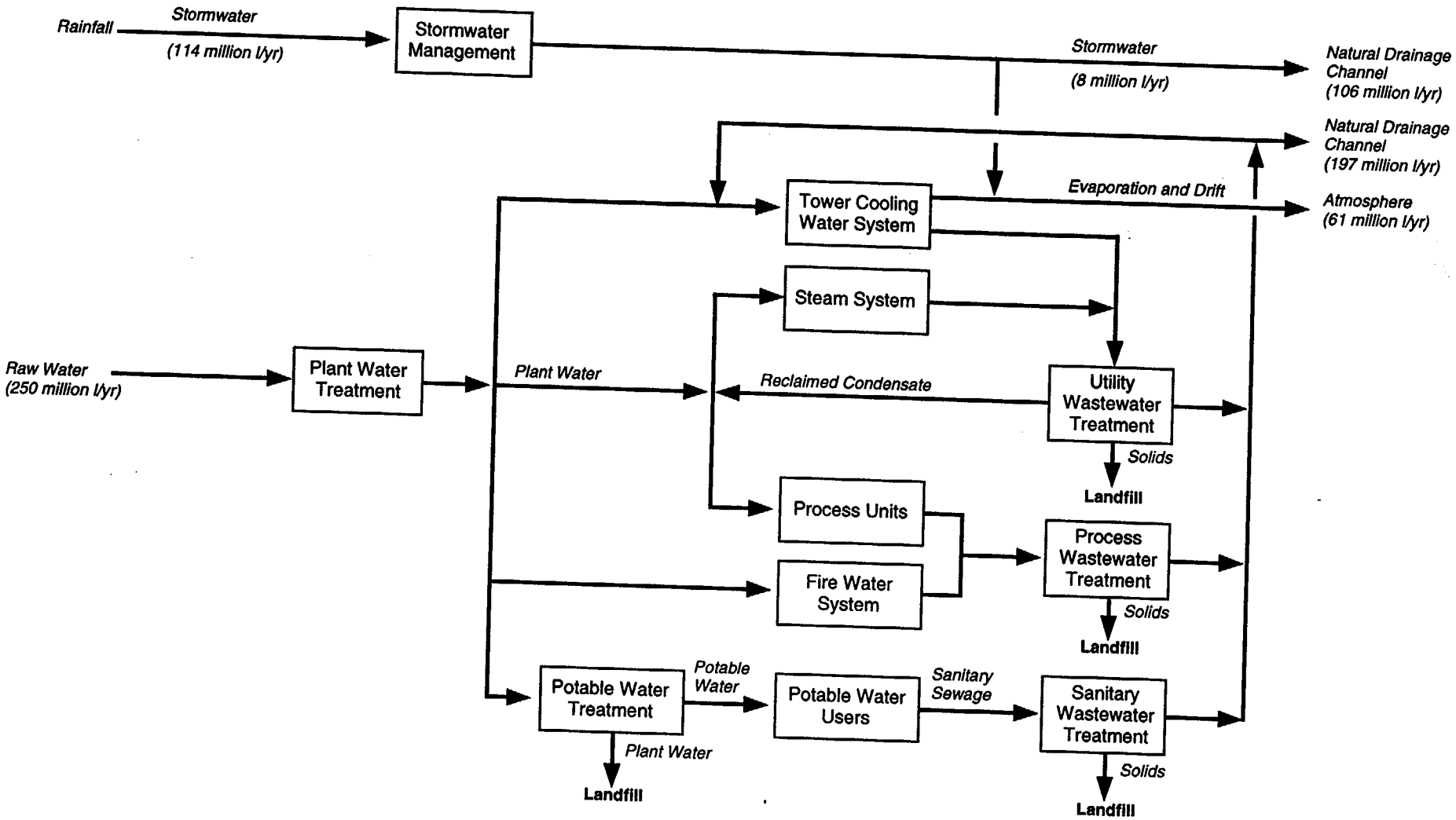
Figure D.3–2. Typical Water Balance for the Deep Borehole Complex—Immobilized Disposition Alternative.



Source: LLNL 1996e.

2596/FMD

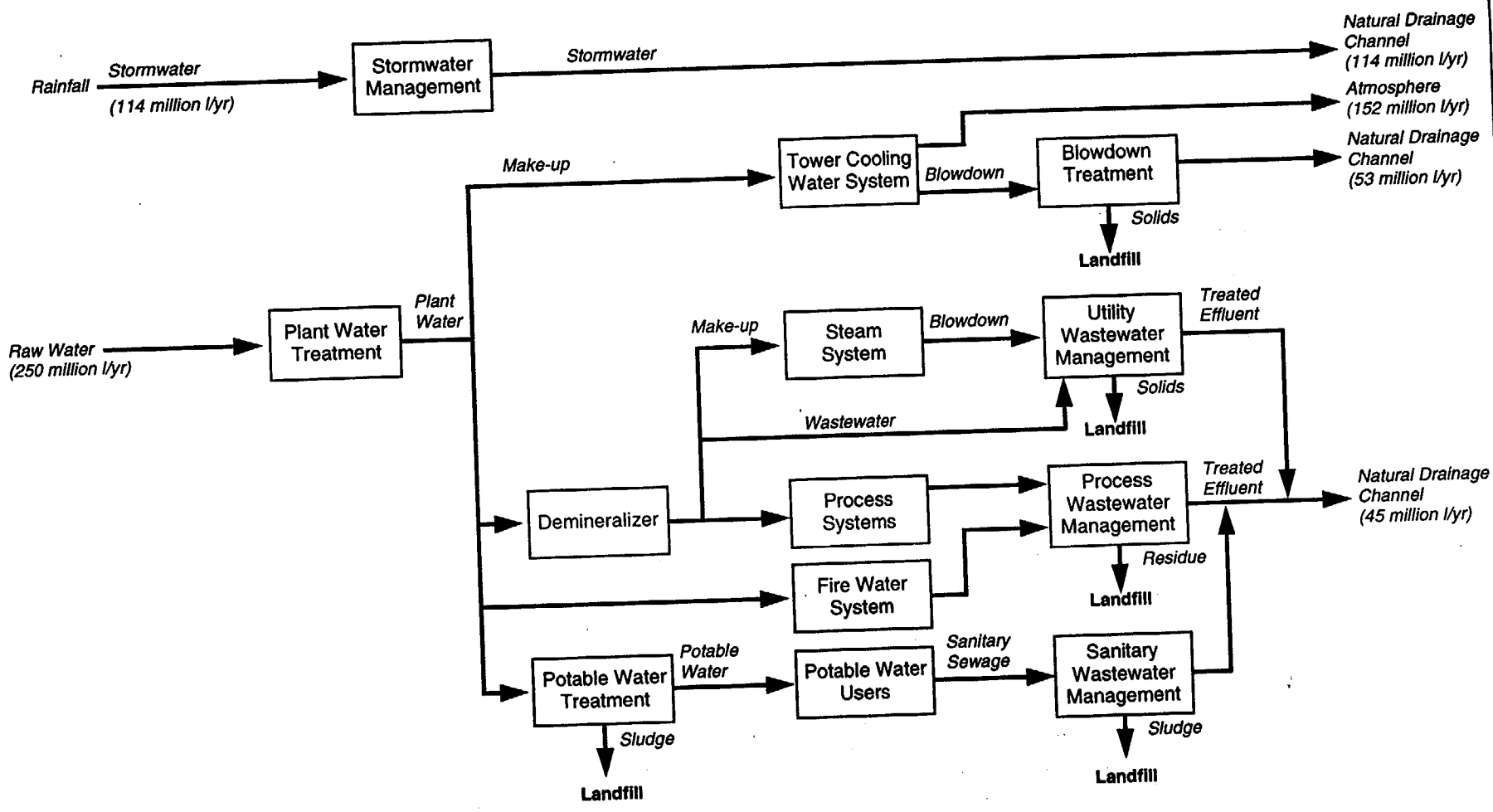
Figure D.3–3. Typical Water Balance for the Ceramic Immobilization Facility—Immobilized Disposition Alternative.



Source: LLNL 1996c.

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

2452/FMD



Source: LLNL 1996d.

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

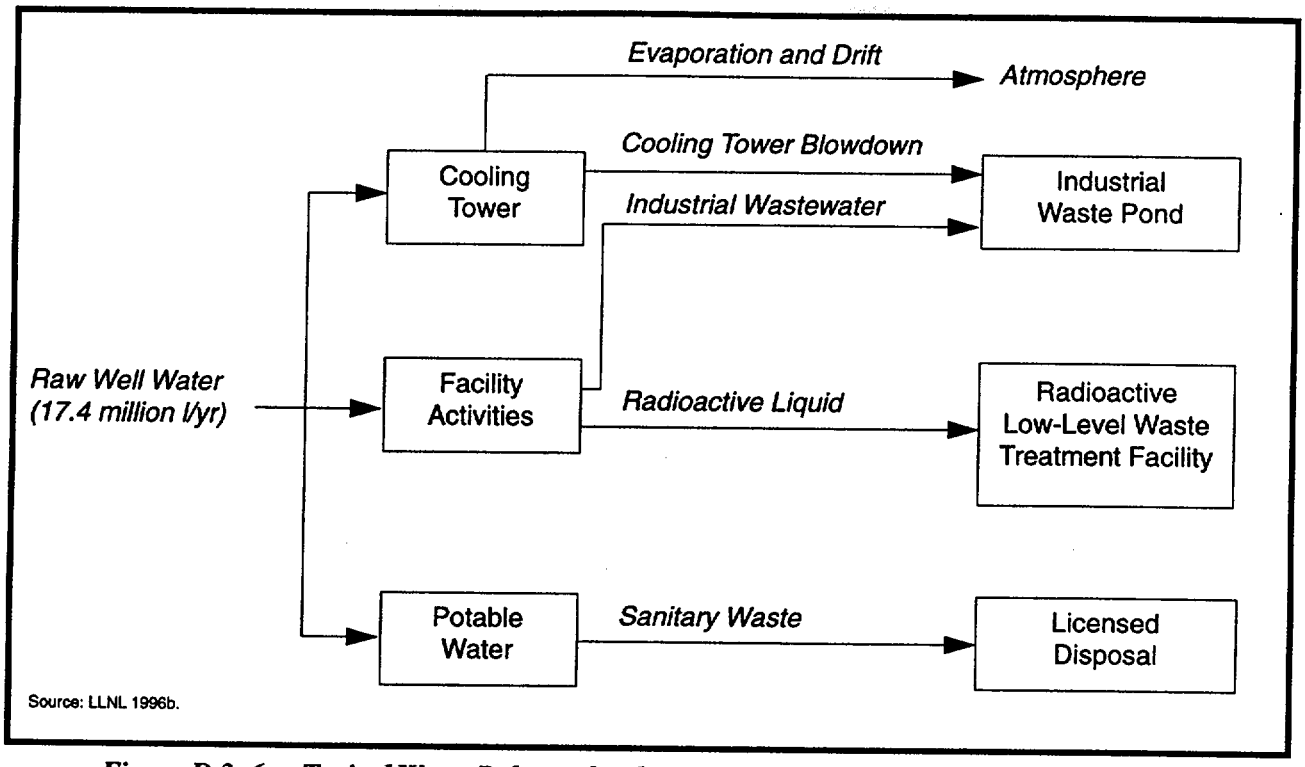
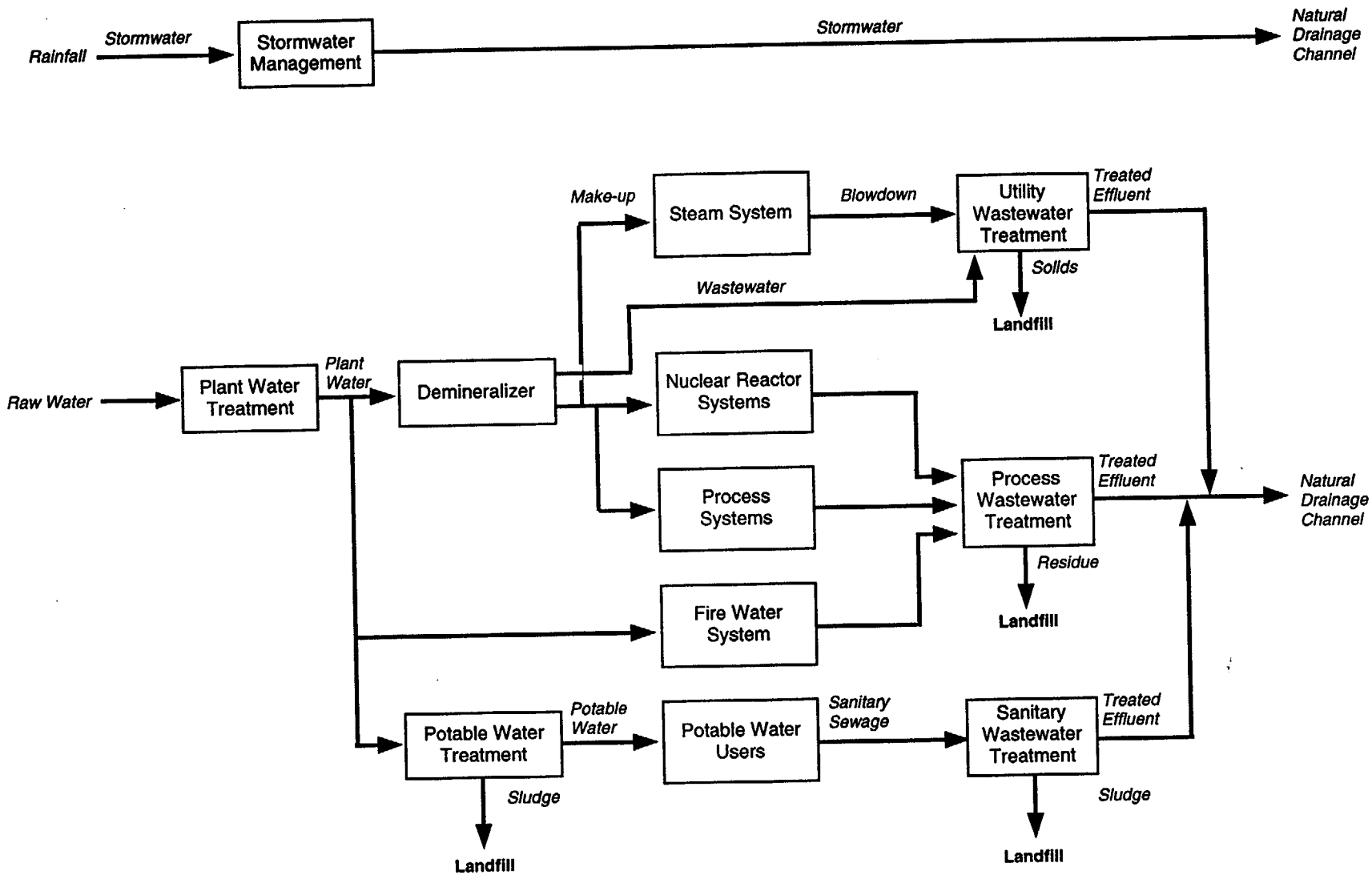


Figure D.3–6. Typical Water Balance for the Electrometallurgical Treatment Alternative (Glass-Bonded Zeolite).



Source: LLNL 1996g.

3038/S&D

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.