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Final Site-Wide Environmental Impact Statement for the Y-12 National Security Complex

Volume I

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TABLE OF CONTENTS

Cover Sheet
Table of Contents i
List of Figures ix
List of Tables xi
Acronyms and Abbreviations xv
Chemicals and Units of Measure xviii
Conversion Chart xxi
Metric Prefixes xxii

CHAPTER 1: INTRODUCTION 1-1
1.1 Background/Overview 1-1
1.1.1 General 1-1
1.1.2 Proposed Action and Scope 1-4
1.1.3 Ongoing Y-12 Downsizing and Modernization Program 1-5
1.2 Alternatives Analyzed 1-9
1.3 Laws and Regulations and *National Environmental Policy Act* Strategy 1-11
1.4 Relationship of this Environmental Impact Statement with Other *National Environmental Policy Act* Reviews 1-12
1.4.1 Programmatic *National Environmental Policy Act* Reviews 1-12
1.4.2 Project-Specific *National Environmental Policy Act* Reviews 1-14
1.4.3 Oak Ridge Reservation *National Environmental Policy Act* Reviews 1-15
1.4.4 Other Documents 1-16
1.5 Time Period Considered in Analysis 1-17
1.6 Issue Identification Process 1-17
1.7 Results of Public Scoping 1-18
1.7.1 Major Scoping Comments 1-18
1.8 Public Comment Period 1-20
1.9 Changes From the Draft Site-Wide Environmental Impact Statement 1-22
1.10 Organization of this Site-Wide Environmental Impact Statement 1-24

CHAPTER 2: PURPOSE OF AND NEED FOR U.S. DEPARTMENT OF ENERGY ACTION 2-1
2.1 Purpose and Need 2-1
2.2 U.S. Department of Energy Program Activities Performed at the Y-12 Site 2-2
2.2.1 Defense Programs 2-2
2.2.2 Environmental Management Programs 2-6
2.2.2.1 Waste Management 2-6
2.2.2.2 Environmental Restoration 2-6
2.2.3 Nuclear Nonproliferation and National Security 2-7
2.2.4 Nuclear Energy, Science and Technology 2-7
2.2.5 Nondefense Research and Development Program 2-7
2.2.6 Work-for-Others Program 2-8
2.2.7 Technology Transfer Program 2-8

CHAPTER 3: DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES 3-1
3.1 Major Planning Assumptions and Basis of Analysis 3-1
3.1.1 No Action - Status Quo Alternative (Defense Programs Operations and Emissions) 3-3
3.1.2 No Action - Planning Basis Operations Alternative (Defense Programs Operations and Emissions) 3-3
3.2 Alternatives 3-4
3.2.1 Alternative 1A (No Action - Planning Basis Operations Alternative) 3-4
3.2.2 Alternative 1B (No Action - Planning Basis Operations Alternative) 3-5
3.2.2.1 Defense Programs 3-5
3.2.2.2 Waste Management 3-16
3.2.2.3 Environmental Restoration 3-24
3.2.2.4 Nuclear Nonproliferation and National Security 3-24
3.2.2.5 Nuclear Energy, Science and Technology 3-25
3.2.2.6 Nondefense Research and Development Program 3-25
3.2.2.7 Work-for-Others Program 3-28
3.2.2.8 Technology Transfer Program 3-28
3.2.3 Alternative 2 (No Action - Planning Basis Operations Plus HEU Storage Mission Alternatives) 3-28
3.2.3.1 Alternative 1B (No Action - Planning Basis Operations Alternative) 3-28
3.2.3.2 Alternative 2A (No Action - Planning Basis Operations Alternative Plus Construct and Operate a New HEU Materials Facility) 3-29
3.2.3.3 Alternative 2B (No Action - Planning Basis Operations Alternative Plus Upgrade Expansion of Building 9215) 3-42
3.2.4 Alternative 3 (No Action - Planning Basis Operations Alternative Plus Special Materials Mission Alternative) 3-47
3.2.4.1 Alternative 1B (No Action - Planning Basis Operations Alternative) 3-48
3.2.4.2 Construct New Special Materials Complex 3-48
3.2.5 Alternative 4 (No Action - Planning Basis Operations Alternative Plus HEU Materials Facility Plus Special Materials Complex) 3-63
3.3 Potential Future Y-12 Site Integrated Modernization Projects 3-66
3.4 Alternatives Considered but Eliminated from Detailed Consideration 3-70
3.5 Comparison of Alternatives and Environmental Impacts 3-71
3.5.1 Land Use 3-71
3.5.2 Transportation 3-72
3.5.3 Socioeconomics 3-73
3.5.4 Geology and Soils 3-74
3.5.5 Water Resources 3-75
3.5.6 Biological Resources 3-79
3.5.7 Air Quality 3-80
3.5.8 Visual Resources 3-81
3.5.9 Noise 3-81
3.5.10 Site Infrastructure 3-82
3.5.11 Cultural Resources 3-83
3.5.12 Waste Management 3-84
3.5.13 Environmental Justice 3-85
3.5.14 Worker and Public Health 3-85
3.5.15 Facility Accidents 3-86
3.5.16 Cumulative Impacts 3-87
3.6 Preferred Alternative 3-118

CHAPTER 4: AFFECTED ENVIRONMENT 4-1
4.1 Land Use 4-1
4.1.1 Land-Use Designations 4-1
4.1.2 Future Land Use and Leasing Agreements 4-9
4.2 Transportation 4-17
4.2.1 On-site Traffic 4-17
4.2.2 Off-site Traffic 4-17
4.2.3 Transportation of Materials and Waste 4-18
4.2.4 Other Transportation 4-18
4.3 Socioeconomics 4-18
4.3.1 Employment and Income 4-19
4.3.2 Population and Housing 4-21
4.3.3 Community Services 4-22
4.4 Geology and Soils 4-23
4.4.1 Physiography 4-23
4.4.2 Geology 4-23
4.4.3 Soils 4-29
4.5 Hydrology 4-29
4.5.1 Surface Hydrology 4-29
4.5.2 Groundwater 4-33
4.5.3 Y-12 Liquid Release 4-40
4.6 Biological Resources 4-41
4.6.1 Terrestrial Resources 4-41
4.6.2 Wetlands 4-49
4.6.3 Aquatic Resources 4-49
4.6.4 Threatened and Endangered Species 4-50
4.7 Air Quality and Climate/Noise 4-53
4.7.1 Meteorology and Climatology 4-53
4.7.2 Air Quality 4-55
4.7.2.1 Nonradiological Air Quality 4-55
4.7.2.2 Radiological Air Quality 4-60
4.7.3 Noise 4-63
4.8 Site Facilities and Support Activities 4-64
4.8.1 Defense Programs Facilities 4-65
4.8.1.1 Building 9212 Complex 4-65
4.8.1.2 Building 9206 Complex 4-65
4.8.1.3 Building 9215 4-66
4.8.1.4 Buildings 9204-2 and 9204-2E 4-66
4.8.1.5 Building 9204-4 4-66
4.8.1.6 Building 9720-12 4-67
4.8.1.7 Building 9201-5 4-67
4.8.1.8 Building 9720-5 4-67
4.8.1.9 Building 9995 4-67
4.8.1.10 Buildings 9119, 9983, and 9710-3 4-67
4.8.1.11 Building 9201-5W 4-68
4.8.1.12 Building 9201-5N 4-68
4.8.1.13 Buildings 9202 and 9203 4-68
4.8.1.14 Building 9996 4-68
4.8.1.15 Building 9201-1 4-68
4.8.2 Waste Management Facilities 4-68
4.8.2.1 Waste Storage at Y-12 4-69
4.8.2.2 Treatment of Waste at Y-12 4-72

4.8.2.3 Disposal of Waste at Y-12 4-75
4.8.3 Site Infrastructure 4-76
4.8.3.1 Roads and Railroads 4-76
4.8.3.2 Electrical Power 4-76
4.8.3.3 Natural Gas 4-77
4.8.3.4 Steam 4-77
4.8.3.5 Raw Water 4-77
4.8.3.6 Treated Water 4-77
4.8.3.7 Demineralized Water 4-78
4.8.3.8 Sanitary Sewer 4-78
4.8.3.9 Chilled Water 4-78
4.8.3.10 Industrial Gases 4-78
4.8.3.11 Telecommunications 4-79
4.9 Visual Resources 4-79
4.10 Cultural and Paleontological Resources 4-80
4.10.1 Cultural Resources 4-80
4.10.2 Paleontological Resources 4-83
4.11 Environmental Management 4-83
4.11.1 Waste Generation from Routine Operations 4-84
4.11.2 Waste Generation from Environmental Restoration Activities 4-85
4.11.3 Pollution Prevention 4-85
4.12 Occupational and Public Health and Safety/Radiation 4-90
4.12.1 Public Health 4-90
4.12.2 Worker Health 4-91
4.13 Environmental Justice 4-93

CHAPTER 5: ENVIRONMENTAL CONSEQUENCES 5-1
5.1 Land Use 5-2
5.1.1 Alternative 1A (No Action - Status Quo Alternative) 5-2
5.1.2 Alternative 1B (No Action - Planning Basis Operations Alternative) 5-3
5.1.3 Alternative 2 (No Action - Planning Basis Operations Plus HEU Storage Mission Alternatives) 5-4
5.1.4 Alternative 3 (No Action - Planning Basis Operations Plus special Materials Mission Alternative) 5-5
5.1.5 Alternative 4 (No Action - Planning Basis Operations Plus HEU Materials Facility Plus Special Materials Complex) 5-6
5.2 Traffic and Transportation 5-6
5.2.1 Alternative 1A (No Action - Status Quo Alternative) 5-7
5.2.2 Alternative 1B (No Action - Planning Basis Operations Alternative) 5-8
5.2.3 Alternative 2 (No Action - Planning Basis Operations Plus HEU Storage Mission Alternatives) 5-9
5.2.4 Alternative 3 (No Action - Planning Basis Operations Plus Special Materials Mission Alternative) 5-10
5.2.5 Alternative 4 (No Action - Planning Basis operations Plus HEU Materials Facility Plus Special Materials Complex) 5-10
5.3 Socioeconomics 5-11
5.3.1 Alternative 1A (No Action - Status Quo Alternative) 5-11
5.3.2 Alternative 1B (No Action - Planning Basis Operations Alternative) 5-12
5.3.3 Alternative 2 (No Action- Planning Basis Operations Plus HEU Storage Mission Alternative) 5-12
5.3.4 Alternative 3 (No Action- Planning Basis Operations Plus Construct and Operate a New Special Materials Complex) 5-13

5.3.5 Alternative 4 (No Action - Planning Basis Operations Plus HEU Materials Facility Plus Special Materials Complex) 5-14
5.4 Geology and Soils 5-14
5.4.1 Alternative 1A (No Action - Status Quo Alternative) 5-14
5.4.2 Alternative 1B (No Action - Planning Basis Operations Alternative) 5-15
5.4.3 Alternative 2 (No Action - Planning Basis Operations Plus HEU Storage Mission Alternatives) 5-15
5.4.4 Alternative 3 (No Action- Planning Basis Operations Plus Special Materials Mission Alternative) 5-16
5.4.5 Alternative 4 (No Action - Planning Basis Operations Plus HEU Materials Facility Plus Special Materials Complex) 5-17
5.4.6 Mitigation 5-17
5.5 Hydrology 5-17
5.5.1 Surface Hydrology 5-18
5.5.1.1 Alternative 1A (No Action - Status Quo Alternative) 5-18
5.5.1.2 Alternative 1B (No Action - Planning Basis Operations Alternative) 5-19
5.5.1.3 Alternative 2 (No Action - Planing Basis Operations Plus HEU Storage Mission Alternatives) 5-20
5.5.1.4 Alternative 3 (No Action - Planning Basis Operation Plus Special Materials Mission Alternative) 5-20
5.5.1.5 Alternative 4 (No Action - Planning Basis Operations Plus HEU Materials Facility Plus Special Materials Complex) 5-21
5.5.2 Groundwater 5-21
5.5.2.1 Alternative 1A (No Action - Status Quo Alternative) 5-21
5.5.2.2 Alternative 1B (No Action - Planning Basis Operations Alternative) 5-22
5.5.2.3 Alternative 2 (No Action - Planning Basis Operations Plus HEU Storage Mission Alternatives) 5-23
5.5.2.4 Alternative 3 (No Action - Planning Basis Operations Plus Special Materials Mission Alternative) 5-24
5.5.2.5 Alternative 4 (No Action - Planning Basis Operations Plus HEU Material Facility Plus Special Materials Complex) 5-24
5.6 Biological Resources 5-25
5.6.1 Alternative 1A (No Action - Status Quo Alternative) 5-24
5.6.2 Alternative 1B (No Action- Planning Basis Operations Alternative) 5-25
5.6.3 Alternative 2 (No Action - Planning Basis Operations Plus HEU Storage Mission Alternatives) 5-27
5.6.4 Alternative 3 (No Action - Planning Basis Operations Plus Special Materials Mission Alternatives) 5-28
5.6.5 Alternative 4 (No Action - Planning Basis Operations Plus HEU Materials Facility Plus Special Materials Complex) 5-28
5.6.6 Mitigation 5-29
5.7 Air Quality/Noise 5-29
5.7.1 Nonradiological Air Quality 5-29
5.7.1.1 Alternative 1A (No Action - Status Quo Alternative) 5-30
5.7.1.2 Alternative 1B (No Action - Planning Basis Operations Alternative) 5-31
5.7.1.3 Alternative 2 (No Action - Planning Basis Operations Plus HEU Storage Mission Alternatives) 5-35
5.7.1.4 Alternative 3 (No Action - Planning Basis Operations Plus Special Materials Mission Alternative) 5-36

5.7.1.5 Alternative 4 (No Action - Planning Basis Operations Plus HEU Materials Facility Plus Special Materials Complex 5-38
5.7.2 Radiological Impacts 5-38
5.7.2.1 Alternative 1A (No Action - Status Quo Alternative) 5-39
5.7.2.2 Alternative 1B (No Action - Planning Basis Operations Alternative) 5-39
5.7.2.3 Alternative 2 (No Action - Planning Basis Operations Plus HEU Storage Mission Alternative) 5-40
5.7.2.4 Alternative 3 (No Action -Planning Basis Operations Plus Special Materials Mission Alternative) 5-40
5.7.2.5 Alternative 4 (No Action - Planning Basis Operations Plus HEU Materials Facility Plus Special Materials Complex) 5-41
5.7.3 Noise 5-41
5.7.3.1 Alternative 1A (No Action - Status Quo Alternative) 5-41
5.7.3.2 Alternative 1B (No Action - Planning Basis Operations Alternative) 5-42
5.7.3.3 Alternative 2 and 3 (No Action - Planning Basis Operations Plus HEU Storage Mission and Special Materials Mission Alternatives) 5-43
5.7.3.4 Alternative 4 (No Action - Planning Basis Operations Plus HEU Materials Facility Plus Special Materials Complex) 5-45
5.8 Site Facilities and Support Activities 5-45
5.8.1 Alternative 1A (No Action - Status Quo Alternative) 5-46
5.8.2 Alternative 1B (No Action - Planning Basis Operations Alternative) 5-46
5.8.3 Alternative 2 (no Action - Planning Basis Operations Plus HEU Storage Mission Alternatives) 5-46
5.8.4 Alternative 3 (No Action - Planning Basis Operations Plus Special Materials Mission Alternative) 5-50
5.8.5 Alternative 4 (No Action -Planning Basis Operations Plus HEU Materials Facility Plus Special Materials Complex) 5-53
5.9 Visual Resources 5-54
5.9.1 Alternative 1A (No Action - Status Quo Alternative) 5-54
5.9.2 Alternative 1B (No Action - Planning Basis Operations Alternative) 5-54
5.9.3 Alternative 2 (No Action - Planning Basis Operations Plus HEU Storage Mission Alternatives) 5-55
5.9.4 Alternative 3 (No Action - Planning Basis Operations Plus Construct and Operate a New Special Materials Mission Alternative) 5-55
5.10 Cultural and Paleontological Resources 5-56
5.10.1 Alternative 1A (No Action - Status Quo Alternative) 5-57
5.10.2 Alternative 1B (No Action - Planning Basis Operations Alternative) 5-57
5.10.3 Alternative 2 (No Action - Planning Basis Operations Plus HEU Storage Mission Alternatives) 5-58
5.10.4 Alternative 3 (No Action - Planning Basis Operations Plus Special Materials Mission Alternative) 5-60
5.10.5 Alternative 4 (No Action- Planning basis Operations Plus HEU Materials Facility Plus Special Materials Complex) 5-61
5.10.6 Mitigation Measures 5-62
5.10.7 Paleontological Resources 5-63

5.11 Waste Management and Pollution Prevention 5-64
5.11.1 Waste Generated During Routine Operations Alternative 1A (No Action - Status Quo Alternative) and Alternatives 1B (No Action -Planning Basis Operations Alternative) 5-65
5.11.1.1 Alternative 1A (No Action - Status Quo Alternative) 5-65
5.11.1.2 Alternative 1B (No Action - Planning Basis Operations Alternative) 5-66
5.11.2 Waste Generated by the Alternatives for the HEU Storage Mission and the Special Materials Mission 5-66
5.11.2.1 Alternative 2 (No Action - Planning Basis Operations Plus HEU Storage Mission Alternatives) 5-69
5.11.2.2 Alternative 3 (No Action - Planning Basis Operations Plus Special Materials Complex) 5-69
5.11.2.3 Alternative 4 (No Action - Planning Basis Operations Plus HEU Materials Complex Plus Special Materials Complex) 5-70
5.11.3 Pollution Prevention/Mitigation 5-70
5.11.3.1 Alternatives 1A and 1B (No Action - Status Quo and No Action - Planning Basis Operations Alternatives) 5-70
5.11.3.2 Alternatives 2, 3, and 4 (HEU Storage Mission and Special Materials Mission Action Alternatives) 5-71
5.12 Occupational and Public Health and Safety Impacts 5-71
5.12.1 Radiological Impacts 5-72
5.12.2 Hazardous Chemical Impacts 5-75
5.12.3 Detailed Evaluation: Beryllium 5-78
5.12.4 Worker Safety 5-80
5.13 Environmental Justice 5-82
5.13.1 Alternative 1A (No Action - Status Quo Alternative) 5-83
5.13.2 Alternative 1B (No Action - Planning Basis Operations Alternative) 5-83
5.13.3 Alternative 2 (No Action - Planning Basis Operations Plus HEU Storage Mission Alternatives) 5-84
5.13.4 Alternative 3 (No Action - Planning Basis Operations Plus Special Materials Mission Alternatives) 5-84
5.13.5 Alternative 4 (No Action - Planning Basis Operations Plus HEU Materials Facility Plus Special Materials Complex) 5-85
5.14 Accidents 5-85
5.14.1 Accident Screening 5-85
5.14.2 Methodology 5-86
5.14.3 Accident Scenarios 5-87
5.14.3.1 Wildfires 5-87
5.14.3.2 Site-wide Earthquakes 5-88
5.14.3.3 Facility Hazards 5-88
5.14.4 Accidents for the HEU Storage Mission and Special Materials Mission Alternatives Compared to the No Action - Status Quo Alternative 5-91
5.15 Resource Commitments 5-94

CHAPTER 6: CUMULATIVE IMPACTS 6-1
6.1 Methodology and Analytical Baseline 6-1
6.2 Potentially Cumulative Actions 6-2
6.2.1 TVA Plants 6-2
6.2.2 Y-12 Modernization Program 6-2
6.2.3 Lease of Parcel ED-1, ED-3, and Land and Facilities Within the ETTP 6-3
6.2.4 Construction and Operation of the Spallation Neutron Source 6-3

6.2.5 Surplus HEU Disposition Activities 6-3
6.2.6 Treating Transuranic/Alpha Low-Level Waste 6-5
6.2.7 ORNL Facilities Revitalization Project 6-5
6.2.8 Oak Ridge Area Infrastructure Upgrades and Expansions 6-5
6.3 Actions Considered But Not Included 6-6
6.3.1 Remediation of Contaminated Areas in the Melton Valley Watershed 6-6
6.3.2 Receipt and Storage of Uranium Materials from the Fernald Site 6-6
6.3.3 Alternative Strategies for the Long-term Management and Use of Depleted Uranium Hexaflouride UF_6 6-6
6.3.4 Management of Potentially Reusable Uranium Materials at the DOE Management Center 6-7
6.3.5 Disposition of Stockpiled Mercury 6-7
6.3.6 Environmental Impact Statement - Proposed Route 475 6-7
6.3.7 Commercial Ventures 6-7
6.4 Cumulative Impacts by Resource Area 6-8
6.4.1 Land Use 6-9
6.4.2 Transportation 6-9
6.4.3 Socioeconomics 6-9
6.4.4 Water Resources 6-10
6.4.5 Air Resources 6-11
6.4.6 Utilities and Energy 6-11
6.4.7 Waste Generation 6-12
6.4.8 Public and Worker Health 6-12

CHAPTER 7: STATUTES, REGULATIONS, CONSULTATIONS, AND OTHER REQUIREMENTS 7-1
7.1 Regulatory Framework 7-1
7.2 Statutes and Regulations 7-2
7.2.1 Federal and State Environmental Statutes and Regulations 7-2
7.2.2 Other Pertinent Laws and Requirements 7-13
7.3 Consultation 7-13

CHAPTER 8: LIST OF PREPARERS AND CONTRIBUTORS 8-1

CHAPTER 9: INDEX 9-1

CHAPTER 10:REFERENCES 10-1

CHAPTER 11:GLOSSARY 11-1

CHAPTER 12:LIST OF AGENCIES, ORGANIZATIONS, AND PERSONS TO WHOM COPIES OF THIS STATEMENT WERE SENT 12-1

LIST OF FIGURES

Figure 1.1.1–1 Location of Oak Ridge Reservation, Principal Facilities, and Surrounding Area. . . . 1-2
Figure 1.1.2–1 The Y-12 Site-Wide Environmental Impact Statement Area of Analysis. 1-6
Figure 1.1.2–2 Alternative 1A (No Action - Status Quo) Facility Location and Utilization at Y-12 1-8
Figure 1.4.1–1 Current Department of Energy Stockpile Stewardship and Management Sites 1-13
Figure 3.2.2–1 Alternative 1B (No Action - Planning Basis Operations) Facilities Within theY-12 SWEIS Area of Analysis. 3-6
Figure 3.2.2–2 Alternative 1B (No Action - Planning Basis Operations) Facility Utilization at Y-12. 3-7
Figure 3.2.2–3 Overview of the Y-12 Enriched Uranium Parts Production Operations. 3-9
Figure 3.2.2–4 Overview of the Y-12 Enriched Uranium Chemical Recovery Operations. . 3-10
Figure 3.2.2–5 Overview of the Y-12 Depleted Uranium Operations. 3-11
Figure 3.2.2–6 Buildings Affected by the Y-12 Restructuring Initiative. 3-15
Figure 3.2.2–7 The Environmental Management Waste Management Facility Site Plan. . . . 3-18
Figure 3.2.2–8 Cross Section of the Environmental Management Waste Management Facility Disposal Cell. 3-19
Figure 3.2.2–9 Y-12 West End Borrow Area. 3-21
Figure 3.2.2–10 Locations of the Background Area and the Initial Test Plots within the Field Research Center, Contaminated Area at Y-12 3-26
Figure 3.2.3–1 Artist's Rendering of Proposed Highly Enriched Uranium Materials Facility. 3-32
Figure 3.2.3–2 Site A for the Proposed Highly Enriched Uranium Materials Facility. 3-34
Figure 3.2.3–3 Highly Enriched Uranium Materials Facility Site A Construction Lay-Down Areas, New Parking Lot, and New Alignment of Bear Creek Road. 3-37
Figure 3.2.3–4 Site B for the Proposed Highly Enriched Uranium Materials Facility. 3-41
Figure 3.2.3–5 Highly Enriched Uranium Materials Facility Site B Construction Lay-Down Area and Temporary Parking Lot 3-43
Figure 3.2.3–6 Proposed Building 9215 Expansion Area. 3-45
Figure 3.2.4–1 Artist's Rendering of Proposed Special Materials Complex. 3-49
Figure 3.2.4–2 Sites 1, 2, and 3 for the Proposed Special Materials Complex. 3-56
Figure 3.2.4–3 Special Materials Complex Construction Lay-Down Areas. 3-58
Figure 3.3–1 Potential Candidate Siting Areas for New Modernization Facilities at Y-12. 3-69
Figure 4.1.1–1 Oak Ridge Reservation, Tennessee, and Region 4-2
Figure 4.1.1–2 Original U.S. Department of Energy Land Purchase and Current Reservation Boundaries. 4-3
Figure 4.1.1–3 Research Areas and Forested Areas. 4-5
Figure 4.1.1–4 Public, Educational, and Recreational Opportunities. 4-8
Figure 4.1.2–1 New Future Use at Oak Ridge Reservation. 4-10
Figure 4.1.2–2 Watershed Areas on Oak Ridge Reservation. 4-14
Figure 4.1.2–3 Sludge Land Application Sites. 4-15
Figure 4.1.2–4 Active Waste Management Facilities and Environmental Restoration Projects. 4-16
Figure 4.2.1–1 Road Network at Y-12 Site. 4-17
Figure 4.3–1 Location of Oak Ridge Reservation and Surrounding Counties. 4-20
Figure 4.4.2–1 Geological Map of the Y-12 Site 4-24

Figure 4.4.2–2 Generalized Stratigraphic in the Y-12 Characterization Area. 4-25
Figure 4.4.2–3 Geology and Karst Features. 4-27
Figure 4.5.1–1 Y-12 Area Surface Water Features 4-31
Figure 4.5.1–2 100- and 500-year Floodplains for Y-12. 4-32
Figure 4.5.2–1 Summed Volatile Organic Compounds in Groundwater. 4-37
Figure 4.5.2–2 Gross Alpha Activity in Groundwater at Y-12. 4-38
Figure 4.5.2–3 Gross Beta Activity in Groundwater at Y-12. 4-39
Figure 4.6.1–1 Distribution of Plant Communities on the Oak Ridge Reservation. 4-42
Figure 4.7.1–1 Wind Rose Data for Y-12. 4-54
Figure 4.7.2–1 Locations of Ambient Air Monitoring Stations for Mercury Vapor and Uranium. 4-58
Figure 4.7.2–2 Location of Oak Ridge Reservation Perimeter Air Monitoring Stations in the Vicinity of Y-12 4-62
Figure 4.13–1 Minority Population in the Region of Influence. 4-96
Figure 4.13–2 Low Income Population in the Region of Influence. 4-97
Figure 4.13–3 City of Oak Ridge Census Tracts. 4-98
Figure 5.7.3–1 Decibel Levels Compared to the Threshold of Human Audibility. 5-44
Figure 5.8.3–1 Potentially Affected Facilities Due to Construction of Highly Enriched Uranium Materials Facility or Building 9215 Expansion. 5-49
Figure 5.8.4.1 Potentially Affected Facilities Due to Construction of HEU Facility or Building 9215 Expansion. 5-51
Figure 6.2.3–1 Locations of Parcels ED-1 and ED-3 6-4

LIST OF TABLES

Table 1.2–1	Y-12 SWEIS Alternatives	1-11
Table 3.2.3–1	Highly Enriched Uranium Materials Facility Construction Requirements and Estimated Waste Volumes for Site A or Site B	3-38
Table 3.2.3–2	Highly Enriched Uranium Materials Facility Annual Operation Requirements and Estimated Waste Volumes	3-39
Table 3.2.3–3	Building 9215 Expansion Construction Requirements and Estimated Waste Volumes	3-46
Table 3.2.3–4	Building 9215 Expansion Storage Facility Annual Operation Requirements and Estimated Waste Volumes	3-47
Table 3.2.4–1	Special Materials Complex Construction Requirements and Estimated Waste Volumes for Site 1	3-59
Table 3.2.4–2	Special Materials Complex Annual Operation Requirements and Estimated Waste Volumes for sites 1, 2, and 3	3-61
Table 3.2.4–3	Special Materials Complex Construction Requirements and Estimated Waste Volumes for Site 2	3-64
Table 3.2.4–4	Special Materials Complex Construction Requirements and Estimated Waste Volumes for Site 3	3-65
Table 3.3–1	Summary of Potential Future Y-SIM Facilities	3-67
Table 3.5–1	Summary of Environmental Consequences for the Y-12 Site-Wide Alternatives	3-89
Table 4.1.1–1	Biosolids Application Sites	4-7
Table 4.2.1–1	Existing Average Daily Traffic Flows (Vehicles per Day) on Oak Ridge Reservation Serving Y-12	4-18
Table 4.3.1–1	Employment by Sector (%)	4-19
Table 4.3.1–2	Region of Influence Unemployment Rates (Percent))	4-21
Table 4.3.2–1	Historic and Projected Population in the Region of Influence	4-21
Table 4.3.2–2	Region of Influence Housing Characteristics (1990)	4-22
Table 4.4.2–1	The Modified Mercalli Intensity Scale of 1931, With Approximate Correlations to Richter Scale and Maximum Ground Acceleration	4-28
Table 4.5.1–1	Surface Water Quality, Upper East Fork Poplar Creek (Station 8 to Station 17) during Flow Augmentation, and Lower Bear Creek (BCK-0.63)	4-33
Table 4.6.1–1	Common and Scientific Names of Some of the Nonthreatened and Nonendangered Plants and Animals Occurring On or In the Vicinity of the ORR	4-43
Table 4.6.1–2	List of Potential Breeding Birds and Relative Abundance on the Oak Ridge Reservation	4-45
Table 4.6.4–1	Federal- or State-Listed Threatened, Endangered, and Other Special Status Species Reported on the Oak Ridge Reservation	4-52
Table 4.7.2–1	National Ambient Air Quality Standards and Tennessee Ambient Air Standards	4-57
Table 4.7.2–2	Tennessee Department of Environment and Conservation Ambient Air Monitoring Data for 1999 in the Vicinity of Y-12/Oak Ridge Reservation	4-57
Table 4.7.2–3	Results of Y-12 Ambient Air Mercury Monitoring Program	4-59
Table 4.7.2–4	Uranium Mass in Ambient Air at Y-12, First Quarter1999	4-59
Table 4.7.2–5	Actual vs. Allowable Air Emissions from the Oak Ridge Y-12 Steam Plant, 1999	4-60
Table 4.7.2–6	Chemical Pollutant Emissions from Y-12 During 1999	4-60
Table 4.7.2–7	Radionuclide Concentrations at Oak Ridge Reservation Perimeter Air Monitoring Stations During 1998	4-63

Table 4.7.3–1	City of Oak Ridge Maximum Allowable Noise Limits Applicable to Oak Ridge Reservation	4-64
Table 4.11.1–1	Summary of Waste Generation Totals by Waste Type in Kilograms (Cubic Meters) for Routine Operations at Y-12, ORNL, and ETTP	4-84
Table 4.11.2–1	Summary of Cleanup/Stabilization Related Waste Generation by Waste Type in Kilograms (Cubic Meters) in 1999	4-85
Table 4.11.3–1	Reduction in Waste Volumes at Y-12 from Total Operations in Kilograms (cubic meters)	4-86
Table 4.11.3–2	Pollution Prevention and Waste Avoidance Accomplishments at Y-12 in 1999	4-88
Table 4.11.3–3	Summary of Pollution Prevention Activities at Y-12, Oak Ridge National Laboratory and East Tennessee Technology Park in 1999	4-89
Table 4.12.1–1	Potential Radiological Impacts to the Public Resulting from Normal Operation of Y-12	4-91
Table 4.12.2–1	Y-12 Radiological Worker Annual Individual and Collective Radiation Doses	4-92
Table 4.12.2–2	Annual Radiation Doses for All Monitored Y-12 Workers	4-93
Table 4.13–1	Population Distribution by Race in Oak Ridge Census Tracts	4-94
Table 4.13–2	Oak Ridge Families Living Below Poverty Level, by Census Tract (1989)	4-94
Table 5.2–1	Nonradiological Unit-Risk Factors for Truck Transport	5-7
Table 5.2.2–1	Annual Incident-Free Doses to Crew and Public and Accident Risk to Public Under Alternative 1B (No Action - Planning Basis Operations Alternative)	5-8
Table 5.2.2–2	Annual Transportation Impacts for Y-12 Operations Under Alternative 1B (No Action- Planning Basis Operations Alternative)	5-9
Table 5.7.1–1	Modeled Criteria Pollutant Concentrations from the Y-12 Steam Plant Under Alternative 1B (No Action - Planning Basis Operations Alternative)	5-33
Table 5.7.1–2	Y-12 Facility Operations Maximum Boundary and On-Site Noncarcinogenic Hazardous Air Pollutant Chemical Concentrations	5-33
Table 5.7.1–3	Y-12 Steam Plant Maximum Boundary Hazardous Air Pollutant Carcinogenic Chemical Concentrations	5-34
Table 5.7.1–4	Y-12 Facility Operations Maximum Boundary and On-site Carcinogenic Hazardous Air Pollutant Chemical Concentrations	5-35
Table 5.7.1–5	Maximum Boundary and On-site Chemical Concentrations from Special Materials Complex Operations	5-38
Table 5.7.2–1	Radiological Doses for Collective Population for All Workers (Radiological and Nonradiological)	5-40
Table 5.7.3–1	Permissible Noise Exposure	5-42
Table 5.7.3–2	Peak Attenuated Noise Levels (in dBA) Expected from Operation of Construction Equipment	5-45
Table 5.8.1–1	Y-12 Site Energy and Resource Requirements—Alternative 1A (No Action - Status Quo Alternative)	5-47
Table 5.8.2–1	Y-12 Site Energy and Resource Requirements—Alternative 1B (No Action - Planning Basis Operations Alternative)	5-48
Table 5.8.3–1	HUE Storage Mission Alternatives Construction Requirements	5-50
Table 5.8.3–2	Annual Operation Requirements for the Y-12 Site No Action Alternative and the HEU Storage Mission Alternatives	5-50
Table 5.8.4–1	Special Materials Complex Construction Requirements.	5-52
Table 5.8.4–2	Annual Operations Requirements Special Materials Complex Annual Operations Requirements	5-52

Table 5.8.5–1 Y-12 Site Energy and Resource Requirements—No Action - Planning Basis Operations Plus the HEU Storage Mission and Special Materials Mission 5-53
Table 5.11.2–1 Summary of Estimated Annual Waste Generation During Routine Operations at Y-12 by Alternative 5-67
Table 5.11.2–2 Summary of Waste Generation from Construction and Associated Decontamination and Decommissioning and Environmental Restoration Activities During Implementation of the Action Alternatives 5-68
Table 5.12.1–1 Radiation Doses and Health Impact to the Public for the Baseline and the Proposed Alternatives 5-73
Table 5.12.1–2 Radiological Health Effects for Workers for Major Production Operations Under Alternative 1B (No Action - Planning Basis Operations Alternative) 5-74
Table 5.12.1–3 Radiation Doses and Health Impacts to Workers Under the HEU Storage Mission Alternatives 5-74
Table 5.12.2–1 Y-12 Facility Operations Maximum Boundary Hazardous Air Pollutants Noncarcinogenic Chemical Hazard Quotients 5-75
Table 5.12.2–2 Y-12 Facility Operations Maximum Boundary Hazardous Air Pollutants Carcinogenic Chemical Excess Cancer Risk 5-76
Table 5.12.2–3 Y-12 Facility Operations Maximum On-Site Hazardous Air PollutantsNoncarcinogenic Chemical Hazard Quotients 5-76
Table 5.12.2–4 Y-12 Facility Operations Maximum On-Site Hazardous Air Pollutants Carcinogenic Chemical Excess Cancer Risks 5-76
Table 5.12.2–5 Y-12 Steam Plant Maximum Boundary Hazardous Air Pollutant Carcinogenic Chemical Concentrations 5-76
Table 5.12.3–1 Y-12 Beryllium Operations Maximum Boundary Hazard Quotient 5-79
Table 5.12.3–2 Y-12 Beryllium Operations Maximum Boundary Excess Cancer Risk 5-79
Table 5.12.3–3 Y-12 Beryllium Operations Maximum On-Site Hazard Quotient 5-79
Table 5.12.3–4 Y-12 Beryllium Operations Maximum On-Site Excess Cancer Risks 5-79
Table 5.12.4–1 Y-12 4-Year Average (1995-1998) Illness/Injury Rate per 100 Workers 5-81
Table 5.12.4–2 Calculated Nonfatal Injuries/Illnesses per Year for Y-12 Workforce by No Action - Status Quo and No Action - Planning Basis Operations 5-81
Table 5.12.4–3 Calculated Non-fatal Injuries/Illnesses for Construction of the HEU Materials Facility 5-81
Table 5.12.4–4 Calculated Non-fatal Injuries/Illnesses for Construction of the Special Materials Complex 5-82
Table 5.14–1 Summary of Beyond Design Evaluation Earthquake Composite Consequences for Y-12 5-93
Table 5.14–2 Summary of Criticality Consequences for Y-12 5-93
Table 5.14–3 Summary of Radiological Fire Consequences for Y-12 5-93
Table 5.15–1 Commitment of Construction Resources for the Highly Enriched Uranium Storage Mission and Special Materials Mission Alternatives 5-96
Table 6.4.4–1 Estimated Average Annual Radiological Doses and Resulting Health Effects to Off-site Population Due to Liquid Releases from Facilities in the Oak Ridge Area 6-10
Table 6.4.5–1 Estimated Average Annual Radiological Doses and Resulting Health Effects to Off-site Population from Airborne Releases 6-11
Table 6.4.7–1 Estimated Annual Volumes of Waste Generated by Actions in the Oak Ridge Area 6-12

Table 6.4.8–1 Estimated Annual Radiological Impacts to Off-site Population and Facility Workers 6-13
Table 7.2.1–1 Major Federal and State Requirements Regulating Environmental Control Remediation and Worker Safety Arranged by Topic 7-3
Table 7.2.1–2 Selected Department of Energy Directives 7-12
Table 7.2.2–1 Agreements Between DOE-ORO and Other Regulatory Agencies 7-14
Table 7.3–1 Applicable Laws and Executive Orders Y-12 Proposed Action and Alternatives 7-15

ACRONYMS AND ABBREVIATIONS

ACGIH	American Conference of Governmental Industrial Hygienists
AEA	*Atomic Energy Act*
AIHA	American Industrial Hygiene Association
ALARA	as low as reasonably achievable
AQCR	Air Quality Control Region
ASER	Annual Site Environmental Report
ATSDR	Agency for Toxic Substances and Disease Registry
BEIR	Biological Effects of Ionizing Radiation
BIO	Basis of Interim Operations
BWXT	BWX Technologies
CAA	*Clean Air Act*
CAVIS	Continuous Automated Vault Inventory System
CDC	Center for Disease Control
CEDE	committed effective dose equivalent
CEDR	Comprehensive Epidemiologic Data Resources
CEQ	Council on Environmental Quality
CERCLA	*Comprehensive Environmental Response, Compensation, and Liability Act*
CFC	chlorofluorcarbon
CFR	*Code of Federal Regulations*
CMTS	Central Mercury Treatment system
CRMP	Cultural Resources Management Plan
CSMO	Central Scrap Management Office
CTBT	Comprehensive Test Ban Treaty
D&D	decontamination and decommissioning
DARA	Disposal Area Remedial Actions
DCG	Derived Concentration Guideline
DoD	Department of Defense
DOE	Department of Energy
DOT	Department of Transportation
DP	Defense Programs
DSWM	Division of Solid Waste Management
EA	environmental assessment
EBE	evaluation basis earthquake
EDE	effective dose equivalent
EEMTS	East End Mercury Treatment System
EFPC	East Fork Poplar Creek
EIS	environmental impact statement
EM	Environmental Management
EMWMF	Environmental Management Waste Management Facility
EPA	Environmental Protection Agency
ERPG	Emergency Response Planning Guideline
ES&H	environment, safety and health
ETTP	East Tennessee Technology Park (formerly the K-25 Site)
FFA	Federal Facility Agreement
FFCA	*Federal Facility Compliance Act* or Agreement
FONSI	finding of no significant impact
FR	*Federal Register*
FY	fiscal year
HAP	hazardous air pollutants

HEPA	high-efficiency particulate air
HEU	highly enriched uranium
HF	hydrogen fluoride
HI	hazard index
HQ	hazard quotient
HVAC	heating, ventilation, and air conditioning
IAEA	International Atomic Energy Agency
ICRP	International Commission on Radiological Protection
IRIS	Integrated Risk Information System
KOH	potassium hydroxide
LCF	latent cancer fatality
LDR	land disposal restrictions
LLW	low level waste
LMES	Lockheed Martin Energy Systems, Inc.
LOAEL	lowest observed adverse effect level
LOS	Level-of-Service
MACCS	MELCOR Accident Consequence Code System
MAR	material at risk
MEI	maximally exposed individual
MMES	Martin Marietta Energy Systems, Inc.
MSDS	Material Safety Data Sheet
MSL	mean sea level
NAAQS	National Ambient Air Quality Standards
NABIR	Natural and Accelerated Bioremediation Research
NDA	nondestructive assay
NE	Office of Nuclear Energy, Science and Technology
NEPA	*National Environmental Policy Act*
NESHAP	National Emissions Standards for Hazardous Air Pollutants
NIOSH	National Institute for Occupational Safety and Health
NN	Nuclear Nonproliferation and National Security
NOAEL	no observed adverse effect level
NOI	Notice of Intent
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
NTS	Nevada Test Site
ORNL	Oak Ridge National Laboratory
ORO	Oak Ridge Operations
ORR	Oak Ridge Reservation
OSHA	Occupational Safety and Health Administration
PC	Performance Categories
PEIS	programmatic environmental impact statement
PEL	permissible exposure limit
PIDAS	Perimeter Intrusion, Detection, and Assessment System
PSA	Project-Specific Analysis
PSD	Prevention of Significant Deterioration
R&D	research and development
RCRA	*Resource Conservation and Recovery Act*
REL	recommended exposure limit
RfC	Reference Concentration
RfD	Reference Dose
RI/FS	remedial investigation/feasibility study

ROD	Record of Decision
ROI	region of influence
S&D	storage and disposition
S&M	surveillance and maintenance
SARA	*Superfund Amendments and Reauthorization Act*
SGT	safe guarded transport
S-HEU	surplus highly enriched uranium
SHPO	State Historic Preservation Officer
SNM	special nuclear material
SNS	Spallation Neutron Source
SSM	stockpile stewardship and management
STEL	short-term exposure limit
START	Strategic Arms Reduction Treaty
SST	safe-secure trailers
SWEIS	site-wide environmental impact statement
SWMU	solid waste management unit
TCA	Tennessee Codes Annotated
TDEC	Tennessee Department of Environment and Conservation
TEEL	temporary emergency exposure limit
TEV	threshold emission values
TI	transportation index
TLV	threshold limit value
TRU	transuranic
TSCA	*Toxic Substances Control Act*
TSR	Tennessee State Route
TVA	Tennessee Valley Authority
TWA	time weighted average
TWRA	Tennessee Wildlife Resources Agency
UCNI	Unclassified Controlled Nuclear Information
UEFPC	Upper East Fork Poplar Creek
USACE	United States Army Corps of Engineers
U.S.C	United States Code
USFWS	U.S. Fish and Wildlife Service
VOC	volatile organic compound
VRM	Visual Resources Management
Y-12	Oak Ridge Y-12 National Security Complex
WETF	West End Treatment Facility
WIPP	Waste Isolation Pilot Plant

CHEMICALS AND UNITS OF MEASURE

ACN	acetonitrile
AHF	anhydrous hydrogen fluoride
BTEX	benzene, toluene, ethylbenzene, and xylenes
Bq	Becquerel
C	Celsius
Ci	curie
CCl_4	carbon tetrachloride
cm	centimeters
CFC	chlorofluorocarbons
CO	carbon monoxide
dB	decibel
dBA	decibel A-weighted
DCE	1, 2-dichloroethylene
F	Fahrenheit
ft	feet
ft^2	square feet
ft^3	cubic feet
ft^3/s	cubic feet per second
g	grams
G	acceleration due to gravity
gal	gallons
GPD	gallons per day
gpm	gallons per minute
GPY	gallons per year
ha	hectares
HF	hydrogen flouride
hr	hour
in	inches
kg	kilograms
km	kilometers
km^2	square kilometers
KOH	potassium hydroxide
kV	kilovolts
kVA	kilovolt-ampere
kW	kilowatts
kWh	kilowatt hours
L	liters
lb	pounds
Li	lithium
LiD	lithium deuteride
LiH	lithium hydride
LiO	lithium oxide
m	meters
m^2	square meters
m^3	cubic meters
m/s	meters per second
Mbps	million bits per second
Mbtu	million British thermal unit
mCi	millicuries (one-thousandth of a curie)

mCi/mL	millicuries per milliliter
mg	milligram (one-thousandth of a gram)
mg/L	milligrams per liter
MGD	million gallons per day
MGY	million gallons per year
mi	miles
mi^2	square miles
MLD	million liters per day
MLY	million liters per year
mph	miles per hour
mrem	millirem (one-thousandth of a rem)
Mscf	million standard cubic feet
MVA	megavolt-ampere
MW	megawatt
MWe	megawatt electric
MWh	megawatt hour
MWt	megawatt thermal
NaK	sodium potassium
NaOCl	sodium hypochlorite
NaOH	sodium hydroxide
nCi	nanocurie (one-billionth of a curie)
nCi/g	nanocuries per gram
NO_2	nitrogen dioxide
NOX	nitrogen oxides
O_3	ozone
Pb	lead
PCB	polychlorinated biphenyl
PVC	polyvinyl chloride
pCi	picocurie (one-trillionth of a curie)
pCi/L	picocuries per liter
PM_{10}	particulate matter (less than 10 microns in diameter)
ppb	parts per billion
ppm	parts per million
psig	pounds per square inch gage
Ra	radium
rem	roentgen equivalent man
s	seconds
scf	standard cubic feet
scfd	standard cubic feet per day
scfm	standard cubic feet per minute
SO_2	sulfur dioxide
Sv	sievert
T	short ton
t	metric tons
TATB	triaminotrinitrobenzene
TC	technetium
TCA	1, 1, 1-trichloroethane
TCE	trichloroethylene
Th	thorium
TNT	trinitrotoluene
UF_4	uranium tetraflouride

UF_6	uranium hexaflouride
yd^3	cubic yards
yr	year
µCi	microcurie (one-millionth of a curie)
µCi/g	microcuries per gram
µg	microgram (one-millionth of a gram)
µg/kg	micrograms per kilogram
µg/L	micrograms per liter
µg/m^3	micrograms per cubic meter
µ	micron or micrometer (one-millionth of a meter)

CONVERSION CHART

To Convert Into Metric			To Convert Into English		
If You Know	**Multiply By**	**To Get**	**If You Know**	**Multiply By**	**To Get**
Length					
inch	2.54	centimeter	centimeter	0.3937	inch
feet	30.48	centimeter	centimeter	0.0328	feet
feet	0.3048	meter	meter	3.281	feet
yard	0.9144	meter	meter	1.0936	yard
mile	1.60934	kilometer	kilometer	0.62414	mile (Statute)
Area					
square inch	6.4516	square centimeter	square centimeter	0.155	square inch
square feet	0.092903	square meter	square meter	10.7639	square feet
square yard	0.8361	square meter	square meter	1.196	square yard
acre	0.40469	hectare	hectare	2.471	acre
square mile	2.58999	square kilometer	square kilometer	0.3861	square mile
Volume					
fluid ounce	29.574	milliliter	milliliter	0.0338	fluid ounce
gallon	3.7854	liter	liter	0.26417	gallon
cubic feet	0.028317	cubic meter	cubic meter	35.315	cubic feet
cubic yard	0.76455	cubic meter	cubic meter	1.308	cubic yard
Weight					
ounce	28.3495	gram	gram	0.03527	ounce
pound	0.45360	kilogram	kilogram	2.2046	pound
short ton	0.90718	metric ton	metric ton	1.1023	short ton
Force					
dyne	0.00001	newton	newton	100,000	dyne
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	l00 = 10^{2}
deka-	da	l0 = 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}

CHAPTER 1: INTRODUCTION

1.1 BACKGROUND/OVERVIEW

1.1.1 General

The U.S. Department of Energy (DOE) is the Federal agency responsible for providing the Nation with nuclear warheads and ensuring that those weapons remain safe, secure, and reliable. The Y-12 National Security Complex (formerly the Y-12 Plant) (Y-12) is one of three primary installations on the DOE Oak Ridge Reservation (ORR) in Oak Ridge, Tennessee. Figure 1.1.1–1 shows the location of the ORR. The other installations are the Oak Ridge National Laboratory (ORNL) and the East Tennessee Technology Park (ETTP) (formerly the Oak Ridge K-25 Site). Construction of Y-12 was started in 1943 as part of the World War II Manhattan Project. The early missions of the site included the separation of ^{235}U from natural uranium by the electromagnetic separation process and manufacturing weapons components from uranium and lithium.

As one of the DOE major production facilities, Y-12 has been the primary site for enriched uranium processing and storage, and one of the primary manufacturing facilities for maintaining the U.S. nuclear weapons stockpile. Y-12 also conducts and/or supports nondefense-related activities including environmental monitoring, remediation, and decontamination and decommissioning (D&D) activities of DOE's Environmental Management (EM) Program; management of waste materials from past and current operations; research activities operated by ORNL; support of other Federal agencies through the Work-for-Others Program and the National Prototyping Center; and the transfer of highly specialized technologies to support the capabilities of the U.S. industrial base (DOE 2000d).

During a September 1994 Defense Nuclear Facilities Safety Board (DNFSB) technical staff review, weaknesses were identified in the Y-12 Conduct of Operations Program related to its criticality safety program. While these weaknesses did not represent a technical risk to facility workers, meaning that the required margins of safety were in place, they did indicate issues with training, document control, understanding of requirements, and procedures (DNFSB 1994). After a full Y-12 review, Y-12 management suspended all work not necessary to maintain regulatory compliance or that would pose a threat to the safety basis for Y-12 (Stand-Down Status) until improvements could be implemented to the Conduct of Operations Program. As of today, most, but not all Y-12 facilities and processes have returned to Operating Status (i.e., executing the work for which the process, facility, or system was designed).

Y-12 and the National Nuclear Security Administration. During 2000, the U.S. Congress passed *Title 32 of the National Defense Authorization Act for Fiscal Year 2000, Public Law 106-65* (*NNSA Act*), which established the National Nuclear Security Administration (NNSA). The mission of the NNSA is to carry out national security responsibilities of DOE, including maintenance of a safe, secure and reliable stockpile of nuclear weapons and associated materials capabilities and technologies; promotion of international nuclear safety and nonproliferation; and administration and management of the naval nuclear propulsion program.

Implementation of the NNSA began on March 1, 2000. At that time, about 2,000 DOE employees were realigned to become employees of NNSA. This figure included those employed by the Office of Defense Programs, Fissile Materials Disposition, and Nonproliferation and National Security. In addition, almost all employees of the Office of Naval Reactors, the Pittsburgh Naval Reactors Office, the Schenectady Naval Reactors Office, and the Nevada and Albuquerque Operations Offices were transferred to NNSA, as were others, mainly at the Oakland, Oak Ridge and Savannah River Operations Offices.

Source: DOE 1996e.

FIGURE 1.1.1–1.—*Location of Oak Ridge Reservation, Principal Facilities, and Surrounding Area.*

There are three program offices within the NNSA: the Office of Deputy Administrator for Defense Programs; the Office of the Deputy Administrator for Defense Nuclear Nonproliferation; and the Office of the Deputy Administration for Naval Reactors. The Office of the Deputy Administrator for Defense Programs is the most relevant to the Y-12 National Security Complex daily mission activities and operations.

The Deputy Administrator for Defense Programs serves as Lead Program Secretarial Officer for the Albuquerque and Nevada Operations Offices. The following laboratories and production/test facilities report to and are accountable to the Deputy Administrator for Defense Programs, through the field operations offices:

- Los Alamos National Laboratory, Los Alamos, New Mexico
- Sandia National Laboratories, Albuquerque, New Mexico and Livermore, California
- Lawrence Livermore National Laboratory, Livermore, California
- The Kansas City Plant, Kansas City, Missouri
- The Pantex Plant, Amarillo, Texas
- The Y-12 National Security Complex at Oak Ridge, Tennessee
- The tritium operations facilities at Savannah River, Aiken, South Carolina
- The Nevada Test Site, Nevada

The functions of the Office of Deputy Administrator for Defense Programs that primarily affect the Y-12 National Security Complex include:

- Management of the Stockpile Stewardship Program, which encompasses operations associated with manufacturing, maintaining, refurbishing, surveillance, and dismantling the nuclear weapons stockpile; and
- Providing assurance, through close coordination with the Department of Defense, that the materials, capabilities, and technologies are provided in an environmentally sound and cost-effective manner to support the production of certified components to extend the lifetime of the nuclear weapons stockpile.

While the creation of the NNSA resulted in significant changes within the management structure of DOE, the day-to-day routine of operations remained essentially the same. All field offices continue to have the same authorities that they have always had, but delegated through different channels. In general, all statutes, regulations, delegations, and directives, including policy statements, orders, notices, manuals, guides and technical standards, applicable to DOE that were in effect on February 29, 2000 continue to apply to DOE functions and activities that have been transferred to NNSA. In addition, NNSA laboratories and facilities, such as Y-12, will continue to perform work and provide services to non-NNSA missions and programs just as they did prior to March 1, 2000. Similarly, non-NNSA laboratories such as ORNL and facilities will perform work and provide services to NNSA missions and programs just as they did prior to March 1, 2000, as a service provider to the NNSA.

This same policy also applies with regard to environmental management activities, including those performed at the national security laboratories and nuclear weapons production/test facilities. The cleanup and environmental management at existing waste sites is not a function of the NNSA. These functions are, and will continue to be, the responsibility of the Office of Environmental Management (EM). The management of newly generated wastes at NNSA laboratories and facilities is the responsibility of the NNSA, but it will be managed by EM pursuant to a service agreement or other arrangement.

As one of the major production facilities within the nuclear weapons complex, the Y-12 National Security Complex falls under the responsibility of the Y-12 Area Office, as of October 2000, under the new NNSA.

1.1.2 Proposed Action and Scope

In response to the end of the Cold War and changes in the world's political regimes, the emphasis of the U.S. nuclear weapons program has shifted dramatically over the past few years from developing and producing new weapons to dismantlement and maintenance of a smaller, enduring stockpile. Even with these significant changes, DOE's responsibilities for the nuclear weapons stockpile continue, and the President and Congress have directed DOE to continue to maintain the safety, security, and reliability of the nuclear weapons stockpile.

In order to meet the challenges of the post-Cold War era, DOE prepared three programmatic environmental impact statements (PEISs) to analyze alternatives dealing with certain national security requirements. The *Final Programmatic Environmental Impact Statement for Stockpile Stewardship and Management* (SSM PEIS) (DOE 1996e), which was completed in September 1996, evaluated alternatives for maintaining the safety and reliability of the nuclear weapons stockpile without underground nuclear testing or production of new-design weapons. In the SSM PEIS Record of Decision (ROD), DOE decided to maintain the national security missions at Y-12, but to downsize the plant consistent with the reduced requirements. These national security missions include (1) maintaining the capability and capacity to fabricate secondaries, limited life components and case parts for nuclear weapons; (2) evaluating components and subsystems returned from the stockpile; (3) storing enriched uranium that is designated for national security purposes (also referred to as nonsurplus enriched uranium); (4) storing depleted uranium and lithium materials and parts; (5) dismantling nuclear weapons secondaries returned from the stockpile; (6) processing uranium and lithium (which includes chemical recovery, purification, and conversion of enriched uranium and lithium to a form suitable for long-term storage and/or future use); and (7) providing support to weapons laboratories.

The *Storage and Disposition of Weapons-Usable Fissile Material Programmatic Environmental Impact Statement* (S&D PEIS) (DOE 1996h), which was completed in December 1996, evaluated alternatives for the long-term storage of fissile material and the disposition of surplus fissile material. In the S&D PEIS ROD, DOE decided that Y-12 would also store surplus enriched uranium pending long-term disposition. In addition, the *Disposition of Surplus Highly Enriched Uranium Final Environmental Impact Statement* (S-HEU EIS) (DOE 1996b), which was completed in June 1996, evaluated alternatives for the disposition of weapons-usable highly enriched uranium (HEU) that has been declared surplus to national defense needs. In the S-HEU EIS ROD, DOE decided that Y-12 would be one of four sites for blending up to 85 percent of the Nation's surplus HEU to low enriched uranium for commercial use as fuel feed for nuclear power plants and dispose of the remaining low enriched uranium as low-level waste (LLW). Section 1.1.4 discusses DOE's decision resulting from these PEISs.

The RODs from the SSM PEIS, the S&D PEIS, and the S-HEU EIS form a starting point for the scope of actions that are included in this Y-12 SWEIS.

In accordance with the SSM and S&D RODs, DOE proposes to provide the capability and capacity to maintain the Nation's stockpile, in support of the U.S. Nuclear Weapons Program. Furthermore, DOE will continue the processing and storage of enriched and depleted uranium, lithium compounds, and other materials, as well as the manufacturing and assembly/disassembly mission assigned to Y-12 in the safest, most secure and most efficient manner practicable. In accordance with the S-HEU EIS ROD, Y-12 may blend down surplus HEU to produce material (low enriched uranium) for commercial use as fuel feed for nuclear power plants and dispose of the remaining material as LLW. Blend stock for this activity may include DOE surplus low enriched uranium and natural uranium or commercial natural uranium. These materials would be stored on-site on an interim basis to support blending of HEU. The Y-12 National Security Complex currently blends small quantities of HEU with low enriched, depleted, or natural uranium to produce a metal or oxide product suitable for use in various reactor programs and for multiple supply orders to DOE customers. The Y-12 National Security Complex does not have the capability to blend large quantities of HEU (tons/year). Facility upgrades or new building construction would be required to install this process at Y-12. Further NEPA review would be needed to initiate these facility upgrades or any new building construction.

The Y-12 SWEIS physical area of analysis for the Y-12 National Security Complex is shown in Figure 1.1.2–1. A detailed map of current facility utilization at Y-12 is provided in Figure 1.1.2–2.

1.1.3 Ongoing Y-12 Downsizing and Modernization Program

Stockpile Management Restructuring Initiative. The ongoing Stockpile Management Restructuring Initiative project supports the plan for downsizing the Y-12 National Security Complex consistent with the future nuclear weapons secondary and case manufacturing mission defined by the SSM PEIS ROD. The purpose of the Stockpile Management Restructuring Initiative project is to assist in preparing the Y-12 National Security Complex for the future production mission requirements for nuclear weapon secondaries, case components, and other miscellaneous components, while providing a smaller, more cost-effective production size. The ongoing downsizing task is to minimize the number of major buildings required while maintaining the capability to perform the Defense Programs (DP) production mission.

Y-12 Modernization Program. In 1999, DOE's Office of Defense Programs initiated activities to develop and implement a program to modernize Y-12's facilities and ensure its capability to meet future stockpile needs. The Y-12 Modernization Program was established at that time to develop plans for modernizing Y-12.

A modernized Y-12 National Security Complex would possibly include the eventual replacement or upgrade of select major production and support facilities. Whereas current operations are housed in multiple facilities throughout the west end of the Y-12 National Security Complex, a modernization initiative would consolidate operations into fewer, more efficient facilities. A number of functions/facilities initially considered for modernization include:

- HEU Materials Facility for storage of assembled weapons secondaries and other forms of HEU
- Special Materials Complex for production of special materials (e.g., beryllium, plastic parts)
- Enriched Uranium Manufacturing Facility for processing enriched uranium
- Assembly/Disassembly/Quality Evaluation Facility for the assembly, disassembly, and surveillance of nuclear weapons secondaries
- Lithium Operations Complex for production of lithium hydride and lithium deuteride parts
- Depleted Uranium Operations Facility for production of depleted uranium parts and other nonnuclear components
- Other production support facilities
- Utility and infrastructure facilities

FIGURE 1.1.2–1.—*The Y-12 Site-Wide Environmental Impact Statement Area of Analysis.*

Source: Tetra Tech, Inc./LMES 2000a.

One of the primary purposes of the Y-12 SWEIS is to provide an overall NEPA baseline for all DOE activities at Y-12, including modernization, that will be useful as a reference when project-specific NEPA documents are prepared.

The first two of these potential modernization projects listed above have moved into the conceptual design phase and are included in the SWEIS. Other potential modernization projects (i.e., production, production support, and utility and infrastructure) are still in the very early planning phase and are not included as proposed projects in the Y-12 SWEIS. However, potential facilities are described in Section 3.3 (Potential Future Y-12 Modernization Projects) based on current information. Further NEPA review would be required when these facilities are formally proposed and ripe for decision. The Y-12 SWEIS will be used to tier future NEPA reviews on modernization projects, as well as other Y-12 Site projects, that are not included as project-specific proposals in this document.

The Modernization Program would improve Y-12 capabilities by:

- Improving worker protection through the use of engineered controls
- Improving safety, environmental, and security compliance through the use of modern facilities and advanced technologies
- Supporting responsiveness to the Science-based Stockpile Stewardship Program through increased flexibility and use of advanced technologies
- Reducing costs through lowered maintenance costs and improved operating efficiencies

In support of the proposed HEU Materials Facility, the first component of the modernization program, the Conceptual Design Report (Y-12 1999a) has been prepared and issued, the Project Execution Plan has been prepared, and activities have been performed to support an Independent Project Assessment and project validation to include it as a Fiscal Year (FY) 2001 Line Item Project. The feasibility, design, costing, and pre-*National Environmental Policy Act* (NEPA) review of the HEU Materials Facility considered different siting locations, different designs (e.g., above-ground, below ground, or combination of both), and issues such as material storage and security requirements. Based partially on cost and security requirements, the above-ground design was selected and the potential sites for constructing the new structure was screened down to two locations. Further DOE internal scoping of the project for NEPA review also revealed a possible alternative to constructing the new HEU Materials Facility (e.g., upgrade the existing HEU facility). This upgraded/expanded facility alternative was considered reasonable for NEPA analyses based on earlier preliminary feasibility and costing studies and is included in the NEPA review for the HEU Storage Mission alternatives.

In addition, the planning and conceptual design of the Special Materials Complex have been expedited so that construction of the proposed new facility is expected to commence in FY 2003. Alternatives for the siting, construction, and operation of the HEU Materials Facility and Special Materials Complex are included in this *Site-Wide Environmental Impact Statement* (SWEIS) *for the Y-12 National Security Complex.*

Source: Tetra Tech, Inc./LMES 2000a.

FIGURE 1.1.2–2.—*Alternative 1A (No Action - Status Quo Alternative) Facility Location and Utilization at Y-12.*

1.2 ALTERNATIVES ANALYZED

The alternatives presented in the Y-12 SWEIS have changed significantly during this NEPA process from those identified in the Notice of Intent (NOI) on March 17, 1999. Internal DOE scoping, which formed the alternatives in the NOI, focused on the modernization of the Y-12 National Security Complex. In this respect, alternatives (e.g., Upgrade Alternative, New Construction Alternative, and Upgrade/New Construction Alternative) centered on upgrades and new construction at Y-12 for DOE to accomplish the mission assigned to Y-12 based on SSM PEIS and S&D PEIS ROD decisions. During preparation of the Y-12 SWEIS it became apparent that these alternatives were too broad, not well defined, and lacked the data needed to analyze the potential impacts. A reevaluation of the DOE proposed action for the Y-12 National Security Complex resulted in the current alternatives analyzed in this SWEIS. The new alternatives focus on two Y-12 National Security Complex mission components; the HEU Storage Mission and the Special Materials Mission.

The alternatives analyzed in the Y-12 SWEIS are based on the fact that the future mission of Y-12 (to maintain the capability and capacity to fabricate nuclear weapons secondaries, and limited life components and case parts in support of the U.S. Nuclear Weapons Program and to store non-surplus HEU long-term and surplus HEU pending disposition) has already been decided in the SSM and S&D PEISs and RODs. Therefore, "traditional" SWEIS alternatives such as Expanded Operations, Reduced Operations, or Site Closure are not appropriate and are not analyzed. Instead, the Y-12 SWEIS alternatives focus on factors that consider (1) Y-12's Mission: Y-12 already has the capability to perform its assigned stockpile mission, (2) Stockpile Management Restructuring Initiative: implementing downsizing actions consistent with the SSM ROD that enable Y-12 to more efficiently and cost effectively maintain that capability, and (3) Y-SIM Program modernization actions.

Because all operations at the Y-12 National Security Complex have not regained operational readiness from the stand-down in 1994, the existing Y-12 activities and environmental conditions do not reflect a true No Action for the Y-12 Site for comparison of action alternative impacts. Therefore, two No Action Alternatives are presented in this SWEIS; No Action - Status Quo and No Action - Planning Basis Operations. The No Action - Status Quo Alternative, which is basically the status of Y-12 in 1999, is presented in this SWEIS to show the increase in production levels and potential impacts under the No Action - Planning Basis Operations Alternative and the action alternatives. The No Action - Status Quo Alternative is not considered reasonable for future Y-12 operations because it would not meet Y-12 mission requirements. The No Action-Planning Basis Operations Alternative represents a Y-12 operated at full planned and required work levels.

Table 1.2–1 shows the alternatives for the Y-12 HEU Storage Mission and Special Materials Mission components analyzed in this Y-12 SWEIS. The alternatives are described in detail in Chapter 3 and summarized in the following discussion.

Implementation of any of the action alternatives for the HEU Storage Mission or Special Materials Mission would result in the potential for surplus DP facilities and their possible transitioning to EM for cleanup and D&D. Appendix A.1 describes the Y-12 facility transition process in detail. Estimated D&D wastes from vacated HEU storage facilities and special materials operation facilities are provided in Chapter 5 (Section 5.11) of this SWEIS.

Y-12 Site Alternatives

Alternative 1A (No Action - Status Quo Alternative). The No Action - Status Quo Alternative represents the current level of operations at Y-12 as reflected by the most recent monitoring data (1999) for the Y-12 Site and reported in the 1999 Annual Site Environmental Report (ASER) issued in 2000. Although approximately 80 percent of these types of operations associated with DP's assigned mission were operational ready in 1999 (following the Y-12 stand-down of 1994), the Y-12 National Security Complex was only operating at 30 percent capacity throughout most of that year. This state/condition is used in the SWEIS as a basis for comparison of the impacts associated with the No Action - Planning Basis Operations Alternative and the actions that reflect full Y-12 DP mission operations at required levels plus recently approved projects by EM and ORNL at Y-12. The No Action - Status Quo Alternative is not considered a reasonable alternative for future Y-12 operations because it would not meet Y-12 mission needs and would not reflect DOE's decision in the SSM PEIS ROD (61 FR 68011) to maintain and downsize the DP mission at Y-12.

Alternative 1B (No Action - Planning Basis Operations Alternative). This alternative reflects the historic nuclear weapons program missions at Y-12, and includes the manufacture and assembly/disassembly of weapons components and the continued processing and storage of enriched uranium materials in existing facilities at required nuclear weapons stockpile support work levels. The No Action - Planning Basis Operations Alternative also includes other nondefense-related program activities at Y-12 that have been approved and would be implemented during the 10-year planning period. Nondefense-related program activities included under the No Action - Planning Basis Operations Alternative are the construction and operation of a new *Comprehensive Environmental Response, Compensation, and Liability Act* (CERCLA) waste disposal cell (referred to as the Environmental Management Waste Management Facility) to accommodate wastes resulting from environmental remediation, and the implementation of an Office of Science Field Research Center project at Y-12.

The Environmental Management Waste Management Facility would be constructed in Bear Creek Valley just west of the Y-12 main facilities in an area currently designated for waste management activities. The Field Research Center component of the ORNL Natural and Accelerated Bioremediation Research (NABIR) Program would also be located in Bear Creek Valley near the Y-12 S-3 Parking Lot.

Alternative 2 (No Action - Planning Basis Operations Alternative Plus HEU Storage Mission Alternatives). This alternative includes the No Action - Planning Basis Operations Alternative Plus an HEU storage facility. Options considered for HEU storage include a new HEU Materials Facility at one of two proposed sites (i.e., Sites A and B), and expansion of Building 9215. Candidate sites for the new HEU Materials Facility are located on the west end of the Y-12 in the West Portal Parking Lot (Site A) and in the area of the Y-12 Scrap Metal Yard (Site B). The proposed HEU Materials Facility would be a single-story concrete structure covered by an earthen berm. The expansion of Building 9215 would be a new two-story concrete and steel structure attached to the north end of the building.

Alternative 3 (No Action - Planning Basis Operations Plus Special Materials Mission Alternative). This alternative includes the No Action - Planning Basis Operations Alternative Plus a new Special Materials Complex at one of three proposed sites (i.e., Sites 1, 2, and 3). Candidate sites for the new Special Materials Complex are located in the west end of the Y-12. Two potential sites are in the area of the Y-12 Scrap Metal Yard (Sites 2 and 3) and one site is located northwest of Building 9114 and on the north side of Bear Creek Road (Site 1). The proposed Special Materials Complex would include a Beryllium Facility, a Manufacturing Warehouse Facility, a Purification Facility, an Isostatic Press Facility, and a Core Support Facility. All facilities in the Complex would be connected by covered corridors.

Alternative 4 (No Action - Planning Basis Operations Plus HEU Materials Facility Plus Special Materials Complex). This alternative includes the No Action - Planning Basis Operations Alternative Plus Construction and Operation of a New HEU Materials Facility at one of two proposed sites and Construction and Operation of a New Special Materials Complex at one of three proposed sites.

TABLE 1.2–1.—*Y-12 SWEIS Alternatives*

Y-12 Mission	Alternative 1A No Action - Status Quo Alternative (Partial Stand-Down Operation, 1999)
	Alternative 1B **No Action - Planning Basis Operations Alternative** (Continue historic mission operations)
HEU Storage Mission	**No Action (Same as Alternative 1B)** (Continue HEU storage in existing facilities) **Alternative 2A** **No Action - Planning Basis Operations Plus Construct and Operate New HEU Materials Facility** (Site A or Site B) **Alternative 2B** **No Action - Planning Basis Operations Plus Upgrade to existing Building 9215**
Special Materials Mission	**No Action (Same as Alternative 1B)** (Continue special materials operations in existing facilities with limited capabilities) **Alternative 3** **No Action - Planning Basis Operations Plus Construct and Operate New Special Materials Complex** (Site 1, Site 2, or Site 3)
Both HEU Storage Mission and Special Materials Mission	**No Action (Same as Alternative 1B)** (Continue historic HEU storage and special materials operations in existing facilities) **Alternative 4** **No Action - Planning Basis Operations Plus Construct and Operate a New HEU Materials Facility and a New Special Materials Complex**

1.3 LAWS AND REGULATIONS AND *NATIONAL ENVIRONMENTAL POLICY ACT* STRATEGY

This SWEIS has been prepared in accordance with Section 102(2)c of NEPA of 1969, as amended in the United States Code (42 U.S.C. 4321 et seq.), and regulations promulgated by the Council on Environmental Quality (CEQ) within the *Code of Federal Regulations* (CFR) (40 CFR 1500-1508) and DOE (10 CFR 1021), and follows DOE guidance (DOE 1998c). Under NEPA, Federal agencies, such as DOE, proposing major actions that could significantly affect the quality of the human environment are required to prepare an EIS to ensure that the environmental consequences of the proposed action and its alternatives are available to the public and considered before decisions to take an action are made.

For certain large multiple-facility sites, such as Y-12, a SWEIS is prepared (10 CFR 1021.330). The purpose of a SWEIS is to (1) provide DOE and its stakeholders with an analysis of the individual and cumulative environmental impacts resulting from both ongoing and reasonably foreseeable new operations and facilities (i.e., reasonable alternatives) at a DOE site, (2) provide a basis for site-wide decision making, and (3) improve and coordinate agency plans, functions, programs, and resource utilization. A SWEIS can be used to efficiently and effectively analyze multiple proposals and help establish an efficient, environmentally sound, and cost-effective plan for operating the site and its facilities. Additionally, a SWEIS provides an overall NEPA baseline for a site that is useful as a reference when project-specific NEPA documents are prepared. In accordance with 10 CFR 1021.330(d), DOE shall evaluate the SWEIS at least every 5 years after its completion to determine whether it remains adequate, should be supplemented, or should be replaced with a new SWEIS.

The DOE strategy for NEPA review of both the SSM and S&D programs consists of multiple phases. The first phase was to prepare PEISs (now completed) to support program-wide decisions. In the second phase, DOE would prepare necessary programmatic and/or project-specific NEPA documents required to implement any site-wide decisions. This Y-12 SWEIS is the next step for DOE's NEPA strategy for Y-12. Project-specific analyses for the proposed HEU Materials Facility and Special Materials Complex are included in this Y-12 SWEIS.

1.4 RELATIONSHIP OF THIS ENVIRONMENTAL IMPACT STATEMENT WITH OTHER *NATIONAL ENVIRONMENTAL POLICY ACT* REVIEWS

DOE has prepared or is currently preparing other programmatic, project-specific, and site-wide NEPA documents that influence the mix of potential long-term missions at Y-12. These documents, and their relationship to the Y-12 SWEIS, are discussed below.

1.4.1 Programmatic *National Environmental Policy Act* Reviews

DOE has prepared several PEISs to determine how best to carry out its national security requirements. As a result, DOE has already made a number of decisions related to the long-term storage and disposition of fissile material, the maintenance of national security, and reliability of the nuclear weapons stockpile. Y-12, based on DOE's programmatic decisions, has been selected to fulfill an integral role in the continuance of DOE's programs supporting the Nation's nuclear defense. The alternatives considered in this SWEIS are consistent with DOE's "higher-tier" programmatic requirements and are designed to support and implement the Y-12 related decisions made by DOE in the respective PEIS and EIS RODs. In these RODs, DOE decided that the mission of Y-12 would not change and that Y-12 would continue to maintain the capability and capacity to fabricate nuclear weapons secondaries and limited life components and case parts in support of the U. S. Nuclear Weapons Program, and store nonsurplus HEU long-term and surplus HEU pending disposition. This SWEIS “tiering” NEPA review (i.e., preparing site-specific analysis concentrating on the issues specific to the Y-12 SWEIS to implement the decisions made in the broader programmatic environmental impact statements) analyzes the potential environmental impacts associated with the various Y-12 proposed actions and alternatives for implementing these decisions. Each of the controlling PEISs is summarized below.

***Final Programmatic Environmental Impact Statement for Stockpile Stewardship and Management* (DOE/EIS-0236, DOE 1996e).** A ROD was issued on December 19, 1996 (61 FR 68014). As identified in the ROD, DOE decided not to change the mission at Y-12 but maintain and downsize the DP missions including the weapons secondary and case component fabrication capability at Y-12. Figure 1.4.1–1 shows the facilities of the DOE complex and the missions of each respective site. The Y-12 SWEIS tiers off of the SSM PEIS and analyzes alternatives for implementing the decisions reached in the SSM PEIS ROD. The ROD decision forms the basis for the No Action - Planning Basis Operations Alternative (e.g., continue historic mission) and the alternative for the Special Materials Mission presented in this Y-12 SWEIS.

FIGURE 1.4.1–1.—*Current Department of Energy Stockpile Stewardship and Management Sites.*

Source: DOE 1996e.

Storage and Disposition of Weapons-Usable Fissile Materials, Final Programmatic Environmental Impact Statement **(DOE/EIS-0229, DOE 1996h).** A ROD was issued on January 14, 1997 (62 FR 3014). In the ROD, DOE decided that Oak Ridge, in particular Y-12, would continue to store nonsurplus HEU (long-term) and surplus HEU (on an interim basis) in upgraded facilities pending disposition. The Y-12 SWEIS tiers off of the S&D PEIS and analyzes alternatives for implementing the decision reached in the S&D PEIS ROD. The ROD decision forms the basis for continuing the HEU Storage Mission at Y-12 and the proposal to construct and operate a new HEU Materials Facility at Y-12.

Waste Management Programmatic Environmental Impact Statement **(DOE/EIS-0200-F, DOE 1997c).** The Final PEIS was issued in May 1997. Multiple RODs are being prepared for various categories of waste. A ROD for the Treatment of Non-Wastewater Hazardous Waste was issued on July 30, 1998 (63 FR 41810). In the ROD, DOE decided to continue to use off-site facilities for the treatment of major portions of the non-wastewater hazardous waste generated at DOE sites. In accordance with the ROD, the ORR, including Y-12, will treat some of its own non-wastewater hazardous waste on-site, where capacity is available in existing facilities and where this is economically favorable. The treatment of Y-12 non-wastewater hazardous waste is included in the Y-12 SWEIS Alternative 1A (No Action - Status Quo Alternative). A second ROD for transuranic (TRU) waste was issued on January 23, 1998 (63 FR 3629). TRU waste at the ORR will be packaged to meet waste acceptance criteria for the Waste Isolation Pilot Plant (WIPP) in New Mexico and then stored on-site for eventual disposal at the WIPP. Y-12 does not generate or manage TRU waste. DOE's preferred alternative for management of LLW and mixed LLW was issued December 5, 1999 (64 FR 69241). For the management of LLW and mixed LLW, DOE prefers regional disposal at the Hanford Site and Nevada Test Site. ORR would continue disposal of LLW generated on-site including Y-12's. The disposal of on-site generated LLW from Y-12 is included in the Y-12 SWEIS Alternative 1B (No Action - Planning Basis Operations Alternative). The ROD for LLW and unified LLW treatment and disposal was consistent with those preferred alternatives and was issued on February 25, 2000 (65 FR 10061).

Final Environmental Impact Statement for the Continued Operation of the Pantex Plant and Associated Storage of Nuclear Weapons Components **(DOE/EIS-0225, DOE 1996f).** The ROD was issued on January 27, 1997 (62 FR 3880). In the ROD, DOE decided that Pantex would continue nuclear weapons operations involving assembly and disassembly of nuclear weapons. The decisions announced in the ROD did not affect the continued shipment of HEU and depleted uranium components to Y-12 resulting from the disassembly of weapons. Uranium components received from Pantex are included in the Y-12 activities and all the alternatives analyzed in this Y-12 SWEIS.

1.4.2 Project-Specific *National Environmental Policy Act* Reviews

Disposition of Surplus Highly Enriched Uranium Final Environmental Impact Statement **(DOE/EIS-0240, DOE 1996b).** A ROD was issued on August 5, 1996 (61 FR 40619). Y-12 is one of four domestic sites selected to potentially down-blend weapons-usable surplus HEU to nonweapons-usable low enriched uranium for use as commercial reactor fuel or as a LLW. Capabilities exist at the Y-12 Building 9212 to perform only small-scale (500 to 700 kg/year) HEU blending operations. The small-scale (500 to 700 kg/year) down-blending of HEU is included in the Y-12 No Action - Planning Basis Operations Alternative. The large-scale (tons/year) down-blending operations cannot be performed at Y-12 without major building and process upgrades or new construction. No projects have been proposed to increase the capacities at Y-12 at this time. Therefore, the potential impacts of this operation are included under cumulative impacts in Chapter 6 of this Y-12 SWEIS. Impacts of upgrades or construction will be analyzed when those projects are identified.

Interim Storage of Enriched Uranium Environmental Assessment **(DOE/EA-0929)**. This Environmental Assessment (EA) and the Finding of No Significant Impact (FONSI) were issued on September 14, 1995 (60 FR 54068). It allowed for the continued interim storage of enriched uranium at Y-12, with an increase in the amount of material stored above the historical maximum level. The S&D PEIS, discussed above, confirmed and extended this mission beyond the 10 years assessed in the EA. The long-term Y-12 HEU Storage Mission is addressed in Alternatives 1B, 2A, 2B and 4 of this Y-12 SWEIS.

***Final Environmental Impact Statement for the Production of Tritium in a Commercial Light Water Reactor* (DOE/EIS-0288, DOE 1999b).** A ROD was issued on May 6, 1999 (64 FR 26369). Y-12 is one of the sites identified to potentially down-blend HEU to low enriched uranium for use in commercial light water reactors to support tritium production. Building 9212 HEU blending operations could be used to support the tritium production mission. See the discussion at the beginning of this section under the *Disposition of Surplus Highly Enriched Uranium Final EIS* for the status of this potential project at Y-12 and its coverage in this Y-12 SWEIS.

***Replacement and Operation of the Anhydrous Hydrogen Fluoride* (AHF) *Supply and Fluidized-Bed Chemical Processing Systems Environmental Assessment* (DOE/EA-1049).** The EA and FONSI were issued on September 20, 1995 (DOE 1995b). This allowed for replacement of the AHF supply and fluidized-bed reactor systems at Y-12 to meet operational and safety requirements and extend the life of the process by approximately 20 years. This construction project is included in the No Action - Status Quo Alternative of this Y-12 SWEIS. However, since the facility was not operational in 1999, operations impacts are included in the No Action - Planning Basis Operations Alternative.

1.4.3 Oak Ridge Reservation *National Environmental Policy Act* Reviews

***Environmental Assessment for Selection and Operation of the Proposed Field Research Centers for the Natural and Accelerated Bioremediation Research* (NABIR) *Program* (DOE/ EA - 1196).** A FONSI was issued on April 18, 2000. The EA evaluated impacts of operating a field research component of the NABIR Program at two alternative sites; ORNL/Y-12 Site and the Pacific Northwest National Laboratory/DOE Hanford 100 - H area in Richland, Washington. The ORNL/Y-12 Site was selected as the site for the field research component. The Field Research Center is included in the Y-12 SWEIS under the No Action - Planning Basis Operations and is proceeding independent of the Y-12 SWEIS. The mission of the NABIR Program or the potential environmental impacts from the operation of the Field Research Center are not expected to change over the proposed 10-year life of the program.

***Spallation Neutron Source* (SNS) *Environmental Impact Statement* (DOE/EIS-0247, DOE 1999c).** The Final EIS was issued in April 1999 and the ROD on June 18, 1999 (64 FR 35140). This document evaluates four DOE alternative sites for construction and operation of a new SNS facility. The preferred alternative, a site near ORNL on the ORR, was selected. The potential cumulative impacts of this project are included in this Y-12 SWEIS.

***Lease of Land and Facilities Within the East Tennessee Technology Park Environmental Assessment* (DOE/EA-1175, DOE 1997d).** A FONSI was issued on December 1, 1997. The EA evaluated impacts of alternatives on future use and/or disposition of surplus facilities at the former K-25 Site on the ORR, and allowed for the lease of some facilities and land to commercial entities. A supplement analysis for a superconductivity cavity was completed February 23, 2000. The potential cumulative impacts of DOE land transfers are included in this Y-12 SWEIS.

***Long-Term Management and Use of Depleted Uranium Hexafluoride Programmatic Environmental Impact Statement* (DOE/EIS-0269, DOE 1999d).** The Final PEIS was issued in April 1999 and the ROD on August 2, 1999 (64 FR 43358). The ETTP (formerly the Oak Ridge K-25 Site) currently manages and stores this material pending transfer to another DOE site. Potential cumulative effects at ORR of this program are included in this Y-12 SWEIS.

Environmental Assessment for the U.S. Department of Energy, Oak Ridge Operations, Receipt and Storage of Uranium Materials for the Fernald Environmental Management Project Site **(DOE/EA-1299, DOE 1999e).** The Final EA/FONSI was issued on April 13, 1999. Y-12 and the ETTP are available sites for storage of materials being removed in the cleanup effort at the Fernald Site in Ohio. Potential impacts on Y-12 from the EM program are included in this Y-12 SWEIS.

Transuranic Waste Treatment Facility Environmental Impact Statement **(DOE/EIS-0305).** The Final EIS was issued June 2000 and the ROD on August 9, 2000 (65 FR 48683). DOE has selected the Low-Temperature Drying Alternative (the preferred alternative in the Final EIS) and will proceed with the construction, operation, and D&D of the TRU Waste Treatment Facility at ORNL. The waste to be treated is legacy waste (i.e., waste generated from past isotope production) and research/development that supported national defense and energy initiatives. Waste generated from ongoing ORNL operations of the Facility will also be treated. All treated TRU waste will be transported and disposed of at the WIPP while treated LLW transported and disposed of at the Nevada Test Site (NTS).

Facilities Revitalization Project at the Oak Ridge National Laboratory (DOE/EA-1362, DOE 2001a). The Final EA/FONSI was issued on June 1, 2001. The proposed action included the construction of a number of major new facilities and the renovation of several others over the next five years. The consolidation of Laboratory mission activities currently performed in Y-12 facilities and relocation of associated personnel to ORNL is part of the proposed action.

1.4.4 Other Documents

Programmatic Environmental Impact Statement for the Long-term Management of the National Defense Stockpile Inventory of Excess Mercury. The Notice of Intent was published in February 2001 (66 FR 8947, February 5, 2001). The Defense Logistics Agency is preparing an EIS on the impacts associated with the disposition of excess mercury that was stockpiled for national defense purposes. Stockpiled mercury is now warehoused at five locations in the United States, including the Y-12 National Security Complex. Approximately 675,000 kg (1.5 million lbs) of Defense Logistics Agency-managed mercury is collocated with approximately 675,000 kg (1.5 million lbs) of DOE-managed mercury at Y-12. DOE is a cooperating agency for the EIS. The impact of continued storage of the mercury at Y-12 is included in the analysis of the No Action - Status Quo Alternative. The Y-12 National Security Complex does not have suitable storage space to be considered an alternative site for consolidation of Defense Logistics Agency-managed mercury.

Environmental, Safety, and Health Vulnerabilities Associated with the Storage of Highly Enriched Uranium **(DOE/EH-0525, DOE 1996g).** This report was issued in December 1996. The related Management Plan (DOE/DP-0139, DOE 1997b) was issued in April 1997. In this report, DOE evaluated 22 sites that handle and store HEU materials in a variety of forms, including disassembled weapons parts, reactor fuels, solids, solutions, and scrap and residues. Most of the HEU vulnerabilities identified at those sites, including Y-12, are associated with poor facility conditions and institutional weaknesses. This document is part of the basis for DOE's initiative to consider the upgrade and/or construction of new facilities and processes at Y-12 to ensure long-term capabilities to support the maintenance of the nuclear weapons stockpile. Proposed action and alternatives in the Y-12 SWEIS for the HEU Materials Facility address the HEU storage vulnerabilities identified at Y-12 facilities.

Report on the Remedial Investigation of the Upper East Fork Poplar Creek Characterization Area at the Oak Ridge Y-12 Plant, Oak Ridge, Tennessee **(DOE/OR/01-1641&D2, DOE 1998b).** The Remedial Investigation Report was issued in August 1998. The Feasibility Study that accompanies the Remedial Investigation was issued in June 1999 (DOE/OR/01-1747&D2, DOE 1999g). A ROD on remediation of the Upper East Fork Poplar Creek (UEFPC) watershed is being prepared and is scheduled to be final in June 2001. The UEFPC characterization area is included in the Y-12 Site physical study area of analysis for this SWEIS.

***Report on the Remedial Investigation of Bear Creek Valley at the Oak Ridge Y-12 Plant, Oak Ridge, Tennessee* (DOE/OR/01-1455&D2, DOE 1997a).** The Remedial Investigation Report was issued in March 1997. The Feasibility Study that accompanies the Remedial Investigation was issued in November 1997 (DOE/OR/02-1525&D2, DOE 1997e). The ROD on remediation of the Bear Creek Valley watershed is being reviewed and should be final in calendar year 2001. A portion of Bear Creek Valley is included as part of the Y-12 Site physical area of analysis in this SWEIS.

Comprehensive Environmental Response, Compensation, and Liability Act Waste Disposal Facility. DOE has published a Remedial Investigation/Feasibility Study for the disposal of ORR CERCLA waste (DOE/OR/02-1637&D2, DOE 1998a). The Proposed Plan (DOE 1999a) and ROD (DOE 1999i) for the Environmental Management Waste Management Facility were issued in January 1999 and November 1999, respectively. The selected action is on-site disposal at a new facility to be constructed in East Bear Creek Valley bordering the west end of the Y-12 Site. This project is included in the Y-12 SWEIS No Action - Planning Basis Operations Alternative.

1.5 TIME PERIOD CONSIDERED IN ANALYSIS

The affected environment described in Chapter 4 is based on data for the calendar year 1999. These data, for the most part, were obtained from the *Oak Ridge Reservation Annual Site Environmental Report* (ASER) for 1999 (DOE 2000d). The Y-12 Site (No Action - Planning Basis Operations Alternative) analysis time period used in the SWEIS is 2001 to 2010. For proposed actions involving the Y-12 HEU Storage Mission and Special Materials Mission, the time period considered would be 50 years (i.e., the design life of the facilities). Impacts for construction and operation of new facilities and the operation of Y-12's missions under the No Action - Planning Basis Operations are presented in annual increments unless noted otherwise.

1.6 ISSUE IDENTIFICATION PROCESS

DOE published the NOI to prepare the Y-12 SWEIS in the *Federal Register* on March 17, 1999 (64 FR 13179). Additional public notice of the proposed EIS and the schedule for public scoping meetings were provided through the placement of advertisements in local newspapers. The public scoping period began on that day and continued through May 17, 1999. DOE invited the public to submit comments during the scoping period by postal mail, electronic mail, fax, telephone, and through written and verbal comments submitted at the public scoping meetings.

Both afternoon and evening public scoping meetings were held in Oak Ridge, TN, on April 13, 1999. More than 345 people attended the two scoping meetings held at the Oak Ridge Community Conference Center at the Oak Ridge Mall. At the beginning of each session, a neutral facilitator explained the scoping meeting format. This was followed by a welcome from a representative of the DOE Y-12 Site Office and a brief overview of the NEPA process by the DOE-ORO NEPA Compliance Officer. The DOE SWEIS Document Manager then presented an introduction and background of the Y-12 missions and history, followed by an overview of the Y-12 SWEIS Proposed Action and alternatives. A question and answer session was then held to encourage the public to ask questions to better understand the project before submitting comments.

At the end of the question and answer period, the formal public comment portion of the scoping meeting began and the facilitator invited members of the public to comment on the scope of the SWEIS. A court reporter typed verbatim transcripts of the entire scoping meetings and an audiotape was made of the proceedings. Blank comment forms were available for those members of the public who preferred to provide written comments. Exhibits and handouts about the Y-12 Site, the Y-12 SWEIS, the NEPA process, and the NOI were available at each meeting. Technical representatives were present to answer questions.

DOE public reading rooms in the Oak Ridge area were provided copies of the public notices, written public comments, and the transcripts of the scoping meetings. A database was created to track written and oral comments received during the scoping period. A total of 574 people submitted 701 individual comments that were recorded in the database. The comments were characterized and grouped within 20 major issue categories.

1.7 RESULTS OF PUBLIC SCOPING

DOE's disposition of the issues raised during public scoping for the Y-12 SWEIS was published in the *Scoping Summary Report for the Site-Wide Environmental Impact Statement, Oak Ridge Y-12 Plant* (DOE 1999h) and placed in the Oak Ridge area DOE Reading Rooms at the following locations:

DOE Public Reading Room
230 Warehouse Road
Building1916-T-2, Suite 300
Oak Ridge, Tennessee 37831

Oak Ridge Public Library
1401 Oak Ridge Turnpike
Oak Ridge, Tennessee 37831

The document can also be viewed on the DOE-ORO Home Page: http://www.oakridge.doe.gov.

1.7.1 Major Scoping Comments

DOE has considered all scoping comments in preparing the draft Y-12 SWEIS. The major issues identified by the public centered on the Proposed Action and Alternatives, the Y-12 Site Integrated Modernization (Y-SIM) Program, and the health and safety of workers and the public. The major issues are discussed further in this section and addressed throughout the SWEIS.

Of 701 total comments, 503 related to the SWEIS alternatives (a postcard campaign accounted for 461 of these comments), 67 addressed modernization, and 17 focused on occupational and public health. Of the remaining 114 comments, 62 addressed specific resource areas, while 52 were considered outside of the scope of this SWEIS.

Shutdown of Y-12. Some commentors opposed continuation of operations at the Y-12 National Security Complex associated with weapons production. Several individuals stated that the production of nuclear weapons and materials should be halted immediately. Public health and safety related to Y-12 weapons production activities were also areas of concern.

The decision to continue the weapons production mission at Y-12 has already been made by DOE in the SSM PEIS ROD. Shutting down Y-12 is not a viable alternative at this time (see Section 3.4). The need for nuclear weapons has already been determined by the President and Congress, and is an issue that is beyond the scope of the Y-12 SWEIS. The impacts on worker and public health and safety from Y-12 operations are included and analyzed in Chapter 5 of this SWEIS.

Proposed Action and Alternatives. Commentors expressed a variety of opinions and preferences on the alternatives addressed in the SWEIS. Comments focused on which alternatives should be implemented in modernizing Y-12 and the preferred alternative that should be selected by DOE.

Commentors expressed confusion as to the exact definition of No Action and how the SWEIS would analyze this alternative. Some commentors stated that a total halt to weapons production at Y-12 and shutdown of the facility should be considered as the No Action Alternative. Other commentors stated that the No Action Alternative was not a viable alternative as indicated in the NOI because Y-12 was needed to support the Nation's Nuclear Weapon Stockpile. However, all the commentors were aware of and noted that NEPA regulations require analysis of a No Action Alternative.

Some commentors stated that the Y-12 mission could be accomplished solely with consolidation and upgrade of existing facilities as analyzed in the SSM PEIS. Others stated that DOE should pursue the total modernization of Y-12 by all new construction. A large number of comments were received through a postcard campaign that supported the modernization of Y-12 by using a combination of upgrades to existing facilities and construction of new facilities as appropriate. Commentors wanted specific buildings identified that would be upgraded or vacated due to construction, even if they were tentative designations.

DOE has considered all comments on alternatives for the Y-12 SWEIS and has addressed the major comments described above in the following manner.

Shutting down Y-12 is not a viable alternative as explained in the NOI on March 17, 1999 (64 FR 13179). DOE has already decided in the SSM PEIS and S&D PEIS RODs that the mission at Y-12 would continue (see Section 3.4). Therefore, the No Action - Planning Basis Operations Alternative analyzed in this SWEIS addresses the continuation of Y-12 historic missions. The No Action - Planning Basis Operations Alternative reflects Y-12 operations at planned weapons production support levels (see Section 3.2.2). A No Action - Status Quo Alternative, which is basically the status of the Y-12 in 1999, is also presented in the SWEIS to show the potential increase in production levels and potential impacts under the No Action - Planning Basis Operations Alternative and action alternatives. The No Action - Status Quo Alternative does not meet Y-12 mission requirements and is not considered reasonable because many Y-12 operations were not operating in 1999 as a result of the 1994 stand-down of Y-12.

The Y-12 National Security Complex consolidation efforts analyzed in the SSM PEIS are included in the Stockpile Management Restructuring Initiative (see Section 1.1.2) which implements the plan for downsizing Y-12. The potential impacts of consolidation and limited upgrade are included under the No Action - Planning Basis Operations Alternative (see Section 3.2.2.1), consistent with the SSM PEIS ROD. Because of the age of Y-12 facilities, new requirements for natural phenomena and worker health standards, and limited budgets, upgrade alone is not considered a reasonable approach to continue the Y-12 National Security Complex mission and meet long- term workload requirements.

Construction of an all new Y-12 National Security Complex is not considered an alternative in the SWEIS. The Y-SIM Program, which is the foundation for an all new Y-12 proposal, is a long-term process and most projects are not developed to the extent that they can be proposed and analyzed under NEPA at this time. However, new construction alternatives to support the Y-12 HEU Storage Mission and the Special Materials Mission are included in the SWEIS (see Section 3.2.3 and 3.2.4). DOE's preferred alternative for the HEU Storage Mission is to construct and operate a new HEU Materials Facility. The preferred alternative for the Special Materials Mission at Y-12 is to construct and operate the new Special Materials Complex. A preferred site for these facilities will be identified in the Final Y-12 SWEIS.

Y-12 Site Integrated Modernization Program. Many commentors expressed concern about the advanced age of the Y-12 facilities, because many of the buildings are more than 40 years old. These commentors stated that the facilities should be modernized to reduce operating costs and to enhance health, safety, and environmental requirements. Some commentors expressed concern about the potential budget impacts of modernization on EM activities and pointed out that it is more difficult to assign a cost to such things as environmental issues and health and safety.

It also was the opinion of many commentors that modernization of Y-12 should not be delayed and should be conducted in an integrated way. Alternatively, one commentor opposed any modernization of nuclear processes and facilities and suggested several sub-alternatives for modernization and consolidation for those activities associated only with dismantling weapons and processing and storage of HEU.

As explained in Section 1.1.2, the Modernization Program is a long-term process designed to modernize Y-12 in an integrated way so as not to disrupt the assigned weapons mission support activities or jeopardize the Y-12 weapons production capabilities. The parts of modernization that can be analyzed at this time are included in the SWEIS (i.e., the HEU Storage Mission Alternatives and the Special Materials Mission Alternatives) (see Section 3.2.3 and 3.2.4). The potential future modernization projects, such as the Enriched Uranium Manufacturing Facility are described in Section 3.3 of the SWEIS, but are not analyzed as proposed projects in the SWEIS. All modernization projects, as well as EM activities, are subject to congressional budget appropriations and changes.

Alternatives that eliminate components of the mission at Y-12 (i.e., weapons production and support activities) are not viable alternatives since they would not continue the current Y-12 mission, nor would such alternatives be consistent with the SSM PEIS ROD (see Section 3.4).

Worker and Public Health and Safety. Comments related to worker and public health and safety stated that the SWEIS should address enriched uranium, beryllium, and other radiological and hazardous materials. This included the request that the SWEIS discuss analysis of off-site exposure to uranium-contaminated dust, potential hazard to workers due to external gamma and possible criticality reactions from storage of enriched uranium, and a chronic beryllium disease management plan.

The SWEIS analyzes potential worker and public health impacts associated with criteria pollutants, hazardous air pollutants and radiological air pollutants in Section 5.12 of this SWEIS. Criticality accidents are addressed in Section 5.14 and Appendix D of this SWEIS. Appendix D.6 presents summaries on past or ongoing beryllium studies associated with Y-12 workers and the public.

1.8 PUBLIC COMMENT PERIOD

In December 2000, DOE issued the Draft Y-12 SWEIS (DOE/EIS-0309). This document explained the need for DOE to maintain the mission at Y-12 and to evaluate alternatives for modernizing Y-12 facilities to ensure its capability to meet future stockpile needs. The SWEIS analyzed the environmental impacts associated with continued operations at the Y-12 National Security Complex, as well as the construction and operation of new facilities for two of Y-12's missions, the Highly Enriched Uranium Materials Storage Mission and the Special Materials Mission. A 45-day public comment period on the Draft Y-12 SWEIS began on December 22, 200 but was extended to end on February 23, 2001 at the request of EPA.

During the comment period, one public hearing with two sessions was held in Oak Ridge, Tennessee on January 25, 2001. The public was encouraged to submit comments via mail service, e-mail, fax, and telephone.

The public hearings were conducted using a traditional public hearing format. A neutral facilitator was present at each hearing to direct and clarify comments on the document. A court reporter was present at each hearing to record the proceedings and provide a transcript of the public comments and dialogue between the public and DOE representatives.

Comments from the public hearings were combined with comments received by other means (mail, e-mail, phone, fax, etc.) during the comment period. The written comments were date-stamped and assigned a sequential document number in the order in which they were received. Appendix G in Volume II of the SWEIS describes the public comment process in detail, provides scanned images of all the comments, and provides DOE’s responses to the public comments.

During the public comment period, approximately 500 comments were received. Most of the comments focused on a limited number of major issues. These issues and DOE’s responses are summarized below.

A majority of the comments opposed the continuation of the Y-12 mission activities and the modernization of its facilities because they (the commentors) were against nuclear weapons in general, opposed spending money "on building new weapons facilities," and "producing more nuclear weapons," rather than using the money for urgent social needs, and believed that the proposed actions were in violation of international nuclear arms control treaties. Other commentors supported the proposed actions and new facilities because of the importance of maintaining the Nation's nuclear weapons stockpile, the economic benefits, and the health and safety improvements that a modernized Y-12 would bring to the area.

In response to these comments, DOE acknowledged there is both public support for and opposition to the continued operation and modernization of Y-12. DOE cited its responsibilities for maintaining the Nation's nuclear weapons stockpile under the *Atomic Energy Act* of 1954 and the requirements of the 1996 Nuclear Weapons Stockpile Plan and accompanying Presidential Decision Directive, which established the size and composition of the Nation's nuclear weapons stockpile. DOE also stated that the United States is a declared weapons state, and the purpose of nonproliferation efforts is to keep non-weapons states from acquiring nuclear weapons while the declared weapons states work toward total disarmament. In response to comments that Y-12 funds would be better spent on other, more urgent social needs, DOE noted that Congress determines how funds are allocated, and DOE does not determine Federal spending priorities. Furthermore, such spending priorities are beyond the scope of the Y-12 SWEIS. The Y-12 SWEIS addresses all of the concerns in Chapters 1, 2, 3, and 5, of the document. DOE's response to these and other related comments may be found in Volume II, Appendix G of the SWEIS, under Category 16: Policy/Purpose and Need/Scope.

Some commentors suggested that the Y-12 SWEIS was deficient and inadequate as a NEPA document because it did not analyze all modernization projects, Y-12 Site activities, or address past operations contamination. Other commentors stated that DOE has a history of polluting and contaminating sites it has operated, including Y-12, and wanted to know why the proposed action would be any different. The commentors emphasized the current contamination at Y-12 from past operations. In addition, commentors believed that clean-up activities by EM would be impacted by diverting funds to modernize Y-12. In response to these comments, DOE stated that it believes the SWEIS is adequate and fully complies with NEPA. This SWEIS evaluates all reasonably foreseeable environmental impacts for all reasonable alternatives, in accordance with the requirements of the Council on Environmental Quality's regulations (40 CFR 1500-1508) and DOE's NEPA regulations (10 CFR 1021) and procedures. In response to the issue of contamination at DOE sites, DOE acknowledged having a number of older facilities and contaminated sites in need of environmental cleanup, and an aggressive program not only to clean up these sites, but to upgrade existing facilities and ensure their continued compliance with Federal and state environment and safety regulations. The proposed new facilities would be constructed and operated using the latest design standards and state-of-the-art technologies. In addition, DOE expressed confidence that the new facilities would be safe and reduce effects on the workers and environment associated with the existing HEU Storage and Special Materials missions at Y-12. To commentors who expressed concern that the Y-12 proposed action expenditures would drain DOE's budget for its facility and site clean-up activities, DOE responded that the funding for both of these programs would come from separate Congressional appropriations. Funding for Y-12 construction projects and operations would not be obtained from funding already allocated for facility and site clean-up activities. DOE's responses to NEPA-related comments are found in Volume II, Appendix G of this SWEIS, under Category 25: Regulatory Compliance - NEPA Process. DOE's responses to waste management and environmental management relationships are found under Category 12: Waste Management.

Several commentors were concerned with public and occupational health and safety issues. Some specifically questioned DOE's history and past practices regarding Y-12 safety issues. In response to these concerns, DOE stated that the environmental impacts and potential chemical and radiological doses to both workers and the public resulting from Y-12 operations and the proposed now facilities would be below the limits considered acceptable by Federal and state regulatory authorities. DOE acknowledged that the potential worker and public radiological doses would increase somewhat from the existing condition (No Action -Status Quo) under the proposed action because all Y-12 operations would be resumed, but the doses would be at far lower levels than experienced when Y-12 was at full production during the Cold War. Public and occupational health and safety issues are discussed in Volume I, Chapter 5, of the Y-12 SWEIS. DOE's responses to public and occupational health and safety comments are found in Volume II, Appendix G, under Category 14: Worker and Public Health.

A number of commentors expressed concern over the public health impacts associated with the proposed action and alternatives. A subset of these commentors specifically pointed out the impacts of Y-12 operations to the Scarboro Community, a predominantly African-American community located about one-half mile from Y-12 on the northern side of Pine Ridge. The commentors stated that the analysis of potential impacts to the Scarboro Community was not substantiated by any data in the SWEIS and contradicted recent health and environmental studies performed in the Scarboro Community. The commentors stated that residents of Scarboro have been significantly impacted by DOE operations at Y-12 and continue to be impacted today. In response, DOE pointed out that changes have been incorporated into the Chapter 5 Environmental Justice impacts section to explain the basis for concluding that there were no disproportionately high and adverse environmental or public health impacts to the residents of Scarboro or other minority or low-income populations within the region of influence (ROI). As discussed in Chapter 5, Section 5.12, they proposed no significant radiological, or nonradiological health risks to people. The conservatively estimated dose to an maximally exposed individual from Alternative 4 (No Action - Planning Basis Operations Plus Construct and Operate a New HEU Materials Facility and Special Materials Complex) would be approximately 4.5 millirem per year which is below the radionuclide NESHAP limit of 10 millirem per year. The risks would not be significant regardless of the racial, ethnic, and economic composition of potentially affected populations.

In addition, it should be noted that the Department has conducted aerial surveys to measure radiation levels in the Scarboro Community since 1959. These surveys, which measure for gamma radiation, have identified no radiation levels over those found in the natural background environment. DOE began working with the Scarboro Community beginning in 1997 with a public meeting to discuss the aerial surveys. Since then, DOE staff has worked closely with the residents in developing plans for conducting radiological and chemical surveys. In 1997, the residents of the Scarboro Community asked the DOE to examine if there is contamination in the soil and water from ORR operations. In response DOE initiated environmental sampling activities in 1998 on soil, surface sediment, and water from over 40 locations in the Scarboro Community to examine for the presence of mercury and uranium. DOE awarded a grant to the Joint Center for Political and Economic Studies that focuses on issues of concern to African Americans and has special expertise in health policy issues affecting black and minority populations. The grant was provided to assist Scarboro residents in interpreting data resulting from the DOE sampling and other Scarboro Community related studies. The Joint Center completed the work in October 2000 with the issuance of five summary publications. While these summaries generated no new epidemiological analyses, they served to help the community understand the purpose and results of the various environmental and health studies involving the community which indicated no disproportionately high and adverse public health impacts from Y-12 operations.

1.9 CHANGES FROM THE DRAFT SITE-WIDE ENVIRONMENTAL IMPACT STATEMENT

In response to comments on the Draft Y-12 SWEIS, and as a result of information that was unavailable at the time of the issuance of the Draft, Volumes I and II of the Final Y-12 SWEIS contain revisions and new information. These revisions and new information are indicated by redline shading. Appendix G, in Volume II of the Final Y-12 SWEIS, contains the comments received during the public review period and DOE's responses to those comments. A brief discussion of the most important changes is provided in the following paragraphs.

Affected Environment Revisions

Sections of Chapter 4 of the SWEIS were revised to incorporate new baseline data from the *Oak Ridge Reservation Annual Site Environmental Report for 1999* (DOE/ORO/2100). Changes within Chapter 4 were concentrated in Section 4.4, Geology and Soils; Section 4.5, Hydrology; Section 4.7, Air Quality and Climate/Noise; and Section 4.12, Occupational and Public Health and Safety/Radiation. Corresponding changes were made in Chapter 5, Environmental Consequences, to reflect the No Action - Status Quo baseline year of 1999, and in Volume II, Appendix D and E as appropriate. In addition, Section 4.11, Waste Management, of the Y-12 SWEIS was updated to reflect new 1999 data presented in the *Annual Report of Waste Generation and Pollution Prevention Progress 1999* (DOE/EM-0545) published in September 2000. Updated data from the two mentioned reports did not significantly change the impact analysis from the Draft SWEIS.

Accident Analysis Revisions

In order to provide the most current information, a number of the safety/operation basis documents used in the accident analysis, presented in Appendix D.7 and in Chapter 5 of the SWEIS, have been updated, and in some instances new ones have been added. A complete review of the most recent approved Authorization Basis, SARs, and emergency management hazards assessment documents was conducted and appropriate revisions made to the accident analysis sections. Changes to the accident impacts presented in the Draft Y-12 SWEIS were not significantly changed by the new basis document review and subsequent Final Y-12 SWEIS changes.

Environmental Justice Revisions

Section 5.13, Environmental Justice, was revised based on public comments. Additional data was presented in Chapter 5, Section 5.13, which substantiate the conclusion that impacts were not disproportionately high and adverse. In addition, an update of the health studies pertinent to the Scarboro community has been included in Volume II, Appendix D.

New and Deleted Sections

A new section within Volume I, Section 1.1.1, and Section S.1.1 of the Summary, has been added to the Final Y-12 SWEIS to describe the new NNSA and its organizational relationship within DOE and to the Y-12 National Security Complex.

A section describing the Emergency Management Program for Y-12 has been added to Volume II, Appendix D, in the Accident Analysis section of the appendix. The section was added to better inform readers of the functions of the program and its relationship to the Y-12 National Security Complex and the Oak Ridge area concerning emergency management planning.

One section of the Draft Y-12 SWEIS was reduced substantially (Section 3.3, Potential Future Modernization Projects). Specifically, the narrative describing the potential future projects was removed because DOE felt that the descriptions and conceptual data of the facilities were not now realistic and did not reflect reasonable future budget expectations, mission needs, or expectations that all the identified potential modernizations projects could be successfully implemented. DOE is currently reevaluating the Modernization Program components and its descriptions of potential projects going forward under modernization.

Miscellaneous Revisions and Editorial Changes

Several sections in the Final Y-12 SWEIS were revised to reflect the availability of more recent data, or to include corrections on erroneous information, improvements in presentation, and other editorial changes. None of these revisions affect the environmental impact assessment of the SWEIS.

In addition, there was a DOE organization change and Y-12 changes that resulted in new name changes since the Draft's SWEIS was issued. The new name changes are now reflected in the Final SWEIS. Specifically, the changes involve:

- The National Nuclear Security Administration was established by Congress to manage the Nation's nuclear weapons complex. The National Nuclear Security Administration is a semi-autonomous agency within the Department of Energy. As one of the major production facilities within the nuclear weapons complex, Y-12 falls under the responsibility of the Y-12 Area Office as of October 1, 2000, under the new National Nuclear Security Administration. The National Nuclear Security Administration was created on March 1, 2000.

- Replacement of Lockheed Martin Energy Systems, Inc., by BWXT-Y12, L.L.C. as the M&O contractor for Y-12 on November 1, 2000.

- Change in the name of the Oak Ridge Y-12 Plant to Y-12 National Security Complex, as of November 2, 2000.

1.10 ORGANIZATION OF THIS SITE-WIDE ENVIRONMENTAL IMPACT STATEMENT

This Y-12 SWEIS consists of three volumes; the Summary, Volume I, which contains the main text, and Volume II, which contains technical appendixes that support the analyses in Volume I and additional project information.

Volume I contains 12 chapters, which include the following information:

Chapter 1 - Introduction. A background of DP activities at Y-12 in support of national security programs, and the NEPA process.

Chapter 2 - Purpose of and Need for DOE Action. Reasons why DOE needs to take action and the objectives DOE proposes to achieve.

Chapter 3 - Description of Alternatives. How DOE proposes to meet the specified need and achieve the objective. The chapter also includes a summary comparison of the potential environmental impacts of the SWEIS alternatives.

Chapter 4 - Affected Environment. Aspects of the environment (i.e., natural, built, and social) that might be affected by the SWEIS alternatives.

Chapter 5 - Environmental Consequences. Analyses of the potential impacts on the human environment. Impacts from activities that are expected to support Y-12 Site missions (the No Action - Planning Basis Operations Alternative) as well as potential impacts from proposed new facilities and alternatives compared to the No Action - Status Quo Alternative. The chapter also includes resource commitments, unavoidable adverse impacts, short-term uses versus long-term productivity, and irreversible or irretrievable resource commitments.

Chapter 6 - Cumulative Impacts. Contains the discussion of cumulative impacts resulting from the proposed action and alternatives when added to past, present, and reasonably foreseeable actions in the SWEIS study area.

Chapter 7 - Statutes, Regulations, Consultations, and Other Requirements. Environmental, safety, and health regulations that would apply to the SWEIS alternatives and agencies consulted for their expertise.

Chapters 8 through 12 - A List of Preparers and Contributors, an Index, a list of references used in preparing the SWEIS, a Glossary, and a list of persons and agencies to whom copies of this SWEIS were sent.

Volume II contains three appendixes of technical information and supporting data for the environmental analyses presented in Volume I. The remaining appendixes in Volume II consist of a copy of the NOI for the SWEIS, consultation letters, contractor disclosure statements, and the Comment Response Document.

CHAPTER 2: PURPOSE OF AND NEED FOR U.S. DEPARTMENT OF ENERGY ACTION

2.1 PURPOSE AND NEED

The end of the Cold War resulted in the curtailment of new nuclear weapons design and production programs, a significant reduction in funding for maintaining the nuclear weapons stockpile, and the adoption of a comprehensive ban on nuclear testing. Y-12, the oldest of the Nation's nuclear weapons production facilities, now faces significant and diverse new challenges in its national security mission.

As discussed in Section 1.1.1, DOE has prepared several PEISs to determine how best to carry out its national security requirements in the post-Cold War era. Based on those PEISs, DOE has made a number of programmatic decisions related to the long-term storage and disposition of fissile material, the maintenance of national security missions, and assurance of the safety and reliability of the nuclear weapons stockpile. Based on DOE's programmatic decisions, Y-12 will continue to play an integral role in the continuance of DOE's programs supporting the Nation's nuclear defense. The purpose of DOE's proposed action is to implement the programmatic decision previously announced in the RODs for the SSM PEIS and the S&D PEIS.

During the Cold War, new weapons programs provided capital investment in the DOE weapons production plants, supporting development of new technologies and construction of new and updated facilities. The end of the Cold War, together with a shrinking defense budget, halted the regular infusion of capital and technology into the weapons production plants. This situation has resulted in an 80 percent reduction in annual capital investments at the Y-12 Site and significantly increased Y-12's maintenance backlog. Today, Y-12 is using 1980s or older processes and technologies to perform its missions. The situation at Y-12 is one in which DOE is faced with the following choices: continue to pursue expensive stop-gap repair operations or invest sufficient capital in Y-12 to modernize technologies and facilities.

The primary purpose of this SWEIS is to document a baseline for Y-12 Site mission operations and to evaluate the reasonable alternatives for implementing the programmatic decisions previously announced in the RODs for the SSM PEIS and the S&D PEIS. In those PEIS RODs, DOE determined that the missions identified in Section 1.1.4 will remain at Y-12. DOE has also determined that the existing Y-12 facilities are old, over-sized, inefficient, not cost-effective, and do not maximize the attainment of environment, safety and health (ES&H) goals. Consequently, this SWEIS evaluates reasonable alternatives for modernizing the HEU Storage Mission and Special Materials Mission at Y-12 to maximize efficiency, cost-effectiveness, and ES&H goals.

The purpose and need for the proposed HEU Storage Facility and the proposed Special Materials Complex are presented below.

HEU Storage Mission. The purpose of DOE's proposed action is to consolidate and modernize the HEU storage operations at Y-12 in accordance with the S&D PEIS ROD. By consolidating HEU in a new modern facility, Y-12 would be able to meet its HEU storage mission in a more safe and efficient manner; improve nuclear materials security and accountability; and enhance worker, public, and environmental safety. DOE's action is needed because existing HEU storage facilities at Y-12 are in buildings that already are 35 to 55 years old and require significant maintenance and funding to maintain operations and security protocol. In addition, some of the buildings in which storage facilities are located do not meet current standards for natural phenomenon events (e.g., tornado and seismic occurrences).

Special Materials Mission. The purpose of DOE's proposed action is to modernize special materials operations to meet projected nuclear weapons stockpile requirements in accordance with the SSM PEIS ROD and meet more protective beryllium exposure limits for workers. The action is needed because the existing processes and facilities at Y-12 needed to support production of special materials have deteriorated to the point that DOE can no longer be assured of their operational reliability. In addition, DOE must meet more stringent American Conference of Governmental Industrial Hygienists (ACGIH) exposure limits for suspended beryllium in air (0.2 Fg/m^3). The new exposure limits cannot be met using existing Y-12 facilities without excessive administrative controls and personal protective equipment which would reduce production efficiencies and jeopardize meeting nuclear weapons stockpile mission support requirements. DOE's action would ensure efficient production of adequate quantities of special materials for all anticipated scenarios considered in the nuclear weapons stockpile for the next 50 years and reduce the health risk to workers and the public.

2.2 U.S. Department of Energy Program Activities Performed at the Y-12 Site

The following sections summarize the activities performed under the various ongoing DOE programs at the Y-12 Site. Applicable to all Y-12 missions is the Safeguards and Security Program. The Protective Services Organization provides policy oversight in the areas of safeguards and security, nuclear materials control and accountability, classification, and technical information for BWXT Y-12. The Protective Services Organization is an integrated organization implementing requirements in a consistent manner at Y-12 in conjunction with Security Forces managed by Wackenhut, Inc. The Protective Services Organization is responsible for ensuring the adequate protection of National Security Information through proper identification and control of corporate assets entrusted to BWXT Y-12. The following describes the DP missions and other DOE missions at Y-12, which may be influenced by proposed actions.

2.2.1 Defense Programs

The DP activities performed at Y-12 include maintaining the capability to produce secondaries and radiation cases for nuclear weapons, storing and processing uranium and lithium materials and parts, dismantling nuclear weapons secondaries returned from the stockpile, and providing special production support to DOE weapons laboratories and to other DOE programs. To accomplish the storage mission, some processing of special nuclear materials may be required to recover materials from returned secondaries. In addition, Y-12 performs stockpile surveillance activities on the components it produces.

The Weapons Stockpile Management Program structure at Y-12 includes:

- Core Stockpile Management
  - Nuclear Materials Management and Storage
  - Quality Evaluation and Surveillance
  - Weapons Dismantlement and Disposal
  - Stockpile Evaluation and Maintenance
  - Materials Recycle and Recovery
  - Modernization and Facility Transition
  - Enriched Uranium Operations
  - Nuclear Packaging Systems
  - Advanced Design and Production Technologies
  - Manufacturing Processes Program
  - Facility Program
  - Capital Program

- Materials Surveillance

- Y-12 Mission Support

A summary of each of the Core Stockpile Management Program components, the Materials Surveillance Program, and Y-12 Mission Support is provided in the following discussion.

Core Stockpile Management. The Core Stockpile Management operations at the Y-12 National Security Complex include the principal activities in support of nuclear weapons stockpile management. These missions are structured into 12 major component programs.

Nuclear Materials Management and Storage. The Nuclear Materials Management and Storage Program includes multi-disciplinary initiatives in numerous facilities throughout Y-12. The program activities include (1) planning, designing, providing, and maintaining storage facilities and storage operations for the safe and secure storage of nuclear materials; (2) multi-year program planning to ensure nuclear weapons components and materials throughout the DOE Nuclear Weapons Complex are returned to Y-12 and prepared for interim or long-term storage; (3) nuclear materials planning, forecasting, and scheduling as a part of the Storage Program and as the integrator for multiple programs utilizing nuclear materials, such as Dismantlement, Stockpile Maintenance, Fissile Materials Disposition, Nuclear Nonproliferation and National Security, and Work-for-Others; (4) supporting development, design, and implementation of innovative and cost-saving technologies for storage, monitoring, and measurement of nuclear materials while reducing risks; (5) developing and maintaining technical standards for the storage of HEU, lithium, and canned subassemblies; (6) providing safeguards and security for Core Stockpile Management nuclear materials and facilities; (7) developing and implementing projects to disposition, monitor and maintain HEU in safe, optimum storage; and (8) providing interim storage of DOE surplus low enriched uranium, natural uranium, or commercial uranium for use as blendstock.

Currently, the program supports six facility areas that store HEU in metal, oxide, or other compound forms. The program also supports several facility areas that store lithium, beryllium, depleted uranium, natural uranium, deuterium, and nonnuclear weapons components.

Quality Evaluation and Surveillance. The Quality Evaluation and Surveillance Program provides for the activities required to assess the integrity of the stockpile, including safety, reliability, design compatibility, and functionality of components over the life of each weapons system in the stockpile. Confidence in the safety and reliability of the Nation's nuclear weapons stockpile is acquired and sustained through a quality evaluation program beginning in early production and continuing throughout each weapon system's life to retirement. The condition of the stockpile is determined through a number of unique tests. Stockpile quality evaluation is supplemented by a surveillance program that includes testing and evaluating accelerated aging units, production core samples, and shelf-life units. These units and/or components never enter the stockpile, but provide additional baseline data that are used to judge a secondary's condition throughout its life in the stockpile.

Y-12 has the responsibility of the Quality Evaluation and Surveillance Program pertaining to the secondaries, case parts, shelf-life units, core samples, and other vital components. The Stockpile Stewardship Program consists of testing, sampling, disassembly, component testing, and collecting and evaluating data. The data and information obtained provide and establish the reliability of the weapon systems. Unique tests and data history provide the basis for a sound technical response for extending the stockpile life.

Weapons Dismantlement and Disposal. The Weapons Dismantlement and Disposal Program provides the activities required for the dismantlement of weapon systems that are retired from the nuclear stockpile. Components are returned to Y-12 as weapon systems directly from the military or from the Pantex Plant after initial dismantlement. At Y-12, these components are stored in various storage facilities prior to further disassembly. Many of the disassembly processes required to separate and remove the various components have been implemented, while others are being developed or modified to enhance protection of personal health and safety or the environment. A variety of machine tools, hand tools, and specialty tools are used to machine, cut, press, or break the components apart. All components are tracked through the storage and processing steps to ensure that no special nuclear material (SNM) is diverted and that no classified information is compromised. The nuclear and special materials are sent to the appropriate processing steps for material recycle; the remainder of the components are modified by melting and recasting, pyrolysis, or chemically altering the material to remove classified features of the components and to render them unusable.

Stockpile Evaluation and Maintenance. The Stockpile Evaluation and Maintenance Program includes activities directed at continuing the fitness of nuclear weapon warheads in the enduring stockpile and producing weapon-related hardware to support DOE and U.S. Department of Defense (DoD) requirements.

The activities include all direct and indirect production efforts to provide Joint Test Assemblies and components for testing stockpile representative hardware. Also included are direct and indirect production efforts to maintain weapons in the enduring stockpile, such as modifications and Limited Life Component Exchange hardware.

Materials Recycle and Recovery. The Materials Recycle and Recovery Program supports the recovery of HEU and lithium from parts recovered from retired weapons programs and quality evaluation weapons teardowns, residue materials from manufacturing processes, lightly irradiated enriched uranium from other DOE sites or commercial and private facilities throughout the country, and wastes containing HEU generated from operations throughout Y-12. The program is responsible for receipt, accountability, processing to a storable form, and interim storage of enriched uranium and lithium.

Modernization and Facility Transition. The Modernization and Facility Transition Program supports the definition, development, and execution of activities required to support the missions and directives of the DOE at Y-12. Support of these missions and directives includes the following activities:

- Planning and execution of the Modernization Program, including site layout studies, technology assessments, facility sizing analysis, and other considerations
- Planning and execution of projects related to the consolidation of operations to reduce the DP existing operations facility footprint under the Stockpile Management Restructuring Initiative
- Planning and execution of activities to safely and compliantly shut down and subsequently manage surplus DP facilities

Enriched Uranium Operations. This program includes the activities directly associated with the resumption of Enriched Uranium Operations and related support at Y-12 for production of nuclear weapons components or other hardware that satisfies national priority requirements. The program also produces uranium products for other DOE programs and DOE customers (e.g., research reactors). These activities include development of process descriptions, drawings, criticality safety requirements, procedures, and training associated with the required process lines.

Nuclear Packaging Systems. The Y-12 Nuclear Packaging Systems Program includes the activities required for safe, efficient, and economical packaging for transporting and storing general cargoes, radioactive materials, and other hazardous materials within and out of Y-12. The packaging program fully complies with DOE directives and Federal, state, tribal, and international regulations, requirements, and standards. Key elements of the program include: (1) design, development, and testing methods; (2) preparation of Safety

Analysis Reports for packaging; (3) an extensive procurement base for packaging needs; (4) a tracking system for required maintenance, testing, and inspection to include mission oversight of fabrication, refurbishment, packing and unpacking, and decommissioning of packaging; and (5) a rigorous quality assurance program compliant with DOE and other applicable regulations and industry standards.

Advanced Design and Production Technologies. The Advanced Design and Production Technologies Program continues and accelerates the development and prototyping of advanced cost-effective and environmentally acceptable nuclear weapons production technologies and design processes required to maintain an affordable and reliable nuclear weapons stockpile. Many processes used in the DOE Nuclear Weapons Complex will be either improved or eliminated when new technologies are available. For Y-12, major program drivers will be the Stockpile Management Restructuring Initiative Plan and emerging DOE Advanced Design and Production Technologies goals, such as reducing refurbishment response time by 50 percent and exhibiting 10 times fewer defects than in the past in stockpile refurbishment hardware. The implemented technologies of the Advanced Design and Production Technologies Program will result in reduced operating costs, improved manufacturing flexibility, improved quality and reduced health, safety, and environmental impacts. The program's major elements include:

- Distributed Computer-Aided Design and Manufacturing
- Integrated Product and Process Design/Agile Manufacturing
- Enterprise Integration
- Hedge Strategies
- Process Development
- Material Research and Development

Manufacturing Processes Program. The Manufacturing Processes Program for Y-12 consists of multiple projects and tasks, all of which are focused on supporting the existing and future manufacturing footprint, processes, and production requirements. Some of these needs are developing, procuring, and implementing manufacturing information systems which support special nuclear material accountability regulations; implementing and enhancing weapon information management systems; implementing the transition plan for maintaining baseline technologies at Y-12; maintaining baseline key manufacturing processes; and providing physical site support in terms of pollution prevention and capital management.

Facility Program. The Facility Program manages 13 production facilities (and the facility systems) that are key to the Core Stockpile Management Program. The Facility Program includes activities required for continuous operations of each facility and also includes specific facility upgrade projects related to non-routine repairs, maintenance or alteration of the facility and facility systems, and ES&H compliance.

Capital Program. The Capital Program manages the capital investments being made to the Y-12 National Security Complex as either line-item projects, general plant projects, or general plant equipment activities. All major facility and process construction activities fall under this program.

Materials Surveillance. The Materials Surveillance Program operations involve handling, processing, storage, and accountability for weapons-grade and nonweapons-grade uranium.

The Uranium Central Scrap Management Office (CSMO) is responsible for making arrangements, including transfer of material, for recovery, storage, and disposition of uranium scrap from DOE sites. In addition to DOE sites, many U.S. colleges/universities and other government agencies possess DOE-owned nuclear materials obtained under DOE contractual or loan/lease agreements for research purposes. The CSMO is also responsible for managing the recovery, and storage and disposition (S&D) of uranium scrap derived from these sources.

The Materials Surveillance Program, through the DOE Business Center for Precious Metals Sales and Recovery, recovers DOE precious metals from contaminated and noncontaminated scrap and excess equipment, and makes this metal available to DOE and its prime contractors. The center has contracts with private refiners and pre-approved refiners for *Resource Conservation and Recovery Act* (RCRA) waste-contaminated, and radiological-contaminated precious metals. Precious metals excess to DOE programmatic needs may be sold on the open market; and proceeds are returned to the U.S. Treasury.

Y-12 Mission Support. The Y-12 Mission Support activities involve functions related to, but not directly assignable to, programs within the Y-12 Site that are necessary for Y-12 to meet its mission.

Mission Support includes those functions necessary to: (1) maintain a minimum capability of processes within the production and support organizations of the Y-12 National Security Complex; (2) ensure personnel are employed, trained, and equipped to perform their assigned jobs; (3) ensure operating and support organizations are managed; (4) and provide tasks that support Y-12 missions from a plant level (e.g., laundry, some utilities, and computer support).

2.2.2 Environmental Management Programs

The Environmental Management (EM) activities at Y-12 include waste management and environmental restoration.

2.2.2.1 *Waste Management*

The Waste Management Program activities at Y-12 are divided into five functional areas: (1) pollution prevention, (2) waste treatment, (3) waste storage, (4) waste disposal, and (5) continuity of operations and program support. The Y-12 waste management activities address all types of facility waste: radioactive, Polychlorinated Biphenyl (PCB), hazardous, mixed (both radioactive and hazardous), sanitary, and industrial. There are over 35 active waste management facilities at Y-12. These facilities are described in Section 4.11 and in Appendix A. Most waste management facilities at Y-12 are for waste storage and treatment. Three land disposal facilities are currently in operation at Y-12, and two more have been permitted and constructed. In addition to active waste management facilities, there are numerous inactive waste management facilities. Many of these are Solid Waste Management Units (SWMUs) managed under RCRA. Some former waste management units are now being addressed through response actions under CERCLA. Closed and inactive waste management facilities are not described individually in waste management sections of this SWEIS. A land disposal facility is currently being designed to accept waste generated as a result of response actions on the ORR. This planned facility, the Environmental Management Waste Management Facility, is described in Section 3.2.1 as a part of the No Action - Planning Basis Operations Alternative at Y-12.

2.2.2.2 *Environmental Restoration*

The lead agency for environmental restoration investigation and remedial activities on the ORR and Y-12 is DOE-ORO. EM oversees and manages ORR remedial activities pursuant to the *Federal Facilities Agreement for the Oak Ridge Reservation* (DOE/OR - 1014, January 1, 1992), serving as primary contact and coordinator with the regulators (the Tennessee Department of Environment and Conservation [TDEC] and the U.S. Environmental Protection Agency [EPA]) for implementing the Federal Facilities Agreement (FFA). There are several environmental restoration projects within the Y-12 area of analysis. These include the Bear Creek and Upper East Fork Poplar Creek (UEFPC) watershed projects which have been merged and is now called the Y-12 Project. The environmental restoration projects are not expected to change as a result of the alternatives analyzed in the SWEIS. Ongoing environmental restoration activities have been analyzed and it is not expected that environmental restoration activities or actions, which may be undertaken pursuant to CERCLA, would change the alternatives considered in this SWEIS. In addition, the schedule for completion of activities would not change.

2.2.3 Nuclear Nonproliferation and National Security

The Nuclear Nonproliferation and National Security (NN) Program is responsible for the disposition of surplus fissile materials. NN is also responsible for implementing nuclear nonproliferation policy, bilateral nuclear treaties, and agreements with the International Atomic Energy Agency (IAEA). The National Security Program Office is responsible for supporting all NN nuclear and nonproliferation programs, verification activities, bilateral treaty support, and the interface role with the IAEA related to uranium. The HEU Disposition Project Office at Y-12 is responsible to NN for planning and technical support for surplus HEU disposition. In support of this mission, programs at Y-12 include Surplus HEU Management and Storage, and the Blending of Surplus HEU, including storage and handling of low enriched uranium and natural or depleted uranium blendstock.

2.2.4 Nuclear Energy, Science and Technology

Nuclear Energy, Science and Technology (NE) is responsible for maintaining the Nation's access to diverse energy sources as well as economic and technological competitiveness. Key activities include providing a power system for National Aeronautics and Space Administration space missions; serving the national need for a reliable supply of isotopes for medicine, industry and research; conducting research and development (R&D) associated with the long-term operations of current nuclear power plants; exploring advanced nuclear energy technologies; and ensuring the safe operations of reactors in DOE laboratories.

2.2.5 Nondefense Research and Development Program

ORNL uses some Y-12 facilities to house and support the laboratory's R&D activities. ORNL currently occupies 29 buildings and 2 trailers at Y-12 that contain a total of 128,360 m^2 (1,381,666 ft^2) of space. The facilities containing ORNL activities at Y-12 lie in the central and eastern portions of the Y-12 Site as shown in Figure 1.1.3–2. ORNL facility uses at Y-12 include Life Sciences, Physical Sciences, Technology Development, Technical Services, and Support Services. Other facilities are used for multiple purposes.

ORNL's activities were placed in available Y-12 facilities; consequently, activities in several functional categories are dispersed among a number of buildings (e.g., Technology Development is accommodated in 12 different buildings). ORNL is responsible for maintaining the buildings it uses at Y-12, but it has only limited responsibility for providing utilities and services that support ORNL activities.

The DOE Office of Science activities at Y-12 include the Field Research Center component for the DOE NABIR Program (DOE 2000b) being implemented at Y-12 as described in Section 3.2.2.6, the ORNL Mouse House, and Fusion Energy research activities.

The Engineering Technology Division has developed a unique capability in manufacturing technologies by integrating complementary resources within ORNL and Y-12. Within this complex, the ORNL R&D capabilities in materials and processes are meshed with the manufacturing, fabrication, and inspection skills of Y-12. This combination of R&D and manufacturing expertise has been combined with over 27,870 m^2 (300,000 ft^2) of manufacturing space and over 1,200 pieces of modern fabrication-related equipment to form the basis for the Oak Ridge Centers for Manufacturing Technology and the Y-12 National Prototyping Center, which is physically located within the east end of Y-12. The division has been the key integrator between Y-12 and ORNL. Capabilities include composites manufacturing technology, photonics, diagnostics, ultraprecision manufacturing, coatings, energy conservation, and environmentally conscious manufacturing.

2.2.6 Work-for-Others Program

The Work-for-Others Program is staffed with personnel working in computer science, mathematics, statistics, physical sciences, social sciences, life sciences, technology development and all engineering disciplines. The Work-for-Others Program's objectives are to make the ORR's R&D and prototyping capabilities available to both Federal agencies (such as U.S. DoD, National Aeronautics and Space Administration, etc.) and the private sector to:

- Solve complex problems of national importance
- Improve present capabilities for future DOE programs
- Transfer technology to industry to strengthen the U.S. industrial base

The Work-for-Others Program at ORR has been and is currently involved in advanced work in the environmental research, information management, materials, precision machining, hardware prototyping, and robotics technologies. These activities are carried out in various Y-12 facilities in conjunction with ongoing DOE DP activities.

2.2.7 Technology Transfer Program

The Technology Transfer Program is hosted by DOE and has as its goal to apply expertise, initially developed for highly specialized military purposes, to a wide range of manufacturing situations to support expansion of the capabilities of the U.S. industrial base. These activities are carried out in various Y-12 facilities in conjunction with ongoing DP activities.

CHAPTER 3: DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES

3.1 MAJOR PLANNING ASSUMPTIONS AND BASIS OF ANALYSIS

The *Stockpile Stewardship and Management Final Programmatic Environmental Impact Statement* (SSM PEIS) (DOE 1996e) identified Y-12 as a key component for maintaining the safety and reliability of the nuclear weapons stockpile without underground nuclear testing or production of new design weapons. Accordingly, DOE decided in the SSM PEIS ROD to maintain the national security missions at Y-12, but to downsize the Plant consistent with reduced stockpile requirements. In the *Storage and Disposition of Weapons-Usable Fissile Materials, Final Programmatic Environment Impact Statement* (DOE 1996h) ROD, DOE decided that Y-12 would store both nonsurplus and surplus enriched uranium pending disposition.

Pursuing these directives, this SWEIS evaluates the potential direct, indirect, and cumulative impacts associated with proposed actions and alternatives to continue current and assigned historical Y-12 missions into the 21st century. The planning assumptions and considerations that form the basis of the analyses and impact assessments presented in the SWEIS are listed below.

- ***Assumption 1*:** The mission at Y-12 will not change and is consistent with the decisions reached in the SSM PEIS ROD and the S&D PEIS ROD. All alternatives are based on this assumption. Two No Action Alternatives are presented in the Y-12 SWEIS: The No Action - Status Quo Alternative and the No Action - Planning Basis Operations Alternative. The No Action - Status Quo Alternative represents the current level of operations, i.e. the operations of Y-12 at the current 1999 level reported in the Annual Site Environmental Report (ASER) issued in 2000. Approximately 80 percent of the operations associated with DP's assigned mission were operational ready in 1999 following the Y-12 stand-down in 1994. (Stand-down status was the suspension of all work at Y-12 that was not necessary to maintain regulatory compliance or the safety basis for Y-12 until improvements could be implemented to the Conduct of Operations program). About 30 percent of actual operating capacity was achieved throughout most of that year. As discussed in the "Forty Most Asked Questions Concerning CEQ's NEPA Regulations," (46 FR 18026, March 23, 1981, as amended), "No Action" may also mean "No Change" from current management directions. Accordingly, the SWEIS also evaluates a No Action - Planning Basis Operations Alternative for the Y-12 Site that presents the continuation of historical mission operations at Y-12 consistent with the RODs from the SSM and S&D PEIS. The No Action - Planning Basis Operations Alternative includes the resumption of all remaining weapons program operations at Y-12 which have been in stand-down since 1994. No major upgrades or new construction of DP facilities to maintain weapon program capabilities or capacity are included under the No Action - Planning Basis Operations Alternative. The No Action - Planning Basis Operations Alternative does incorporate ongoing upgrades to existing facilities that address action items or findings from past reviews (e.g., HEU vulnerability or health and safety studies) to resolve the findings.

- ***Assumption 2*:** To modernize Y-12's current mission capabilities and address long-term ES&H requirements, DOE is proposing new facilities for the HEU Storage Mission and Special Materials Mission at Y-12. Various alternatives for these two new facilities, the HEU Materials Facility and the Special Materials Complex, are analyzed in this SWEIS. These proposed projects are independent actions to each other, i.e., decisionmaking for one project does not influence, and is not influenced by, decision making for the other project.

  Other potential modernization projects in the very early planning stages have been developed to the extent practical and are described in Section 3.3. The potential impacts of these projects are addressed qualitatively and are included in the cumulative impacts in Chapter 6. These potential future projects would be addressed under separate NEPA review when conceptual design information is available and the time is appropriate to make a decision on the need for a specific facility.

- ***Assumption 3*****:** The non-DP missions at Y-12 conducted by the Nuclear Energy, Nuclear Nonproliferation and National Security (NN), Work-for-Others, and Technology Transfer programs are not expected to change significantly over the next 10 years and would be the same as described in Chapter 2 and reflected in the current affected environment shown in Chapter 4. These missions are consistent with the missions already analyzed in the SSM PEIS, S&D PEIS, and the S-HEU EIS and are not expected to change. Budgeting and long-range planning for these programs indicate no major upgrades or new construction are proposed for these missions. To the extent that these missions do change or additional buildings or facilities are needed, they will undergo the appropriate NEPA analysis once sufficient data are available with which to assess the potential environmental impacts associated with such proposals.

- ***Assumption 4*****:** NN missions at Y-12 involve the management of surplus HEU, including blending small quantities (i.e., 500 to 700 kg/year) of HEU with low enriched uranium or natural uranium to produce a metal or oxide product suitable for use in various reactor programs, and for multiple supply orders to DOE customers. The HEU blending operations using existing Y-12 facilities and processes are included in the No Action - Planning Basis Operations Alternative.

- ***Assumption 5*****:** Large volume (tons/year) down-blending of HEU at Y-12 has been considered by NN and analyzed under NEPA in the S-HEU EIS, DOE/EIS-0240 (1996), but no projects to implement the activities (upgrade existing functions or new construction) have been proposed. Therefore, potential impacts of this down-blending are not included under No Action. However, the potential impacts from down-blending large quantities of HEU at Y-12 as described in the S-HEU EIS have been included in Chapter 6 (Cumulative Impacts) of this Y-12 SWEIS. Impacts of projects to upgrade or construct facilities will be analyzed when those projects are identified.

- ***Assumption 6*****:** DP is currently storing ^{233}U in Building 3019 (Radiological Development Facility) at the ORNL. This facility is DOE's repository for ^{233}U and has been an ongoing operation at ORNL since 1982. The storage and disposition of this ^{233}U is not included in the scope of analysis for the Y-12 SWEIS because the material is not associated with Y-12's Missions or located at the Y-12 National Security Complex. The storage and disposition of this ^{233}U is currently planned for a separate NEPA review in the future. The planned NEPA review is expected to consider the status of the existing storage facility, the characterization of the material in storage (e.g., useful material or waste), the potential for beneficial uses of the material, the treatment of ^{233}U material prior to disposal, and the possible alternatives for relocation and storage. The potential use of Y-12 facilities or processes for treatment and/or storage of ^{233}U would be analyzed, if determined to be a viable candidate site for these actions, in the subsequent NEPA review.

- ***Assumption 7*****:** Project construction material lay-down areas have been identified for the proposed HEU Materials Facility, the upgrade expansion of Building 9215, and the Special Materials Complex. Potential impacts associated with these lay-down areas are discussed in the SWEIS under each alternative. The identified sites of the construction lay-down areas are considered to be the best locations for each project based on project engineering cost and efficiencies, environmental concerns, and their reasonable proximity to the actual construction sites. An optional construction material lay-down area may be available. The potential site is the current permanent MK Ferguson (on-site General Contractor) construction lay-down area located on Old Bear Creek Road west of the S-3 Parking Lot, as shown in Figure 3.2.2–1. Other than erection of a fence to separate the area into two areas (one for MK Ferguson materials and one for SWEIS project materials) there would be no additional major site preparations. Since the site is an operating construction material lay-down area, there would be no additional environmental impacts with the use of the site. However, availability of the MK Ferguson site for proposed HEU Storage Mission or Special Materials Mission project construction support is uncertain, therefore, the impacts of this potential option are not presented in the SWEIS. If the MK Ferguson construction lay-down area were available and used for the HEU Storage Mission or Special Materials Mission Alternatives construction projects, the potential impacts discussed in the SWEIS associated with the identified construction lay-down areas would not occur.

3.1.1 No Action - Status Quo Alternative (Operations and Emissions)

The stand-down of the Y-12 National Security Complex in 1994 essentially curtailed most Y-12 weapons program support activities (see Section 1.1.1). Because operations still have not resumed to full levels, the 1999 environmental conditions and operations described in Chapter 4 of the SWEIS do not reflect a fully functional Y-12 performing its assigned mission at required and planned work levels.

In 1999, approximately 80 percent of the types of Y-12 operations needed to support Y-12 mission requirements had achieved operational readiness from the 1994 stand-down, and about 30 percent of Y-12 operational capacity was being used throughout most of the year. Most of the 30 percent operating capacity during 1999 resulted from operations at Y-12 that were required to maintain the nuclear weapons stockpile. Therefore, the environmental monitoring and environmental surveillance information described in Chapter 4 reflect less than typical operating conditions, i.e., as occurred prior to the 1994 stand-down and as will resume in the near future. To aid the reader in identifying the differences between operations and environmental conditions as they are now compared to what they will be under a fully operational Y-12, a No Action - Status Quo Alternative is provided in the SWEIS. The No Action - Planning Basis Operations Alternative discussed below provides a second benchmark for comparison of the Action Alternative. The No Action - Status Quo Alternative, which is basically a continuation of the status of Y-12 in 1999, is presented in the SWEIS to show the potential increase in production levels and potential impacts under the No Action - Planning Basis Operations Alternative and other alternatives described in Section 3.1.2. The No Action - Status Quo Alternative is not considered reasonable for future Y-12 operations because it does not meet Y-12 mission requirements.

3.1.2 No Action - Planning Basis Operations Alternative (Operations and Emissions)

The Y-12 National Security Complex has not operated at required and planned operation levels since the stand-down in September 1994. Additionally, enriched uranium metal operations performed in Building 9212 were shut down prior to the stand-down for modification in 1989. The modifications were completed but not before the stand-down prevented their restart. Since all required Y-12 DP mission functions have not been operating, existing Y-12 conditions for the most part do not represent a fully operational Y-12 performing assigned mission operations at required levels to support the nuclear weapons stockpile. Therefore, an estimate of planned Weapons Program and Y-12 workload schedules was compared to historical Y-12 operations prior to the 1994 stand-down to estimate the DP planning basis operations requirements and potential emissions for use as a second No Action Alternative in the Y-12 SWEIS for the 10-year planning period (Garber 2000).

The major production-related operations at the Y-12 National Security Complex during the late 1980s involved enriched and depleted (or natural) uranium. These operations would resume and would continue under the No Action - Planning Basis Operations Alternative. Other activities conducted in that time period involving weapons materials included weapons disassembly, joint test assembly production, quality evaluation, and special materials production. These other activities have not been suspended and would continue through 2010. The contribution of these other program activities to uranium emissions and other effluents is very small relative to enriched and depleted uranium operations. While weapons dismantlement is expected to increase during the next 10 years, Y-12 National Security Complex DP effluents and resource requirements should not vary appreciably from current baseline levels.

During the 1987 timeframe, enriched uranium recovery operations in Building 9212 were performed on a 3 shift-a-day, 7 day-a-week operation (21 shifts). Recovery operations in Building 9206 were also functioning at full capacity. An estimated 50 percent of the 1987 uranium operations emissions were from production operations and the remaining 50 percent were from enriched uranium recovery operations.

Enriched uranium activity levels have been projected for the period 2001-2010 from Stockpile Life Extension Programs and other Y-12 workload schedules. The activity levels for this period were then associated with the respective enriched uranium production and recovery activities. The activity level is estimated to be approximately 30 percent of the activity level at Y-12 experienced in 1987. Enriched uranium recovery operations during the period 2001-2010 is expected to be at levels equal to 1987 using 21-shift (3 shift-a-day, 7 day-a-week) operations. Therefore, uranium emission levels expected during the period 2001-2010 for enriched uranium recovery is estimated to be equal to 50 percent of the total uranium emissions for 1987. Enriched uranium emissions due to other production activities are estimated to be 30 percent of the remaining 50 percent of the total uranium emissions for 1987. Thus the annual enriched uranium emissions and other process effluents from the Y-12 National Security Complex for the period 2001-2010 are estimated to be 65 percent of the Y-12 levels experienced in 1987. This estimate is considered a bounding case because of various process and facility improvements that have been incorporated at Y-12 since 1987, and because actual production levels will not exceed historic high levels over the 2001-2010 time period.

Depleted uranium and non-enriched uranium operations and emissions involving materials are also expected to be at 30 percent of the levels experienced at Y-12 in 1987 except for Lithium Recovery Operations. During the period 2001-2010, Lithium Recovery Operations are expected to return to 100 percent of the levels experienced at Y-12 in 1987.

3.2 ALTERNATIVES

A No Action - Status Quo Alternative is presented in the SWEIS but is not considered a reasonable alternative for future Y-12 operations because it would not meet Y-12 mission needs. The No Action - Status Quo Alternative is used in this SWEIS as a benchmark for comparison of the impacts associated with the No Action - Planning Basis Operations Alternative and action alternatives that reflects full Y-12 DP mission operations at required levels and approved projects by EM and Office of Science at Y-12 over the 10-year planning period.

Alternatives analyzed in the Y-12 SWEIS include the No Action - Planning Basis Operations Alternative for the mission at Y-12 and site-specific alternatives for two of Y-12's mission components (i.e., HEU Storage Mission and Specials Materials Mission). There are two options for the Y-12 HEU Storage Mission: (1) construct a new HEU Materials Facility and (2) construct an upgrade expansion to existing Building 9215. The preferred option is to construct and operate the new HEU Materials Facility. Under the new HEU Materials Facility construction alternative, two siting alternatives are analyzed (i.e., Sites A and B).

For the Special Materials Mission at Y-12, the proposed action is to construct and operate a new Special Materials Complex. Three candidate sites are analyzed for construction of the Special Materials Complex (i.e., Sites 1, 2, and 3). (Site 3 is the same as Site B.)

3.2.1 Alternative 1A (No Action - Status Quo Alternative)

The No Action - Status Quo Alternative represents the current level of operations at Y-12 as reflected by the most recent monitoring data (1999) for the Y-12 Site and reported in the ASER issued in 2000. Although approximately 80 percent of the types of operations associated with DP's assigned mission were operational ready in 1999 (following the Y-12 stand-down in 1994), the Y-12 National Security Complex was only operating at 30 percent capacity for the most of that year. The state of conditions are used in the SWEIS as a basis for comparison of the impacts associated with the No Action - Planning Basis Operations Alternative and the action alternatives that reflect full Y-12 DP mission operations at required levels and recently approved projects by EM and ORNL at Y-12. The No Action - Status Quo Alternative is not considered reasonable for future Y-12 operations because it would not meet Y-12 mission needs and would not reflect DOE's decision in the SSM PEIS ROD (61 FR 68014) to maintain and downsize the mission at Y-12.

3.2.2 Alternative 1B (No Action - Planning Basis Operations Alternative)

Under the No Action - Planning Basis Operations Alternative, Y-12 would continue facility operations in support of assigned missions. The No Action - Planning Basis Operations Alternative reflects the implementation of the DOE decision in the SSM PEIS ROD (61 FR 68014) to maintain the DP national security mission at Y-12, but to downsize Y-12 consistent with reduced requirements. Downsizing of the Y-12 National Security Complex is being implemented under the direction of the Stockpile Management Restructuring Initiative Project described in Section 3.2.1.1. Y-12 assigned missions include: DP capabilities to produce and assemble uranium and lithium components, to recover uranium and lithium materials from the component fabrication process and disassembled weapons, to produce secondaries, cases, and related nonnuclear weapons components, to process and store enriched uranium (see Appendix A.3 and A.4 for a description of Y-12 major facilities and processes, respectively), and to supply enriched uranium, lithium, and other material products; EM activities at Y-12 related to environmental monitoring, remediation, D&D, and management of waste materials from past and current operations; Office of Science activities operated by ORNL; and DP support of other Federal agencies through the Work-for-Others Program, the National Prototype Center, and the transfer of highly specialized technologies to support the capabilities of the U.S. industrial base. The No Action - Planning Basis Operations Alternative also includes activities to store surplus enriched uranium pending disposition in accordance with the S&D PEIS ROD (62 FR 3014). Figure 3.2.2–1 shows the Y-12 National Security Complex and EM waste management facilities outside the Y-12 Site fenced area within the Y-12 SWEIS physical study area of analysis, while Figure 3.2.2–2 presents a detailed map of facility location and utilization at the Y-12 National Security Complex under the No Action - Planning Basis Operations Alternative.

3.2.2.1 *Defense Programs*

Enriched Uranium Operations. Under the No Action - Planning Basis Operations Alternative, Enriched Uranium Operations performed in the Building 9212 Complex and the Building 9215 Complex would resume and continue. Appendix A.4 gives a description of the Buildings 9212 and 9215 Complexes that house uranium operations, and Appendix A.3.1 describes Y-12 uranium processing. Figures 3.2.2–3 and 3.2.2–4 show an overview of the enriched uranium processing stream and the enriched uranium chemical recovery operations stream, respectively. A major upgrade of the Building 9212 AHF supply and fluidized-bed reactor systems has been completed (DOE 1995b). The new systems design provide for 99.9 percent control of fugitive emissions of AHF during normal operations and, in the event of an accident, capture of the entire inventory of AHF in a secondary containment enclosure.

Highly Enriched Uranium Storage. Buildings 9720-5, 9204-2E, 9204-2, 9998, 9215, and 9204-4 would continue to be used for storage of Categories I and II HEU (See Glossary for description of Categories). (See Appendix A.4 for a description of these facilities.) Adequate storage space exists within these facilities to accommodate expected mission storage requirements for HEU at Y-12 through 2010. No major upgrades or new facility construction would occur under the No Action - Planning Basis Operations Alternative.

Source: Tetra Tech, Inc./LMES 2000a.

FIGURE 3.2.2–1.—*Alternative 1B (No Action - Planning Basis Operations Alternative) Facilities within Y-12 SWEIS Area of Analysis.*

Source: Tetra Tech, Inc/LMES 2000a.

FIGURE 3.2.2–2.—*Alternative 1B (No Action - Planning Basis Operations Alternative) Facility Location and Utilization at Y-12.*

Special Materials Operations. The existing facilities used to perform the Special Materials functions, including beryllium operations, would continue to be used under the No Action - Planning Basis Operations Alternative. Special Materials Operations would include activities associated with beryllium machining and spraying, and production, purification, and processing of certain special materials (nonradiological). Facilities supporting Special Materials Operations include Building 9731, 9202, 9201-5, 9201-5N, 9995, 9204-2, and 9404-11. Special Materials Operations production levels would vary according to mission requirements but would be at or below Y-12 historic operating levels for these activities.

Assembly/Disassembly/Quality Evaluation Operations. The evaluating, rebuilding, or dismantling weapons and storage of returned weapons components would continue to be performed in Buildings 9204-2E, 9204-2, and 9204-4. Supporting operations including container refurbishment, nondestructive examination, metallurgical laboratory activities, and dimensional inspection would also continue. Quality Evaluation facilities are currently being consolidated and relocated from Building 9204-4 to Building 9204-2 as part of the Stockpile Management Restructuring Initiative and the Quality Evaluation Relocation Project. Projected Assembly/Disassembly/Quality Evaluation production levels for the No Action - Planning Basis Operations Alternative are expected to continue at the current levels, which are approximately 30 percent of historic levels Y-12 experienced in 1987 when Y-12 was in full Cold War weapons production mode.

Depleted Uranium Operations. Buildings 9215, 9204-4, 9998, 9201-5, and 9201-5N would continue to be used for Depleted Uranium Operations activities under the No Action - Planning Basis Operations Alternative. These operations would include metal casting, rolling, forming, machining, plating, and waste and scrap metal management and processing. Figure 3.2.2–5 shows an overview of the Y-12 depleted uranium operations. Most depleted uranium operations are performed in the Building 9201-5 and the Building 9215 Complexes. (See Appendix A.4 for a description of these facilities.) Depleted Uranium Operations are currently being consolidated primarily in Building 9998 and the Buildings 9215 and 9201-5 Complexes as part of the Stockpile Management Restructuring Initiative. Depleted Uranium Operations production levels through 2010 under the No Action - Planning Basis Operations Alternative are expected to continue at levels approximately 30 percent of the historic levels Y-12 experienced in 1987 when Y-12 was in full Cold War weapons production mode.

Lithium Operations. Current lithium and support operations performed in Buildings 9204-2, 9404-9, 9805-1, 9720-19, and 9720-19A would continue under the No Action - Planning Basis Operations Alternative. A description of the Y-12 lithium process and activities is found in Appendix A.3.1. The buildings housing lithium production and support functions are described in Appendix A.4. Projected lithium production operations through 2010 under the No Action - Planning Basis Operations Alternative are expected to continue at historic levels Y-12 experienced in 1987 when Y-12 was in full Cold War weapons production mode.

Product Certification Organization. Under the No Action - Planning Basis Operations Alternative, the Product Certification Organization would continue to provide independent tests, inspections, and quality assurance for weapons programs and other approved Y-12 customers. The testing and inspection services provided would include a full range of physical testing and dimensional inspection services for a wide variety of materials and components. All materials utilized in Y-12 weapons activities would be tested by these operations, including fissile, non-nuclear, and hazardous materials, as well as materials requiring special handling. There are 15 major Product Certification Organization facilities operational within the Y-12 National Security Complex. These facilities are generally located in proximity to production capabilities developed at Y-12. Many facilities were consolidated in the 1990s and that consolidation would continue under the No Action - Planning Basis Operations Alternative. Product Certification Organization activities through 2010 under the No Action - Planning Basis Operations Alternative are projected to continue at current operation levels.

FIGURE 3.2.2–3.—*Overview of the Y-12 Enriched Uranium Parts Production Operations.*

FIGURE 3.2.2–4.—*Overview of the Plant Enriched Uranium Chemical Recovery Operations.*

FIGURE 3.2.2–5.—*Overview of the Y-12 Depleted Uranium Operations.*

Analytical Chemistry Organization. Under the No Action - Planning Basis Operations Alternative, the Analytical Chemistry Organization would continue to provide analytical services including project management, sampling, analyses, and data evaluation in support of DP and other customers. The services would include a full range of chemical and physical tests applied to a wide variety of materials and components including fissile, nuclear, non-nuclear, and hazardous. The Bioassay Program, which assesses any potential uranium exposure of personnel, would continue to be performed at the Analytical Chemistry Organization's Union Valley Facility located outside Y-12. Building 9995, which houses the primary operations area of the Analytical Chemistry Organization at Y-12, would continue to be used for analytical chemistry mission support of DP and other customers. Analytical chemistry activities at Y-12 under the No Action - Planning Basis Operations Alternative are projected to increase from current operations levels through 2010 to support projected activities associated with TVA, USEC, and Naval Reactors program work.

Y-12 Utility and Support Infrastructure. The Y-12 National Security Complex is supported by a broad range of utilities including: (1) steam and condensate, (2) raw and treated water, (3) sanitary sewer, (4) demineralized water, (5) natural gas, (6) plant and instrument air, (7) industrial gases, (8) electrical power, and (9) telecommunications systems.

1. Steam is used at the Y-12 National Security Complex for a variety of purposes, but primarily for building heating, ventilation, and humidity control. Additional uses include heating of process materials, hot water heating, and vacuum production using steam ejectors. The Y-12 Steam Plant (Building 9401-3) would continue to produce and distribute steam to Y-12 facilities and operations. The projected peak steam load over the next 10 years is expected to remain at historic levels of approximately 226,800 kg/hr (500,000 lb/hr). Average steam usage under the No Action - Status Quo Alternative is 83,900 kg/hr (185,000 lb/hr).

2. The source of raw water for the Y-12 National Security Complex and the city of Oak Ridge Water Treatment Plant is the Melton Hill Reservoir. The projected long-range requirements for raw and treated water for Y-12 National Security Complex is expected to be within the currently available capacities of 26,497,800 L/day (7 MGD) for treated water and 20,819,700 L/day (5.5 MGD) for raw water. Under the No Action - Status Quo Alternative, treated water usage at Y-12 averaged 15,950,000 L/day (4.2 MGD) or 479 million L/month (126 million gal/month).

3. Sanitary sewage from Y-12 flows by gravity to the city of Oak Ridge Treatment Plant. The current system capacity is approximately 5,678,100 L/day (1.5 MGD). A project initiated in the early 1990s to upgrade the Y-12 sewer system operations and correct inflow infiltration problems is now complete and the system is functioning efficiently. The No Action - Status Quo Alternative usage is approximately 2,880,000 L/day (0.76 MGD). The current capacity is adequate for projected long-term use through 2010.

4. Demineralized water is used to support various processes at Y-12 that require high-purity water. A central system located in and adjacent to Building 9404-18 would continue to serve the entire plant through a distribution piping system. The system includes four mixed-bed-type demineralizer units, each capable of delivering 545,090 L/day (144,000 gal/day) of water. The system also includes three storage tanks: one with a 113,560-L (30,000-gal) capacity and two with 75,700-L (20,000-gal) capacity each. The No Action - Status Quo Alternative usage is approximately 7,400 L/day (1,955 gal/day). The projected long-range requirements for demineralized water through 2010 are expected to be within available capacity of the current system.

5. The Y-12 National Security Complex would continue to use natural gas and coal to fuel process furnaces and steam generation and natural gas for laboratory needs. Natural gas requirements for the next 10 years are projected to be within currently available capacity. Approximately

3,965,000 m³ (140 million scf) of natural gas and 81,000 t (89,300 T) of coal would be used annually through 2010. The No Action - Status Quo Alternative usage of natural gas was 2,750,000 m³ (97 million scf) while coal usage was 64,350 t (71,000 T).

6. Plant and instrument air would continue to be supplied by compressors and air-drying equipment located throughout Y-12. The total installed compressor capacity is approximately 386,968,100 m³/yr (13,700 million scf/yr), while the average usage is approximately 200,925,740 m³/yr (7,100 million scf/yr). Plant and instrument air requirements for the next 10 years under the No Action - Planning Basis Operations Alternative are projected to be within currently available capacity. The No Action - Status Quo Alternative usage is approximately 156,000,000 m³/yr (5,500 million scf/yr).

7. Industrial gases (argon, helium, hydrogen, nitrogen, and oxygen) would continue to be delivered by truck to storage and distribution facilities at Y-12. The storage and use of industrial gases to support Y-12 operations is expected to continue at current levels through 2010. The storage capacity for argon is 116,350 L (30,737 gal), equivalent to approximately 396,270 m³ (3.4 million scf) of gas. Total capacity of distribution is 13,395,040 m³/yr (473 million scf/yr) or approximately 26 million scf/month.

   Helium storage capacity is 4,530 m³ (160,000 scf) with an additional 1,020 m³ (36,000 scf) of emergency standby storage. The No Action - Status Quo Alternative helium usage is approximately 63,150 m³/yr (2,230,000 scf/yr). Hydrogen storage capacity is 2,550 m³ (90,000 scf). The No Action - Status Quo Alternative hydrogen usage is approximately 8,774 m³/yr (310,000 scf/yr).

   The Y-12 nitrogen supply system consists of five liquid-nitrogen storage tanks, a bank of atmosphere vaporizers, a steam-to-nitrogen vaporizer, and hot-water vaporizers. Nitrogen use at the Y-12 National Security Complex under the No Action - Status Quo Alternative is 5,465,000 m³ (193 million scf).

   The Y-12 oxygen supply system consists of one 25, 890 m³ (914,460 scf) vacuum insulated storage tank for liquid oxygen. Distribution capacity is 1,438,720 m³/yr (49.2 million scf/yr). The No Action - Status Quo Alternative usage is approximately 94,000 m³ (3.3 million scf). Average annual oxygen consumption ranges from 84,950 m³ to 113,260 m³ (3 to 4 million scf).

8. Electrical power would continue to be distributed throughout the Y-12 National Security Complex using existing 161-kV feeder lines and distribution substations. The total installed transformer capacity at Y-12 is approximately 400 MVA. The Y-12 load during the 1990s averaged approximately 44 MVA. Projected electrical power requirements for Y-12 under the No Action - Planning Basis Operations Alternative are 565,710 MWhr/yr over the next 10 years, an increase of 207,810 MWhr/yr from the No Action - Status Quo Alternative levels.

9. Telecommunications systems within the Y-12 National Security Complex include the Oak Ridge Integrated Communications Network, the Cable Television Network, the unclassified Y-12 Intrasite Network, and the classified Y-12 Defense Programs Network. Under the No Action, Y-12 would continue to use the existing telecommunications systems. The existing networks are sufficient for near-term needs. Updating the networks systems would be reviewed as necessary based on technology advances and Y-12 requirements.

Stockpile Management Restructuring Initiative. The Stockpile Management Restructuring Initiative project supports the plan for downsizing Y-12 consistent with the future secondary and case manufacturing mission defined by the SSM PEIS and ROD. No new facilities were analyzed at Y-12 to support the DP national security missions in the SSM PEIS. The construction, operation, emissions, employment, and waste management data of the downsizing and building upgrades of the DP weapons mission at Y-12 are detailed in the SSM PEIS Section 3.4.4.2 and Appendix A.3.2.

The purpose of the Stockpile Management Restructuring Initiative project is to assist in preparing the Y-12 National Security Complex for the future production mission requirements for nuclear weapon secondaries, case components and other miscellaneous components, as well as providing a smaller, more cost-effective production size.

The ongoing downsizing task, which is included under the No Action - Status Quo Alternative is to minimize the number of major buildings required while maintaining the capability to perform the DP production mission. Figure 3.2.2–6 shows the buildings affected by the Stockpile Management Restructuring Initiative. The project utilizes previous production consolidation activities started in the early 1990s and continues these efforts by consolidating and downsizing additional production operations into a minimum number of major buildings. The consolidation and downsizing of these facilities are as follows:

- Consolidating enriched uranium machining in Building 9215

- Placing Building 9201-5 machine shop in active status to maintain production machining capability

- Installing a depleted uranium sawing facility in Building 9212 to handle surge production as well as centralizing depleted uranium operations and providing a furnace for dismantled weapon material consolidation

- Refurbishing two vacuum induction furnaces in Building 9998

- Relocating the ceramic machining function out of Building 9201-5 to a smaller capacity operation in Building 9204-2 to enable the transition of Building 9201-5 for surplus

- The material phenomena upgrades originally defined for the Stockpile Management Restructuring Initiative were postponed and a plan was being developed for all Y-12 DP facilities. Implementation of this plan when completed may require major upgrades.

The Stockpile Management Restructuring Initiative project has been covered under NEPA by existing, approved Categorical Exclusion.

FIGURE 3.2.2–6.—*Buildings Affected by the Y-12 Restructuring Initiative.*

3.2.2.2 *Waste Management*

Radioactive and hazardous waste has been generated at Y-12 by the processing and storage of enriched and depleted uranium, lithium compounds, and other materials; the weapons manufacturing and assembly/disassembly mission; and the nondefense-related activities associated with the environmental restoration, nondefense R&D, and Work-for-Others Programs. As DOE missions have changed, an increasing volume of waste has been generated through the environmental restoration activities at Y-12. This increase is expected to continue into the future.

In addition to the Environmental Management Waste Management Facility described in this section that is included under the No Action - Planning Basis Operations Alternative, the following ongoing waste management activities would continue at Y-12:

- Providing LLW and mixed waste treatment and storage capabilities to the Y-12 generators
- Storing and/or treating hazardous waste
- Storing hazardous waste pending off-site shipment for treatment, storage, and/or disposal
- Storing mixed waste awaiting treatment or disposal, treatment at Y-12, or shipping to another ORR facility for treatment or disposal
- Continuing closure of inactive waste sites, as planned
- Storing PCB waste, pending off-site shipment for treatment, storage, and/or disposal
- Providing disposal capability for on-site generated, solid nonhazardous waste
- Continuing the Waste Minimization/Pollution Prevention Program

Environmental Management Waste Management Facility

DOE's Office of Environmental Management will construct and operate an on-site waste disposal facility for CERCLA waste expected to be generated by cleanup of the ORR and associated sites. The new disposal facility would be located in West Bear Creek Valley within the Y-12 SWEIS area of analysis and would require the clearing of 26 - 39 ha (64 - 98 acres). The permanent commitment of land for this facility would be 9 - 23.5 ha (22-58 acres).

Detailed information on the Environmental Management Waste Management Facility and potential construction and operation impacts can be reviewed in the remedial investigation/feasibility study (RI/FS) (DOE 1998a), its addendum (DOE 1998d), and proposed plan (DOE 1999a). The ROD (DOE 1999i) selecting the proposed remedy (construction and operation of the Environmental Management Waste Management Facility at Y-12) was published in November 1999. The TDEC and EPA are still reviewing the final design for the Environmental Management Waste Management Facility. As a result, some of the data present in this section of the SWEIS may change.

Design elements of the Environmental Management Waste Management Facility include site development, the above-ground engineered disposal cell, and support facilities. The total disposal cell capacity is 273,000 m^3 (357,000 yd^3) for the low-end conceptual design and 1.3 million m^3 (1.7 million yd^3) for the high-end design.

Site Development. The following development actions would prepare the site for construction of the disposal facility. The existing east-west trending 13.8-kV overhead electric transmission lines would require relocation to the south before significant mobilization for construction. Water, electricity, telephone lines, and sanitary waste facilities (septic system or collection tanks) would be established onsite.

Trees would be removed from the construction, spoils, and borrow areas as required. Topsoil would be removed and stored, and the facility site and borrow area would be prepared for construction activities. Fences and gates would be installed to restrict the controlled area site. Site development actions would be performed to minimize environmental impacts. Existing gravel roads would be upgraded, new gravel roads would be constructed between the borrow area and the disposal facility (as required), and temporary roads and the staging area would be developed. Detention basins and runoff control ditches would be constructed to prevent run-on and protect streams from construction activities (Figure 3.2.2–7).

Disposal Facility. The disposal facility conceptual design includes a clean-fill perimeter dike; a 3 m (10 ft) geologic buffer below a 2-m (6-ft)-thick multilayer base liner system consisting of primary and secondary geosynthetic membranes and clay liners, primary and secondary leachate collection/detection systems, and a protective soil layer; a 5-m (16-ft)-thick multilayer cap consisting of a low-permeability liner, a flexible geomembrane, a drainage layer, a biointrusion layer, and a soil/rock matrix cover (Figure 3.2.2–8). A detailed description of each of these disposal cell components can be reviewed in the *Remedial Investigation/Feasibility Study for the Disposal of Oak Ridge Reservation Comprehensive Environmental Response, Compensation, and Liability Act of 1980 Waste* (DOE 1998a).

Support Facilities. A support area and an exclusion area would be established within the fenced control area of the disposal facility. The conceptual design for the support area includes truck scales, an office area, employee and visitor parking area, and a guard station at the main gate. An employee facility would connect the exclusion area to the support area and would include personnel showers, bathrooms, monitoring and decontamination equipment, and a break area. Water from showers and toilet facilities would go to a septic tank and drain field or to a collection tank for disposal at a wastewater treatment plant.

Waste operations would be conducted in the exclusion area, which would be assumed to be contaminated during operations. Any personnel, equipment, vehicles, or containers leaving the exclusion area would be monitored and, if necessary, decontaminated. Clothing worn in the exclusion area would be washed or packaged for disposal. Water from the washers would go to a decontamination tank. An enclosed decontamination facility with a collection sump and pump and high-pressure water spray equipment would be available to inspect and decontaminate vehicles, equipment, and containers. Decontamination water collected in the sump would be pumped to the decontamination tank. The tank would be emptied, as needed, and decontamination water would be transported by tanker truck to the ETTP Central Neutralization Facility or used for dust control in the exclusion area.

An equipment storage, maintenance, and fueling area would be constructed in the exclusion area for use during operations. A waste staging area inside the exclusion area would serve as a temporary storage area for incoming waste. This area would be used if the rate of incoming waste deliveries exceeds the rate of waste placement in the disposal facility, as could occur during inclement weather. A covered storage area would be included in the staging area.

Existing groundwater monitoring wells would be used, where possible, and additional groundwater monitoring wells would be installed as needed. Air monitoring equipment would be installed for use during construction and operations.

Source: Tetra Tech, Inc./ DOE 1998a.

FIGURE 3.2.2–7.—*The Environmental Management Waste Management Facility Site Plan.*

FIGURE 3.2.2–8.—*Cross Section of the Environmental Management Waste Management Facility Disposal Cell.*

Source: Tetra Tech, Inc./ DOE 1998a.

Project Borrow Area. A large volume of clay-rich soil would be needed from a borrow area in the vicinity of the disposal facility for construction of the geologic buffer, base liner, temporary covers during operations, and cap. Based on the results of the *Environmental Restoration Soil Borrow Area Site Selection Study for the Remediation of Lower East Fork Poplar Creek Floodplain Soils* (DOE 1994b), the Y-12 West End Borrow Area contains a suitable volume and quality of material to meet the construction needs for the disposal unit. This facility is located on Chestnut Ridge, immediately south of Bear Creek Road and approximately 0.62 km (1 mi) east of SR 95. The Y-12 West End Borrow Area would be expanded from its current area of 7.1 ha (17.5 acres) to between 12 and 15 ha (29 and 36 acres), depending on the waste volume scenario. This would represent an increase of between 4.8 and 7.3 ha (11.8 and 18 acres). Figure 3.2.2–9 shows the Y-12 West End Borrow Area, including the areas projected to be impacted by excavation of fill for construction of the low- and high-end design facilities.

Construction

Construction activities for the disposal facility would include site development, disposal cell construction, construction of support facilities, capping, and closure. The disposal cell would be constructed in phases consistent with waste generation schedules. The conceptual schedule assumes that the disposal facility would be constructed and operated in two phases for the high-end scenario with the first phase of construction for the high-end scenario approximating the total low-end volume capacity. Disposal would begin once construction of the Phase I area was complete. An interim cap would be placed over the Phase I area as soon as that portion of the cell was filled. Phase II construction would be completed and this area would be ready to accept waste concurrent with interim capping of the Phase I area.

For the conceptual high-end scenario construction schedule, Phase I would include construction of all support facilities and that portion of the clean-fill dike, liner, and leachate systems to allow receipt of approximately 30-35 percent of the planned waste capacity. Phase I would include complete site clearing and preparation, and the construction of security fences, access roads, the leachate collection tanks, sediment detention basins B and C, and other necessary support facilities. A small dike would be constructed to delineate the boundary between the two phases and separate contact runoff (i.e., the rainfall that potentially contacts waste) from noncontact runoff. The clean-fill dike would be left open facing Phase II construction.

Phase II would involve construction of the remainder of the clean-fill dike, liner, leachate system, and sediment detention basin A. Construction of this phase would likely take two to three years. Phase II construction would follow Phase I construction during placement of waste in the completed Phase I area. During this period, vehicles hauling waste and fill material would use the same site access road. Once on-site, fill traffic and waste traffic would use separate routes. Installation of the final cover for the entire cell would occur during closure of Phase II.

Operations and Waste Placement

Operational scenarios would be different for the low-end and high-end waste volumes. Under the low-end scenario, most of the candidate waste volumes would be generated by FY 2009. Because it would not be cost-effective to operate the disposal facility for the small volumes generated after that date, operations would discontinue after FY 2009 and the facility would be closed by FY 2011. Candidate wastes generated after operations cease would be shipped to off-site facilities. Long-term surveillance and maintenance (S&M) would continue indefinitely. For the high-end volume scenario, on-site disposal operations are assumed to continue through FY 2030. Closure would be completed in FY 2033 and active institutional controls would continue indefinitely.

FIGURE 3.2.2–9.—*Y-12 West End Borrow Area.*

Source: Tetra Tech, Inc./ DOE 1998a.

The operations phase would consist of waste acceptance and inspections, placement of wastes into the disposal cell, decontamination of waste containers and transport vehicles, and maintenance of the disposal facility. Facility maintenance would include providing daily cover over the emplaced waste, leachate collection and management, equipment maintenance, support facility maintenance (e.g., roads, buildings), and record keeping.

The facility would have temporary storage capacity to accommodate disposal requirements or accept deliveries during inclement weather when waste placement operations are curtailed. The temporary storage capacity would include a 1,858 m^2 (20,000 ft^2) covered storage building capable of housing approximately 612 m^3 (800 yd^3) of packaged waste.

To ensure that waste received at the disposal facility could be properly handled, the physical form of waste would be restricted. Bulk waste containing debris no larger than 20 cm (8 in) in any dimension would be handled and compacted in the disposal cell with standard earth-moving equipment. Large debris (i.e., debris with any dimension larger than 20 cm [8 in]), containers, and solidified waste could be accepted if special handling arrangements were made. Limitations on large debris would be developed to minimize void spaces in the disposal cell and prevent damage to the liner system. Appropriately sized, solidified waste in the form of slabs would be accepted. No free liquids would be permitted.

Wastes would be transported in closed trucks or by truck in large containers (e.g., intermodals) or discrete packaging such as B-25 boxes, drums, and bags. Bulk waste in the form of soil, debris, miscellaneous solids, and stabilized sediment/sludge shipped in closed dump trucks and self-dumping large containers is expected to compose the largest portion of waste received at the disposal facility, although equipment for unloading a number of different types of transport vehicles and containers would be available.

Trucks carrying waste would enter the facility via the waste traffic access road and proceed to the truck scale/acceptance facility. The trucks would be weighed, waste manifests would be verified, and waste packages would be inspected. The trucks would then proceed into the disposal facility.

Within the disposal facility, active 30 by 30 m (100 by 100 ft) working faces would be prepared to receive waste. The 0.3-m (1-ft)-thick protective soil layer placed over the geotextile during construction would be removed as needed and replaced with sand or gravel before the placement of waste in the first lift. Removal of a portion of the soil layer would allow drainage of precipitation into the leachate collection system. It is assumed that only one or two faces would be active and other faces would have temporary covers to provide containment and shielding and reduce infiltration. If more accurate waste generation data indicate that exposures would be acceptable, additional faces could be opened during periods of high disposal rates or when segregation of incoming waste streams is appropriate. Segregation of incompatible wastes is assumed to be unnecessary because wastes would be treated to land disposal restrictions (LDRs). Segregation for other purposes may be desirable but is not expected to affect productivity.

Flatbed trucks carrying discrete, smaller containers such as B-25 boxes and drums would be off-loaded onto a mobile dock in the cell. Large containers would be emptied directly into the working cell. After depositing the wastes, the containers and trucks would be decontaminated before leaving the disposal cell. Before leaving the waste staging area and entering the uncontrolled area, trucks and containers would be checked at the vehicle and waste container monitoring/decontamination facility and decontaminated again, as required.

Bulk waste would be placed in 0.3-m (1-ft) lifts and compacted. Debris and containers would be placed to minimize possible damage to the geotextile layer and to minimize void spaces after backfilling. Void spaces in the disposed waste would be filled with waste soil, clean soil, or flowable fill (e.g., low-strength grout). A cover made of soil or foam would be placed over the cell following each day's operations and would be removed from the active cell before placement of the next layer of waste. This cover would prevent precipitation from contacting the waste and reduce fugitive emissions.

A berm would separate the working face of the cell from completed cells and those areas of the cell that have yet to receive waste. This berm would segregate collected precipitation that has not contacted disposed waste from collected precipitation that is potentially contaminated because of contact with waste. Precipitation accumulating in the working cells would infiltrate into the leachate collection system. Precipitation accumulating in the unused portion of the cell would be collected in a temporary sump or basin and pumped to one of the sediment detention basins south of the facility. Leachate would be pumped from collection sumps located outside the cell to collection tanks south of the cell for storage. During peak leachate generation, up to six 18,927-L (5,000-gal) tanker truck loads per day would be required to transport leachate from the collection sumps to the ETTP Central Neutralization Facility or other wastewater treatment facility on ORR.

After storm events, the detention basins would be inspected. The basins would be excavated to original design grade when 60 percent of the capacity is filled with sediment. The sediment would be hauled to a sanitary or construction landfill on ORR.

Closure

For the high-end scenario, Phase I disposal operations and Phase II construction of the geologic buffer, clean-fill dike, and liner should be near completion at the same time. When Phase II disposal operations start, installation of the final cover on Phase I could begin.

Closure activities would include removal of leachate storage tanks (after collection volumes diminish) and other support facilities and placement of contaminated media into the disposal cell, installation of the final cover, and site restoration. Restoration could include removal of the sediment ponds, replacement of wetlands if necessary, and grading and seeding the disturbed areas outside the disposal cell to restore the area.

Deed restrictions would prohibit residential use of the property, construction of any facilities that could damage the cover, or installation of groundwater extraction wells (for purposes other than monitoring). These deed restrictions would also identify other administrative controls necessary to protect the public and the integrity of the disposal cell and would be attached to the deed description and filed with the appropriate local governmental authority.

Post-Closure Care

During development of the support facilities, monitoring of the disposal facility and its environs would begin as soon as monitoring facilities were installed. Historic information and results from pre-disposal monitoring would be used to develop a baseline for comparison with post-operation monitoring results. S&M and monitoring would be performed for an indefinite period after facility closure. These activities and the associated reporting requirements would be conducted in accordance with approved facility-specific S&M and monitoring plans.

Surveillance. An integral part of post-closure care is surveillance and site inspection. The site would be inspected to verify adequate performance of the containment features installed and to alert DOE and regulatory agencies of any potential problems. The inspections would provide an early warning that specific elements may need more careful evaluation and monitoring.

During the first year of operation, one or two inspections could be performed immediately after high rainfall events to verify the effectiveness of water retention and transport systems and the accuracy of the performance predictions. Additional data should be collected after significant events such as storm events of a 5-year intensity or greater. In the first 5 years after closure, inspections could be performed more frequently than in later years to evaluate seasonal effects on operation of the systems. Certain elements, such as disposal-cell stability, may require more frequent inspections. The timing of the inspections could be determined after evaluation of the first year's seasonal results to provide the most useful information. After the fifth year and upon completion of the first CERCLA 5-year review, inspection frequency could be adjusted as appropriate.

Maintenance. Post-closure maintenance activities would include the clearing of uncontrolled plant growth from the disposal-cell crest and side slopes; clearing, repair, and realignment of surface water transport structures; inspection, emptying, and maintenance of the leachate collection/detection system; replacement of signs; reestablishment of survey monuments; and collection of piezometer data. Undesired plant growth would be cleared annually for the period of active institutional controls. Regrading, ditch realignment, fence and sign repair, survey monument reestablishment, and other minor maintenance items would be conducted based on surveillance findings.

Long-Term Maintenance. Long-term media monitoring (groundwater, surface water, air, and biota) would be performed to detect releases from the disposal cell. A groundwater monitoring system with wells located upgradient and downgradient of the disposal cell would be sampled annually to monitor containment concentrations and determine whether there have been contaminant releases from the disposal cell. Continued monitoring would support 5-year reviews under CERCLA [40 CFR 300.430 f(4)V]. The surface water downstream from the disposal cell would be monitored during operation of the facility and through post-closure care in support of 5-year CERCLA reviews.

3.2.2.3 *Environmental Restoration*

Environmental Restoration activities would continue in the form of characterization and remediation of contaminated areas or facilities. Environmental Restoration is not considered a land use, but an activity necessary for reuse or disposition of land and facilities. The Environmental Restoration projects at Y-12 that would continue under the No Action - Planning Basis Operation Alternative include:

- Decontamination and Decommissioning Facilities
- Upper East Fork Poplar Creek Actions
- Upper East Fork Poplar Creek East End Volatile Organic Compound (VOC) Plumes
- Upper East Fork Poplar Creek West End Mercury Area Remediation
- Groundwater/Surface Water Actions
- Soils/Sediments Contamination Reduction Actions
- Soils/Sediments Remediation Actions

3.2.2.4 *Nuclear Nonproliferation and National Security*

The No Action - Planning Basis Operations Alternative would also include continued down-blending of small quantities (kg/year) of HEU to various degrees of enriched uranium by blending HEU with depleted or natural uranium in Building 9212. The product would be metal or oxide used in various reactor programs, weapons programs, and for multiple uranium supply orders to DOE customers.

Y-12 would continue to support ongoing NN programs, operations and activities under the No Action - Planning Basis Operations Alternative. Ongoing and planned National Security Program Offices activities include:

- Verification activities
- Bilateral treaty support
- IAEA interface activities related to uranium
- Support activities pertaining to all National Security Nuclear Nonproliferation Programs

3.2.2.5 *Nuclear Energy, Science and Technology*

Under the No Action - Planning Basis Operations Alternative, DOE would continue to host existing projects and program activities of Nuclear Energy, Science and Technology at levels not exceeding those of the recent past.

3.2.2.6 *Nondefense Research and Development Program*

Y-12 would continue supporting ongoing program operations. Ongoing and planned nondefense R&D operations and activities at Y-12 that would continue under the No Action - Planning Basis Operations Alternative include:

- National Environmental Research Park Program Activities
- ORNL General Research and Support Activities
- ORNL Engineering Technology Division Activities
- ORNL Fusion Energy Division Activities
- ORNL Biology and Environmental Research Program Activities

One new Nondefense Research and Development Program initiative included under the No Action - Planning Basis Operations Alternative is the Field Research Center associated with the DOE NABIR Program. The NABIR Program is a basic research program designed to increase the understanding of fundamental biogeochemical processes that would allow the use of bioremediation approaches for cleaning up DOE's contaminated site. Because subsurface hydrogeologic and geochemical conditions at contaminated DOE sites cannot easily be duplicated in a laboratory, the Office of Science needs a field site to allow laboratory research results to be field-tested on a small scale in a controlled outdoor setting.

The Office of Biological and Environmental Research, within the Office of Science, is adding a Field Research Center component to the existing NABIR Program at Y-12, which was analyzed at ORNL (ORNL 1999). DOE has prepared an EA for the project (DOE/EA-1196, DOE 2000b) and issued a FONSI on April 18, 2000, which provides a description of the proposed action, alternatives, and potential impacts. A summary of the project is presented here. The fieldResearch Center activities are proceding independant of the Y-12 SWEIS proposed actions and alternatives.

The Y-12 Field Research Center site includes a 98 ha (243 acre) previously disturbed contaminated area and a 163-ha (440-acre) background area. The contaminated area will be used for conducting experiments on contaminated groundwater and subsurface sediments. The background area provides for comparison studies in an uncontaminated area and is outside the Y-12 SWEIS analysis area shown in Figure 3.2.2–1. The contaminated area and background area is located in Bear Creek Valley. Bear Creek Valley is approximately 16 km (10 mi) long and extends from the eastern end of the Y-12 Site to the Clinch River on the west. Bear Creek is a tributary to East Fork Poplar Creek (EFPC), which drains into the Clinch River at the ETTP. Except for the extreme eastern end of the contaminated area of the Field Research Center, the area is outside any security fences, adjacent to public use roads, but protected from unwarranted passersby. Initially, test plots of less than 0.4 ha (1 acre) will be constructed in proximity to the S-3 Ponds Site Parking Lot (Figure 3.2.2–10).

FIGURE 3.2.2–10.—*Locations of the Background Area and the Initial Test Plots within the Field Research Center (FRC), Contaminated Area at Y-12.*

A CERCLA Remedial Investigation Report was completed on the Bear Creek Valley in 1997 (DOE 1997a). The report provided a significant amount of characterization data on the S-3 Ponds Site as well as other areas of the Bear Creek Valley. The contaminated and background areas will serve as the primary field site for small-scale basic bioremediation research activities. The types of activities that could occur at the Field Research Center can be categorized into passive and active site characterization, obtaining research-quality samples, and in-situ research. Because the activities at the Field Research Center will be undertaken in an area limited to less than an acre and a depth of 23 m (75 ft), the scale of research activities would be considered small.

Passive subsurface characterization activities are described as nonintrusive (e.g., ground penetrating radar, electromagnetics, and resistivity) and intrusive (e.g., seismic tomography, direct push penetrometer, creation and use of injection/extraction wells). Active characterization can be defined as the addition of some substance (e.g., air, nontoxic chemical tracers such as bromide, or a gas tracer such as helium or neon) to the subsurface under controlled conditions. These active characterization studies will allow the NABIR investigators to better understand the hydraulic properties of the subsurface, provide a detailed understanding of groundwater flow paths and the speed at which groundwater and other substances might move through the aquifer, and could assist in determining additional chemical and physical properties of an aquifer.

The Field Research Center will be a primary source for groundwater and sediment samples for NABIR investigations. Groundwater will be sampled by pumping water from existing wells or by installing new wells. Approximately 200 groundwater samples per year would be expected. These would be small quantity samples, approximately 1 L (0.264 gal) each and totaling less than 76,000 L (20,000 gal) per year, and would not change the groundwater flow rates or availability of groundwater. Approximately 600 core samples of sediments would be taken over the 10-year life of the proposed Field Research Center through the use of a drill rig or split-spoon sampler. Again, the sediment samples will be small in volume (approximately less than 1 m^3) (35.31 ft^3) and the drilling holes will be backfilled when no longer needed.

Collection and transportation of samples within the boundaries of the Y-12 Site will follow existing DOE procedures and meet all ES&H requirements. Samples could be shipped off-site to researchers at universities and commercial laboratories. Any shipment of hazardous materials to or from the Field Research Center will follow U.S. Department of Transportation (DOT) Hazardous Materials Regulations.

Approximately 40 in-situ research activities will be conducted over the 10-year life of the proposed Field Research Center. Two types of in-situ activities are proposed to take place: biostimulation and bioaugmentation.

Biostimulation would involve introducing substances into the subsurface to stimulate naturally occurring microorganisms in-situ to bioaccumulate or transform a heavy metal or radionuclide. Biostimulation activities might include (1) injection of electron donors or electron acceptors to change part of the chemical environment of the subsurface so that it is more favorable for microbial activity or growth, (2) injection of gases or nutrients to stimulate the growth of selected microorganisms, (3) injection of chelators to test the extent of contaminate mobilization, or (4) injection of surfactant to reduce the toxicity of a specific contaminant to microorganisms.

Bioaugmentation would involve the injection of additional microorganisms (either native or non-native) into the subsurface to either bioaccumulate heavy metals or radionuclides, or transform them such that they become less toxic or less mobile in the subsurface.

With the exception of the placement of temporary work/sample preparation trailers at the test plots, no new construction is involved with the operation of the Field Research Center. Existing utilities will be used. Heavy equipment (e.g., drill rigs, brush hogs, augers) will be used when necessary for site clearing prior to conducting research at the background or contaminated sites. The equipment will used for short periods of time. Best management practices and all applicable rules and regulations will be followed during the use of equipment.

3.2.2.7 *Work-for-Others Program*

The Work-for-Others Program and the National Prototyping Center are hosted by DOE and include the shared use of certain facilities and resources at Y-12. Under the No Action - Planning Basis Operations Alternative, DOE would continue to host the projects and activities of other Federal agencies, foreign governments, and other countries at activity levels not exceeding those of the historic past. The Work-for-Others Program was not affected by the 1994 stand-down of Y-12 DP mission activities.

3.2.2.8 *Technology Transfer Program*

The Technology Transfer Program, hosted by DOE, has a goal to apply unique expertise, initially developed for highly specialized military purposes, to a wide range of manufacturing situations to support expansion of the capabilities of the U.S. industrial base. Under the No Action - Planning Basis Operations Alternative, DOE would continue to host the projects and activities of the Technology Transfer Program at levels not exceeding those of the historic past. The Technology Transfer Program was not affected by the 1994 stand-down of Y-12 DP mission activities.

Technology Transfer activities that would be expected to continue include the following:

- Predictive Maintenance
- Computer-aided Design/Manufacturing/Engineering/Specific Technologies
- Manufacturing and Inspection Technologies

3.2.3 Alternative 2 (No Action - Planning Basis Operations Alternative Plus HEU Storage Mission Alternatives)

This alternative includes the No Action - Planning Basis Operations Alternative plus a New HEU Storage Mission Facility. There are two proposed options for the HEU Storage Mission at Y-12: (1) construct a new HEU Materials Facility at one of two potential candidate sites, and (2) construct an upgrade expansion to existing Building 9215. The preferred option is to construct and operate the new HEU Materials Facility, which would enable Y-12 to continue to safely and securely store Categories I and II HEU, including canned subassemblies that contain HEU; HEU in metal and oxide form in cans that is part of the strategic reserve or excess inventories. Scrap material that contains HEU awaiting recovery (Central Scrap Management Office scrap metal, oxides and other miscellaneous compounds that are being returned from other DOE facilities and university programs) will be stored in existing facilities until reprocessed to an acceptable form. A discussion of each of the options and the candidate sites for the proposed new HEU Materials Facility is provided in the following sections.

3.2.3.1 *Alternative 1B (No Action - Planning Basis Operations Alternative)*

Under the No Action - Planning Basis Operations Alternative, the HEU Materials Facility would not be constructed. The Y-12 National Security Complex would continue to use the existing storage facilities (Buildings 9204-2, 9204-2E, 9204-4, 9215, 9720-5, 9206, and 9998) to perform the HEU Storage Mission and meet DOE requirements. Appendix A.4 gives a detailed description of these buildings. Most of these facilities have been constructed for HEU storage by building vault space within existing buildings or as appendages to buildings. The existing storage facilities rely upon an appropriate mix of both physical, engineered, and administrative controls to safely and securely store HEU. Some of the buildings in which storage facilities are located have been identified as not meeting current DOE standards for natural phenomena events (e.g., tornado and seismic occurrences). Although the facilities now used for HEU storage provide sufficient space for current and near-term future national security needs, they do so at increasingly greater difficulty and costs associated with meeting DOE, design, ES&H, and security requirements.

3.2.3.2 *Alternative 2A (No Action - Planning Basis Operations Alternative Plus Construct and Operate a New HEU Materials Facility)*

This section includes a description of the proposed new HEU Materials Facility, its construction and operation, the candidate sites for the facility, and infrastructure requirements. The new HEU Materials Facility would replace the use of the existing storage vaults and facilities located within existing Y-12 buildings as described in Section 3.2.2.1. The Category I and II HEU materials in storage facilities located in Building 9720-5, 9204-2E, 9204-2, 9998, 9215, 9206, and 9204-4 would be consolidated in the new HEU Materials Facility. All operations associated with HEU storage, including transport and receiving, would be transferred to the new HEU Materials Facility. Existing storage facilities would be used for other activities or declared surplus and turned over to EM for D&D, based on a formal transition process review described in Appendix A.1.2. D&D estimated wastes volumes are provided in Section 5.11.2 of this document.

HEU Materials Facility Description

The proposed HEU Materials Facility would be a single structure with a total footprint of approximately 12,077 m^2 (130,000 ft^2). The HEU Materials Facility would be used for long-term storage of Categories I and II HEU that is not “in process.” In process HEU is material that is actually being used in manufacturing and is tied up in equipment or being handled within manufacturing facilities or part of processing activities. The new facility would provide the capacity to store approximately 14,000 cans and 14,000 drums (208-L [55-gal] equivalents) of HEU, a surge capacity area for an additional 4,000 drums, and a storage area for material currently under international safeguards. The facility would be covered by an earthen berm. Figure 3.2.3–1 shows an artist’s rendering of the proposed HEU Materials Facility.

The design of the HEU Materials Facility would meet Y-12 Conduct of Operations and Integrated Safety Management requirements; minimize the number of personnel required for operations and security; and meet DOE requirements for SNM accountability and control. The design service life of the proposed new facility would be 50 years. The HEU Materials Facility would be equipped with appropriately sized filtered heating, ventilation, and air conditioning (HVAC) systems. These systems would constitute a vital component in the protection of workers, the public, and the environment. While the facility would not have airborne uranium emissions under routine operations, sensors would trigger a series of barriers to prevent the escape of radioactive materials from within the HEU Materials Facility during an off-normal occurrence.

The material processing areas within the HEU Materials Facility would incorporate the appropriate use of gloveboxes, inert atmosphere, negative air pressure, and other engineered controls, supported by administrative controls, to protect the facility workers from exposure to radiological and hazardous materials. Exhaust emissions for the facility would comply with the applicable Federal and state requirements. In conjunction with other engineered containment measures at the container and storage vault levels and with supporting administrative controls, the ventilation system barriers would provide a layered system of protection.

Other systems that would be included in the new HEU Materials Facility for facility operation and ES&H protection include:

- Criticality Accident Alarm System
- Emergency Notification System
- Central Alarm System
- Fire Suppression Alarm Systems
- Telephone and public address system

- Classified and unclassified computer network
- Personnel Monitoring System
- Berm and other security-related sensors
- Automated inventory system with continuous real-time monitoring

The HEU Materials Facility would provide secure docking for safeguard transports (SGTs) and safe-secure trailers (SSTs) to ensure the secure, safe transfer of secondaries and other materials containing HEU. The shipping and receiving docks at the HEU Materials Facility would accommodate the simultaneous loading and unloading of three SGTs or SSTs. A parking area for an additional seven SGTs and/or SSTs would be included within the facility site footprint. The docks and long-term parking areas would accommodate the trailers and associated tractors. The dock parking area would have the electrical hookups required for the SGTs and SSTs.

Separate confirmatory areas would contain the equipment necessary to perform material receipt verification and nondestructive assay (NDA) of the materials received. Access to the storage and work areas in the facility would be controlled and monitored using both active and passive technological methods and administrative controls. To further reduce operational costs, the new HEU Materials Facility would include provisions for an enclosed and secure transit corridor. The corridor would connect the HEU Materials Facility with potential future modernization projects such as the Enriched Uranium Manufacturing Facility. HEU storage practices would involve application of simple, rugged, easily maintained, state-of-the-art technologies and techniques. The use of a horizontal drum-storage system that would place individual drums on a seismically qualified, storage rack is being evaluated. The racks would be designed, fabricated, and installed to meet the applicable requirements specified in DOE-STD-1020-94, *Natural Phenomena Hazards Design and Evaluation Criteria for Department of Energy Facilities*. All racks, which would have six vertical storage locations, would include features to ensure that during a seismic event, drums/containers would not become dislodged from their storage locations. The system would require the use of a turret-mast forklift to permit straight-in and straight-out aisle entrance and exit. In addition, this forklift would also be able to handle drums from either the left or right because of the ability to reverse the fork mechanism. A guidance system would be installed to guide the forklift when operating in the storage aisle. Such a system would maximize storage space by eliminating the need for forklift turning space within the storage bays.

The can storage system being evaluated for use in the facility consists of a palletized rack storage system which will have cavities to receive the cans. Each pallet would include a removable, lockable metal cover. Final decisions on storage systems would depend on the completion of a detailed nuclear criticality safety analysis. The impact of the various storage systems and materials on workers and public health and safety would be evaluated and would be incorporated in the facility Preliminary and Final Safety Analysis Reports.

Design, site preparation, construction, and operational activities would be conducted in accordance with applicable regulations, DOE Orders, national codes, and other requirements identified in Chapter 7, and the requirements established during preparation of the Preliminary Safety Analysis Report. Some elements of the new HEU Materials Facility would be designed to meet natural phenomena PC-3 requirements (See Glossary for definition of PC levels).

The preliminary schedule for the project indicates that site preparation would begin in the second quarter of FY 2002, with construction complete in FY 2006.

HEU Materials Facility Construction

The current HEU Materials Facility design calls for a single-story storage structure with reinforced concrete floors, roofs, and walls. The entire facility would be surrounded and covered by an earthen berm of compacted clay and rock riprap (see Figure 3.2.3–1). The last clay fill would be installed to create a finish slope that would enable water to drain off to the west, north, and east sides of the berm. Once the final clay cap has been installed, the entire berm would receive a layer of gravel.

The structure's foundation would be concrete piers that are drilled down into the bedrock of the site, or a thick concrete slab. To reduce the overall footprint of the structure, a precast-concrete crib retaining wall would be constructed on the north and west sides of the proposed HEU Materials Facility. The precast-concrete retaining wall would be 8 to 10 m (25 to 30 ft) high. A suitable foundation would be provided for the crib wall. Double cells would be required because of the proposed height of the crib walls. Crib walls would be backfilled with rock riprap.

Conventional construction techniques would be used to build the HEU Materials Facility. TDEC would be included on all permitting and inspections during construction. Construction activities would be performed in a manner that assures protection of the environment during the construction phase. Techniques would be used to minimize the generation of construction debris that would require disposal. Disposal of construction debris would be made in accordance with waste management requirements in properly permitted disposal facilities. The extent and exact nature of such activities as site clearing, infrastructure improvements, and support facility construction required would depend on the candidate site considered for the HEU Materials Facility. Throughout the construction process stormwater management techniques, such as silt fences and runoff diversion ditches, would be used to prevent erosion and potential water pollutants from being washed from the construction site during rainfall events.

As conceptually designed, about 4 ha (10 acres) of land would be required for the HEU Materials Facility. Additional land area may be required to accommodate parking, access roads, and support structures (e.g., security infrastructure requirements). The actual amount of land required depends on the selected site. During construction, about 0.8 ha (2 acres) of land would be required for a construction lay-down area. The lay-down area would be located within or near the location designated for the facility. Following construction, the lay-down area would be restored to its pre-construction condition or incorporated into the landscape or infrastructure support design of the site.

HEU Materials Facility Operation

The following discussion outlines the anticipated workflow for storage operations in the proposed new HEU Materials Facility. Storage operations in the new facility would replace existing HEU storage operations for Categories I and II as described in Section 3.2.2.1. Appropriate procedures to implement this workflow would be developed after the final design is approved.

Drum Storage. The following list identifies the main operational steps that would be involved in handling drums containing HEU materials.

- SST arrives at the loading dock
- Shipping containers are offloaded and moved to the NDA and re-containerization area
- A transfer check is performed
- Drums undergo nondestructive assay (NDA)
- HEU materials are placed in new containers if required
- Each drum is entered into the computerized tracking system and is assigned a rack location
- Each drum is moved by forklift to its assigned location in the storage area
- Each drum is connected to the automated inventory system

Canned Storage. The Continuous Automated Vault Inventory System (CAVIS), a computerized inventory and monitoring system, is being evaluated for use on those cans stored in the HEU Materials Facility. The following list identifies the main operational steps that would be used in handling cans containing HEU materials.

FIGURE 3.2.3–1.—*Artist's Rendering of Proposed Highly Enriched Uranium Materials Facility at Site A.*

- SST or in-plant transfer vehicle arrives at the loading dock
- Shipping containers with cans are offloaded and moved to the NDA and re-containterization area
- A transfer check is performed
- Cans undergo NDA
- Cans are placed in the can pallets
- Each can and pallet is entered into the computerized tracking system and is assigned a rack location
- Each loaded pallet is moved by forklift to its assigned location in the storage area
- Each loaded pallet is connected to CAVIS and then activated

An operational consideration that must be accommodated is the need to operate both the existing HEU storage facilities and the new HEU Materials Facility in parallel for approximately 1 year after the new facility is certified operational. This dual operation period would also cover the transfer of materials from the current storage facilities to the new facility. Such dual operation would result in a short-term increase in personnel and operational costs because of the need to staff the new facility while the current facilities also remain in operation. When a currently used storage facility is emptied of material (the material having been transferred to the new facility), that facility would be eligible for reuse or shutdown.

HEU Materials Facility Candidate Sites

Site A

Site A for the proposed HEU Materials Facility is in the Y-12 West Portal Parking Lot, just north of Portal 16. This site is outside of but adjacent to the existing Perimeter Intrusion, Detection, and Assessment System (PIDAS). Figure 3.2.3–2 shows the location of Site A relative to other buildings at Y-12. This West Portal Parking Lot is close to the existing HEU processing complex and represents a large level site with minimal site preparation requirements.

Site A preparation involves site design, relocation of existing utilities (e.g., lights, towers, and underground pipelines), construction of an addition to the Polaris Parking Lot, extension of utilities to the new facility site, modifications to an existing portal, removal of nearby office trailers, and modification of a cooling tower. The PIDAS would need to be extended to encompass this area after the HEU Materials Facility was completed.

Source: Tetra Tech, Inc./LMES 2000b.

FIGURE 3.2.3–2.—*Site A for the Proposed Highly Enriched Uranium Materials Facility.*

Construction and Operation

Construction

Relocation of Utilities and Other Features. Site A would be cleared of electrical utilities that would interfere with construction of the HEU Materials Facility. Pole-mounted lighting fixtures, public address system speakers, and associated aerial cables would be removed. An overhead 13.8-kV yard feeder that enters the parking lot from the south would be rerouted around the east side of the parking lot. Overhead electrical services to a guard tower at the northeast corner of the parking lot would be removed and then the tower would be demolished. A high-mast lighting tower located on the northern boundary of the parking lot would be relocated to the north side of Bear Creek Road. Other electrical lines would be relocated as appropriate to cross under the PIDAS. Services to office trailers scheduled for removal would be disconnected.

A water line that passes under the proposed location of the vehicle gate for the new HEU Materials Facility would be relocated to pass under the existing PIDAS at another point. Water service would be extended to the new facility from the relocated water line. Another water line would also be rerouted under the PIDAS from an existing water line just north of Building 9111. An abandoned water line on the north side of the proposed facility site would be removed where it runs within the limits of the proposed project site, and concrete caps would be placed on the end points. A polyvinyl chloride (PVC) sanitary sewer main would be extended to the new facility from the current sanitary sewer system just west of Building 9703-11.

The HEU Materials Facility storm sewer system would include a comprehensive collection system that would tie into the existing system near the northeast corner of the project site. Storm sewer pipe would be reinforced concrete and would be designed to collect a 100-year storm event. The storm sewer system along Bear Creek Road would be designed to accommodate the simultaneous failure of the two 5.7 million L (1.5 million gal) water tanks on the south side of Pine Ridge. Pipe sizes, number of catch basins, locations, etc., would be a consideration of the design of the storm sewer system along Bear Creek Road.

Traffic Planning, Polaris Parking Lot, and Construction Lay-Down Area. The HEU Materials Facility footprint and the alignment of the new PIDAS may require relocation of a short stretch of Bear Creek Road (Figure 3.2.3–3). Early engineering studies show that the new PIDAS would infringe upon the southernmost lane of Bear Creek Road near the northwest corner of the site. If so, an additional vehicle lane would be built on the north side of the existing road. The new lane would be approximately 122 m (400 ft) long. Support poles to the traffic light would be relocated northward. Up to 200 car spaces may be built to replace the parking spaces lost when the proposed HEU Materials Facility is constructed on the existing West Portal Parking Lot. These additional parking spaces would be an extension of the existing Polaris Parking Lot, which is located on the north side of Bear Creek Road, just northwest of the HEU Materials Facility site (see Figure 3.2.3–3). A storm collection system featuring reinforced concrete pipe and curb and gutter catch basins and precast concrete head walls would be designed for the new parking lot expansion. The new storm sewer system would tie into the existing storm sewer system.

The construction staging area for the HEU Materials Facility would occupy approximately 0.8 ha (2 acres) of land and would be north of Bear Creek Road or at a site on the west end of Y-12. The site would be sufficiently graded and developed to accommodate a number of temporary construction trailers, storage buildings, and materials storage yards. The staging area would have electric power and potable water. Sanitary service would be provided by PVC double-wall collection tanks, which would be pumped out as needed. A smaller area 0.4 ha (1 acre) would be available for daily lay-down construction needs in the adjacent parking lot west of Site A. Figure 3.2.3–3 shows the location of the two construction lay-down areas.

Utility Extension. The cooling and potable water lines, electrical services, security systems, standby power, and telephone systems would be extended under the existing PIDAS. All the utility services would be extended from existing Y-12 services from within the Protected Area of Y-12. When completed, the new HEU Materials Facility would have no overhead utilities.

Cooling Tower Modifications. A chilled water loop would be installed to support the new HEU Materials Facility HVAC requirements. This also would require that the new cooling tower (Building 9409-24E) be completed and brought on-line. Piping would be laid in accordance with all necessary safety and security precautions. A chilled water booster pump and piping would be required in conjunction with the new chiller cell. Return chilled water would be used as condenser water.

Removal of Office Trailers. Three office trailers are located east of the West Portal Parking Lot. Personnel would be relocated, and these trailers would be removed and salvaged. The utilities to these trailers would be removed. The area where these trailers are located would be used for the approach road and new PIDAS vehicle entrance to the HEU Materials Facility.

Remediate Construction Lay-Down Area. Once the construction of the HEU Materials Facility is complete, the construction office trailers would be removed and material lay-down areas would be re-graded and seeded after removal of any soil that may have become contaminated with construction-related materials such as diesel fuel.

Site Preparation and Facility Construction. Table 3.2.3–1 lists the construction resource requirements, number of construction workers, and estimated waste generation of constructing the proposed facility on Site A. Site preparation would follow the advanced work described above and would include any excavation, filling, and grading needed to meet design requirements for an on-grade, reinforced concrete structure. Preliminary testing of Site A has shown that the parking lot was partially built on top of a filled area. The subsurface conditions encountered during testing vary widely across the site and include existing fill, residual silts, and weathered shale. Bedrock dips across the site at an angle of approximately 45 degrees as indicated by the auger refusal depths that ranged from 6 to 18 m (20 to 60 ft) below grade. Additional detailed testing would be conducted to fully characterize site geology, hydrology, and soil compaction, as well as to sample for radioactive contamination, mercury, and other materials of concern before construction.

On Site A, the HEU Materials Facility would be a one-story, reinforced concrete building covered by a soil overburden roof. The floor of the facility would be reinforced concrete slab supported on well-compacted sub-grade. Because of the extremely large loading imposed by the soil overburden and the thick roof slab, the columns, exterior walls, and storage area perimeter walls would be supported by reinforced concrete drilled piers or thick concrete mat. Piers would be socketed into sound bedrock to a depth of 1.8 m (6 ft). Drilled pier diameters and depths would vary across the building length with an average depth approximately 12 m (40 ft). The HEU Materials Facility structure would be designed to meet the requirements of the applicable DOE Orders and Standards and the appropriate model building codes for specialized construction. The design for the natural phenomena hazards (earthquake, tornadic winds, floods, and lightning) would be in accordance with DOE-STD-1020-94, *Natural Phenomena Hazards Design and Evaluation Criteria for Department of Energy Facilities*.

Operation

The HEU Materials Facility operations would be the same as described earlier. Table 3.2.3–2 lists the operations requirement, number of operations workers, and the expected waste generations for the proposed HEU Materials Facility.

Source: Tetra Tech, Inc./LMES 2000b.

FIGURE 3.2.3–3.—*Highly Enriched Uranium Materials Facility Site A Construction Lay-Down Areas, New Parking Lot, and New Alignment of Bear Creek Road.*

TABLE 3.2.3–1.—*Highly Enriched Uranium Materials Facility Construction Requirements and Estimated Waste Volumes for Site A or Site B*

Requirements	Consumption	
Materials/Resource		
Electrical energy (MWh)	5,000	
Concrete m³ (yd³)	25,100 (32, 830)	
Steel (t)	2,100	
Liquid fuel and lube oil L (gal)	568,000 (150, 050)	
Water L (gal)	7,571,000 (2,000,046)	
Aggregate m³ (yd³)	1,550 (2,027)	
Land ha (acre)	5 (12.3)	
Employment		
Total employment (worker years)	145	
Peak employment (workers)	220	
Construction period (years)	4	
Waste Category	**Volume**	
	Site A	**Site B**
Low-level		
Liquid m³ (gal)	none	none
Solid m³ (yd³)	none	none
Mixed Low-level		
Liquid m³ (gal)	none	none
Solid m³ (yd³)	none	22,707[a] (29,700)
Hazardous		
Liquid m³ (gal)[b]	3 (800)	3 (800)
Solid m³ (yd³)	38.2 (50)	38.2 (50)
Nonhazardous (Sanitary)		
Liquid m³ (gal)	14,347 (3,970,000)	14,349 (3,970,000)
Solid m³ (yd³)	none	none
Nonhazardous (Other)		
Liquid m³ (gal)	none	none
Solid m³ (yd³)[b]	3,823 (5,000)	3,823 (5,000)

[a]Excavated contaminated soil to a depth of 3 ft at Site B.
[b]Construction debris.
Source: LMES 2000b.

TABLE 3.2.3–2.—*Highly Enriched Uranium Materials Facility Annual Operation Requirements and Estimated Waste Volumes*

Requirements	Consumption
Electrical energy (MWh)	5,900
Peak electrical demand (MWe)	1.1
Liquid fuel L (gal)	none
Natural gas m^3 (yd^3)	none
Water L (gal)	550,000 (145,295)
Plant footprint ha (acres)	4 (9.9)
Employment (workers)	30 (100[a])

Waste Category	Average Annual Volume
Low-level	
Liquid m^3 (gal)	0.8 (200)
Solid m^3 (yd^3)	119 (156)
Mixed Low-level	
Liquid m^3 (gal)	none
Solid m^3 (yd^3)	none
Hazardous	
Liquid m^3 (gal)	2.5 (660)
Solid m^3 (yd^3)	1.5 (2)
Nonhazardous (Sanitary)	
Liquid m^3 (gal)	777.1 (205,300)
Solid m^3 (yd^3)	none
Nonhazardous (other)	
Liquid m^3 (gal)	4.2 (1,100)
Solid m^3 (yd^3)	178.9 (234)

[a]Approximately 100 workers would be required during the 1-year transition period while the existing HEU materials in storage are transferred to the new HEU Materials Facility.
Source: LMES 2000b.

Site B

Site B for the proposed HEU Materials Facility is located at the Y-12 Scrap Metal Yard. The site is south of Building 9114, west of the westernmost portion of the Y-12 PIDAS fence, and north of Portal 33 and Second Street. Figure 3.2.3–4 shows the location of Site B relative to other buildings at Y-12. Old Bear Creek Road is the western boundary of the proposed Site B.

Site B preparation would involve site design, relocation of existing utilities (e.g., lights, underground water lines, storm sewers, steam lines, etc.), a portion of Old Bear Creek Road, numerous structures, office trailers, and a portion of the Y-12 Scrap Metal Yard. The PIDAS would need to be extended to encompass this area after the HEU Materials Facility was completed. A sector of the existing PIDAS fence would need to be modified to install a vehicular entry gate for the new facility.

Construction and Operation

Construction

Table 3.2.3–1 lists the construction requirements and estimated waste volumes for the proposed HEU Materials Facility.

Relocation of Utilities and Other Features. A steam line and steam condensate line that serves the Y-12 West End Tank Farm and Building 9114 would be relocated. Numerous overhead electrical lines within the proposed site would have to be removed and a 143.8-kV electrical line along Old Bear Creek Road would be relocated westward from its current location. Numerous communications and computer lines would have to be rerouted. Portions of a sanitary sewer main that serve the west end of Y-12 would be rerouted. A water line that follows the Old Bear Creek Road alignment would also be relocated for the new facility.

Sanitary sewer services would be provided for the new facility by extending a sanitary sewer main from the relocated sewer main along Old Bear Creek Road. Potable water and firewater services for the new facility would be extended from the relocated water line along Old Bear Creek Road.

Electrical services, chilled water lines, security service lines, and computer services that would serve the proposed new facility would be extended from the Y-12 Site. These existing Y-12 services would be rerouted under the existing Y-12 PIDAS just north of Post 33.

The proposed HEU Materials Facility storm sewer system for Site B would include a comprehensive collection system that would tie into the existing Y-12 storm sewer system. Off-site water, which would be coming from the north of the proposed site, would be rerouted around the new HEU Materials Facility on the west side along the relocated Old Bear Creek Road. Storm sewer pipe would be reinforced concrete pipe and would be designed for a 100-year storm event.

FIGURE 3.2.3–4.—*Site B for the Proposed Highly Enriched Uranium Materials Facility.*

Source: Tetra Tech, Inc./LMES 2000b.

Traffic Planning, Construction Lay-Down Areas, and Parking. Additional parking areas would not be needed to meet the needs of the operations personnel associated with the new HEU Materials Facility at Site B. Sufficient parking is available at the S-3 Parking Lot. However, temporary parking spaces for construction workers and plant personnel would need to be developed in the west tank area and just south of old Post 17 during construction of the new facility on Site B. Approximately 0.8 ha (2 acres) would be needed for the temporary parking spaces. The temporary parking would be needed because the S-3 Parking Lot would be used as a construction lay-down area for the new facility. Figure 3.2.3–5 shows the Site B construction lay-down area and temporary parking locations. The construction staging area would have electrical power and potable water. Sanitary sewer services would be provided by PVC double-wall collection tanks, which would be pumped out as needed.

Remediate Construction Lay-Down Area. Once the construction of the HEU Materials Facility is complete, the construction office trailers and material lay-down areas would undergo remediation. The potable water lines and the electrical services would be removed. Any office trailers would be removed. The parking lot would then be paved with a 4-cm (1.5-in)-thick asphalt concrete surface. The parking lot spaces would then be relined for employee parking.

Demolition of Existing Structures. Trailers 9983-18, 9983-24, 9983-29, 9983-45, 9983-46, 9983-74, and 9983-99 would have to be removed and relocated or salvaged. Structures 9831, 9720-15, 9814, 9819, 9420, 9420-1, 9627, and 9626 would have to be demolished. The functions that occur within the buildings to be demolished would be relocated to other areas at Y-12.

Site B Environmental Remediation. A portion of the existing Y-12 Scrap Metal Yard would have to be cleared of materials and environmentally stabilized before construction of the new HEU Materials Facility could be started. Approximately 15,290 m^3 (20,000 yd^3) of scrap and an estimated 13,000 m^3 (17,000 yd^3) of contaminated soil (VOCs, metals, and radionucluides) would be removed from the site. Current planning is to dispose of this material in the new Environmental Management Waste Management Facility being constructed in the West Bear Creek Valley area of Y-12.

Operation

The HEU Materials Facility operations would be the same as described earlier. Table 3.2.3–2 lists the operations requirements, number of operation workers, and expected waste generations for the proposed HEU Materials Facility.

3.2.3.3 *Alternative 2B (No Action - Planning Basis Operations Alternative Plus Upgrade Expansion of Building 9215)*

Under this alternative, the storage of HEU would be accommodated through the expansion of the existing Building 9215. The building expansion would be approximately 48 by 90 m (160 by 300 ft) with two floors and would be sized to handle all of the long-term storage requirements anticipated for Y-12 similar to that described for the proposed new HEU Materials Facility. The upgrade expansion of Building 9215 would replace the use of existing storage vaults and facilities located within existing Y-12 buildings as described in Section 3.2.2.1, under the No Action - Planning Basis Operations Alternative for the DP HEU Storage Mission. The Categories I and II HEU materials in storage facilities located in Buildings 9720-5, 9204-2E, 9204-2, 9998, 9206, and 9204-4 would be consolidated in the new Building 9215 storage expansion. A modest amount of in-process storage associated with processing activities in Buildings 9212 and 9215 would continue. All operations associated with HEU storage, including transport and receiving, would be transferred to the new Building 9215 storage expansion.

Source: Tetra Tech, Inc./LMES 2000b.

FIGURE 3.2.3–5.—*Highly Enriched Uranium Materials Facility Site B Construction Lay-Down Area and Temporary Parking Lot.*

The proposed site for construction of the Building 9215 expansion is a parcel of land located west of Buildings 9212 and 9998 and north of Building 9215 as shown in Figure 3.2.3–6. This parcel has no major permanent structures and is currently occupied by trailers and temporary facilities. The proposed site is on high ground, not susceptible to flooding or storm water runoff.

The expansion of Building 9215 would allow the automated transfer of material between the storage building expansion and Building 9215, from which the material can be moved internally to Buildings 9212 and 9204-2E. An enclosed transfer system between these major production facilities is envisioned.

The design of the storage building expansion would allow much more efficient utilization of storage space than can be achieved in existing storage buildings. This would be accomplished by layout of the building expansion in repetitive bays specifically sized for optimum storage using modular storage vaults for can storage and 1.2 by 1.2 m (4 by 4 ft) pallets for drum storage. Should future needs for storage increase beyond current projections, the new expansion storage facility could be expanded by adding additional bays. The expansion of Building 9215 for consolidated HEU storage would allow the potential use of existing storage facilities for other Y-12 mission activities or to be declared surplus.

Building 9215 Expansion Site Preparation

The expansion of Building 9215 for HEU storage would require approximately 0.8 ha (2 acres) to accommodate the construction activities and the building expansion footprint. The proposed site for the expansion is shown in Figure 3.2.3–6. Personnel in the existing trailers would be relocated and the trailers would be removed and salvaged. Other temporary facilities would be relocated and utilities and other infrastructure would be modified to support the construction activities and operation of the new expansion.

Construction waste from the storage building expansion would consist of excavated soils and general construction debris. Construction activities would be planned and performed to minimize the quantities of excavated soils needing disposal. Table 3.2.3–3 shows the construction resource requirements, number of construction workers, and estimated waste generation of constructing the Building 9215 expansion storage facility. The expansion of Building 9215 for consolidated storage of HEU would take approximately 4 years to implement.

Building 9215 Expansion Storage Operations

Operations within the proposed storage building expansion would be the same as described earlier under Site A for the proposed new HEU Materials Facility. Storage operations in the Building 9215 storage expansion would replace existing HEU storage operations as described in Section 3.2.2.1. Table 3.2.3–4 shows the annual operations requirements for the Building 9215 expansion storage facility.

Source: Tetra Tech, Inc/LMES 2000b.

FIGURE 3.2.3–6.—*Proposed Building 9215 Expansion Area.*

TABLE 3.2.3–3.—*Building 9215 Expansion Construction Requirements and Estimated Waste Volumes*

Requirements	Consumption
Materials/Resource	
Electrical energy (MWh)	5,000
Concrete m^3 (yd^3)	7,650 (10,005)
Steel (t)	1,100
Liquid fuel and lube oil L (gal)	265,000 (70,006)
Water L (gal)	5,678,000 (1,499,968)
Land ha (acre)	1 (2.5)
Employment	
Total employment (worker years)	145
Peak employment (workers)	220
Construction period (years)	4
Waste Category	**Volume**
Low-level	
Liquid m^3 (gal)	none
Solid m^3 (yd^3)	none
Mixed Low-level	
Liquid m^3 (gal)	none
Solid m^3 (yd^3)	none
Hazardous	
Liquid m^3 (gal)	1.1 (300)
Solid m^3 (yd^3)	15.3 (20)
Nonhazardous (Sanitary)	
Liquid m^3 (gal)	14,347 (3,970,000)
Solid m^3 (yd^3)	none
Nonhazardous (Other)	
Liquid m^3 (gal)	none
Solid m^3 (yd^3)[a]	3,058 (4,000)

[a]Construction debris.
Source: LMES 2000b.

TABLE 3.2.3–4.—*Building 9215 Expansion Storage Facility Annual Operation Requirements and Estimated Waste Volumes*

Requirements	Consumption
Electrical energy (MWh)	10,900
Peak electrical demand (MWe)	1.4
Liquid fuel L (gal)	none
Natural gas m^3 (yd^3)	none
Water L (gal)	720,000 (190,204)
Plant footprint ha (acre)	0.5 (1.2)
Employment (Workers)	49 (100[a])
Waste Category	**Average Annual Volume**
Low-level	
Liquid m^3 (gal)	0.6 (160)
Solid m^3 (yd^3)	119 (156)
Mixed Low-level	
Liquid m^3 (gal)	none
Solid m^3 (yd^3)	none
Hazardous	
Liquid m^3 (gal)	2.5 (660)
Solid m^3 (yd^3)	1.5 (2)
Nonhazardous (Sanitary)	
Liquid m^3 (gal)	1269.4 (335,350)
Solid m^3 (yd^3)	none
Nonhazardous (Other)	
Liquid m^3 (gal)	4.2 (1,100)
Solid m^3 (yd^3)	178.9 (234)

[a]Approximately 100 workers would be required during the 1-year transition period while the existing HEU materials in storage are transferred to the new HEU Materials Facility.
Source: LMES 2000b.

3.2.4 Alternative 3 (No Action - Planning Basis Operations Alternative Plus Special Materials Mission Alternative)

This alternative includes the No Action - Planning Basis Operations Alternative Plus a New Special Materials Complex at one of three candidate sites. The proposed action is to construct and operate a new Special Materials Complex which would enable Y-12 to ensure efficient production of adequate quantities of special materials for all anticipated scenarios considered for the enduring nuclear weapons stockpile while providing for improved worker health and safety. A key component of the proposed Special Materials Complex is the construction of a new Beryllium Facility to house all beryllium production operations at

Y-12. Facility design would incorporate strategies that replace the current administrative safety and health controls and personal protective equipment with engineered controls. A discussion of the alternatives and the candidate sites for the proposed new Special Materials Complex is provided in the following sections.

3.2.4.1 *Alternative 1B (No Action - Planning Basis Operations Alternative)*

Under the No Action - Planning Basis Operations Alternative, the new Special Materials Complex would not be constructed. The Y-12 National Security Complex would continue to use the existing special materials operations facilities (Buildings 9204-2, 9202, 9201-5, 9201-5N, 9731, 9404-11, and 9995) to perform the Special Materials Mission and meet DOE requirements. Appendix A.4 gives a detailed description of these buildings. The existing special materials operations facilities range in age from 27 to more than 50 years old, and the operations contained within them were not designed to meet today's health, safety, natural phenomena, environmental, and security requirements. These facilities therefore rely heavily on administrative controls to provide for the protection of workers, the public, and the environment from the hazards associated with beryllium and other special materials. In addition, some processes have not been operated in several years and would require extensive equipment upgrades and facility refurbishment. Even so, worker health and safety protection would still rely on administrative rather than engineered controls.

3.2.4.2 *Construct New Special Materials Complex*

This section includes a description of the proposed Special Materials Complex, its construction and operation, the candidate sites for the facility, and infrastructure requirements. The Special Materials Complex would replace special materials operations currently performed in Building 9731, 9202, 9201-5, 9201-5N, 9995, 9204-2, and 9404-11, as described in Section 3.2.2.1 under the No Action - Planning Basis Operations Alternative for the DP Special Materials Operations Mission.

Special Materials Complex Description

The proposed Special Materials Complex shown in Figure 3.2.4–1 would house a number of separate processing operations and the support facilities to serve each. These operations would be housed in distinct areas to ensure that the safety basis of operation of each is independent of the other operation. Included in the Special Materials Complex would be:

- All beryllium production operations at Y-12
- A facility for purification of special material
- A manufacturing/warehouse facility to produce special materials and provide for storage of raw materials and parts
- An isostatic press for forming blanks for machining
- A core support structure to house common support functions for the Complex

The facilities would be attached to one another with weather-protected walkways to facilitate the flow of materials.

The preliminary schedule for the Special Materials Complex project indicates that site preparation could begin as early as FY 2002 with construction complete in the FY 2006 - 2007 timeframe.

Beryllium Facility Description

The Beryllium Facility would be a two-story building constructed from reinforced concrete. Portions of the roof and exterior walls would be designed to resist the wind and missiles generated from a tornado. The first floor slab, beams, and columns would also be reinforced concrete. The ground floor would be a concrete

Source: LMES 2000c.

FIGURE 3.2.4–1.—*Artist's Rendering of Proposed Special Materials Complex.*

slab, and foundations for the concrete columns would be spread footings supported on a well-compacted subgrade. The area of the Beryllium Facility would be approximately 13,378 m^2 (144,000 ft^2). Ventilation zones would be used to contain contamination. The primary (regulated) zone would house the actual process operations, the buffer zone would be for all areas directly surrounding the primary zone, and nonregulated zones would surround the buffer zone. Each zone would have increasing negative air pressure passing from the nonregulated zone inward to the primary zone.

A containment system would be established for the collection and HEPA filtration of ventilation exhaust air from primary enclosures and equipment containing hazardous materials before discharge to the main ventilation exhaust system. Centralized air emission control systems would ensure environmentally acceptable discharges of all ventilation and would include a central discharge stack and a system to permit collection of appropriate air samples.

The major function of the second floor would be to provide space for materials storage, non-toxic support facilities, and for the HVAC and electrical support needed by the equipment on the first floor. This would allow the support equipment to be placed in close proximity to the operations without actually placing it within the regulated buffer areas.

The Beryllium Facility would house all production operations that must be performed in a beryllium control area. The facility would use state-of-the-art engineered controls to eliminate the required use of respirators during normal operations and comply with the new ACGIH limit for suspended beryllium in air of 0.2 Fg/m^3 (125 x 10^{-11} lb/ft^3). In addition to housing all the beryllium production operations at Y-12, the Beryllium Facility would house major support functions involving beryllium. The Beryllium Facility would house the following activities:

- Beryllium blank forming operations
- Beryllium machining
- Beryllium inspection and certification
- Materials and parts storage
- Beryllium analytical laboratory work
- Beryllium air monitoring laboratory analysis
- Laboratory analysis of smears to detect beryllium
- Spray operation for beryllium sprayed parts
- Inspection and certification of parts
- Tooling preparation
- Maintenance
- Prototype development
- Packaging of accepted parts

Because of the toxic nature of beryllium, appropriate measures would be incorporated in the building design to ensure isolation of workers from hazardous materials (e.g., the use of multiple occupancy zones to achieve containment; and the isolation of all people, equipment, and processes not required to be in direct contact with the toxic materials).

The Beryllium Facility would have two main production areas: (1) the blank forming and machining operations, and (2) the plasma spray operations. Equipment and supporting services would be provided to form beryllium powder into blanks. All blank forming operations would be enclosed in gloveboxes to protect workers from exposure to beryllium. Blank forming operations would include removing containers of powder from storage units, weighing and blending the powder, loading it into molds to be pressed, pressing, disassembling the molds, removing the formed blanks, cleaning and certifying blanks, and transferring them to machining.

The machining process would rough and finish grind the formed blanks to the required dimensions using speciality grinding machines. The machining operations would be enclosed in gloveboxes. The machined parts would be cleaned, inspected, and nondestructively tested. Parts that pass inspection and nondestructive testing would be certified. Beryllium part certification would include physical testing, dimensional metrology, and radiography. The certified parts would be packaged and transported to the beryllium shipping area.

All plasma spraying would be performed in inert atmosphere gloveboxes. Plasma spray operations would require a tooling preparation area, dimensional inspection area, and a radiographic inspection area to certify components. The tooling preparation area would include a demineralized water tank, a nickel plating tank, and an acid-cleaning tank. After acceptance, the completed parts would be cleaned and packaged for shipment.

The gloveboxes and any enclosed area within the secondary zone would be equipped with wash-down capability. Any water used for washing down these areas would be collected for filtration and sampling prior to their discharge to the Y-12 sanitary sewer system. The Beryllium Facility would also include a shower and change area for operations workers, and storage area for in-process and completed parts, equipment, and supplies.

A developmental laboratory area would be provided in the Beryllium Facility to support the development of process improvements and to troubleshoot existing beryllium mechanical and chemical processes. An analytical laboratory would also be included to support the Beryllium Worker Protection Program and the material production process.

Special Materials Manufacturing/Warehouse Facility Description

The Special Materials Manufacturing/Warehouse Facility would contain only standard industrial hazards. Although certain special materials production requires isolating workers from the process, it would not pose a risk that would exceed a standard industrial design approach.

The Special Materials Manufacturing/Warehouse Facility would be a rigid-framed, pre-engineered building and would occupy approximately 2,508 m^2 (27,000 ft^2). The roof structure over the production area would range from at least 7.3 to 9.75 m (24 to 32 ft). The exterior walls would be insulated with an interior liner panel. The roof would be sloped from one end to the other and be insulated. The foundation for the building columns would be spread footing supported by a well-compacted subgrade. A portion of the production processing area would be contained in a separate room constructed to maintain the required environmental control. This room would be masonry construction.

The Special Materials Manufacturing Facility would produce rough pressed parts that would be transferred to a separate building for machining and inspection. Gloveboxes would contain some special materials processing operations and would be supplied when required. Workers in the Special Materials Manufacturing Facility would use the Core Support Facility change houses.

The Facility would also have warehouse space to serve all the Special Materials Complex. The warehouse would house raw materials for special materials production and nontoxic materials that may be needed for the Beryllium Facility. Flammable solvents would not be stored in this warehouse.

Purification Facility Description

The Purification Facility would replace a production process to purify a special material that has deteriorated since the end of the Cold War. Currently, only a development-scale facility and capability for this special material exists at Y-12. This development facility will not meet the level of production projected to support the enduring stockpile.

The Purification Facility would be a single-story, high-bay building with a partial second-level mezzanine. The Purification Facility would be approximately 929 m^2 (10,000 ft^2) in area. The purification process uses the flammable liquid acetonitrile (ACN). As a result, facility design would be required to meet appropriate safety requirements involved with handling ACN. It would have an adjoining tank farm to store the ACN, which would have a concrete pad and roof but no exterior walls. The Purification Facility would be constructed from structural steel framing with metal roof deck and siding. The mezzanine would be steel plate supported on structural steel framing (beams and columns). The roof and wall panels would be backed with insulation and interior metal liner panels. One of the exterior walls would be constructed to relieve internal pressure. The foundation for the columns would be spread footings supported on a well-compacted subgrade. Sealed concrete curbing would contain any liquids spilled in the exterior tank farm.

Purification operations would include the following: (1) dissolution, filtration, and recrystallization (2) powder processing in a nitrogen atmosphere; and (3) drying. Because ACN would be present in substantial quantities, the purification operation would be designed with high-hazard electrical components and operations would be performed in a closed system consisting of tanks, process piping, gloveboxes, and suitable storage containers. An inert cover gas would be used in the system, in conjunction with an ACN vapor recovery system. Portions of both the main level and the mezzanine would be enclosed in a room that would contain gloveboxes and other equipment for handling the solvent ACN. All fixtures in these rooms would be explosion proof. An enclosed control room would have egress paths that do not transverse the rest of the purification operating area. The wall between the building and the covered, outdoor area would be designed to withstand an explosion in the tank farm. The main design consideration of this wall would be the protection of workers in the facility from an accidental detonation of solvent. An area for unloading and loading ACN drums would be included in the Purification Facility design.

Press Facility Description

The Press Facility would contain one 0.84-m (33-in) diameter isostatic press that would be used in the blank forming operations for special materials. The press could also be used by future lithium operations. Because of the large amount of stored mechanical energy in the press vessel during operation, the facility would have a wall capable of absorbing any inadvertent release of energy, directing it toward a metal panel wall away from the remainder of the Special Material Complex.

The isostatic press area would house the pressure vessel, the low-pressure mineral oil supply system, the high-pressure mineral oil supply system, a heated mineral oil supply system, press control console, material handling equipment, and parts staging area, and would provide a barricade to protect operating personnel in the event of a failure of the pressure vessel. The current design of the operating and support areas of the Press Facility divides it into three vertical levels. The Press Facility would occupy approximately 836 m^2 (9,000 ft^2) and would be constructed of structural steel and reinforced concrete. The foundation for the structural columns would have spread footings supported on a well-compacted subgrade.

Core Support Facility Description

A Core Support Facility, approximately 1,728 m^2 (18,600 ft^2) in total area, would support the beryllium, purification, and special materials processes to be located in the Special Materials Complex.

The Core Support Facility would be a 7.3-m (24-ft) two-story building of typical industrial construction, with masonry walls and a steel structural frame. Some of the interior partitions in the administration area would be gypsum board on metal studs. The facility is intended to house as many services for the production facilities of the Special Materials Complex as possible, including a common administration area, support and engineering offices, a lunchroom, a maintenance shop, and a central loading dock and some utilities. It would also include change houses to serve all Special Materials Complex workers, except for the beryllium workers who would have a separate change house in the Beryllium Facility.

On-Site Facilities Description

Several additional on-site facilities would also be part of the Special Materials Complex, such as a chiller building, standby diesel generator building, fire protection pump house, and ozonation building. All of these would be unoccupied, remote, stand-alone buildings.

Special Materials Complex Construction

The current Special Materials Complex design calls for a number of separate operations and support facilities with varying design features (see Figure 3.2.4–1). The new Beryllium Facility would be a two-story building constructed from reinforced concrete. The roof and exterior walls would be reinforced concrete and portions would be designed to resist the wind and missiles generated from a tornado. The first floor slab, beams, and columns would also be reinforced concrete. The ground floor would be a concrete slab, and foundations for the concrete columns would be spread footings supported on a well-compacted subgrade.

The Special Materials Manufacturing/Warehouse Facility would be a rigid-framed, pre-engineered building. The foundation for the new facility would be spread footing supported by a well-compacted subgrade.

The Purification Facility would be a single-story, high-bay building constructed from structural steel framing with metal roof deck and siding. One of the exterior walls would be constructed to relieve internal pressure. The foundation for the structure columns would be spread footings supported on a well-compacted subgrade. The Purification Facility would have an adjoining tank farm that would have a concrete pad and roof but no exterior walls.

The Isostatic Press Facility would be a three-level building constructed from structural steel and reinforced concrete. The foundation for the structural columns would be spread footings supported on a well-compacted subgrade.

Conventional construction techniques would be used to build the Special Materials Complex. TDEC would be included on all permitting and inspections during construction. Construction activities would be performed in a manner that assures protection of the environment during the construction phase. Construction techniques would be used to minimize the generation of construction debris that would require disposal. Disposal of construction debris would be made in accordance with waste management requirements in properly permitted disposal facilities. The extent and exact nature of such activities as site clearing, infrastructure improvements, and support facility construction required would depend on the candidate site considered for the Special Materials Complex. Throughout the construction process storm-water management techniques, such as silt fences and runoff diversion ditches, would be used to prevent erosion and potential water pollutants from being washed from the construction site during rainfall events.

As conceptually designed, about 4 to 8 ha (10 to 20 acres) of land would be required for the Special Materials Complex. Additional land area may be required to accommodate parking, access roads, and support structures (e.g., security infrastructure requirements). The actual amount of land required depends on the selected site. During construction, about 0.8 ha (2 acres) of land would be required for a construction lay-down area. The lay-down area would be located within or near the location designated for the facility.

Following construction, the lay-down area would be restored to its pre-construction condition or incorporated into the landscape or infrastructure support design of the site.

Special Materials Complex Operation

The following discussion outlines the different operations in the proposed new Special Materials Complex. The new operations would replace existing Special Materials Operations Mission activities described in Section 3.2.2.1. Appropriate procedures to implement specific operations would be developed after the final design of each facility within the Special Materials Complex is approved.

Beryllium Operations. The Beryllium Facility would have two main production areas: (1) the blank forming and machining operations, and (2) the plasma spray operations. Equipment and supporting services would be provided to form beryllium blanks. All blank forming operations would be enclosed in gloveboxes to protect workers from exposure to beryllium. Blank forming operations would include removing containers of powder from storage units, weighing and blending the powder, loading it into molds to be pressed, pressing, disassembling the molds, removing the formed blanks, cleaning and certifying blanks, and transferring them to machining.

The machining process would rough and finish grind the formed blanks to the required dimensions using speciality grinding machines. The machined parts would be cleaned, inspected, and nondestructively tested. Parts that pass inspection and nondestructive testing would be certified. Beryllium part certification would include physical testing, dimensional metrology, and radiography. The certified parts would be packaged and transported to the beryllium shipping area.

All plasma spraying would be performed in inert atmosphere gloveboxes. Plasma spray operations would require a tooling preparation area, dimensional inspection area, and a radiographic inspection area to certify components. The tooling preparation area would include a demineralized water tank, a nickel plating tank, and an acid-cleaning tank. After acceptance, the completed parts would be cleaned and packaged for shipment.

Special Materials Manufacturing Operations. The manufacturing process produces pressed plastic parts. The blank-forming production process includes hot forming plastic materials into rough forms through a two-step pressing operation. The finished blanks are then x-rayed and visually inspected. Additional equipment used to produce O-rings includes a rolling mill, an oven with vacuum pipes, an extruder, a cutting table, and an O-ring press.

Purification Operations. Purification operations include the following: (1) dissolution, filtration, and recrystallization; (2) powder processing in a nitrogen atmosphere; and (3) drying. Because ACN would be present in substantial quantities, the purification operation would be designated a high-hazard facility for design of electrical components, and operations would be performed in a closed system consisting of tanks, process piping, gloveboxes, and suitable storage containers. An inert cover gas would be used in the system, in conjunction with an ACN vapor recovery system.

Isostatic Press Operations. Parts to be pressed are received in the staging area and placed in thick, flexible PVC containers referred to as bladders. The bladders are attached to a handling fixture that permits multiple bladders to be loaded into the press. The load is then lowered into the pressure vessel and the press closed. The air inside the vessel is displaced with mineral oil under low pressure and then the vessel is subjected to high pressure. When the pressure cycle is completed, the bladders are removed using the handling fixture. The pressed blanks are then removed from the bladders, packaged, and returned to the appropriate Special Materials Complex processing area.

Special Materials Complex Candidate Sites

Site 1

Site 1 for the proposed Special Materials Complex is approximately 16 ha (20 acres) and is located northwest of Building 9114 and on the north side of Bear Creek Road. The site is situated on the drainage divide of EFPC and Bear Creek Watersheds. Approximately 50 percent of the site is currently cleared at the base of Pine Ridge and the other 50 percent is wooded on the slope of the ridge. The site area has been used for a construction lay-down area in the past. Potential construction problems associated with legacy contamination from prior operations support activities are not expected.

This site is outside the existing Y-12 PIDAS. Figure 3.2.4–2 shows the location for Site 1 relative to other buildings at Y-12. Site 1 represents a large site with no permanent building structures and minimal infrastructure. The topography of the site would require a moderate amount of earthwork to prepare the site for construction.

Site 1 preparation for the proposed new Special Materials Complex involves site design, relocation of some existing utilities (e.g., underground pipelines, communications lines, and power lines), extension of utilities to the new facilities, and possibly relocation of the west meteorological tower.

Construction and Operation

Construction

Relocation of Utilities and Other Features. The Site 1 area would be cleared of vegetation and electrical utilities that would interfere with construction of the Special Materials Complex. The 161-kV power line that traverses the site would be rerouted around the construction area along with underground telephone lines. An existing sanitary sewer line would be replaced and upgraded to accommodate the proposed new Special Materials Complex facilities.

FIGURE 3.2.4–2.—*Sites 1, 2, and 3 for the Proposed Special Materials Complex.*

Source: Tetra Tech, Inc./LMES 2000c.

The Special Materials Complex storm sewer system would include a comprehensive collection system that would tie into the existing Y-12 sewer system. Storm sewer pipe would be reinforced concrete and would be designed to collect a 100-year storm event. Pipe sizes, number of catch basins, locations, etc., would be a consideration of the design of the storm sewer system along Bear Creek Road.

Traffic Planning, Parking, and Construction Lay-Down Areas. The construction of the Special Materials Complex at Site 1 would not require the rerouting of Bear Creek Road. Sufficient parking space is available at the S-3 and Building 9114 parking lots to accommodate construction workers and operations workers when the project is completed. The construction staging area for the Special Materials Complex is shown in Figure 3.2.4–3. The 0.8-ha (2-acre) lay-down area would be sufficiently graded and developed to accommodate a number of temporary construction trailers, small storage buildings, and materials storage yards. The staging area would have electric power and potable water. Sanitary service would be provided by PVC double-wall collection tanks, which would be pumped out as needed.

Utility Extensions. The potable water lines, electrical service, security systems, and telephone systems would be extended from the existing Y-12 production area to Site 1. When completed, the new Special Materials Complex would have no overhead utilities.

Remediate Construction Lay-Down Area. Once construction of the Special Materials Complex is complete, the construction office trailers would be removed and the material staging areas would be re-graded and incorporated into the landscape design of the Special Materials Complex. Although not anticipated, soils contaminated by construction-related materials such as diesel fuel would be removed and disposed in accordance with Y-12 waste management plans.

Site Preparation and Facility Construction. Table 3.2.4–1 lists the construction resource requirements, number of construction workers, and estimated waste generation to construct the proposed Special Materials Complex at Site 1. Site preparation would follow the advanced work and would include any excavation, filling, and grading needed to meet design requirements for on-grade, reinforced concrete and pre-engineered structures. Historical research of the site indicated that two areas within the site have received non-engineered fill and some unknown amount of construction debris from a past project within Y-12. The non-engineered fill/construction debris areas are not expected to be contaminated. Detailed testing would be conducted to fully characterize site geology, hydrology, and soil compaction, as well as sample for potential contamination before construction.

On Site 1, the Special Materials Complex major facilities would consist of a Beryllium Facility, a Manufacturing/Warehouse Facility, a Purification Facility, an Isostatic Press Facility, and a Core Support Facility. A detailed description of these facilities was presented earlier. A brief summary of the structural aspects of the facility is provided here.

The Beryllium Facility would be a two-story building constructed from reinforced concrete. The roof, exterior walls, first floor slab, beams, and columns would be reinforced concrete. The ground floor of the building would be a concrete slab, and foundation for the concrete columns would be spread footings supported on well-compacted subgrade. The Manufacturing/Warehouse Facility would be a rigid-framed, pre-engineered building. The roof structure over the manufacturing area would range from 7.3 to 9.75 m (24 to 32 ft). The foundation of the building columns would be spread footing supported by a well-compacted subgrade.

FIGURE 3.2.4–3.—*Special Materials Complex Construction Lay-Down Areas.*

Source: Tetra Tech, Inc./LMES 2000c.

TABLE 3.2.4–1.—*Special Materials Complex Construction Requirements and Estimated Waste Volumes for Site 1*

Requirements	Consumption
Materials/Resource	
Electrical energy (MWh)	8,000
Concrete m^3(yd^3)	13,800 (18,050)
Steel (t)	3,000
Liquid fuel and lube oil L (gal)	984,200 (259,998)
Industrial gases m^3 (yd^3)	5,700 (7,455)
Water L (gal)	5,700,000 (150,578)
Land ha (acre)	8 (19.8)
Employment	
Total employment (worker years)	125
Peak employment (workers)	210
Construction Period (years)	3.5
Waste Category	**Volume**
Low-level	
Liquid m^3 (gal)	none
Solid m^3 (yd^3)	none
Mixed Low-level	
Liquid m^3 (gal)	none
Solid m^3 (yd^3)	none
Hazardous	
Liquid m^3 (gal)	11.4 (3,000)
Solid m^3 (yd^3)	107 (140)
Nonhazardous (Sanitary)	
Liquid m^3 (gal)	1448 (382,400)
Solid m^3 (yd^3)	none
Nonhazardous	
Liquid m^3 (gal)	none
Solid m^3 (yd^3)	917.4 (1200)

Source: LMES 2000c.

The Purification Facility would be a single-story, high bay building with a partial second-level mezzanine. The building would be constructed from structural steel framing with metal roof deck and siding. The mezzanine would be steel plate supported on structural steel framing (beams and columns). The foundation for the columns would be spread footings supported on a well-compacted subgrade. An adjoining tank farm to the facility would have a concrete pad and roof but no exterior walls. Concrete curbing would be constructed around the tank farm to contain any liquids.

The Isostatic Press Facility would be a three-level structure constructed from structural steel framing and concrete. The foundation for the building columns would be spread footings supported on a well-compacted subgrade.

The Core Support Facility would be a two-story building of typical industrial construction with masonry walls and a steel structural frame. The ground floor would be a concrete slab, and foundation for the building columns would be spread footings supported on a well-compacted subgrade.

All of the Special Materials Complex facilities would be designed to meet the requirements of the Standard Building Code. In addition, the design for the natural phenomena hazards (earthquake, tornadic winds, floods, and lightning) would be in accordance with DOE-STD-1020-94, *Natural Phenomena Hazards Design and Evaluation Criteria for Department of Energy Facilities*.

Operation

The Special Materials Complex operations would be the same as described earlier in this section. Table 3.2.4–2 lists the operation resource requirements, number of operation workers, and estimated waste generation for the proposed new Special Materials Complex.

Site 2

Site 2 for the proposed Special Materials Complex is approximately 4 ha (10 acres) and is located at the Y-12 Scrap Metal Yard southeast of Building 9114 and east of the westernmost portion of the Y-12 PIDAS fence. Figure 3.2.4–2 shows the location of Site 2 relative to other buildings at Y-12.

Site 2 preparation would include site design, relocation of existing utilities (e.g., lights, underground water lines, storm sewers, steam lines, etc.), two structures, and a portion of the Y-12 Scrap Metal Yard. The existing Y-12 PIDAS would not be affected since Site 2 is entirely within the PIDAS. However, a security fence would be erected to isolate the work site during construction.

Construction and Operation

Construction

Relocation of Utilities and Other Features. An abandoned above-ground acid pipeline that traverses Site 2 would be demolished. Numerous overhead electrical lines within the proposed site would have to be removed, and communications and computer lines would have to be rerouted. Portions of a sanitary sewer main that serve the west end of Y-12 would be rerouted. Sanitary sewer services would be provided for the new facilities by connecting to an existing sanitary sewer main in the area. Potable water and firewater service already exist at the site and would be connected to the new facilities. The storm sewer system at Site 2 would include a comprehensive collection system that would tie into the existing Y-12 storm sewer system. Off-site stormwater, which would be from the north of the proposed site, would be rerouted around the new Special Materials Complex. Storm sewer pipe would be reinforced concrete pipe and would be designed for a 100-year storm event.

TABLE 3.2.4–2.—*Special Materials Complex Annual Operation Requirements and Estimated Waste Volumes for Sites 1, 2, and 3*

Requirements	**Consumption**
Electrical energy (MWh)	30,400
Peak electrical demand (MWe)	5.5
Steam kg (lb)	28,600,000 (63,000,000)
Demineralized water L (gal)	2,000,000 (520,000)
Industrial Gas	
Liquid nitrogen L (gal)	4,550 (1,202)
Mixed gas m^3 (scf)	374 (13,200)
Helium m^3 (scf)	14,725 (520,000)
Oxygen m^3 (scf)	396 (14,000)
Nitrogen gas m^3 (scf)	1,500,800 (53,000,000)
Natural gas (m^3)	none
Water L (gal)	8.3×10^7 (2.2×10^7)
Plant footprint ha (acre)	4 (9.9)
Employment (workers)	36
Waste Category	**Average Annual Volume**
Low-level	
Liquid m^3 (gal)	none
Solid m^3 (yd^3)	0.8 (1)
Mixed Low-level	
Liquid m^3 (gal)	none
Solid m^3 (yd^3)	none
Hazardous	
Liquid m^3 (gal)	12.5 (3,302)
Solid m^3 (yd^3)	9.2 (12)
Nonhazardous (Sanitary)	
Liquid m^3 (gal)	932.7 (246,400)
Solid m^3 (yd^3)	none
Nonhazardous (other)	
Liquid m^3 (gal)	none
Solid m^3 (yd^3)	175.1 (229)

Source: LMES 2000c.

Electrical service, chilled water lines, security service lines, and computer services would tie into the existing services in the proposed Site 2 area.

Traffic Planning, Parking, and Construction Lay-Down Areas. Bear Creek Road alignment would not be affected by construction of the Special Materials Complex at Site 2. Additional parking areas would not be needed to meet the needs of the operations personnel associated with the new Special Materials Complex. Sufficient parking is available at the S-3 Parking Lot. However, temporary parking spaces for construction workers would need to be developed in the west tank area and just south of old Post 17 during construction of the new facility at Site 2 (see Figure 3.2.4–3). The temporary parking area would require approximately 0.8-ha (2-acres). The temporary parking would be needed because the S-3 Parking Lot would be used as a construction lay-down area for the new facility. The construction staging area would have electrical power and potable water. Sanitary sewer services would be provided by PVC double-wall collection tanks, which would be pumped out as needed.

Remediate Construction Lay-Down Area. Once the construction of the Special Materials Complex is complete, the construction office trailers and material lay-down areas would undergo remediation. The potable water lines and the electrical services would be removed. Any construction office trailers would be removed. The parking lot would then be paved with a 4-cm (1.5-in)-thick asphalt concrete surface. The parking lot spaces would then be relined for employee parking.

Site 2 Environmental Remediation. A portion of the existing Y-12 Scrap Metal Yard would have to be cleared of materials and environmentally stabilized before construction of the new Special Materials Complex could be started. Approximately 15,290 m^3 (20,000 yd^3) of scrap and an estimated 46,867 m^3 (61,300 yd^3) of contaminated soil (VOCs, metals, and radionuclides) would be removed from the site. Current planning is to dispose of this material in the new Environmental Management Waste Management Facility being constructed in the West Bear Creek Valley area of Y-12.

Site Preparation and Facility Construction. Table 3.2.4–3 lists the construction resource requirements, number of construction workers, and estimated waste generation to construct the proposed Special Materials Complex at Site 2. Site preparation would follow the advanced work described above and would include any excavation, filling, and grading needed to meet design requirements for on-grade, reinforced concrete and pre-engineered structures. As discussed above, Site 2 would have to be environmentally stabilized prior to facility construction. Detailed testing would be conducted to fully characterize site geology, hydrology, and soil compaction, as well as sample for legacy contamination before construction. The description of facility construction discussed previously in this section under Site 1 would be the same for Site 2.

Operation

The Special Materials Complex operations at Site 2 would be the same as described earlier in this section.

Site 3

Site 3 for the Special Materials Complex (see Figure 3.2.4–2) is the same site as Site B for the proposed HEU Materials Facility (see Figure 3.2.3–4) described in Section 3.2.3.2. (Note: Site A for the HEU Materials Facility was not considered for the Special Materials Complex based on siting evaluation criteria which considered the need to modify the PIDAS. This criteria, among others, ranked Site A for the HEU Materials Facility above the Special Materials Complex.) The discussion of construction activities associated with the HEU Materials Facility in Section 3.2.3.2 would also apply to the construction of the proposed Special Materials Complex at Site 3. Table 3.2.4–4 lists the construction resource requirements, number of construction workers, and estimated waste generation of constructing the Special Materials Complex at Site 3. The PIDAS would not be extended around the Special Materials Complex.

Operation

The Special Materials Complex operations at Site 3 would be the same as described earlier in this section.

3.2.5 *Alternative 4 (No Action - Planning Basis Operations Alternative Plus HEU Materials Facility Plus Special Materials Complex)*

This alternative includes the No Action - Planning Basis Operations Alternative Plus construction and operation of a new HEU Materials Facility at one of two proposed sites (Alternative 2A) and construction and operation of a New Special Materials Complex at one of three proposed sites (Alternative 3).

TABLE 3.2.4–3.—*Special Materials Complex Construction Requirements and Estimated Waste Volumes for Site 2*

Requirements	**Consumption**
Materials/Resource	
Electrical energy (MWh)	8,000
Concrete m^3 (yd^3)	14,500 (18,965)
Steel (t)	3,200
Liquid fuel and lube oil L (gal)	1,583,000 (418,000)
Industrial gases m^3 (yd^3)	5,700 (7,455)
Water L (gal)	5,700,000 (1,505,781)
Land ha (acre)	5 (12.3)
Employment	
Total employment (worker years)	137
Peak employment (workers)	210
Construction period (years)	3.5
Waste Category	**Volume**
Low-level	
Liquid m^3 (gal)	none
Solid m^3 (yd^3)	none
Mixed Low-level	
Liquid m^3 (gal)	none
Solid m^3 (yd^3)	46,867[a] (61,300)
Hazardous	
Liquid m^3 (gal)	11.4 (3,000)
Solid m^3 (yd^3)	107 (140)
Nonhazardous (Sanitary)	
Liquid m^3 (gal)	1,448 (382,400)
Solid m^3 (yd^3)	none
Nonhazardous (other)	
Liquid m^3 (gal)	none
Solid m^3 (yd^3)	3,420 (4,470)

[a] Excavated contaminated soil to a depth of 3 ft.
Source: LMES 2000c.

TABLE 3.2.4–4.—*Special Materials Complex Construction Requirements and Estimated Waste Volumes for Site 3*

Requirements	Consumption
Materials/Resource	
Electrical energy (MWh)	8,000
Concrete m^3 (yd^3)	14,500 (18,965)
Steel (t)	3,200
Liquid fuel and lube oil L (gal)	1,582,300 (418,000)
Industrial gases m^3 (yd^3)	5,700 (7,455)
Water L (gal)	5,700,000 (1,505,781)
Land ha (acre)	5 (12.3)
Employment	
Total employment (worker years)	137
Peak employment (workers)	210
Construction period (years)	3.5
Waste Category	**Volume**
Low-level	
Liquid m^3 (gal)	none
Solid m^3(yd^3)	none
Mixed Low-level	
Liquid m^3 (gal)	none
Solid m^3 (yd^3)	22,707[a] (29,700)
Hazardous	
Liquid m^3 (gal)	11.4 (3,000)
Solid m^3 (yd^3)	107 (140)
Nonhazardous (Sanitary)	
Liquid m^3 (gal)	1,448 (382,400)
Solid m^3 (yd^3)	none
Nonhazardous (other)	
Liquid m^3 (gal)	none
Solid m^3 (yd^3)	3,440 (4,500)

[a]Excavated contaminated soil to a depth of 3 ft.
Source: LMES 2000c.

3.3 POTENTIAL FUTURE Y-12 MODERNIZATION PROJECTS

While the proposed HEU Materials Facility and Special Materials Complex have progressed to the conceptual design level, other facilities considered for Y-12 modernization are still in the early planning phase and do not have conceptual design data to analyze at this time.

This section addresses several potential future facilities that may be considered as part of the integrated modernization efforts. These potential new facilities are summarized in Table 3.3–1 along with the existing facilities that are currently used to perform the functions addressed by potential new facilities. None of the potential future modernization projects listed in Table 3.3–1 is included in the No Action - Planning Basis Operations Alternative or the action alternatives for the Y-12 HEU Storage Mission or Special Materials Mission.

Siting

Space requirements for potential modernization projects were determined and four major areas at Y-12 have been identified as possible candidate site areas. Additionally, a greenfield option was considered. The site areas were labeled A - E. Sites A - D are shown in Figure 3.3–1 and described in the information that follows. As shown in Figure 3.3–1, there is some overlap in boundaries for the candidate site areas.

Site A is a 27-ha (67-acre) site area located primarily outside Y-12's PIDAS security area and encompasses uncontaminated parking lots containing approximately 2,100 parking spaces. Site A includes a site area (see Figure 3.2.2–2) for the proposed HEU Materials Facility. This site area possibly represents the most physically unconstrained of the available candidate sites.

Site B is a 32-ha (79-acre) site area located in Y-12's extreme western end. Current uses of the site area include construction services, non-SNM storage, and a scrap yard for contaminated metal. Use of this site would require demolition of approximately 13,935 m^2 (150,000 ft^2) of existing low-value floor space and the provision of replacement space for functions displaced. Remediation of the contaminated metal scrap yard would be required. Site B includes a potential site area for the proposed HEU Materials Facility or the Special Materials Complex (see Figure 3.2.2–4 and 3.2.3–2). The scrap yard is currently scheduled to be cleaned to industrial standards by the end of FY 2005 by the EM program, assuming funding is in place.

Site C is 26 ha (65 acres) in area and is wholly contained in the Y-12 PIDAS. This area contains three major Y-12 production buildings currently planned for D&D within the next 5-10 years. Building 9201-4, approximately 52,210 m^2 (562,000 ft^2) and currently owned by the EM Program, is planned for future warehouse use after D&D. This building is heavily contaminated with mercury. Buildings 9201-5 and 9204-4, 49,240 m^2 (530,000 ft^2) and 28,520 m^2 (307,000 ft^2), respectively, are still owned by DP but are planned for D&D within the next 10 years. Use of the Site C area would necessitate either demolition of or upgrades to these structures.

The Site D area is approximately 28 ha (69 acres) and lies outside the PIDAS area in the Property Protection Area of Y-12. Much of the space in the Site D area is 1940s era construction and primarily houses Y-12's administrative and support functions. Examples of functions within the Site D area include DOE and BWXT Y-12 Management, Engineering, the main Y-12 Cafeteria, Protective Services Organization, and Medical Services. Most of the site area is uncontaminated.

TABLE 3.3–1.—*Summary of Potential Future Y-SIM Facilities* [Page 1 of 2]

New Y-SIM Facilities	Scope	Existing Facilities Currently Used to Perform Function
Enriched Uranium Manufacturing Facility	Contains metal processing, chemical recovery operations, and support functions required for the production of enriched uranium components. Specialized metallurgical and chemical operations, include casting, rolling, forming, machining, chemical recovery, and conversion of salvage and scrap to uranium compounds and metal.	9212, 9215, 9980, 9981, 9204-2E, 9998, 9995, 9818, 9815, 9812, 9723-25, 9999
Assembly/Disassembly/ Quality Evaluation Facility	Contains the assembly, disassembly, and quality evaluation functions for the stockpile management program.	9204-2E, 9204-2, 9204-4
Depleted Uranium Operations Facility	Depleted uranium operations could potentially be performed in a combination of new and upgraded facilities. A new facility would contain the metallurgical operations and support functions required for the production of depleted uranium components. Specialized metallurgical operations would include casting, rolling, and forming of cast and wrought depleted uranium and wrought uranium-niobium alloys. Existing machine shops in Buildings 9201-5W and 9201-5N could be upgraded to provide machining capability.	9215, 9204-4, 9998, 9201-5, 9201-5N, 9201-5W
Lithium Operations Complex	Would contain the chemical processes, fabrication operations, and support functions associated with the production of LiH and LiD components. Specialized operations include LiCl power production, Li metal production, salt production, forming, machining, inspection, and chemical recovery of lithium compounds from retired and rejected components. Ancillary facilities include deuterium production and tank farms for holding process chemicals.	9204-2, 9805-1, 9404-9, 9720
Administrative/ Technical Facilities	These facilities would provide space for LMES and DOE infrastructure and support functions including administrative and technical offices, records storage, cafeteria, medical, photography, reproduction, and other functions.	9710-2, 9706-2, 9739, 9734, 9733-1, -2, -3, 9704-2, 9766

TABLE 3.3–1.—*Summary of Potential Future Y-SIM Facilities* [Page 2 of 2]

New Y-SIM Facilities	Scope	Existing Facilities Currently Used to Perform Function
Development/Product Certification/Analytical Chemistry	Consideration would be given to a combination of new and existing facilities to house the R&D function as well as centralized facilities needed for Product Certification and Analytical Chemistry laboratories.	9202, 9203, 9731, 9102-2, 9203A, 9205, 9625, 9720-34, 9824-4, 9723-24, 9995
Production Support Facility	Would provide general manufacturing support including can manufacturing, graphite machining, and other general fabrication support.	9201-1, 9215
Non-SNM Strategic Materials Storage Facility	New and existing facilities would be considered for storage of non-SNM materials and other strategic assets.	9720-33, Drum Yard, 81-22, 9204-2, 9204-4, 9998, 9201-5, 9720-46, 9720-38, 9720-14, 9720-1, 9720-18, 9720-26
Other facilities (To be determined)	A number of other facilities are also under evaluation including maintenance facilities, fire hall, emergency management, and others.	Specific facilities have not yet been determined
Utilities	Utilities and other services would be evaluated for needed upgrades and/or replacement of generating equipment, controls, and distribution systems.	Includes steam and condensate, raw and treated water, sanitary sewer, electrical power, natural and industrial gases, plant and instrument air, and telecommunications systems facilities.

Note: Li - lithium, LiCl - lithium chloride; LiD - lithium deuteride; LiH - lithium hydride.
Source: LMES 1999c.

FIGURE 3.3–1.—*Potential Candidate Siting Areas for New Modernization Facilities at Y-12.*

Source: Tetra Tech, Inc./LMES 2000c.

Site E is a generic greenfield site area located in concept on Y-12's Area of Responsibility. A greenfield site represents the ideal choice for maximizing the efficient layout of manufacturing facilities; however, extended construction schedules, the need to provide new infrastructure, and the prospect of possible future contamination of an existing "green" site are major constraints on this candidate site area.

Site screening and evaluation would be performed for each potential future modernization project, and alternative sites analyzed under appropriate NEPA reviews when proposals to construct these facilities are submitted.

3.4 ALTERNATIVES CONSIDERED BUT ELIMINATED FROM DETAILED CONSIDERATION

DOE is the Federal agency responsible for providing the Nation with nuclear warheads and ensuring that those weapons remain safe, secure, and reliable. By law, DOE is required to support the Nuclear Weapons Stockpile Plan. To do this, DOE must maintain a nuclear weapons production, maintenance, and surveillance capacity consistent with the President's *Nuclear Weapons Stockpile Plan*. For the proposed action (Continued Operation of Y-12 Missions), the following alternatives were considered but eliminated from detailed study for the reasons stated.

Site Closure with Complete Environmental Restoration. Members of the public have in the past and during public scoping for the SWEIS stated that DOE should analyze shutting down all operations at Y-12, deactivating some or all of the facilities, and cleaning up the site for other potential uses. DOE has already considered these suggestions in previous DOE programmatic NEPA documents, specifically the SSM PEIS (DOE 1996e) and the S&D PEIS (DOE/EIS-0229, DOE 1996h). DOE recognizes that Y-12 has unique capabilities and diverse roles supporting a variety of national programs, and that there is an essential near-term need to manage and maintain the safety and stability of the existing nuclear materials inventory. In addition, the *National Security Strategy for a New Century*, issued by the White House in October 1998, emphasizes the need to "ensure the continued viability of the infrastructure that supports U.S. nuclear forces and weapons." Until relieved of its mission to support the enduring nuclear weapons stockpile by the President and Congress, DOE must maintain its DP operations at the Y-12 National Security Complex. Accordingly, to shut down or further reduce Y-12 missions within the timeframe of the SWEIS (i.e., next 5-10 years) would be highly unlikely and an unreasonable alternative.

Construction of an All New, Smaller Y-12. Some members of the public proposed that DOE analyze building an all new Y-12 (implementing all of the Modernization Program projects), cleaning up the vacated facilities, and encouraging reindustrialization of the old Y-12 Site.

The long-term planning for Y-12 is being addressed in the Modernization Program; however, this program spans 30 years or more and includes many potential production, support, and infrastructure projects (see Section 3.3). The new smaller and more modern Y-12 envisioned by the Modernization Program is only conceptual at best. Although some components of the program are more defined and further along in the planning process, there is no proposal or data to support analyses of a "new" Y-12. Components of the program are prioritized based on Y-12 mission requirements and ES&H needs and are subject to limited funding levels. Therefore, creating an all new Y-12 National Security Complex would be highly unlikely, financially remote, and unsupported by design information and data for analysis to be considered a reasonable alternative at this time.

Upgrade Existing Facilities for Special Materials Missions. DOE considered the feasibility of renovating existing facilities needed to meet Special Materials Operations requirements as part of the Modernization Program. The review indicated that extensive and costly renovation of the facilities would be required to meet ES&H and mission requirements. The existing special materials facilities range from 27 to more than 50 years old and incur significant maintenance and operating costs while failing to meet future missions and safety requirements. Although renovation of some existing facilities is possible to meet capability, capacity, and ES&H requirements, other facilities cannot be upgraded. Those facilities that can be upgraded would incur extensive costs and inefficiencies because of the use of multiple aging facilities. Facilities that cannot be upgraded must be replaced by new facilities or newly constructed operations areas in existing buildings. Even though requirements could be satisfied, inefficiency from the use of multiple facilities, duplication of support services, and continued degradation of the structural integrity of old buildings and infrastructure renders this a nonviable alternative.

3.5 COMPARISON OF ALTERNATIVES AND ENVIRONMENTAL IMPACTS

This comparison of potential environmental impacts is based on the information in Chapter 4, Affected Environment, and analyses in Chapter 5, Environmental Consequences. Its purpose is to present the impacts of the alternatives in comparative form.

Table 3.5–1 (located at the end of this section) presents the comparison summary of the environmental impacts for construction and operation associated with the No Action - Status Quo Alternative, the No Action - Planning Basis Operations Alternative, and alternatives for the HEU Storage Mission and Special Materials Mission evaluated in this SWEIS. The No Action - Status Quo Alternative is presented in Table 3.5–1 as a benchmark for comparison of the impacts associated with the No Action - Planning Basis Operations Alternative and other alternatives that reflect full Y-12 DP mission operations at required levels, and specific activities by EM, and the Office of Science at Y-12. The No Action - Status Quo Alternative is not considered reasonable for future Y-12 operations because it would not meet Y-12 mission needs. The following sections summarize the potential impacts by resource area.

3.5.1 Land Use

Construction. No new DP facilities or major upgrades to existing DP facilities would occur under the No Action - Planning Basis Operations Alternative. Potential land disturbance associated with construction of the Environmental Management Waste Management Facility and activities of the Office of Science Field Research Center would be approximately 31 to 47 ha (77 to 116 acres) and 4 ha (10 acres), respectively. The land disturbance would occur in areas that are already disturbed and designated for waste management and industrial use.

Potential land disturbance associated with the alternatives for the HEU Storage Mission range from 0 ha (No Action) to 5 ha (12 acres) (construct HEU Materials Facility). The Upgrade Expansion of Building 9215 would potentially disturb less than 1 ha. The No Action - Planning Basis Operations Alternative Plus the HEU Materials Facility would potentially disturb up to 56 ha (138 acres) during construction. The Upgrade Expansion of Building 9215 Plus the No Action - Planning Basis Operations Alternative would disturb up to 52 ha (128 acres).

Construction of the Special Materials Complex would potentially disturb between 0 ha (No Action) and 8 ha (20 acres) (Site 1 location). Site 2 and Site 3 locations for the proposed Special Materials Complex would disturb approximately 5 ha (12.4 acres). Except for a 2-ha (5-acre) portion of Site 1 which is covered by trees, all proposed sites are located in previously disturbed areas of Y-12 that are designated for industrial use. The clearing of the forest cover on Site 1 would result in a land use change for that area. The No Action - Planning Basis Operations Alternative plus the Special Materials Complex would potentially disturb up to 59 ha (146 acres) (Site 1) and 56 ha (138 acres) for Sites 2 and 3.

The No Action - Planning Basis Operations Alternative plus the HEU Materials Facility and the Special Materials Complex would disturb up to 64 ha (158 acres) during construction activities.

Operation. Under the No Action - Planning Basis Operations Alternative, the Environmental Management Waste Management Facility and the Field Research Center activities would require approximately 14 to 25 ha (35-62 acres) and less than 4 ha (10 acres) of land, respectively. These activities are consistent with ORR land use plans.

The potential permanent land requirement for the HEU Storage Mission alternatives range from 0.5 ha for the Upgrade Expansion of Building 9215 to 4 ha (10 acres) for the HEU Materials Facility. There would be no difference in land requirements between Site A or Site B for the HEU Materials Facility. Operation of the HEU Materials Facility or the Upgrade Expansion of Building 9215 would be consistent with current ORR land use plans, and Oak Ridge End-Use Working Group recommendations (PEC 1998). The No Action - Planning Basis Operations Alternative plus the HEU Materials Facility would result in a potential permanent land requirements of up to 33 ha (82 acres) for operations. The Upgrade Expansion of Building 9215 plus the No Action - Planning Basis Operations Alternative would require up to 29.5 ha (73 acres).

Operation of the Special Materials Complex would require 4 ha (10 acres) of land. There would be no difference in land requirement between Sites 1, 2, or 3. Operation of the Special Materials Complex would be consistent with current ORR land use plans, and Oak Ridge End-Use Working Group recommendations (PEC 1998). The No Action - Planning Basis Operations Alternative plus the Special Materials Complex would result in a potential permanent land requirement of up to 33 ha (82 acres) for operations.

The No Action - Planning Basis Operations Alternative plus the HEU Materials Facility and the Special Materials Complex would result in a potential permanent land requirement of up to 37 ha (91 acres) for operations.

3.5.2 Transportation

Construction. Under the No Action - Planning Basis Operations Alternative, approximately 75 additional vehicles per day would use area roads to support construction of the Environmental Management Waste Management Facility. Less than 10 vehicles per day would be added to area traffic for the Field Research Center activities. The additional construction-related traffic for these two activities would have a negligible impact on area roads and traffic. The Level-of-Service (LOS) on area roads would not change under this alternative from the No Action - Status Quo Alternative.

Construction-related traffic for the HEU Storage Mission Alternative would add 165 worker vehicles per day to support construction of the HEU Materials Facility at either site or the Upgrade Expansion of Building 9215. In addition, three to eight trucks per day would be expected to bring construction materials to the project site. The No Action - Planning Basis Operations Alternative plus the Construction of the HEU Materials Facility would potentially add 258 vehicles per day on area roads. The additional construction-related traffic would have a minor impact on area roads and traffic because most project traffic would occur at off-peak travel periods. Appropriate traffic control and coordination measures would be implemented during construction activities to minimize Field Research Center worker access impacts to the NABIR program activities at Y-12.

Construction-related traffic for the Special Materials Mission Alternative would add 157 worker vehicles per day to support construction of the Special Materials Complex at any of the 3 sites. An additional five trucks per day would bring construction materials to the project site. The No Action - Planning Basis Operations Alternative plus construction of the Special Materials Complex would potentially add 247 vehicles per day on area roads. The additional construction-related traffic would have a minor impact on area roads and traffic because most project traffic would occur at off-peak travel periods. Appropriate traffic control and coordination measures would be implemented during construction activities to minimize Field Research Center worker access impacts to the NABIR program activities at Y-12.

Operation. Under the No Action - Planning Basis Operations Alternative, an additional 28 vehicles per day and 6 vehicles per day would be expected from operation of the Environmental Management Waste Management Facility and the Field Research Center activities, respectively. Because a majority of this traffic would occur on the Y-12 Site, the additional traffic would have a negligible impact on area roads and traffic.

Radiological materials and waste transportation impacts associated with the Environmental Management Waste Management Facility would include routine and accidental doses of radioactivity. The risks associated with radiological materials transportation would be less than 0.1 fatality per year. The risks associated with radiological waste transportation would be less than 0.1 fatality per year.

Operation of the HEU Materials Facility or the Upgrade Expansion of Building 9215 would result in no additional work traffic since the existing workforce would be used. The No Action - Planning Basis Operations Alternative plus the operation of HEU Materials Facility or the Upgrade Expansion of Building 9215 would result in approximately 34 additional vehicles per day on area roads. The additional traffic would not change the LOS on area roads. Appropriate measures would be implemented to minimize research worker access impacts to Field Research Center activities by any new Y-12 facility security requirement. There would be a one-time relocation of stored HEU to the new facility (HEU Materials Facility or Expansion of Building 9215) which would require approximately 3,000 on-site truck trips to complete.

Radiological materials and waste transportation impacts would include routine and accidental doses of radioactivity. The risks associated with routine radiological materials transportation would be less than 0.1 fatality per year. The risks associated with radiological waste transportation would be less than 0.01 fatality per year. The one-time relocation of stored HEU to the new HEU Materials Facility or the Upgrade Expansion of Building 9215 would result in less than 0.001 fatality.

Operation of the Special Materials Complex would result in no additional worker traffic since the existing workforce would be used. The No Action - Planning Basis Operations Alternative plus the operation of the Special Materials Complex would result in approximately 34 additional vehicles per day on area roads. The additional traffic would not change the LOS on area roads. Appropriate measures would be implemented to minimize research worker access impacts to Field Research Center activities by any new Y-12 facility security requirement.

There would be no additional radiological materials and waste transportation impacts associated with the Special Materials Complex since the facilities do not use radioactive materials.

3.5.3 Socioeconomics

Construction. A peak construction workforce of approximately 100 would be needed for the Environmental Management Waste Management Facility, and less than 10 would be needed for the Field Research Center activities included under the No Action - Planning Basis Operations Alternative. The workforce increase represents less than one percent of The No Action - Status Quo Alternative ORR workforce and would have no substantial benefit or negative impact on the socioeconomics of the Oak Ridge area or regional economy.

The construction of the HEU Materials Facility or the Upgrade Expansion of Building 9215 would have negligible impact on the socioecomonics of the Oak Ridge area or regional economy. Both projects would have a peak construction workforce of 220 workers and generate a total of 460 jobs (220 direct and 240 indirect) in the Region of Influence (ROI). This represents an increase of 0.2 percent in The No Action - Status Quo Alternative ROI employment. The existing ROI labor force is sufficient to accommodate the labor requirements and no change to the level of community services provided in the ROI is expected.

The No Action - Planning Basis Operations Alternative plus the construction of a new HEU Materials Facility or Upgrade Expansion of Building 9215 would require a peak period total of approximately 330 construction workers. A total of 690 jobs (330 direct and 360 indirect) would be generated. This would increase the No Action - Status Quo Alternative ROI employment by approximately 0.2 percent. The total No Action - Status Quo Alternative ROI income would increase by approximately $17.8 million, or 0.1 percent.

The construction of the Special Materials Complex would have a peak construction workforce of 210 workers and generate a total of 440 jobs (210 direct and 230 indirect) in the ROI. This represents an increase of 0.2 percent in ROI employment. The existing labor force is sufficient to accommodate the labor requirements, and no change in the level of community services provided in the ROI is expected. The Special Materials Complex construction would have a negligible impact on the socioeconomics of the Oak Ridge area or regional economy.

The No Action - Planning Basis Operations Alternative plus the construction of a new Special Materials Complex would result in a peak period total of approximately 320 construction workers. A total of 670 jobs (320 direct and 350 indirect) would be generated. This would increase The No Action - Status Quo Alternative ROI employment by approximately 0.2 percent. The Total No Action - Status Quo Alternative ROI income would increase by approximately $17.2 million, or 0.1 percent.

The construction periods of the HEU Materials Facility and Special Materials Complex could overlap with the construction activities included under the No Action - Planning Basis Operations Alternative. In that case, there would be a greater construction workforce at Y-12 at one time, resulting in a greater increase in ROI employment, and income in any one year. The peak construction employment could reach approximately 540 direct employees, generating a total of 1,130 jobs (540 direct and 590 indirect). This would be an increase of approximately 0.4 percent in the No Action - Status Quo Alternative ROI employment and would result in an increase in ROI income of almost $30 million, or 0.2 percent. These changes would be temporary, lasting only the duration of the construction period. The existing ROI labor force could likely fill all of the jobs generated by the increased employment and expenditures. Therefore, there would be no impacts to the ROI's population or housing sector. Because there would be no change in the ROI population, there would be no change to the level of community services provided in the ROI.

Operation. Under the No Action - Planning Basis Operations Alternative, potential benefits of employment associated with the Environmental Management Waste Management Facility or the Field Research Center activities would be very small. Approximately 25 workers and 6 workers, respectively, would be needed for the two activities. Workers for the Environmental Management Waste Management Facility would be drawn from the local workforce. Some of the workforce associated with the Field Research Center would be researchers from outside the ROI. Visiting staff and scientists would contribute in a beneficial manner to the local economy, but the impact would be negligible.

The operation of the HEU Materials Facility or the Upgrade Expansion of Building 9215 would result in no change in the No Action - Status Quo Alternative ROI employment, income, or population. The anticipated operation workforce of 30 for the HEU Materials Facility and 49 for the Upgrade Expansion of Building 9215 would come from existing employees. Operation of the Special Materials Complex would not result in any change in workforce requirements since existing workers would staff the facilities. No impacts to ROI employment, income, or population are expected.

Because both the HEU Materials Facility and the Special Materials Complex would be staffed by the existing Y-12 workforce during operations, there would be no change from the No Action - Planning Basis Operations Alternative Y-12 workforce and no impacts to ROI employment, income, or population.

3.5.4 Geology and Soils

Construction. The Environmental Management Waste Management Facility and the Field Research Center activities included under the No Action - Planning Basis Operations Alternative would result in a potential increase in soil erosion at the construction sites. However, soil impacts are expected to be small with proposed design controls. No impacts to geology are expected.

Construction of the HEU Materials Facility at Site A would result in a potential increase in soil erosion from the lay-down area and new parking lot. Detention basins and runoff control ditches would minimize soil erosion and impacts. No impacts to geology are expected because the facility is above ground and foundation construction would not disturb bedrock. Site B soil erosion impacts would be negligible with appropriate standard construction control measures. The Upgrade Expansion of Building 9215 would have negligible soil erosion impacts with standard construction control measures. No geology impacts are expected at Site B or at the Building 9215 expansion construction sites because the facility is above ground and foundation construction would not disturb bedrock.

Construction of the Special Materials Complex at Site 1 would result in a potential increase in soil erosion from the lay-down area and project site land clearing. Detention basins, silt fences, and runoff control ditches would minimize soil erosion and impacts. No impacts to geology are expected because the facility is above ground and foundation construction would not disturb bedrock.

Activities included under the No Action - Planning Basis Operations Alternative plus the construction of the HEU Materials Facility and the Special Materials Complex would result in a potential increase in soil disturbance and soil erosion from construction activities. Appropriate mitigation, including detention basins, runoff control ditches, silt fences, and protection of stockpiled soils would minimize soil erosion and impacts. No impacts to geology area expected because all new facilities would be above ground structures and foundation construction would not disturb bedrock.

Operation. Under the No Action - Planning Basis Operations Alternative, minor soil erosion impacts are expected from the Environmental Management Waste Management Facility. Detention basins, runoff control ditches, and cell design components would minimize impacts. The Field Research Center would have no impacts on geology and soils with standard construction-type soil erosion control measures.

The HEU Storage Mission Alternatives and Special Materials Mission Alternatives would have no impact on geology or soils during operation because of site design and engineered control measures.

The No Action - Planning Basis Operations Alternative plus the operation of the HEU Materials Facility and Special Materials Complex would have no impact on geology or soils. Appropriate facility site design and engineered control measures (e.g., detention basins) would be used to minimize soil erosion impacts.

3.5.5 Water Resources

Construction

Surface Hydrology. Under the No Action - Planning Basis Operations Alternative, surface water usage at the Y-12 National Security Complex would increase slightly from the No Action-Status Quo Alternative (20.8 MLD [5.5 MGD] to 21.2 MLD [5.6 MGD]). This would represent less than a 2 percent increase in raw water use. The Environmental Restoration Program would continue to address surface water contamination sources and, over time, improve the quality of water in both UEFPC and Bear Creek, the two surface water bodies most directly impacted by activities at Y-12.

The Environmental Management Waste Management Facility activities in eastern Bear Creek Valley are included under the No Action - Planning Basis Operations Alternative. Potential short-term impacts to surface water resources could result from sediment loading to surface water bodies or migration of existing contaminants. Land clearing and construction activities would expose varying areas depending on the ultimate size of the facility. Best management practices, including standard erosion controls such as siltation fences and buffer zones of natural riparian vegetation, during construction activities would minimize the potential impacts to surface water resources. Some impacts to surface water would be expected. Tributary NT-4 would be rerouted and partially eliminated during construction at the East Bear Creek Valley site.

Construction and rerouting of NT-4 would impact some areas of wetland (approximately 0.4 ha [1 acre]) which will be mitigated as part of a wetlands mitigation plan for all CERCLA activities in Bear Creek Valley (DOE 1999j).

The No Action - Planning Basis Operations Alternative also includes activities of the Field Research Center at the Y-12 Site. The primary activities of the Field Research Center at Y-12 comprise subsurface injections of possible treatment additives into the groundwater at the contaminated area. Although only small volume injections are planned, it is possible that the groundwater additives might pass through the subsurface and reach the surface waters of Bear Creek. However, previous experiences with larger tracer injections near Bear Creek (DOE 1997a, LMER 1999c) and close monitoring of environmental conditions at the contaminated area suggest that the impacts to surface waters are predictable and would be minor.

Y-12 surface water withdrawals and discharges would not increase substantially during construction of the HEU Materials Facility whether at construction Sites A or B or during the Upgrade Expansion of Building 9215. Construction water requirements are very small and would not raise the average daily water use for Y-12. During construction, stormwater control and erosion control measures would be implemented to minimize soil erosion and transport to UEFPC. Contaminated wastewater would be collected and disposed of in accordance with applicable regulations. Neither of the proposed construction sites (Sites A or B) or the upgrade expansion site (Building 9215) is located within either the 100-year or 500-year floodplains.

Surface water withdrawals and discharges would not increase substantially during construction of the Special Materials Complex. Construction water requirements are very small and would not raise the average daily water use for Y-12. During construction, stormwater control and erosion control measures would be implemented to minimize soil erosion and transport to surface water (UEFPC). Contaminated wastewater would be collected and disposed of in accordance with applicable regulations. None of the proposed sites (Sites 1, 2, or 3) are located within either the 100-year or 500-year floodplains.

Groundwater. All water for the No Action - Planning Basis Operations Alternative would be taken from the Clinch River, with no plans for withdrawal from groundwater resources. All process, utility, and sanitary wastewater would be treated prior to discharge into UEFPC in accordance with NPDES permits.

Groundwater resources could be degraded by the Environmental Management Waste Management Facility in the short-term by contaminant releases from the surface or disposal cell that migrate to groundwater. Contaminant sources include construction materials (e.g., concrete and asphalt), spills of oil and diesel fuel, releases from transportation or waste handling accidents, and accidental releases of leachate from the disposal cell. Compliance with an approved erosion and sedimentation control plan and a spill prevention, control, and countermeasures plan would mitigate potential impacts from surface spills. Engineered controls and active controls, including the leachate collection system, would drastically reduce the potential for impact to groundwater resources that could result from contaminant migration from the disposal cell. Construction and operation of the disposal cell would result in few or no overall short-term impacts to groundwater resources.

Long-term, the design, construction, and maintenance of the new disposal facility would prevent or minimize contaminant releases to groundwater. These control elements would include a multilayer cap to minimize infiltration, synthetic and clay barriers in the cell liner, a geologic buffer, and institutional controls that would include monitoring and groundwater use restrictions. If releases were detected during the period of active institutional controls, mitigative measures would be implemented to protect human health and the environment. Long-term impacts to groundwater quality resulting from the disposal cell are expected to be insignificant.

Research activities of the Field Research Center at the Y-12 Site would focus on injections of additives to the groundwater at both the background and contaminated areas. Although the additives would modify the chemistry of the groundwater in the immediate study area, injections of additives would be so small that impacts would be limited to the immediate study areas.

Groundwater would be extracted in the Field Research Center contaminated area at Y-12 as part of characterization-related hydraulic tests. In addition, groundwater sample collection would increase. However, groundwater extractions associated with major hydraulic tests would collect no more than 76,000 L (20,000 gal) of groundwater per year (DOE 2000b). Sampling activities in years with no major hydraulic testing would collect no more than 7,600 L (2,000 gal) of groundwater. All extracted groundwater would be collected and treated in on-site facilities prior to surface water discharge to meet existing NPDES permit limits.

All water for construction of the HEU Materials Facility would be taken from the Clinch River as part of the normal water uses at Y-12. Some groundwater may be extracted during construction activities at either construction site (Sites A or B) or during the Upgrade Expansion of Building 9215 to remove water from excavations. Appropriate construction techniques would be implemented to minimize the seepage of groundwater into excavation sites. Therefore, dewatering is expected to be minimal and a short-term activity. No impact on groundwater (direction or flow rate) in the NABIR project area would be expected from constructing the HEU Materials Facility at Site A or B. Based on the results of the Remedial Investigation of UEFPC (DOE 1998b), groundwater extracted from excavations at Site A and in the area of the Upgrade Expansion of Building 9215 probably would not be contaminated. Groundwater extracted from excavations at Site B would probably be contaminated with VOCs, metals, and radionuclides from the nearby former S-3 Ponds and the Y-12 Scrap Metal Yard (DOE 1998b). Minimal impacts to groundwater quality are expected because regardless of site, extracted groundwater would be collected and treated in on-site treatment facilities to meet the discharge limits of the NPDES permit prior to release to surface water; no plans exist for routine withdrawal from groundwater resources.

All water for construction of the Special Materials Complex would be taken from the Clinch River as part of the normal water uses at Y-12. Some groundwater may be extracted during construction activities to remove water from excavations. Appropriate construction techniques would be implemented to minimize the seepage of groundwater into excavation sites. Therefore, dewatering is expected to be minimal and a short-term activity. No impact on groundwater (direction or flow rate) in the NABIR project area would be expected from constructing the Special Materials Complex at Site 1, 2, or 3. Based on the historical site use and the results of the Remedial Investigation of the UEFPC (DOE 1998b), groundwater extracted from excavations at Site 1 probably would not be contaminated. Groundwater extracted from excavations at Sites 2 and 3 would be the same as that described for the HEU Materials Facility Site B. The groundwater is contaminated with VOCs, metals, and radionuclides from the nearby former S-3 Ponds and the Y-12 Scrap Metal Yard (DOE 1998b). Minimal impacts to groundwater quality are expected because, regardless of site, extracted groundwater would be collected and treated in on-site treatment facilities to meet the discharge limits of the NPDES permit prior to release to surface water.

Under the No Action - Planning Basis Operations Alternative plus the construction of the HEU Materials Facility and Special Materials Complex, no groundwater would be used for construction activities. Some groundwater may be extracted during construction from excavation and field research activities. No impact on groundwater (direction or flow rate) in the NABIR project area would be expected from constructing the HEU Materials Facility or the Special Materials Complex at any of the candidate sites. Depending on the construction site, extracted groundwater may be contaminated with VOCs, metals, and radionuclides. Minimal impacts to groundwater and groundwater quality are expected because extracted groundwater would be collected and treated in on-site treatment facilities to meet discharge limits of the NPDES permit prior to release to surface water.

Operation

Surface Hydrology. Under the No Action - Planning Basis Operations Alternative, surface water usage at Y-12 would increase from the No Action - Status Quo Alternative (15.9 MLD [4.2 MGD] to 20.2 MLD [5.3 MGD]). This would represent a 27 percent increase in treated water use.

HEU storage operations, whether located in a new HEU Materials Facility or in the Upgrade Expansion of Building 9215, would require an estimated 550,000 L to 720,000 L per year (146,000 GPY to 190,000 GPY), a small percentage of the No Action - Status Quo Alternative Y-12 water usage of approximately 5,822 MLY (1,538 MGY).

The No Action - Planning Basis Operations Alternative plus the HEU Materials Facility or the Upgrade Expansion of Building 9215 would increase water use requirements by approximately 140 MLY (37 MGY) from the 5,822 MLY (1,500 MGY) water use under the No Action - Status Quo Alternative. This represents an increase of approximately 2.5 percent. Sufficient excess water capacity exists to accommodate the additional 140 MLY (37 MGY). No adverse impacts to surface water resources or surface water quality are expected because all discharges would be maintained to comply with NPDES permit limits.

Operations of the Special Materials Complex would require an estimated 59 MLY (15.5 MGY) (approximately 53 MLY [14 MGY] for cooling tower make-up water and 6 MLY [1.5 MGY] for processes). This would be approximately 1 percent of the No Action - Status Quo Alternative Y-12 Site water usage of 5,822 MLY (1,538 MGY). This water use would potentially be offset by the vacating of operations in existing special materials operations facilities. No adverse impacts to surface water or surface water quality are expected because all discharges would be monitored to comply with the NPDES permit limits.

The No Action - Planning Basis Operations Alternative plus the Special Materials Complex would increase water use requirements by approximately 197 MLY (52 MGY) from the 5,822 MLY (1,538 MGY) water use under the No Action - Status Quo Alternative. This represents an increase of approximately 3.5 percent. Sufficient excess water capacity exists to accommodate the additional 197 MLY (52 MGY). No adverse impacts to surface water resources or surface water quality are expected because all discharges would be monitored to comply with NPDES permit limits.

Under Alternative 4 (No Action - Planning Basis Operations Alternative plus HEU Materials Facility plus Special Materials Complex), surface water withdrawals and discharges would increase slightly. Water requirements would increase by approximately 197.5 MLY (52.2 MGY) from the 5,822 MLY (1,538 MGY) water usage under the No Action - Status Quo Alternative. This represents an increase of 3.5 percent. Historical water use by Y-12 has been as high as 8,328 MLY (2,200 MGY). Sufficient excess water capacity exists to accommodate the additional 197.5 MLY (52.2 MGY) increase. No adverse impacts to surface water or surface water quality are expected because all discharges would be monitored to comply with the NPDES permit limits.

Groundwater. All water for the No Action - Planning Basis Operations Alternative would be taken from the Clinch River, with no plans for withdrawal from groundwater resources at the Environmental Management Waste Management Facility. Sampling at the Field Research Center would remove a minimal amount (7,570 [2,000 gal]) a year for research purposes. All process, utility, and sanitary wastewater would be treated prior to discharge into EFPC in accordance with NPDES permits.

All water for operation of the HEU Materials Facility or the Upgrade Expansion of Building 9215 would be taken from the Clinch River. As a storage facility, there would be no process water; utility and sanitary wastewater would be treated prior to discharge into EFPC in accordance with the existing NPDES permits.

All water for operation of the Special Materials Complex would be taken from the Clinch River. No plans exist for groundwater withdrawal to support operation of the Special Materials Complex. Utility and sanitary wastewater would be treated prior to discharge into the EFPC in accordance with the existing NPDES permits.

Under Alternative 4 (the No Action - Planning Basis Operations Alternative plus HEU Materials Facility plus Special Materials Complex), no groundwater would be used for operations of facilities. No plans exist for routine withdrawal from groundwater resources; and utility and sanitary wastewater would be treated prior to discharge in accordance with NPDES permits.

3.5.6 Biological Resources

Construction. Under Alternative 1B (No Action - Planning Basis Operations Alternative), potential impacts to terrestrial, wetlands, and threatened/endangered species are expected. Land clearing activities for the Environmental Management Waste Management Facility and soil borrow area would remove grassland, old field habitat, and forest habitat. Additionally, construction of the Environmental Management Waste Management Facility would require rerouting of 330 m (1,000 ft) of tributary NT-4, and the associated wetland, approximately 0.4 ha (1 acre) in size, would be impacted by potential construction related sediment and loss of adjacent wooded areas. Impacts would be mitigated as part of a wetland mitigation plan for all CERCLA activities in Bear Creek Valley. Potential threatened/endangered species affected by construction activities include the Tennessee endangered pink lady slipper and Tennessee threatened tuberculed rein-orchid and carolina quillwort. There would be only a minor impact on terrestrial resources from Field Research Center activities because test plots would be located in areas where site clearing and past construction have occurred.

Construction of the HEU Materials Facility at Site A would potentially impact terrestrial resources and three wetlands (0.4 ha [1 acre]) at the materials lay-down and new parking lot areas due to land clearing activities. No impact to aquatic resources or threatened/endangered species is expected at Site A. Impacts to biological resources from construction of the HEU Materials Facility at Site B or the Upgrade Expansion of Building 9215 are not expected because these areas have been previously disturbed and do not contain habitat sufficient to support a biologically diverse species mix.

If the Special Materials Complex is constructed at Site 1, approximately 4 ha (1 acre) of terrestrial habitat would be eliminated and wildlife would be dislocated and/or disturbed. Two man-made wetlands (0.4 ha [1 acre]) would potentially be impacted due to construction land clearing and sedimentation from the construction site. No impacts to aquatic or threatened/endangered species are expected at Site 1. If the Special Materials Complex is constructed at Site 2 or Site 3, no impacts to biological resources are expected because of the highly disturbed and industrialized nature of these sites and the minimal biological resources present.

Operation. Under the No Action - Planning Basis Operations Alternative, minor impacts to terrestrial resources are expected due to operation noise and human activities associated with the Environmental Management Waste Management Facility and soils borrow area. No impacts to wetlands, aquatic, or threatened/endangered species are expected. The Field Research Center operations activities would have a minor impact on terrestrial resources due to noise and human activity but would have no impacts on aquatic, wetlands, or threatened/endangered species.

Operation of the HEU Materials Facility, the Special Materials Complex, or the Upgrade Expansion of Building 9215 would not impact biological resources because they would be located in previously disturbed or heavily industrialized portions of the Y-12 Site that do not contain habitat sufficient to support a biologically diverse species mix.

Activities associated with the Environmental Management Waste Management Facility, Field Research Center activities under the No Action - Planning Basis Operations Alternative, and construction and operation of the HEU Materials Facility and Special Materials Complex is anticipated to disturb natural habitat as discussed above during land cleaning activities for new facilities.

3.5.7 Air Quality

Construction. Under the No Action - Planning Basis Operations Alternative, the Environmental Management Waste Management Facility and the Field Research Center activities would potentially have an impact on the project areas due to fugitive dust emissions. However, engineered controls, such as the application of water or chemical dust suppressants and seeding of soil piles and exposed soils, would be implemented to minimize fugitive dust emissions. Based on the activities and the dust control measures, DOE expects that dust emissions at the Y-12 Site boundary would be below the PM_{10} National Ambient Air Quality Standards (NAAQS) at the DOE boundary and only negligible levels of airborne dust would be expected at the nearest residential area.

Construction of the HEU Materials Facility at Site A and Site B would result in small fugitive dust impacts in the construction area. Site A construction activities would generate slightly more fugitive dust emissions because of more earth moving activities associated with the materials lay-down area and new parking lot. If the expansion to Building 9215 is constructed, small fugitive dust impacts in the construction area would be expected. Effective control measures commonly used to reduce fugitive dust emissions include wet suppression, wind speed reduction using barriers, reduced vehicle speed, and chemical stabilization. Necessary control measures would be applied to ensure that PM_{10} concentrations remain below applicable standards.

Construction of the Special Materials Complex at Site 1, Site 2, or Site 3 would generate fugitive dust emissions which would have a small impact in the construction area. Site 1 construction would generate more fugitive dust emissions than Site 2 or Site 3 due to the larger scale of land clearing and earth moving activities to prepare the site for construction. Fugitive dust emissions would not exceed applicable standards when dust suppression methods are used.

Operation. Under the No Action - Planning Basis Operations Alternative, nonradiological air pollutant concentration would be well within established criteria under normal operations. Radiological dose to the maximally exposed individual (MEI) and off-site population under the No Action - Planning Basis Operations Alternative would increase from the No Action - Status Quo Alternative due to the restart of all Y-12 mission operations. The conservatively estimated dose to the MEI (1,120 m [3,675 ft] from Y-12) would increase from 0.53 mrem/yr (under the No Action - Status Quo Alternative) to 4.5 mrem/yr, and the dose to the population within 80 km (50 mi) would increase from 4.5 person-rem/yr (under the No Action - Status Quo Alternative) to 33.7 person-rem/yr. Statistically, this equates to 2.25×10^{-6} latent cancer fatality (LCF) for each year of Y-12 normal operation.

The impacts under Alternative 2A (No Action - Planning Basis Operations Alternative plus Construct and Operate a New HEU Materials Facility) and Alternative 2B (No Action - Planning Basis Operations Alternative plus Upgrade Expansion of Building 9215) would remain unchanged from the No Action - Planning Basis Operations Alternative impacts (i.e., 4.5 mrem per year for the MEI, and 33.7 person-rem for the off-site population). The collective dose to the workers (35) under Alternative 1B (No Action - Planning Basis Operations Alternative) for the existing HEU Storage Mission is 1.16 person-rem. The collective dose to workers due to relocation of existing stored HEU to the new HEU storage facility is 5.25 person-rem. The collective dose to workers (14) during normal operations due to storage of HEU in the HEU Materials Facility is 0.46 person-rem.

There would be no radiological material associated with the Special Materials Complex operation. No change from the No Action - Planning Basis Operations Alternative radiological emissions described above at Y-12 are expected.

Under Alternative 4 (No Action - Planning Basis Operations Alternative plus HEU Materials Facility plus Special Materials Complex), the collective dose to workers at Y-12 would be the same as Alternative 1B (No Action - Planning Basis Operations Alternative). There would be a slight decrease in HEU storage mission worker collective dose from 1.16 person-rem to 0.49 person-rem if the HEU Materials Facility were constructed and operated. This reduction is due to the decrease in number of workers from 35 under the No Action - Planning Basis Operations Alternative to 14 workers for the new HEU Materials Facility. The overall collective Y-12 worker dose however would not change from the 59.48 person-rem under the No Action - Planning Basis Operations Alternative because of the increased production levels and radiological emissions associated with enriched uranium operations. The Special Materials Complex is a non-rad facility and does not handle radioactive materials.

The MEI and population dose within 80 km (50 mi) of the Y-12 Site under this alternative would be the same as Alternative 1B (No Action - Planning Basis Operations Alternative). The conservatively estimated dose received by the hypothetical MEI is 4.5 mrem/yr. The collective population dose would be 33.7 person-rem. This would be a substantial increase from the No Action - Status Quo Alternative dose to the MEI and population of 0.53 mrem/yr and 4.5 person-rem, respectively. The increase is due to the Y-12 National Security Complex operating at planned and required workload levels under Alternative 1B (No Action - Planning Basis Operations Alternative).

3.5.8 Visual Resources

Construction. No additional impact to visual resources is expected under the No Action - Planning Basis Operations Alternative or from the HEU Storage Mission and Special Materials Mission Alternatives because of the design of the proposed new facilities and the existing setting of Y-12.

Operation. No additional impact to visual resources is expected under the No Action - Planning Basis Operations Alternative or from the HEU Storage Mission and Special Materials Mission Alternatives because of the design of the proposed new facilities and the existing setting of Y-12. Alternative 4 (No Action - Planning Basis Operations Alternative plus HEU Material Facility plus Special Materials Complex) would have no additional impacts to visual resources.

3.5.9 Noise

Construction. Under the No Action - Planning Basis Operations Alternative, small noise impacts are expected from construction equipment and activities associated with the Environmental Management Waste Management Facility and the Field Research Center activities. Impacts would be limited to the general construction area. Feasible administrative or engineered controls would be used in addition to personal protective equipment (e.g., ear plugs) to protect workers against the effects of noise exposure.

Construction of the HEU Materials Facility or the Upgrade Expansion of Building 9215 would have small noise impacts in the general construction area. Construction of the Special Materials Complex would have small noise impacts in the general construction area. Feasible administrative or engineered controls would be used in addition to personal protective equipment (e.g., ear plugs) to protect workers against the effects of noise exposure. No off-site noise impacts are expected because peak attenuated noise levels from construction of these facilities would be below background noise levels (53 to 62 dBA) at off-site locations within the city of Oak Ridge.

Construction related noise impacts under Alternative 4 (No Action - Planning Basis Operations Alternative plus HEU Materials Facility plus Special Materials Complex) would result from relatively high and continuous levels of noise in the range of 89 to 108 dBA. Because of the distance between construction sites and locations relative to Y-12 facilities commutative noise impacts to Y-12 employees population would be the mitigated to acceptable levels (approximately 70 dBA). Potential construction activity locations under the alternative are at sufficient distance from the ORR boundary and the city of Oak Ridge to result in no change to background noise levels at these areas.

Operation. Under the No Action - Planning Basis Operations Alternative, small noise impacts are expected from heavy equipment and activities associated with the Environmental Management Waste Management Facility and the Field Research Center. Impacts would be limited to the general operation areas.

Operation of the HEU Materials Facility and the Special Materials Complex would generate some noise, caused particularly by site traffic and mechanical systems associated with operation of the facility (e.g., cooling systems, transformers, engines, pumps, paging systems, and materials-handling equipment). In general, sound levels for all action alternatives are expected to be characteristic of a light industrial setting within the range of 50 to 70 dBA and would be within existing No Action - Status Quo Alternative levels. Effects upon residential areas are attenuated by the distance from the facility, topography, and by a vegetated buffer zone.

3.5.10 Site Infrastructure

Construction. There would be no measurable change in Y-12 Site energy usage or other infrastructure resources under the No Action - Planning Basis Operations Alternative due to the construction of the Environmental Management Waste Management Facility or the Field Research Center activities. Existing site infrastructure would be used and energy usage would be minimal during the construction phase.

Construction of the HEU Materials Facility at Site A would result in less infrastructure impacts than Site B since no buildings would be demolished and utility relocation would be minimal. Site B would require demolition of eight buildings and realignment of Old Bear Creek Road. Construction materials and resources for the HEU Materials Facility would be the same for Site A and Site B. If the Upgrade Expansion of Building 9215 is constructed, some utility relocation would be necessary but no permanent buildings would require demolition. Construction materials and resources for the HEU Materials Facility would be the same for Site A and Site B. Construction materials and resources requirements for the Expansion of Building 9215 would be less than that for the HEU Materials Facility.

Construction materials and resource requirements for the Special Materials Complex would be the same for Site 1, Site 2, or Site 3. Construction of the Special Materials Complex at Site 1 would result in the least impact to infrastructure since no buildings would be demolished and only small utility relocation would be required. At Site 2, five buildings would be removed. At Site 3, eight buildings would be removed and a portion of Old Bear Creek Road would be realigned.

Operation. Under the No Action - Planning Basis Operations Alternative, there would be a slight increase from the No Action - Status Quo Alternative in energy and resource requirements. Electrical energy consumption would increase by approximately 208,000 MWh/yr to 566,000 MWh/yr and water use would increase by 4.3 MLD (1.1 MGD) to 20.2 MLD (5.3 MGD) due to restart of remaining operations that were halted by the 1994 stand-down.

Operation of the HEU Materials Facility would require approximately 5,900 MWh/yr of electricity and 1,510 L/day (400 gal/day) of water. Operation of the Upgrade Expansion of Building 9215 would require approximately 10,900 MWh/year and 1,975 L/day (520 gal/day) of water. Sufficient electrical energy and water capacity exists at Y-12 to support the expected increases. Combined with the No Action - Planning Basis Operations Alternative, the preferred alternative (new HEU Materials Facility) would require a total of 572,000 MWh/yr of electricity and 20.2 MLD (5.3 MGD) of water.

Operation of the Special Materials Complex would require approximately 30,400 MWh/yr and 228,600 L/day (63,000 gal/day) of water. Sufficient electrical energy and water capacity exists at Y-12 to support the expected increases. Combined with the No Action - Planning Basis Operations Alternative, this alternative would require a total of 596,000 MWh/yr of electricity and 20.4 MLD (5.4 MGD) of water.

Operation of the new HEU Materials Facility and the Special Materials Complex when combined with The No Action - Planning Basis Operations Alternative would require an increase in electrical usage to 602,000 MWh/yr and an increase of water usage to 20.4 MLD (5.4 MGD).

The vacating of existing HEU storage facilities and special materials operations facilities, if new projects are constructed, could potentially effect the projected increases and minimize potential impacts on site infrastructure and resources.

3.5.11 Cultural Resources

Construction. No impacts to cultural resources are expected under the No Action - Planning Basis Operations Alternative. NRHP-eligible properties in the proposed historic district encompassing the Y-12 National Security Complex would continue to be actively used for DOE mission activities.

The impacts to cultural resources resulting from the Environmental Management Waste Management Facility and Field Research Center activities has been assessed in consultation with the SHPO (DOE 1999j, DOE 2000b). Although there are no known archaeological resources in the Y-12 Site area, there would be a remote possibility of encountering buried cultural resources during ground-disturbing activities. Procedures for addressing the unanticipated discovery of cultural resources are described in the Y-12 Cultural Resource Management Plan (CRMP).

No impacts to cultural resources are expected from construction of the HEU Materials Facility at Site A or Site B. The Upgrade Expansion of Building 9215 would be considered a major alteration of a historic property and require consultation with the SHPO in accordance with the Y-12 CRMP. Although there are no known archaeological resources in the Y-12 Site area, there would be a remote possibility of encountering buried cultural resources during ground-disturbing activities. Procedures for addressing the unanticipated discovery of cultural resources are described in the Y-12 CRMP.

No impacts to cultural resources are expected from construction of the Special Materials Complex at Site 1, Site 2, or Site 3. Because use of Site 1 would probably involve ground disturbance in an undisturbed area and may involve disturbance exceeding the depth and extent of previous ground disturbances the DOE-ORO would consult with SHPO and other parties to determine whether an archaeological survey is warranted. If a survey is conducted, any resources found would be evaluated for NRHP-eligibility and the effects determined in consultation with the SHPO and other parties. Although there are no known archaeological resources in the Y-12 Site area, there would be a remote possibility of encountering buried cultural resources during ground-disturbing activities. Procedures for addressing the unanticipated discovery of cultural resources are described in the Y-12 CRMP.

Operation. No impacts to cultural resources are expected under the No Action - Planning Basis Operations Alternative because NRHP-eligible properties would not be modified or demolished and ground-disturbing activities would be minimal. No impacts to cultural resources are expected from operation of HEU Materials Facility, the Upgrade Expansion of Building 9215, or the Special Materials Complex. Upon completion of the new HEU Materials Facility or Upgrade Expansion of Building 9215, NRHP-eligible buildings (9204-2, 9204-2E, 9204-4, 9215, 9720-5, and 9998) would no longer be used for the HEU storage mission. Upon completion of the Special Materials Complex, NRHP-eligible buildings (9201-5, 9202, 9731, and 9995) would no longer be used for the Special Materials Mission. Depending on the disposition of these historic properties, there could be impacts associated with moving the HEU Storage Mission and Special Materials

Operations from these buildings. Potential impacts include changes in the character of the properties' use, the physical destruction of historic properties, and the neglect of properties leading to deterioration. If adverse effects on historic properties could result from the change of mission or subsequent disposition of these buildings, the SHPO must be consulted regarding the application of the criteria of adverse effect and in mitigation efforts to avoid or reduce any impacts in accordance with 36 CFR 800.

3.5.12 Waste Management

Construction. The Environmental Management Waste Management Facility and the Field Research Center activities would generate small amounts of nonhazardous construction waste under the No Action - Planning Basis Operations Alternative.

If the HEU Materials Facility is constructed at Site A, construction waste would be less than Site B. At Site A, approximately 3,823 m^3 (5,000 yd^3) of nonhazardous construction debris and 14.8 million L (3.9 million gal) of nonhazardous sanitary waste would be generated during the 4-year construction period. At Site B an additional 22,707 m^3 (29,700 yd^3) of contaminated soil (mixed LLW) would be excavated before building construction could begin. Construction of the Upgrade Expansion of Building 9215 would generate the least amount of construction waste; approximately 3,058 m^3 (4,000 yd^3) of nonhazardous construction debris and 14.8 million L (3.9 million gal) of nonhazardous sanitary waste. Small amounts of hazardous waste (e.g., used oil and diesel contaminated soil) would be generated by the use of construction equipment, and disposed of in accordance with applicable hazardous waste management plans.

Construction of the Special Materials Complex at Site 2 would generate the most construction waste and Site 1 the least. At Site 2, approximately 46,867 m^3 (61,300 yd^3) of contaminated soil (mixed LLW) would be excavated and an additional 3,420 m^3 (4,470 yd^3) of nonhazardous construction debris and 1.4 million L (382,400 gal) of nonhazardous sanitary waste would be generated. At Site 3, approximately 22,707 m^3 (29,700 yd^3) of contaminated soil would be excavated. The amount of construction debris and sanitary waste would be the same as Site 2. No contaminated soil would be excavated at Site 1 and approximately 1.4 million L (382,400 gal) of nonhazardous sanitary waste would be generated. Small amounts of hazardous waste (e.g., used oil and diesel contaminated soil) would be generated by the use of construction equipment, and disposed of in accordance with applicable hazardous waste management plans.

If both a new HEU Materials Facility and a new Special Materials Complex were constructed, the waste generated would be added to waste generated under the No Action - Planning Basis Operations Alternative. The contaminated soils would be mixed LLW. Use of construction equipment would generate small amounts of hazardous waste. Non-hazardous waste would consist primarily of construction debris and wastewater.

Operation. Under the No Action - Planning Basis Operations Alternative, mixed LLW and hazardous waste are expected to increase slightly from the No Action - Status Quo Alternative. LLW generation rate is expected to remain approximately the same as the No Action - Status Quo Alternative. Sanitary/industrial wastes are expected to decrease by a small amount (see Table 3.5–1 for amounts). The operation of the Environmental Management Waste Management Facility would be a beneficial impact on Y-12 Waste Management operations because it would expand on-site CERCLA waste disposal capacity.

Operation of the HEU Materials Facility would be expected to generate small amounts of LLW, hazardous, and nonhazardous waste per year (see Table 3.5–1 for amounts). The Upgrade Expansion of Building 9215 would generate similar small amounts of the same types of waste (see Table 3.5–1 for amounts). Adequate waste management capacity exists to support the expected waste volumes. The No Action - Planning Basis Operations Alternative plus the HEU Materials Facility operation waste generation is shown in Table 3.5–1.

Operation of the Special Materials Complex would generate small amounts of hazardous and nonhazardous waste per year (see Table 3.5–1 for amounts). Less than 1 yd^3 of LLW would be generated per year from

Analytical Chemistry testing in support of special materials operations. Special materials operations use no radiological materials. Adequate waste management capacity exists to support the expected waste volumes. The No Action - Planning Basis Operations Alternative plus the Special Materials Complex operation waste generation is shown in Table 3.5–1.

Operation of both an HEU Materials Facility and a new Special Materials Complex would add to waste generated under the No Action - Planning Basis Operations Alternative (Table 3.5–1).

3.5.13 Environmental Justice

Construction. As discussed in Section 5.3, the short-term socioeconomic impacts during construction of the facilities would be positive and not result in any disproportionately high and adverse effects on minority populations or low-income populations. Therefore, no disproportionately high and adverse effects on minority populations or low-income populations would be expected.

Operation. As discussed in Section 5.14, none of the proposed alternatives would pose significant health risks to the public and radiological emissions would remain below the annual dose limit of 10 mrem (the MEI dose is 4.5 mrem/yr for Alternative 4). Results from the ORR ambient air monitoring program show that the hypothetical EDE received within the Scarboro Community (Monitoring Station 46) is typically lower (0.16 mrem/yr) than at other monitoring stations to the south (Monitoring Station 48) and west (Monitoring Station 35) of Y-12 where the hypothetical EDE would be 0.18 mrem/yr (Monitoring Station 48) or 0.19 mrem/yr (Monitoring Station 35) (DOE 2000d). There are no special circumstances that would result in any greater impact on minority or low-income populations than the population as a whole.

3.5.14 Worker and Public Health

Construction. Under the No Action - Planning Basis Operations Alternative, construction activities of the Environmental Management Waste Management Facility would be expected to result in approximately nine non-fatal occupational injuries/illnesses per year.

Construction of the HEU Materials Facility or the Upgrade Expansion of Building 9215 would be expected to result in approximately three additional non-fatal occupational injuries/illnesses per year. Both facilities would require a 4-year construction period.

Construction of the Special Materials Complex would be expected to result in approximately three additional non-fatal occupational injuries/illnesses per year. The construction period for the Special Materials Complex is 3.5 years.

Operation. Under the No Action - Planning Basis Operations Alternative, the estimated number of non-fatal occupational injuries/illnesses per year for the total Y-12 workforce is 440. Because of the restart of all Y-12 mission operations, radiological impacts are expected. The annual average dose to workers would decrease from the No Action - Status Quo Alternative (26 mrem [7.04×10^{-5} LCF per year]) by 14.6 mrem and result in an estimated 4.64×10^{-6} LCFs per year. The decrease in worker dose is due in part to the use of the new International Commission Radiological Protection (ICRP) 66 lung model and the bio-kinetic model for uranium from ICRP 78 approved by DOE for monitoring worker exposure. These models are based on the latest scientific information from the ICRP. The conservatively estimated MEI dose would increase from the No Action - Status Quo Alternative (0.53 mrem [2.65×10^{-7}]) by 3.97 mrem/yr to 4.5 mrem/yr and result in an estimated 2.25×10^{-6} LCFs per year. The dose to the population within 80km (50 mi) would increase from The No Action - Status Quo Alternative (4.5 person-rem/yr [2.25×10^{-6} LCFs per year]) by 29.2 person-rem/yr to 33.7 person-rem/yr and result in an estimated 1.69×10^{-5} LCFs per year. The increase in public dose is due to the resumption of all uranium operations, including those remaining in stand-down since 1994, under planning basis operations and conservative assumptions used in the analysis.

Once constructed, the HEU Materials Facility or the Upgrade Expansion of Building 9215 would require the transfer of stored HEU in existing facilities to the new storage facility. This one-time transfer would expose workers involved in the transfer to an estimated dose of 150 mrem. An estimated 0.002 LCFs are expected from the transfer. For normal operation of the HEU Materials Facility or the Upgrade Expansion of Building 9215, the worker dose is expected to be 33 mrem/yr and the same as for The No Action - Planning Basis Operations Alternative or The No Action - Status Quo Alternative. The MEI dose and the dose to the population within 80km (50 mi) would not change from the No Action - Planning Basis Operations Alternative or the No Action - Status Quo Alternative.

Operation of the Special Materials Complex involves no radiological materials. No additional hazardous air pollutant impacts are expected. The MEI dose and the dose to the population within 80 km (50 mi) would not change from that described above for the No Action - Planning Basis Operations Alternative.

3.5.15 Facility Accidents

Operation. Under the No Action - Planning Basis Operations Alternative, the postulated beyond-design-basis earthquake accident involving radiological materials would result in an estimated 0.21 LCFs to the population living within 80km (50 mi), the same as The No Action - Status Quo Alternative. The MEI of the public would receive a dose of 17 rem and result in an estimated 0.008 LCFs.

The postulated criticality accident Under the No Action - Planning Basis Operations Alternative would result in an estimated 0.0043 LCFs to the population living within 80km (50 mi), the same as The No Action - Status Quo Alternative. The MEI of the public would receive a dose of 3 rem and result in an estimated 1.5 x 10^{-3} LCFs.

The postulated fire accident scenario involving radioactive materials under the No Action - Planning Basis Operation Alternative would result in an estimated 9 x 10^{-5} to 0.28 LCFs to the population living within 80km (50 mi), the same as The No Action - Status Quo Alternative. The dose to the MEI of the public would be 0.01 to 16 rem and result in an estimated 5 x 10^{-6} to 0.008 LCFs.

The potential bounding accident involving a chemical release due to loss of contaminant under the No Action - Planning Basis Operation Alternative would potentially expose between 80 and 310 workers at Y-12 to Emergency Response Planning Guideline-2 (ERPG) concentrations or greater, the same as The No Action - Status Quo Alternative (See Appendix Section D.7.2.3 for definition of ERPG-2). No significant off-site exposure is expected.

Most of the accidents analyzed in this SWEIS do not vary by alternative because the same facilities are potentially involved in the accidents and subsequent consequences. However, the construction and use of the HEU Materials Facility and Special Materials Complex would replace existing facilities that were originally designed for other purposes with facilities that incorporate modern features to prevent the occurrence of accidents, as well as mitigate the accident consequences.

Due to the design and facility construction, the HEU Materials Facility or the Upgrade Expansion of Building 9215 is expected to reduce the likelihood of a beyond-evaluation-basis earthquake accident for the HEU Storage Mission by approximately a factor of 5, the criticality accident by a factor of 2 to 5, and the accident involving radiological material by a factor of 2 to 5 compared to the current situation under the No Action - Status Quo Alternative. There would be no change from The No Action - Planning Basis Operations Alternative for chemical accidents.

There would be no change from the No Action - Planning Basis Operations Alternative for radiological accidents if the Special Materials Complex is constructed. The likelihood of chemical accidents for the Special Materials Complex would be lower by approximately a factor of 2 to 5 compared to the current situation under the No Action - Status Quo Alternative due to design and facility construction.

The Y-12 Emergency Management Program incorporates all the planning, preparedness, response, recovery, and readiness assurance elements necessary to protect on-site personnel, the public, the environment, and property in case of credible emergencies involving Y-12 facilities, activities, or operations. Provisions are in place for the Y-12 National Security Complex interface and coordination with Federal, state, and local agencies and with those organizations responsible for off-site emergency response. In the event of an emergency at Y-12, a number of resources are available for mitigation, re-entry, and recovery activities associated with the response.

3.5.16 Cumulative Impacts

Potential cumulative impacts due to the impacts of the proposed action and alternatives analyzed in the SWEIS are expected to be minimal. Potential cumulative impacts from the Preferred Alternative (Alternative 4) would be expected during construction of the HEU Materials Facility (Site A) and the Special Materials Complex (Site 1). The construction impacts would be adverse but temporary. Normal operations of the new facilities would contribute to cumulative impacts because they would replace existing storage and special materials operations in existing facilities.

The existing and potential future projects included in the cumulative impact analyses were the TVA operated Bull Run and Kingston coal-fired steam plants, and Watts Bar Nuclear Power Plant; the lease of parcels ED-1, ED-3, and land and facilities within ETTP; construction and operation of the Spallation Neutron Source; surplus HEU disposition activities at Y-12; the treating of transuranic/alpha low-level waste at ORNL; construction of the ORNL Facilities Revitalization Project facilities; and various Oak Ridge area infrastructure upgrade and proposed new construction projects. The following describes issues/resource areas where potential cumulative impacts could result.

Land Use. Alternatives 3 and 4 could result in a land use change for approximately 4 ha (10 acres) if Site 1 is selected for the Special Materials Complex. The 4 ha (10 acres) portion of Site 1 is currently wooded but would change to industrial classification if developed. Construction of the SNS on ORR has cleared an approximately 45 ha (110 acres) greenfield site and resulted in a change in use from Mixed Research/Future Initiatives to Institutional/Research. Other projects on ORR, e.g., the ORNL Facilities Revitalization Project (FRP) and TRU Waste Treatment Facility involve small areas and use existing developed sites (Brownfield) and would not change existing land use classifications. These potential developments and projects would result in small area land use changes on ORR that would be adverse but would not affect land use or residential development outside the ORR boundary.

Transportation. The incremental impact of operation worker traffic at Y-12 is not expected to impact ORR or off-site area traffic because no increase in workers is expected. The existing workforce would be used for Y-12 planning basis operations levels and staffing proposed new facilities. Potential cumulative impacts to area traffic and roads could occur with all the SWEIS alternatives during construction. Depending on project scheduling, peak construction workforce traffic could be a high or an additional 433 vehicles per day with Alternative 4. Construction of the SNS would add approximately 578 workers during peak construction and increase traffic on ORNL access roads by approximately 7 percent. The ORNL FRP and the TRU Waste Treatment Facility would add a smaller amount of workers vehicles (approximately 100) to area traffic. Adverse cumulative impacts could occur if these project construction schedules overlap during peak construction periods. The impact would result in area traffic congestion, and decreased levels-of-service on area access roads to ORR. Recent improvements to ORR access roads should minimize these cumulative impacts as well as the continued staggered work schedule currently in effect at the ORR for operations workers.

Socioeconomics. The proposed actions and alternatives analyzed in the SWEIS would not have adverse impact on socioeconomic issues in the ROI. There would be no substantial change in the workforce associated with Y-12 operations under any of the alternatives and therefore no direct or indirect adverse or beneficial cumulative impact.

Water Emissions. An increase in radioactive or chemical releases to area surface waters is not expected under No Action - Planning Basis Operation or the action alternatives. Routine operations at ORR, including Y-12, result in some release of radionuclides. The MEI dose of 4 mrem per year and the population dose of 3 person-rem per year from waterborne sources near ORR would not change. The cumulative effect from the Watts Bar Nuclear Plant waterborne emissions are estimated to be 4.2 person-rem per year to the population. This cumulative effect (ORR and Watts Bar Nuclear Plant) translates into 0.004 cancer fatalities for each year of exposure to the population living within 80 km (50 miles) of ORR. Therefore, no adverse cumulative effects from radiological waterborne releases are expected.

Air Emissions. Cumulative impacts to air from airborne radioactive releases are expected. The cumulative dose to the population within 80 km (50 miles) of ORR from ORR and other sources identified in the area would be 61.6 person-rem per year. The total annual cumulative dose translates into 0.03 LCF for each year of exposure. The contribution of Y-12 activities under the No Action - Planning Basis Operations and action alternatives would be approximately 33.7 person-rem and 0.017 LCF per year of exposure. The cumulative impacts would not be significant.

The major source of nonradiological air emissions at Y-12 is the Steam Plant. The conservative analysis in the SWEIS (see Section 5.7) shows that Y-12 NAAQs criteria pollutant concentrations when added to background concentrations (which include concentrations from all working sources including the Y-12 Steam Plant) would increase but are below the national and TDEC standards. No significant adverse cumulative impacts are expected from any of the alternatives in the SWEIS.

Utilities and Energy. The incremental increase in utilities and energy use among the alternatives would be minimal (see Site Infrastructure). TVA has excess electrical capacity to accommodate future uses at Y-12, ORR, and projected growth in the surrounding Oak Ridge and Knoxville area. In addition, installed capacity of Y-12 and ORR site utilities is much greater than projected usage. Therefore, no adverse significant cumulative impacts to utility and infrastructure supply and capacity are expected. The installed excess utility infrastructure and capacity at ORR would be a beneficial effect on future public use/development on the ORR.

Waste Generation. The cumulative volumes of LLW, mixed LLW, hazardous waste, and sanitary/industrial waste for the Oak Ridge ROI were analyzed and compared to the existing ORR and off-site waste management facilities capacity and capabilities for treatment, disposal and/or storage. The cumulative volumes from all analyzed actions resulted in generation of 37,819 m^3/yr of LLW, 1,946 m^3/yr of mixed LLW, 203 m^3/yr of hazardous waste, and 29,412 m^3/yr of sanitary/industrial waste. The Y-12 incremental portion of this volume was 1,404 m^3/yr of LLW, 69 m^3/year of mixed LLW, 18.5 m^3/year of hazardous waste, and 7,295 m^3/year of sanitary/industrial waste. The existing ORR and off-site waste management facilities have sufficient capacity and capabilities for treatment, disposal and/or storage. Therefore, no significant cumulative impacts on ORR or area waste management facilities are expected.

Public Health. The analysis of potential cumulative radiological health effects of routine ORR operations includes Y-12 proposed actions and other identified radiological sources within the study area. The cumulative effect from all sources for the general population is a small (less than 5 percent) increase over that from ORR. The ORR total dose to the population within 80 km (50 miles) was conservatively estimated at 90 person- rem per year and translates into 0.045 LCF per year. The cumulative dose to the population was conservatively estimated to be 94 person-rem per year and results in an estimated 0.047 LCF per year. Therefore, no significant cumulative impacts on public or worker health are expected from the proposed actions and SWEIS alternatives.

TABLE 3.5–1.—*Summary of Environmental Consequences for the Y-12 Site-Wide Alternatives* [Page 1 of 29]

	Alternative 1		Alternative 2		Alternative 3	Alternative 4
Resource/ Material Categories	**1A No Action - Status Quo Alternative**	**1B No Action - Planning Basis Operations Alternative**	**2A Alternative 1B Plus Construct and Operate New HEU Materials Facility**	**2B Alternative 1B Plus Upgrade Expansion to Building 9215**	**Alternative 1B Plus Construct and Operate New Special Materials Complex**	**Preferred Alternative Alternative 1B Plus HEU Materials Facility and Special Materials Complex**
Land Use						
Construction:						
Potential Land Disturbance	None	26 to 40 ha (64 to 99 acres) for EMWMF	5 ha (12.4 acres) at Site A	0.8 ha (2 acres)	8 ha (20 acres) at Site 1	10-13 ha (24.7-32.1 acres)
		5 to 7 ha (12.4 to 17 acres) Y-12 West End Borrow Area	5 ha (12.4 acres) at Site B		5 ha (12.4 acres) at Site 2 and Site 3	
		4 ha (10 acres) Field Research Center				
		Total: 35-51 ha	**Total with No Action - Planning Basis Operations Alternative: 40-56 ha**	**Total with No Action - Planning Basis Operations Alternative: 36-52 ha**	**Total with No Action - Planning Basis Operations Alternative: 56-59 ha**	**Total with No Action - Planning Basis Operations Alternative: 45-64 ha**
Operation:						
Potential Permanent Land Requirement	No change from existing 2,136 ha (5,279 acres) comprising Y-12 Site	9 to 18 ha (22 to 44 acres) for EMWMF	4 ha (10 acres) at Site A	0.5 ha (1.2 acres)	4 ha (10 acres) at Sites 1, 2 or 3	8 ha (20 acres)
		5 to 7 ha (12.4 to 17 acres) for Borrow Area	4 ha (10 acres) at Site B			
		< 4 ha (<10 acres) Field Research Center				
		Total: 18-29 ha	**Total with No Action - Planning Basis Operations Alternative: 22-33 ha**	**Total with No Action - Planning Basis Operations Alternative: 18.5-29.5 ha**	**Total with No Action - Planning Basis Operations Alternative: 22-33 ha**	**Total with No Action - Planning Basis Operations Alternative: 26-37 ha**

Table 3.5–1.—*Summary of Environmental Consequences for the Y-12 Site-Wide Alternatives* [Page 2 of 29]

	Alternative 1		Alternative 2		Alternative 3	Alternative 4
Resource/ Material Categories	**1A No Action - Status Quo Alternative**	**1B No Action - Planning Basis Operations Alternative**	**2A Alternative 1B Plus Construct and Operate New HEU Materials Facility**	**2B Alternative 1B Plus Upgrade Expansion to Building 9215**	**Alternative 1B Plus Construct and Operate New Special Materials Complex**	**Preferred Alternative Alternative 1B Plus HEU Materials Facility and Special Materials Complex**
Transportation						
Construction:						
Additional Vehicles/Day	None	75 for EMWMF	165 worker vehicles at Site A and Site B; 8 material trucks	165 worker vehicles; 3 material trucks	157 worker vehicles at Site 1, Site 2, Site 3; 5 material trucks	335 worker vehicles; 13 material trucks
		< 10 for Field Research Center				
		Total: 85 vehicles	**Total with No Action - Planning Basis Operations Alternative: 258 vehicles**	**Total with No Action - Planning Basis Operations Alternative: 253 vehicles**	**Total with No Action - Planning Basis Operations Alternative: 247 vehicles**	**Total with No Action - Planning Basis Operations Alternative: 433 vehicles**
Operation:						
Additional Vehicles/Day	No change from average daily traffic volume of 32,100	28 for EMWMF	No additional worker traffic	No additional worker traffic	No additional worker traffic	No additional worker traffic
		6 for Field Research Center	3,000 additional truck trips on site to relocate stored HEU to new facility	3,000 additional truck trips on site to relocate stored HEU to new facility		
		Total: 34 vehicles	**Total with No Action - Planning Basis Operations Alternative: 34 vehicles**	**Total with No Action - Planning Basis Operations Alternative: 34 vehicles**	**Total with No Action - Planning Basis Operations Alternative: 34 vehicles**	**Total with No Action - Planning Basis Operations Alternative: 34 vehicles**

TABLE 3.5–1.—*Summary of Environmental Consequences for the Y-12 Site-Wide Alternatives* [Page 3 of 29]

	Alternative 1		**Alternative 2**		**Alternative 3**	**Alternative 4**
Resource/ Material Categories	**1A No Action - Status Quo Alternative**	**1B No Action - Planning Basis Operations Alternative**	**2A Alternative 1B Plus Construct and Operate New HEU Materials Facility**	**2B Alternative 1B Plus Upgrade Expansion to Building 9215**	**Alternative 1B Plus Construct and Operate New Special Materials Complex**	**Preferred Alternative Alternative 1B Plus HEU Materials Facility and Special Materials Complex**
Transportation Risk	The risk associated with radiological material transportation would be less than 0.1 fatality per year.	The risk associated with radiological material transportation would be less than 0.1 fatality per year.	The risk associated with radiological material transportation would be less than 0.1 fatality per year.	The risk associated with radiological material transportation would be less than 0.1 fatality per year.	No additional risk from No Action - Status Quo Alternative associated with radiological material transportation under this alternative.	The risk associated with radiological material transportation would be less than 0.1 fatality per year.
	The risk associated with radiological waste transportation would be less than 0.1 fatality per year.	The risk associated with radiological waste transportation would be less than 0.1 fatality per year.	The risk associated with radiological waste transportation would be less than 0.1 fatality per year. The risk associated with the one-time on site transport of stored HEU to new facility would be less than 0.001 fatality.	The risk associated with radiological waste transportation would be less than 0.1 fatality per year. The risk associated with the one-time on site transport of stored HEU to new facility would be less than 0.001 fatality.	No additional risk from No Action - Status Quo Alternative with radiological waste transportation under this alternative.	The risk associated with radiological waste transportation would be less than 0.1 fatality per year.
Socioeconomics						
Construction:	No new construction	100 for EMWMF	220 for Site A and Site B	220	210 for Site 1, Site 2, Site 3	430
Peak Workforce		< 10 for Field Research Center				
		Total: 110 workers	**Total with No Action - Planning Basis Operations Alternative: 330 workers**	**Total with No Action - Planning Basis Operations Alternative: 330 workers**	**Total with No Action - Planning Basis Operations Alternative: 320 workers**	**Total with No Action - Planning Basis Operations Alternative: 540 workers**

TABLE 3.5–1.—*Summary of Environmental Consequences for the Y-12 Site-Wide Alternatives* [Page 4 of 29]

	Alternative 1		Alternative 2		Alternative 3	Alternative 4
Resource/ Material Categories	**1A No Action - Status Quo Alternative**	**1B No Action - Planning Basis Operations Alternative**	**2A Alternative 1B Plus Construct and Operate New HEU Materials Facility**	**2B Alternative 1B Plus Upgrade Expansion to Building 9215**	**Alternative 1B Plus Construct and Operate New Special Materials Complex**	**Preferred Alternative Alternative 1B Plus HEU Materials Facility and Special Materials Complex**
Operation: (Workers)	No change from existing workforce of 8,900	25 for EMWMF	100 during year transition period	100 during year transition period	36 for Site 1, Site 2, Site 3	66
		6 for Field Research Center	30 for normal operation	49 for normal operation		
		Total: 31	**Total with No Action - Planning Basis Operations Alternative: 61**	**Total with No Action - Planning Basis Operations Alternative: 70**	**Total with No Action - Planning Basis Operations Alternative: 97**	**Total with No Action - Planning Basis Operations Alternative: 97**
		Impact on Regional Economy < 1 percent	Impact on Regional Economy < 1 percent	Impact on Regional Economy < 1 percent	Impact on Regional Economy < 1 percent	Impact on Regional Economy < 1 percent
Geology and Soils						
Construction:	No new construction or potential increase in soil erosion	Potential increase in soil erosion due to storm water runoff from EMWMF and Y-12 borrow area. Detention basins and runoff control ditches would minimize soil erosion and impacts.	Potential increase in soil erosion due to storm water runoff at Site A construction lay down area and new parking lot. Detention basins and runoff control ditches would minimize soil erosion and impacts. No impacts to geology are expected.	Small potential for increase in soil erosion. Standard soil erosion control measures would be used to minimize impacts. No impacts to geology are expected.	At Site 1, potential impact to soil profile and increase in soil erosion due to storm water runoff at construction lay down area and new parking lot. Detention basins and runoff control ditches would minimize soil erosion and impacts. No impacts to geology are expected.	Potential increase in soil erosion due to storm water runoff. Detention basins, silt fences, and runoff control ditches would minimize soil erosion and impacts. No impacts to geology are expected.
		Small potential increase in soil erosion from Field Research Center. Soil erosion controls would minimize impacts.			Small potential increase in soil erosion at Site 2 and Site 3. No impacts to geology are expected.	

TABLE 3.5–1.—*Summary of Environmental Consequences for the Y-12 Site-Wide Alternatives* [Page 5 of 29]

	Alternative 1		Alternative 2		Alternative 3	Alternative 4
Resource/ Material Categories	**1A No Action - Status Quo Alternative**	**1B No Action - Planning Basis Operations Alternative**	**2A Alternative 1B Plus Construct and Operate New HEU Materials Facility**	**2B Alternative 1B Plus Upgrade Expansion to Building 9215**	**Alternative 1B Plus Construct and Operate New Special Materials Complex**	**Preferred Alternative Alternative 1B Plus HEU Materials Facility and Special Materials Complex**
Operation:	No increase in soil erosion or impact to geology.	Minimal impacts expected from EMWMF and Y-12 borrow area activities. Detention basins, runoff control ditches, and cell design components would minimize impacts to geology and soils.	No impacts to geology or soils are expected at Site A or Site B with engineered design measures.	No impacts to geology or soils are expected with engineered design measures.	No impacts to geology or soils are expected at Site 1, Site 2, or Site 3 with engineered design measures.	Minimal impact expected due to EMWMF and borrow site activities. Engineered controls would minimize impacts.
Water Resources						
Surface Water:						
Construction:	No change from 15.9 MLD treated water requirement or 17.9 MLD raw water requirement. Surface water discharges meet NPDES permit limits.	No substantial change to surface raw water requirements, discharge, or water quality conditions. Small increase of 4.3 MLD (1.2 MGD) to 20.2 MLD (5.34 MGD) in treated water requirement. Minimal impacts from sediment loading or contaminated runoff from EMWMF or Y-12 borrow area due to engineered barriers (e.g., detention basins, stormwater runoff control ditches).	No substantial change to surface raw water requirements, discharge, or water quality conditions. Small amount (5,140 L/day) of treated water requirement (7.5 million L during 4-yr. construction period) if HEU Materials Facility is constructed at Site A or Site B. Potential for increased storm water runoff at Site A.	No substantial change to surface raw water requirements, discharge, or water quality conditions. Small amount (3,980 L/day) of treated water requirements (5.7 million L during 4-yr. construction period) if Upgrade Expansion to Building 9215 is constructed.	No substantial change to surface raw water requirements, discharge, or water quality. Small amount (4,460 L/day) of treated water requirement (5.7 million L during 3.5-yr. construction period) if Special Materials Complex is constructed at Site 1, Site 2 or Site 3. Potential for increased stormwater runoff at Site 1.	No substantial change to surface raw water requirements, discharge, or water quality. Small increase (4.51 MLD) to 20.21 MLD in treated water requirement.

TABLE 3.5–1.—*Summary of Environmental Consequences for the Y-12 Site-Wide Alternatives* [Page 6 of 29]

	Alternative 1		Alternative 2		Alternative 3	Alternative 4
Resource/ Material Categories	**1A No Action - Status Quo Alternative**	**1B No Action - Planning Basis Operations Alternative**	**2A Alternative 1B Plus Construct and Operate New HEU Materials Facility**	**2B Alternative 1B Plus Upgrade Expansion to Building 9215**	**Alternative 1B Plus Construct and Operate New Special Materials Complex**	**Preferred Alternative Alternative 1B Plus HEU Materials Facility and Special Materials Complex**
Operation:	No change from 15.9 MLD treated water requirement or 17.9 MLD raw water requirement. Surface water discharges meet NPDES permit limits.	No impacts from Field Research Center activities. No substantial change to surface raw water requirements, discharge, or water quality conditions. Small increase of (4.3 MLD (1.2 MGD) to 20.2 MLD (5.3 MGD) in treated water requirement. Minimal impacts from sediment loading or contaminated runoff from EMWMF or Y-12 borrow area due to engineered barriers (e.g., detention basins, stormwater runoff control ditches).	Negligible impact to surface water with soil erosion and surface water control measures. Small increase of 1,510 L/day (400 gal/day) in treated water requirements and discharge but negligible increase from No Action - Planning Basis Operations Alternative surface water requirements, discharges, or water quality conditions at Site A or Site B. All water quality parameters within established limits with pretreatment.	Negligible impact to surface water with soil erosion and surface water control measures. Small increase of 1,975 L/day (520 gal/day) in treated water requirements and discharge but negligible increase from No Action - Planning Basis Operations Alternative water requirements, discharge, or water quality conditions. All water quality parameters within established limits with pretreatment.	Negligible impact to surface water with soil erosion and surface water control measures. Small increase of 228,600 L/day (63,000 gal/day) in treated water requirements and discharge but negligible increase from No Action - Planning Basis Operations Alternative surface water requirements, discharges, or water quality conditions. All water quality parameters within established limits with pretreatment.	Negligible impact to surface water with soil erosion and surface water control measures. Small increase to 20.43 MLD (5.4 MGD) in treated water requirements over No Action - Status Quo Alternative but negligible increase to raw water requirements, discharges, or water quality conditions. All water quality parameters within established limits with pretreatment. Negligible impacts to surface water with soil erosion and surface No Action - Planning Basis Operations Alternative water control measures.
Groundwater						
Construction:	No new construction or change in groundwater use or quality.	Negligible impact from tracer material used in Field Research Center tests. No groundwater requirement or additional impacts to groundwater quality conditions from the EMWMF or Y-12 borrow area. No groundwater requirement or additional impacts to groundwater quality conditions from the Field Research Center.	Negligible impacts to surface water with soil erosion and surface water control measures. No groundwater requirement or additional impacts to groundwater quality conditions if new HEU Materials Facility is constructed at Site A or Site B.	Negligible impacts to surface water with soil erosion and surface water control measures. No groundwater requirement or additional impacts to groundwater quality conditions if new Building 9215 expansion is constructed.	Negligible impacts to surface water with soil erosion and surface water control measures. No groundwater requirement or additional impacts to groundwater quality conditions if new Special Materials Complex is constructed at Site 1, Site 2, or Site3.	No groundwater requirement or additional impacts to groundwater quality conditions.

TABLE 3.5–1.—*Summary of Environmental Consequences for the Y-12 Site-Wide Alternatives* [Page 7 of 29]

	Alternative 1		Alternative 2		Alternative 3	Alternative 4
Resource/ Material Categories	**1A No Action - Status Quo Alternative**	**1B No Action - Planning Basis Operations Alternative**	**2A Alternative 1B Plus Construct and Operate New HEU Materials Facility**	**2B Alternative 1B Plus Upgrade Expansion to Building 9215**	**Alternative 1B Plus Construct and Operate New Special Materials Complex**	**Preferred Alternative Alternative 1B Plus HEU Materials Facility and Special Materials Complex**
Operation:	No groundwater requirement or change in groundwater use or quality.	No groundwater requirement or additional impacts to groundwater quality conditions from the EMWMF. The EMWMF design measures (e.g., natural and man-made synthetic liners) would prevent releases that could impact groundwater quality.	No groundwater requirement or additional impacts to groundwater quality conditions from new facility.	No groundwater requirement or additional impacts to groundwater quality conditions from new facility.	No groundwater requirement or additional impacts to groundwater quality conditions from new facility.	No groundwater requirement or additional impacts to groundwater quality conditions from new facility.
		Field Research Center sampling activities would remove approximately 7,570 L (2,000 gal) of groundwater per year. Minor impacts to groundwater quality due to injected additives and tracers for research study. Groundwater quality may improve with some research study treatment tests.	Same as No Action - Planning Basis Operations Alternative Field Research Center potential groundwater impacts.	Same as No Action - Planning Basis Operations Alternative Field Research Center potential groundwater impacts.	Same as No Action - Planning Basis Operations Alternative Field Research Center potential groundwater impacts.	Same as No Action - Planning Basis Operations Alternative Field Research Center potential groundwater impacts.

TABLE 3.5–1.—*Summary of Environmental Consequences for the Y-12 Site-Wide Alternatives* [Page 8 of 29]

	Alternative 1		Alternative 2		Alternative 3	Alternative 4
Resource/ Material Categories	**1A No Action - Status Quo Alternative**	**1B No Action - Planning Basis Operations Alternative**	**2A Alternative 1B Plus Construct and Operate New HEU Materials Facility**	**2B Alternative 1B Plus Upgrade Expansion to Building 9215**	**Alternative 1B Plus Construct and Operate New Special Materials Complex**	**Preferred Alternative Alternative 1B Plus HEU Materials Facility and Special Materials Complex**
Biological Resources						
Terrestrial						
Construction:	No new construction or impacts to terrestrial resources.	Impacts due to land clearing activities associated with EMWMF and Y-12 borrow area, loss of grassland, old field habitat, and mixed hardwood/conifer forest habitat. Small animal dislocation and reduction in abundance can be expected.	Impacts due to land clearing activities for construction and new parking lot if HEU Materials Facility is constructed at Site A. Loss of grassland, habitat (~2 ha [5 acres]) and small animal dislocation and disturbance can be expected.	Negligible impacts if new addition to Building 9215 is constructed.	Impacts due to land clearing activities at constructions site and construction lay down area if Special Materials Complex is constructed at Site 1. Loss of approximately 4 ha (10 acres) terrestrial habitat and dislocation/disturb-ance of wildlife.	Impacts due to land clearing activities and construction sites. Loss of grassland, old field habitat, and mixed hardwood/conifer forest habitat. Dislocation and disturbance to wildlife can be expected.
		Minimal impact to terrestrial species or habitat from Field Research Center activities.	Negligible impacts if HEU Materials Facility is constructed at Site B.		Negligible impacts if Special Materials Complex is constructed at Site 2 or Site 3.	
Operation:	No new impacts to terrestrial resources from Y-12 operations.	Minor impact to terrestrial resources from the EMWMF or Y-12 borrow area. Operations noise and human activity may disturb or displace some wildlife. Negligible impact to terrestrial resources from Field Research Center activities. Noise and human activity may disturb or displace some wildlife.	Negligible impacts at Site A or Site B from operations due to noise and human activity.	Negligible impacts from operations due to noise and human activity.	Negligible impacts at Site 1, Site 2, or Site 3 from operations due to noise and human activity.	Negligible impacts due to operation noise and human disturbance.

TABLE 3.5–1.—*Summary of Environmental Consequences for the Y-12 Site-Wide Alternatives* [Page 9 of 29]

	Alternative 1		Alternative 2		Alternative 3	Alternative 4
Resource/ Material Categories	**1A No Action - Status Quo Alternative**	**1B No Action - Planning Basis Operations Alternative**	**2A Alternative 1B Plus Construct and Operate New HEU Materials Facility**	**2B Alternative 1B Plus Upgrade Expansion to Building 9215**	**Alternative 1B Plus Construct and Operate New Special Materials Complex**	**Preferred Alternative Alternative 1B Plus HEU Materials Facility and Special Materials Complex**
Wetlands						
Construction:	No change in the 18 wetlands (6.14 ha [15.2 acres]) within the Y-12 area of analysis.	Potential impact to 0.4 ha (1 acre) wetland from EMWMF. No impact from Y-12 borrow area activities.	Potential impact to 3 man-made wetlands (0.4 ha [1 acre]) if the HEU Materials Facility is constructed at Site A. Impacts due to construction of lay down area and new parking lot.	No impacts to wetlands if new expansion to Building 9215 is constructed.	Potential impact on 2 man-made wetlands (0.4 ha [1 acres]) if Special Materials Complex is constructed at Site 1. Impacts due to land clearing and potential sedimentation from construction activities.	Potential impact to 0.8 ha (2 acres) of wetlands within the Y-12 area of analysis.
		No impact from Field Research Center activities.	No impacts to wetlands if HEU Materials Facility is constructed at Site B.		No impact on wetlands if Special Materials Complex is constructed at Site 2 or Site 3.	
		Total: 0.4 ha (1 acre)	**Total with No Action - Planning Basis Operations Alternative: 0.8 ha (2 acres)**	**Total with No Action - Planning Basis Operations Alternative: 0.4 ha (1 acre)**	**Total with No Action - Planning Basis Operations Alternative: 0.8 ha (2 acres)**	**Total with No Action - Planning Basis Operations Alternative: 1.2 ha (3 acres)**
Operation:	No change in the 18 wetlands within the Y-12 area of analysis.	No impacts on wetlands from EMWMF or Y-12 borrow area operation activities. No impacts on wetlands from Field Research Center operation activities.	No impacts on wetlands at Site A or Site B from HEU Materials Facility operation.	No impacts to wetlands from operation.	No impacts on wetlands from Special Materials Complex operation.	No impacts on wetlands.

TABLE 3.5–1.—*Summary of Environmental Consequences for the Y-12 Site-Wide Alternatives* [Page 10 of 29]

	Alternative 1		Alternative 2		Alternative 3	Alternative 4
Resource/ Material Categories	**1A No Action - Status Quo Alternative**	**1B No Action - Planning Basis Operations Alternative**	**2A Alternative 1B Plus Construct and Operate New HEU Materials Facility**	**2B Alternative 1B Plus Upgrade Expansion to Building 9215**	**Alternative 1B Plus Construct and Operate New Special Materials Complex**	**Preferred Alternative Alternative 1B Plus HEU Materials Facility and Special Materials Complex**
Aquatic						
Construction:	No new construction or change to aquatic resources.	No impacts to aquatic resources from EMWMF or Y-12 borrow area activities. No impact from Field Research Center activities.	No impacts to aquatic resources if HEU Materials Facility is constructed at Site A or Site B.	No impacts to aquatic resources if expansion to Building 9215 is constructed.	No impacts to aquatic resources if Special Materials Complex is constructed at Site 1, Site 2, or Site 3.	No impacts to aquatic resources.
Operation:	No change in aquatic resources from Y-12 operation activities. No impacts to aquatic resources.	No impacts to aquatic resources from EMWMF or Y-12 borrow area operation. No impact from Field Research Center operations activities.	No impacts to aquatic resources from HEU Materials Facility operation.	No impacts to aquatic resources from new storage expansion operation.	No impacts to aquatic resources from Special Materials Complex operation.	No impacts to aquatic resources.
Threatened/Endangered Species						
Construction:	No new construction or impacts to threatened/ endangered species within Y-12 area of analysis.	Potential impacts to Tennessee Endangered species pink lady slipper and Tennessee Threatened species tuberculed rein-orchid and carolina quillwort from EMWMF construction activities. Impacts due to forest clearing and construction activities in close proximity to sensitive habitat.	Potential impacts from EMWMF under No Action - Planning Basis Operations Alternative. No impacts to threatened/endangered species if HEU Materials Facility is constructed at Site A or Site B.	Potential impacts from EMWMF under No Action - Planning Basis Operations Alternative. No impacts to threatened/endangered species if storage expansion to Building 9215 is constructed.	Potential impacts from EMWMF under No Action - Planning Basis Operations Alternative. No impacts to threatened/endangered species if Special Materials Complex is constructed at Site 1, Site 2 or Site 3.	Potential impacts from EMWMF under No Action - Planning Basis Operations Alternative. No impacts to threatened/endangered species from HEU Materials Facility or Special Materials Complex.

TABLE 3.5–1.—*Summary of Environmental Consequences for the Y-12 Site-Wide Alternatives* [Page 11 of 29]

	Alternative 1		Alternative 2		Alternative 3	Alternative 4
Resource/ Material Categories	**1A No Action - Status Quo Alternative**	**1B No Action - Planning Basis Operations Alternative**	**2A Alternative 1B Plus Construct and Operate New HEU Materials Facility**	**2B Alternative 1B Plus Upgrade Expansion to Building 9215**	**Alternative 1B Plus Construct and Operate New Special Materials Complex**	**Preferred Alternative Alternative 1B Plus HEU Materials Facility and Special Materials Complex**
Operation:	No impacts to threatened/ endangered species from operation activities.	No impact from Y-12 borrow area activities to threatened/endangered species. No impact from Field Research Center operation activities.	No impact to threatened/endangered species from HEU Materials Facility operation.	No impact to threatened/endangered species from storage expansion operation.	No impact to threatened/endangered species from Special Materials Complex operation.	No impact to threatened/endangered species from operations.
Air Quality						
Nonradiological Emissions						
Construction:	No new construction. All criteria pollutant levels within acceptable standards.	Potential fugitive dust emissions from EMWMF and Y-12 borrow area during construction. Standard dust control measures would be used. No off-site impact. Potential fugitive dust emissions from Field Research Center due to minor site clearing and drilling activities. Standard dust control measures would be used. No off-site impacts.	Potential fugitive dust emissions if HEU Materials Facility is constructed at Site A or Site B. Site A construction activities would generate more fugitive dust emissions due to site preparation for new parking lot and lay down area. Standard dust control measures would be used. No off-site impacts.	Potential fugitive dust emissions if expansion to Building 9215 is constructed. Standard dust control measures would be used. No off-site impacts.	Potential fugitive dust emissions if Special Materials Complex is constructed at Site 1, Site 2, or Site 3. Site 1 construction activities would generate more fugitive dust emissions than Site 2 or Site 3 due to larger construction site, land clearing, and lay-down area site preparation. Standard dust control measures would be used. No off-site impacts.	Potential fugitive dust emissions due to land disturbance and construction activities. Standard dust control measures would be used to minimize fugitive dust impacts. No off-site impacts.

TABLE 3.5–1.—*Summary of Environmental Consequences for the Y-12 Site-Wide Alternatives* [Page 12 of 29]

	Alternative 1		Alternative 2		Alternative 3	Alternative 4
Resource/ Material Categories	**1A No Action - Status Quo Alternative**	**1B No Action - Planning Basis Operations Alternative**	**2A Alternative 1B Plus Construct and Operate New HEU Materials Facility**	**2B Alternative 1B Plus Upgrade Expansion to Building 9215**	**Alternative 1B Plus Construct and Operate New Special Materials Complex**	**Preferred Alternative Alternative 1B Plus HEU Materials Facility and Special Materials Complex**
Operation:	Concentrations of regulated nonradiological air pollutants are within standards.	No change to No Action - Status Quo Alternative air quality conditions from Y-12 mission normal operations. Nonradiological air pollutant concentrations would increase but would be well within established criteria. Potential impact if Y-12 Steam Plant operated at 522 million BTU/hr heat input capacity from higher ozone concentrations.	No change to No Action - Planning Basis Operations Alternative air quality conditions from HEU storage operations. Nonradiological air pollutant concentrations would be well within established criteria. Potential impact if Y-12 Steam Plant operated at 522 million BTU/hr heat input capacity from higher ozone concentrations.	No change to No Action - Planning Basis Operations Alternative air quality conditions from new storage expansion operations. Nonradiological air pollutant concentrations would be well within established criteria. Potential impact if Y-12 Steam Plant operated at 522 million BTU/hr heat input capacity from higher ozone concentrations.	No change to No Action - Planning Basis Operations Alternative air quality conditions from special materials operations. Nonradiological air pollutant concentrations would be well within established criteria. Potential impact if Y-12 Steam Plant operated at 522 million BTU/hr heat input capacity from higher ozone concentrations.	No change to No Action - Status Quo Alternative air quality conditions. Nonradiological air pollutant concentrations would increase but would be within established standards. Potential impact if Y-12 Steam Plant operated at 522 million BTU/hr heat input capacity from higher ozone concentrations.
Radiological Emissions						
Construction:	No new construction or change in Y-12 radiological emissions.	No radiological emissions from EMWMF construction activities.	No radiological emissions from construction of HEU Materials Facility at Site A or Site B.	No radiological emission from construction of storage expansion to Building 9215.	No radiological emissions from construction of Special Materials Complex at Site 1, Site 2, or Site 3.	No radiological emissions.
		No radiological emissions from Field Research Center construction activities.				
Operation:	Radiation dose to the MEI is 0.53 mrem from Y-12 operations. Dose from ORR to MEI is 0.69 mrem. The dose is well below the NESHAP standard of 10 mrem/yr for ORR.	Radiation dose to the MEI (1,120 m [3,675 ft] from Y-12) would increase from 0.53 mrem/yr under No Action - Status Quo Alternative to 4.5 mrem/yr. The dose when added to the ORNL and ETTP dose is well below the NESHAP standard of 10 mrem/yr for ORR.	No change from No Action - Planning Basis Operations Alternative if HEU Materials Facility is constructed. Radiation dose to MEI would be 4.5 mrem/yr.	No change from No Action - Planning Basis Operations Alternative if storage expansion to Building 9215 is constructed. Radiation dose to MEI would be 4.5 mrem/yr.	No change from No Action - Planning Basis Operations Alternative. No radioactive materials would be used or stored at the complex. Radiation dose to MEI would be 4.5 mrem/yr.	Radiation dose to the MEI would increase from 0.53 mrem/yr under No Action - Status Quo Alternative to 4.5 mrem/yr. The dose when added to the ORNL and ETTP dose is well below the NESHAP standard of 10 mrem/yr for ORR.

TABLE 3.5–1.—*Summary of Environmental Consequences for the Y-12 Site-Wide Alternatives* [Page 13 of 29]

	Alternative 1		Alternative 2		Alternative 3	Alternative 4
Resource/ Material Categories	**1A No Action - Status Quo Alternative**	**1B No Action - Planning Basis Operations Alternative**	**2A Alternative 1B Plus Construct and Operate New HEU Materials Facility**	**2B Alternative 1B Plus Upgrade Expansion to Building 9215**	**Alternative 1B Plus Construct and Operate New Special Materials Complex**	**Preferred Alternative Alternative 1B Plus HEU Materials Facility and Special Materials Complex**
	Radiation dose to the population within 80 km (50 mi) is 4.5 person-rem/yr.	Radiation dose to the population (80 km [50 mi] radius) would be 33.7 person-rem/yr.	Radiation dose to the population within 80 km (50 mi) would be 33.7 person-rem/yr.	Radiation dose to the population within 80 km (50 mi) would be 33.7 person-rem/yr.	Radiation dose to the population within 80 km (50 mi) would be 33.7 person-rem/yr.	Radiation dose to the population within 80 km (50 mi) would be 33.7 person-rem/yr.
Visual Resources						
<u>*Construction:*</u>	No change in Y-12 Site visual setting or visual resources.	The EMWMF, Y-12 borrow area, and Field Research Center Project areas are not visible to the public. The site construction activities would be compatible with current uses and consistent with existing visual character of the area. No additional impact to visual resources.	Site A and Site B for the HEU Materials Facility are not visible to the public. No additional impact to visual resources from No Action - Status Quo Alternative under this alternative.	The Building 9215 expansion site is not visible to the public. No additional impact to visual resources from No Action - Status Quo Alternative under this alternative.	Site 1, Site 2, and Site 3 for the new Special Materials Complex are not visible to the public. No additional impact to visual resources from No Action - Status Quo Alternative under this alternative.	No additional impact to visual resources from No Action - Status Quo Alternative under this alternative.
<u>*Operation:*</u>	No change in Y-12 Site visual setting or visual resources.	No additional impact to visual resources from No Action - Status Quo Alternative.	No additional impact to visual resources from No Action - Status Quo Alternative. The new HEU materials facility would be consistent with the existing visual character of the area.	No additional impact to visual resources from No Action - Status Quo Alternative. The Building 9215 expansion would be consistent with the existing visual character of the area.	No additional impact to visual resources from No Action - Status Quo Alternative. The new Special Materials Complex would be consistent with the existing visual character of the area.	No additional impact to visual resources from No Action - Status Quo Alternative. New facilities would be consistent with the existing visual character of the area.

TABLE 3.5–1.—*Summary of Environmental Consequences for the Y-12 Site-Wide Alternatives* [Page 14 of 29]

	Alternative 1		Alternative 2		Alternative 3	Alternative 4
Resource/ Material Categories	**1A No Action - Status Quo Alternative**	**1B No Action - Planning Basis Operations Alternative**	**2A Alternative 1B Plus Construct and Operate New HEU Materials Facility**	**2B Alternative 1B Plus Upgrade Expansion to Building 9215**	**Alternative 1B Plus Construct and Operate New Special Materials Complex**	**Preferred Alternative Alternative 1B Plus HEU Materials Facility and Special Materials Complex**
Noise						
Construction:	No change in on-site noise levels of 50 to 70 dBA. Off-site noise levels would remain at 35 to 50 dBA in rural locations and 53 to 62 dBA in city of Oak Ridge.	Increase in noise levels due to construction equipment and activities associated with EMWMF and Y-12 borrow area. Impact would be limited to general construction area and not noticeable to the public. Small increase in noise levels from Field Research Center activities but localized in study area.	Increase in noise levels (89 to 108 dBA) if HEU Materials Facility is constructed at Site A or Site B. Impacts would be limited to general construction area. No off-site noise impacts except for construction vehicle traffic.	Localized increase in noise levels (89 to 108 dBA) if storage expansion to Building 9215 is constructed. No off-site noise impacts except for construction vehicle traffic.	Increase in noise levels (89 to 108 dBA) if Special Materials Complex is constructed at Site 1, Site 2, or Site 3. Impacts would be limited to general construction area. No off-site impacts except for construction vehicle traffic.	Increase in noise levels (89 to 108 dBA) due to construction equipment and activities. Impacts would be limited to the general construction area sites. Cumulative noise levels 70 dBA. No off-site impacts except for construction vehicle traffic.
Operation:	No change in on-site noise levels of 50 to 70 dBA. Off-site noise levels would remain at 35 to 50 dBA in rural locations and 53 to 62 dBA in city of Oak Ridge.	No off-site increase in noise levels from No Action - Status Quo Alternative due to operation of the EMWMF, the Field Research Center, or activities at Y-12 borrow area.	No off-site change from No Action - Status Quo Alternative noise levels. On-site noise levels would be in range of 50 to 70 dBA.	No off-site change from No Action - Status Quo Alternative noise levels. On-site noise levels would be in range of 50 to 70 dBA.	No off-site change from No Action - Status Quo Alternative noise levels. On-site noise levels would be in range of 50 to 70 dBA.	No off-site change from No Action - Status Quo Alternative noise levels. On-site noise levels would be in range of 50 to 70 dBA.

TABLE 3.5–1.—*Summary of Environmental Consequences for the Y-12 Site-Wide Alternatives* [Page 15 of 29]

	Alternative 1		Alternative 2		Alternative 3	Alternative 4
Resource/ Material Categories	**1A No Action - Status Quo Alternative**	**1B No Action - Planning Basis Operations Alternative**	**2A Alternative 1B Plus Construct and Operate New HEU Materials Facility**	**2B Alternative 1B Plus Upgrade Expansion to Building 9215**	**Alternative 1B Plus Construct and Operate New Special Materials Complex**	**Preferred Alternative Alternative 1B Plus HEU Materials Facility and Special Materials Complex**
Site Infrastructure						
<u>*Construction:*</u>	No measurable change in Y-12 site energy usage or other infrastructure resources.	No measurable change in Y-12 site energy usage or other infrastructure resources from the construction of the EMWMF or Field Research Center.	If the HEU Materials Facility is constructed at Site A, existing utilities would require relocation but no buildings would be demolished. Construction resources include 25,100 m^3 (32,830 yd^3) of concrete and 7.5 million L (2 million gal) of water during the 4-year construction period. If the HEU Materials Facility is constructed at Site B, existing infrastructure (Old Bear Creek Road) and utilities would require relocation. Eight buildings would be demolished. Construction resources include 25,100 m^3 (32,830 yd^3) of concrete and 7.5 million L (2 million gal) of water during the 4-year construction period.	If the Building 9215 expansion is constructed existing utilites would require relocation. No permanent building would be demolished. Construction resources include 7,650 m^3 (10,005 yd^3) of concrete and 5.7 million L (1.5 million gal) of water during the 4-year construction period.	If the Special Materials Complex is constructed at Sites 1, 2, or 3, existing utilities would require relocation. A number of buildings would be demolished at Site 2 and Site 3. Construction resources include 13,800 m^3 (18,050 yd^3) of concrete for Site 1 and 14,500m^3 (18,966 yd^3) for Site 2 and Site 3.	If the HEU Material Facility is constructed at Site A or B and the Special Materials Complex is constructed at Site 1, 2, or 3, existing utilities would require relocation and up to 16 buildings would be demolished. Construction resources would include 46,630 m^3 (61,000 yd^3) of concrete and 13.2 million L (3.5 million gal) of water during the construction period which could run from 4 to 7.5 years.

TABLE 3.5–1.—*Summary of Environmental Consequences for the Y-12 Site-Wide Alternatives* [Page 16 of 29]

	Alternative 1		Alternative 2		Alternative 3	Alternative 4
Resource/ Material Categories	**1A No Action - Status Quo Alternative**	**1B No Action - Planning Basis Operations Alternative**	**2A Alternative 1B Plus Construct and Operate New HEU Materials Facility**	**2B Alternative 1B Plus Upgrade Expansion to Building 9215**	**Alternative 1B Plus Construct and Operate New Special Materials Complex**	**Preferred Alternative Alternative 1B Plus HEU Materials Facility and Special Materials Complex**
Operation:	Continue electrical usage of 358,000 MWh/yr and water usage of 15.9 MLD (4.2 MGD). Both amounts well within existing Y-12 site capacities.	Small increase in overall Y-12 energy and resource requirements. Electrical energy consumption would increase to 566,000 MWh/yr from 358,000 MWh/yr under No Action - Status Quo Alternative. Increases would be well within existing capacities at Y-12. Water usage would increase to 20.2 MLD (5.3 MGD) from 15.9 MLD (4.2 MGD) under No Action - Status Quo Alternative.	Increase of electrical usage by 5,900 MWh/yr and water usage of 1,510L/day (400 gal/day). Vacating existing HEU storage facilities could partially offset these increases. Sufficient capacity exists to support the increases.	Increase in electrical usage by 10,900 MWh/yr and water usage of 1,975L/day (520 gal/day). Vacating existing HEU storage facilities could partially offset these projected increases. Sufficient capacity exists to support the increases.	Increase in electrical usage by 30,400 Mwh/yr and water usage of 228,600L/day (60,400 gal/day). Vacating existing Special Materials operations facilities could partially offset these projected increases. Sufficient capacity exists to support the increases.	Increase in electrical usage by 36,300 Mwh/yr Water usage would increase by 230,110 L/day (60,788 gal/day). Sufficient capacity exists to support the increases.
		Total: 566,000 MWh/y in electrical usage (an increase of 208,000). Combined water use increase of 1.1 MGD.	**Total with No Action - Planning Basis Operations Alternative:** 572,000 MWh/yr in electrical usage (an increase of 214,000). Combined water use increase would still be approximately 1.1 MGD.	**Total with No Action - Planning Basis Operations Alternative:** 577,000 Mwh/yr in electrical usage (an increase of 219,000). Combined water usage increase would still be approximately 1.1 MGD.	**Total with No Action - Planning Basis Operations Alternative:** 596,000 Mwh/yr in electrical usage (an increase of 238,000). Combined water usage increase would still be approximately 1.1 MGD.	**Total with No Action - Planning Basis Operations Alternative:** 602,000 Mwh/yr in electrical usage (an increase of 244,000). Combined water usage increase would still be approximately 1.2 MGD.

TABLE 3.5–1.—*Summary of Environmental Consequences for the Y-12 Site-Wide Alternatives* [Page 17 of 29]

	Alternative 1		Alternative 2		Alternative 3	Alternative 4
Resource/ Material Categories	**1A No Action - Status Quo Alternative**	**1B No Action - Planning Basis Operations Alternative**	**2A Alternative 1B Plus Construct and Operate New HEU Materials Facility**	**2B Alternative 1B Plus Upgrade Expansion to Building 9215**	**Alternative 1B Plus Construct and Operate New Special Materials Complex**	**Preferred Alternative Alternative 1B Plus HEU Materials Facility and Special Materials Complex**
Cultural Resources						
Construction:	No new construction or building modification; no impacts to cultural resources is expected	No impact to cultural resources is expected from the EMWMF, Y-12 Borrow area, or Field Research Center activities.	No impact to cultural resources is expected from construction of HEU Materials Facility at Site A or Site B. Utility relocation associated with construction could encounter buried cultural resources. Any potential adverse effects are anticipated to be minor and mitigatable.	The expansion of Building 9215 would be a major alteration of a historic property. Consultation with the Tennessee Historical Commission (SHPO)would be conducted in accordance with procedures in the Y-12 Cultural Resources Management Plan.	No impact to cultural resources is expected from construction of the Special Materials Complex at Site 1, Site 2, or Site 3. No historic properties would be affected. Utility relocation or site construction activities could encounter buried cultural resources. Any potential effects are anticipated to be minor and mitigatable.	No impact to cultural resources is expected. Utility relocation or site construction activities could encounter buried cultural resources. Any potential effects are anticipated to be minor and mitigatable.
Operation:	The continued use of buildings in their historic role would have a positive impact on the integrity of historic properties. Ongoing minor impacts due to aging of historic structures.	No additional impact from No Action - Status Quo Alternative to cultural resources is expected.	No additional impact from No Action - Status Quo Alternative to cultural resources is expected.	No additional impact from No Action - Status Quo Alternative to cultural resources is expected.	No additional impact from No Action - Status Quo Alternative to cultural resources is expected.	No additional impact from No Action - Status Quo Alternative to cultural resources is expected.

TABLE 3.5–1.—*Summary of Environmental Consequences for the Y-12 Site-Wide Alternatives* [Page 18 of 29]

	Alternative 1		Alternative 2		Alternative 3	Alternative 4
Resource/ Material Categories	**1A No Action - Status Quo Alternative**	**1B No Action - Planning Basis Operations Alternative**	**2A Alternative 1B Plus Construct and Operate New HEU Materials Facility**	**2B Alternative 1B Plus Upgrade Expansion to Building 9215**	**Alternative 1B Plus Construct and Operate New Special Materials Complex**	**Preferred Alternative Alternative 1B Plus HEU Materials Facility and Special Materials Complex**
Waste Management						
Construction:	No new construction waste would be generated as a result of operations.	Small amounts of non-hazardous construction waste generated from the EMWMF, Y-12 borrow area, and Field Research Center construction activities.	At Site A, approximately 3,823m^3 (5,000 yd^3) of non-hazardous construction debris and 14.8 million L (3.9 million gal) of non-hazardous sanitary waste would be generated during the 4-year construction period.	Approximately 3,058 m^3 (4,000 yd^3) of non-hazardous construction debris and 14.8 million L (3.9 million gal) of non-hazardous sanitary waste would be generated during the 4-year construction period.	At Site 1, approximately 917m^3 (1,200 yd^3) of non-hazardous construction debris and 1,447,541 L (382,400 gal) of non-hazardous sanitary waste would be generated during the 3.5-year construction period.	Under this alternative approximable 7,268m^3 (9,506 yd^3) of non-hazardous construction debris and 15,995,000L (4.2 million gal) of non-hazardous sanitary waste and would be generated.
			At Site B, approximately 3,823m^3 (5,000 yd^3) of non-hazardous construction debris and 14.8 million L (3.9 million gal) of non-hazardous sanitary waste would be generated during the 4-year construction period.		At Site 2, approximately 3,420 m^3 (4,470 yd^3) of non-hazardous construction debris and 1,447,541 L (382,400 gal) of non-hazardous sanitary waste would be generated during the 3.5-year construction period.	
			An additional 22,707m^3 (29,700 yd^3) of contaminated soil (mixed LLW) would be excavated.		An additional 46,867 m^3 (61,300 yd^3) of contaminated soil (mixed LLW) would be excavated.	An additional 69,574m^3 (90,999 yd^3) of contaminated soil would be excavated (mixed LLW).

TABLE 3.5–1.—*Summary of Environmental Consequences for the Y-12 Site-Wide Alternatives* [Page 19 of 29]

	Alternative 1		Alternative 2		Alternative 3	Alternative 4
Resource/ Material Categories	**1A No Action - Status Quo Alternative**	**1B No Action - Planning Basis Operations Alternative**	**2A Alternative 1B Plus Construct and Operate New HEU Materials Facility**	**2B Alternative 1B Plus Upgrade Expansion to Building 9215**	**Alternative 1B Plus Construct and Operate New Special Materials Complex**	**Preferred Alternative Alternative 1B Plus HEU Materials Facility and Special Materials Complex**
					At Site 3, approximately 22,707m3 (29,700 yd^3) of contaminated soil (mixed LLW) would be excavated. An additional 3,445m^3 (4,500 yd^3) of non-hazardous construction debris and 1,447,541m3 (382,400 gal) of non hazardous sanitary waste would be generated during the 3.5 year construction period.	
			An estimated 3,000L (800 gal) and 38m^3 (50 yd^3) of hazardous waste would be generated from the use of construction equipment.	An estimated 1,100L (300 gal) and 15m^3 (20 yd^3) of hazardous waste would be generated from the use of construction equipment.	Up to 11,400L (3,000 gal) and 107m^3 (140 yd^3) of hazardous waste would be generated at any one site from the use of construction equipment.	An estimated 14,400L (3,804 gal) and 145m^3 (190 yd^3) of hazardous waste would be generated from use of construction equipment.

TABLE 3.5–1.—*Summary of Environmental Consequences for the Y-12 Site-Wide Alternatives* [Page 20 of 29]

	Alternative 1		Alternative 2		Alternative 3	Alternative 4
Resource/ Material Categories	**1A No Action - Status Quo Alternative**	**1B No Action - Planning Basis Operations Alternative**	**2A Alternative 1B Plus Construct and Operate New HEU Materials Facility**	**2B Alternative 1B Plus Upgrade Expansion to Building 9215**	**Alternative 1B Plus Construct and Operate New Special Materials Complex**	**Preferred Alternative Alternative 1B Plus HEU Materials Facility and Special Materials Complex**
Operation:	Annual waste generation at Y-12 (1999) included:	Projected annual waste generation:	Operation of the HEU Materials Facility would generate the following additional amounts of waste per year:	Operation of the Building 9215 storage expansion would generate the following additional amounts of waste per year:	Operation of the Special Materials Complex would generate the following additional amounts of waste per year:	Operation of the HEU Materials Facility and Special Materials Complex would generate the following total additional amounts of waste per year:
	LLW Liquid 1,000,000L (264,172 gal) Solid 1,404 m^3 (1,826 yd^3)	**LLW** Liquid 1,118,800L (295,556 gal) Solid 2,099 m^3 (2,745 yd^3)	**LLW** Liquid 757L (200 gal) Solid 119 m^3 (156 yd^3)	**LLW** Liquid 606L (160 gal) Solid 119m^3 (156 yd^3)	**LLW** Liquid - None Solid 0.8 m^3 (1 yd^3)	**LLW** Liquid 757 L (200 gal) Solid 120 m^3 (157 yd^3)
	Mixed LLW Liquid 22,500L (5,944 gal) Solid 69 m^3 (90 yd^3)	**Mixed LLW** Liquid 936,783 L (247,477 gal) Solid 162 m^3 (212 yd^3)	**Mixed LLW** Liquid - None Solid - None	**Mixed LLW** Liquid - None Solid - None	**Mixed LLW** Liquid - None Solid - None	**Mixed LLW** Liquid - None Solid - None
	Hazardous Liquid 3,300L (872 gal) Solid 18 m^3 (24 yd^3)	**Hazardous** Liquid 10,400L (2,748 gal) Solid 26 m^3 (34 yd^3)	**Hazardous** Liquid 2,498L (660 gal) Solid 1.5 m^3 (2 yd^3)	**Hazardous** Liquid 2,498L (660 gal) Solid 1.5 m^3 (2 yd^3)	**Hazardous** Liquid 12,500L (3,302 gal) Solid 9.2 m^3 (12 yd^3)	**Hazardous** Liquid 14,998 L (3,962 gal) Solid 10.7 m^3 (48 yd^3)
	Sanitary/Ind Liquid 1,406,000L (371,426 gal) Solid 7,295 m^3 (9,541 yd^3).	**Sanitary/Ind** Liquid 2,318,000L (612,298 gal) Solid 8,883 m^3 (11,619 yd^3). The EMWMF would have a beneficial impact on Y-12 legacy waste management by providing on-site disposal capacity.	**Sanitary/Ind** Liquid 781,309L (206,400 gal) Solid 179 m^3 (234 yd^3).	**Sanitary/Ind** Liquid 1,273,601L (336,450 gal) Solid 179 m^3 (234 yd^3).	**Sanitary/Ind** Liquid 932,725L (246,400 gal) Solid 175 m^3 (229 yd^3).	**Sanitary/Ind** Liquid 1,714,034 L (452,800 gal) Solid 354 m^3 (463 yd^3)

TABLE 3.5–1.—*Summary of Environmental Consequences for the Y-12 Site-Wide Alternatives* [Page 21 of 29]

	Alternative 1		Alternative 2		Alternative 3	Alternative 4
Resource/ Material Categories	**1A No Action - Status Quo Alternative**	**1B No Action - Planning Basis Operations Alternative**	**2A Alternative 1B Plus Construct and Operate New HEU Materials Facility**	**2B Alternative 1B Plus Upgrade Expansion to Building 9215**	**Alternative 1B Plus Construct and Operate New Special Materials Complex**	**Preferred Alternative Alternative 1B Plus HEU Materials Facility and Special Materials Complex**
			Total with No Action - Planning Basis Operations Alternative:	**Total with No Action - Planning Basis Operations Alternative:**	**Total with No Action - Planning Basis Operations Alternative:**	**Total with No Action - Planning Basis Operations Alternative:**
			LLW Liquid 1,119,557L (295,756 gal) Solid 2,218 m^3 (2,901 yd^3)	**LLW** Liquid 1,119,406L (295,716 gal) Solid 2,218 m^3 (2,901 yd^3);	**LLW** Liquid 1,118,800L (295,556 gal) Solid 2,100 m^3 (2,746 yd^3)	**LLW** Liquid 1,119,557L (295,756 gal) Solid 2,219 m^3 (2,902 yd^3)
			Mixed LLW Liquid 936,783L (247,477 gal) Solid 162 m^3 (212 yd^3)	**Mixed LLW** Liquid 936,783L (247,477 gal) Solid 162 m^3 (212 yd^3)	**Mixed LLW** Liquid 936,783L (247,477 gal) Solid 162 m^3 (212 yd^3)	**Mixed LLW** Liquid 936,783L (247,477 gal) Solid 162m^3 (212 yd^3)
			Hazardous Liquid 12,898L (3,408 gal) Solid 27.7 m^3 (36.2 yd^3)	**Hazardous** Liquid 12,898L (3,408 gal) Solid 27.7 m^3 (36.2 yd^3)	**Hazardous** Liquid 22,900L (6,050 gal) Solid 35.3 m^3 (46.2 yd^3)	**Hazardous** Liquid 25,398L (6,710 gal) Solid 37 m^3 (48 yd^3)
			Sanitary/Ind Liquid 3,099,309L (818,698 gal) Solid 9,062 m^3 (11,853 yd^3)	**Sanitary/Ind** Liquid 3,591,601L (948,748 gal) Solid 9,062 m^3 (11,853 yd^3)	**Sanitary/Ind** Liquid 3,250,725L (858,698 gal) Solid 9,058 m^3 (11,848 yd^3)	**Sanitary/Ind** Liquid 4,032,034L (1,065,100 gal) Solid 9,237 m^3 (12,082 yd^3)
			These increases could be partially offset by reductions due to the phase-out of existing HEU storage operations and facilities. Adequate waste management capacity exists to support the expected waste volumes.	These increases could be partially offset by reductions due to the phase-out of existing HEU storage operations and facilities. Adequate waste management capacity exists to support the expected waste volumes.	These increases could be partially offset by reductions due to the phase-out of existing Special Materials operations and facilities. Adequate waste management capacity exists to support the expected waste volumes.	These increases could be partially offset by reductions due to the phase-out of existing HEU storage and Special Materials operations and facilities. Adequate waste management capacity exists to support the expected waste volumes.

TABLE 3.5–1.—*Summary of Environmental Consequences for the Y-12 Site-Wide Alternatives* [Page 22 of 29]

	Alternative 1		Alternative 2		Alternative 3	Alternative 4
Resource/ Material Categories	**1A No Action - Status Quo Alternative**	**1B No Action - Planning Basis Operations Alternative**	**2A Alternative 1B Plus Construct and Operate New HEU Materials Facility**	**2B Alternative 1B Plus Upgrade Expansion to Building 9215**	**Alternative 1B Plus Construct and Operate New Special Materials Complex**	**Preferred Alternative Alternative 1B Plus HEU Materials Facility and Special Materials Complex**
Worker and Public Health						
Construction:	Nonfatal occupational injury/illness rate (per 100 workers) 4-year average is 8.26. Total number of injuries/illnesses calculated for a Y-12 worker population of 5,128 under No Action - Status Quo Alternative is 424 per year.	Construction of the EMWMF and activities associated with the Field Research Center would be expected to result in approximately 9 additional non-fatal occupational injuries/illnesses per year during construction.	Construction of the HEU Materials Facility would be expected to result in approximately 3 additional non-fatal occupational injuries/illnesses per year during the 4-year construction period.	Construction of the Building 9215 storage expansions would be expected to result in approximately 3 additional non-fatal occupational injuries/illnesses per year during the 4-year construction period.	Construction of the Special Materials Complex would be expected to result in approximately 3 additional non-fatal injuries/illnesses per year during the 3.5-year construction period.	Construction activities would result in approximately 15 additional nonfatal injuries/illnesses per year during construction under this alternative.
			Total with No Action - Planning Basis Operations Alternative: 12 additional nonfatal injuries/illnesses per year during construction.	**Total with No Action - Planning Basis Operations Alternative: 12 additional nonfatal injuries/illnesses per year during construction.**	**Total with No Action - Planning Basis Operations Alternative: 12 additional nonfatal injuries/illnesses per year during construction.**	**Total with No Action - Planning Basis Operations Alternative: 15 additional nonfatal injuries/illnesses per year during construction.**

TABLE 3.5–1.—*Summary of Environmental Consequences for the Y-12 Site-Wide Alternatives* [Page 23 of 29]

	Alternative 1		Alternative 2		Alternative 3	Alternative 4
Resource/ Material Categories	**1A No Action - Status Quo Alternative**	**1B No Action - Planning Basis Operations Alternative**	**2A Alternative 1B Plus Construct and Operate New HEU Materials Facility**	**2B Alternative 1B Plus Upgrade Expansion to Building 9215**	**Alternative 1B Plus Construct and Operate New Special Materials Complex**	**Preferred Alternative Alternative 1B Plus HEU Materials Facility and Special Materials Complex**
Operation:	Nonfatal occupational injury/illness rate (per 100 workers) 4-year average is 8.26. Total number of injuries/illnesses calculated for a Y-12 worker population of 5,128 under No Action - Status Quo Alternative is 424.	The estimated total number of non-fatal occupational injuries/illnesses per year for the Y-12 workforce (5,128) is 424.	The estimated total number of nonfatal occupational injuries/illnesses per year for the Y-12 workforce would be 424.	The estimated total number of nonfatal occupational injuries/illnesses per year for the Y-12 workforce would be 424.	The estimated total number of nonfatal occupational injuries/illnesses per year for the Y-12 workforce would be 424.	The estimated total number of nonfatal occupational injuries/illnesses per year would be 424.
	No change in the annual average dose to workers of 26.0 mrem. LCF's per year of exposure would be 7.04×10^{-5}. HEU storage operations worker dose of 33 mrem per year (0.0004 LCF's).	The annual average dose to workers would decrease by 14.6 mrem to 11.6 mrem. The estimated number of LCFs per year of exposure would decrease to 4.64×10^{-6}. HEU storage operations worker dose of 33 mrem per year (0.0004 LCF's).	The annual average dose to Y-12 workers would be the same as No Action - Planning Basis Operations Alternative (11.6 mrem) a decrease of 14.6 mrem from No Action - Status Quo Alternative. The estimated number of LCFs would be 4.64×10^{-6} per year.	The annual average dose to Y-12 workers would be the same as No Action - Planning Basis Operations Alternative (11.6 mrem) a decrease of 14.6 mrem from No Action - Status Quo Alternative. The estimated number of LCFs would be 4.64×10^{-6} per year.	The annual average dose to Y-12 workers would be the same as No Action - Planning Basis Operations Alternative (11.6 mrem) a decrease of 14.6 mrem from No Action - Status Quo Alternative. The estimated number of LCFs would be 4.64×10^{-6} per year.	The annual average worker dose to all Y-12 workers would decrease from 26.0 mrem under No Action - Status Quo Alternative to 11.6 mrem under this alternative. The estimated number of LCFs per years of exposure would decrease to 4.64×10^{-6} from 7.04×10^{-5} (No Action - Status Quo Alternative).
			For the HEU Materials Facility normal operations the worker dose would be 33 mrem. The estimated number of LCFs would decrease from 0.0004 for No Action - Status Quo Alternative HEU storage operations to 0.0001 under this alternative because of fewer involved workers.	For Building 9215 storage expansion normal operations, the worker dose would be 33 mrem. The estimated number of LCFs would decrease from 0.0004 for No Action - Status Quo Alternative to 0.0001 under this alternative HEU storage operations because of fewer involved workers.		For the HEU Materials Facility normal operations the worker dose would be 33 mrem per year. The estimated number of LCFs would decrease from 0.0004 for No Action - Status Quo Alternative HEU storage operations to 0.0001 under this alternative because of fewer involved workers.

TABLE 3.5–1.—*Summary of Environmental Consequences for the Y-12 Site-Wide Alternatives* [Page 24 of 29]

	Alternative 1		Alternative 2		Alternative 3	Alternative 4
Resource/ Material Categories	**1A No Action - Status Quo Alternative**	**1B No Action - Planning Basis Operations Alternative**	**2A Alternative 1B Plus Construct and Operate New HEU Materials Facility**	**2B Alternative 1B Plus Upgrade Expansion to Building 9215**	**Alternative 1B Plus Construct and Operate New Special Materials Complex**	**Preferred Alternative Alternative 1B Plus HEU Materials Facility and Special Materials Complex**
			The one-time transfer of stored HEU to the new HEU Materials Facility would result in a worker dose of 150 mrem to the 35 involved workers. The estimated number of LCFs is 0.002.	The one-time transfer of stored HEU to the new Building 9215 expansion would result in a worker dose of 150 mrem to the 35 involved workers. The estimated number of LCFs is 0.002.		This one-time transfer of stored HEU to the new HEU Materials Facility would result in a worker dose of 150 mrem to the 35 involved workers. The estimated number of LCFs is 0.002.
	The MEI dose is 0.53 mrem/yr. The estimated number of LCF's is $2.65x10^{-7}$.	The MEI dose would increase by 3.97 mrem/yr to 4.5 mrem/yr. The estimated number of LCFs per year of exposure would increase by $1.985x10^{-6}$ to $2.25x10^{-6}$.	The MEI dose would not change from the 4.5 mrem/yr under No Action - Planning Basis Operations Alternative (this would be an increase of 3.97 mrem/yr from the 0.53 mrem/yr under No Action - Status Quo Alternative).	The MEI dose would not change from the 4.5 mrem/yr under No Action - Planning Basis Operations Alternative (this would be an increase of 3.97 mrem/yr from the 0.53 mrem/yr under No Action - Status Quo Alternative).	The MEI dose would not change from the 4.5 mrem/yr under No Action - Planning Basis Operations Alternative (this would be an increase of 3.97 mrem/yr from the 0.53 mrem/yr under No Action - Status Quo Alternative).	The MEI dose would increase by 3.97 mrem/yr from 0.53 mrem/yr under No Action - Status Quo Alternative to 4.5 mrem/yr under this alternative. The estimated number of LCFs per year of exposure would increase to $2.25x10^{-6}$ from $2.65x10^{-7}$ (No Action- Status Quo Alternative).
	The 80 km (50 mi) population dose is 4.5 person-rem/yr. The estimated number of LCF's is $2.25x10^{-6}$.	The 80 km (50 mi) population dose would increase by 29.2 person-rem/yr to 33.7 person-rem/yr. The estimated number of LCFs per year of exposure would increase to $1.69x10^{-5}$.	The 80 km (50 mi) population dose would not change from the 33.7 person-rem/yr under No Action - Planning Basis Operations Alternative (this would be an increase of 29.2 person-rem/yr under No Action - Status Quo Alternative).	The 80 km (50 mi) population dose would not change from the 33.7 person-rem/yr under No Action - Planning Basis Operations Alternative (this would be an increase from of 29.2 person-rem/yr under No Action - Status Quo Alternative).	The 80 km (50 mi) population dose would not change from the 33.7 person-rem/yr under No Action - Planning Basis Operations Alternative (this would be an increase from of 29.2 person-rem/yr under No Action - Status Quo Alternative).	The 80 km (50 mi) population dose would increase by 29.2 person-rem/yr from 4.5 person-rem/yr under No Action - Status Quo Alternative to 33.7 person-rem/yr under this alternative. The estimated number of LCFs per year would increase to $1.69x10^{-5}$ from $2.25x10^{-6}$ (No Action - Status Quo).

TABLE 3.5–1.—*Summary of Environmental Consequences for the Y-12 Site-Wide Alternatives* [Page 25 of 29]

	Alternative 1		Alternative 2		Alternative 3	Alternative 4
Resource/ Material Categories	**1A No Action - Status Quo Alternative**	**1B No Action - Planning Basis Operations Alternative**	**2A Alternative 1B Plus Construct and Operate New HEU Materials Facility**	**2B Alternative 1B Plus Upgrade Expansion to Building 9215**	**Alternative 1B Plus Construct and Operate New Special Materials Complex**	**Preferred Alternative Alternative 1B Plus HEU Materials Facility and Special Materials Complex**
Environmental Justice						
Operation:	Routine operations pose no significant health risks or adverse socioeconomic impacts to the public; no disproportionately high and or adverse effects on minority or low-income populations.	Routine operations would pose no significant health risks or adverse socioeconomic impacts to the public under this alternative; therefore no disproportionately high or adverse effects on minority or low-income populations is expected.	Routine operations would pose no significant health risks or adverse socioeconomic impacts to the public under this alternative; therefore no disproportionately high or adverse effects on minority or low-income populations is expected.	Routine operations would pose no significant health risks or adverse socioeconomic impacts to the public under this alternative; therefore no disproportionately high or adverse effects on minority or low-income populations is expected.	Routine operations would pose no significant health risks or adverse socioeconomic impacts to the public under this alternative; therefore no disproportionately high or adverse effects on minority or low-income populations is expected.	Routine operations would pose no significant health risks or adverse socioeconomic impacts to the public under this alternative; therefore no disproportionately high or adverse effects on minority or low-income populations is expected.

TABLE 3.5–1.—*Summary of Environmental Consequences for the Y-12 Site-Wide Alternatives* [Page 26 of 29]

	Alternative 1		Alternative 2		Alternative 3	Alternative 4
Resource/ Material Categories	**1A No Action - Status Quo Alternative**	**1B No Action - Planning Basis Operations Alternative**	**2A Alternative 1B Plus Construct and Operate New HEU Materials Facility**	**2B Alternative 1B Plus Upgrade Expansion to Building 9215**	**Alternative 1B Plus Construct and Operate New Special Materials Complex**	**Preferred Alternative Alternative 1B Plus HEU Materials Facility and Special Materials Complex**
Facility Accidents						
Operation: (Radiological):	**Beyond Evaluation Basis Earthquake Accident:**	**Beyond Evaluation Basis Earthquake Accident:**	**Beyond Evaluation Basis Earthquake Accident:**	**Beyond Evaluation Basis Earthquake Accident:**	**Beyond Evaluation Basis Earthquake Accident:**	**Beyond Evaluation Basis Earthquake Accident:**
Calculated potential doses and number of latent cancer fatalities:	Collocated Worker Maximally Exposed Individual: Dose-30 rem LCF-0.012	Collocated Worker Maximally Exposed Individual: Dose-30 rem LCF-0.012	Collocated Worker Maximally Exposed Individual: Dose-30 rem LCF-0.012	Collocated Worker Maximally Exposed Individual: Dose-30 rem LCF-0.012	Collocated Worker Maximally Exposed Individual: Dose-30 rem LCF-0.012	Collocated Worker Maximally Exposed Individual: Dose-30 rem LCF-0.012
	Y-12 Population: Dose-26,500 person-rem LCF-11	Y-12 Population: Dose-26,500 person-rem LCF-11	Y-12 Population: Dose-26,500 person-rem LCF-11	Y-12 Population: Dose-26,500 person-rem LCF-11	Y-12 Population: Dose-26,500 person-rem LCF-11	Y-12 Population: Dose-26,500 person-rem LCF-11
	Public Maximally Exposed Individual: Dose-17 rem LCF-0.008	Public Maximally Exposed Individual: Dose-17 rem LCF-0.008	Public Maximally Exposed Individual: Dose-17 rem LCF-0.008	Public Maximally Exposed Individual: Dose-17 rem LCF-0.008	Public Maximally Exposed Individual: Dose-17 rem LCF-0.008	Public Maximally Exposed Individual: Dose-17 rem LCF-0.008
	80km (50-mi) population: Dose-404 person-rem LCF 0.21	80km (50-mi) population: Dose-404 person-rem LCF 0.21	80km (50-mi) population: Dose-404 person-rem LCF 0.21	80km (50-mi) population: Dose-404 person-rem LCF 0.21	80km (50-mi) population: Dose-404 person-rem LCF 0.21	80km (50-mi) population: Dose-404 person-rem LCF 0.21
			Likelihood of Beyond Evaluation Basis Earthquake for the HEU Storage Mission Accident lower than Alternative 1A by approximately a factor of 5.	Likelihood of Beyond Evaluation Basis Earthquake Accident for the HEU Storage Mission lower than Alternative 1A by approximately factor of 5.		Likelihood of Beyond Evaluation Basis Earthquake Accident for the HEU Storage Mission lower than Alternative 1A by approximately factor of 5.

TABLE 3.5–1.—*Summary of Environmental Consequences for the Y-12 Site-Wide Alternatives* [Page 27 of 29]

	Alternative 1		Alternative 2		Alternative 3	Alternative 4
Resource/ Material Categories	**1A No Action - Status Quo Alternative**	**1B No Action - Planning Basis Operations Alternative**	**2A Alternative 1B Plus Construct and Operate New HEU Materials Facility**	**2B Alternative 1B Plus Upgrade Expansion to Building 9215**	**Alternative 1B Plus Construct and Operate New Special Materials Complex**	**Preferred Alternative Alternative 1B Plus HEU Materials Facility and Special Materials Complex**
	Criticality Accident: Collocated Worker Maximally exposed individual: Dose-8 rem LCF-4x10^{-3} Y-12 Population: Dose-870 person-rem LCF-0.35 Public Maximally Exposed Individual: Dose-3 rem LCF-1.5x10^{-3} 80km (50-mi) Population: Dose-8.6 person rem LCF-0.0043	**Criticality Accident:** Collocated Worker Maximally exposed individual: Dose-8 rem LCF-4x10^{-3} Y-12 Population: Dose-870 person-rem LCF-0.35 Public Maximally Exposed Individual: Dose-3 rem LCF-1.5x10^{-3} 80km (50-mi) Population: Dose-8.6 person rem LCF-0.0043	**Criticality Accident:** Collocated Worker Maximally exposed individual: Dose-8 rem LCF-4x10^{-3} Y-12 Population: Dose-870 person-rem LCF-0.35 Public Maximally Exposed Individual: Dose-3 rem LCF-1.5x10^{-3} 80km (50-mi) Population: Dose-8.6 person rem LCF-0.0043 Likelihood of criticality accident for the HEU Storage Mission lower than Alternative 1A by approximately a factor of 2 to 5.	**Criticality Accident:** Collocated Worker Maximally exposed individual: Dose-8 rem LCF-4x10^{-3} Y-12 Population: Dose-870 person-rem LCF-0.35 Public Maximally Exposed Individual: Dose-3 rem LCF-1.5x10^{-3} 80km (50-mi) Population: Dose-8.6 person rem LCF-0.0043 Likelihood of criticality accident for the HEU Storage Mission lower than Alternative 1A by approximately a factor of 2 to 5.	**Criticality Accident:** Collocated Worker Maximally exposed individual: Dose-8 rem LCF-4x10^{-3} Y-12 Population: Dose-870 person-rem LCF-0.35 Public Maximally Exposed Individual: Dose-3 rem LCF-1.5x10^{-3} 80km (50-mi) Population: Dose-8.6 person rem LCF-0.0043	**Criticality Accident:** Collocated Worker Maximally exposed individual: Dose-8 rem LCF-4x10^{-3} Y-12 Population: Dose-870 person-rem LCF-0.35 Public Maximally Exposed Individual: Dose-3 rem LCF-1.5x10^{-3} 80km (50-mi) Population: Dose-8.6 person rem LCF-0.0043 Likelihood of criticality accident for the HEU Storage Mission lower than Alternative 1A by approximately a factor of 2 to 5.

TABLE 3.5–1.—*Summary of Environmental Consequences for the Y-12 Site-Wide Alternatives* [Page 28 of 29]

	Alternative 1		Alternative 2		Alternative 3	Alternative 4
Resource/ Material Categories	**1A No Action - Status Quo Alternative**	**1B No Action - Planning Basis Operations Alternative**	**2A Alternative 1B Plus Construct and Operate New HEU Materials Facility**	**2B Alternative 1B Plus Upgrade Expansion to Building 9215**	**Alternative 1B Plus Construct and Operate New Special Materials Complex**	**Preferred Alternative Alternative 1B Plus HEU Materials Facility and Special Materials Complex**
	FIRES INVOLVING RADIOACTIVE MATERIAL:	**FIRES INVOLVING RADIOACTIVE MATERIAL:**	**FIRES INVOLVING RADIOACTIVE MATERIAL:**	**FIRES INVOLVING RADIOACTIVE MATERIAL:**	**FIRES INVOLVING RADIOACTIVE MATERIAL:**	**FIRES INVOLVING RADIOACTIVE MATERIAL:**
	Collocated Worker Maximally Exposed Individual: Dose-0.01 to 41 rem LCF-$5x10^{-6}$ to 0.02 Y-12 Population: Dose-12 to 3,300 person/rem LCF-0.005 to 1.3	Collocated Worker Maximally Exposed Individual: Dose-0.01 to 41 rem LCF-$5x10^{-6}$ to 0.02 Y-12 Population: Dose-12 to 3,300 person/rem LCF-0.005 to 1.3	Collocated Worker Maximally Exposed Individual: Dose-0.01 to 41 rem LCF-$5x10^{-6}$ to 0.02 Y-12 Population: Dose-12 to 3,300 person/rem LCF-0.005 to 1.3	Collocated Worker Maximally Exposed Individual: Dose-0.01 to 41 rem LCF-$5x10^{-6}$ to 0.02 Y-12 Population: Dose-12 to 3,300 person/rem LCF-0.005 to 1.3	Collocated Worker Maximally Exposed Individual: Dose-0.01 to 41 rem LCF-$5x10^{-6}$ to 0.02 Y-12 Population: Dose-12 to 3,300 person/rem LCF-0.005 to 1.3	Collocated Worker Maximally Exposed Individual: Dose-0.01 to 41 rem LCF-$5x10^{-6}$ to 0.02 Y-12 Population: Dose-12 to 3,300 person/rem LCF-0.005 to 1.3
	Public Maximally Exposed Individual: Dose-0.01 to 16 rem LCF-$5x10^{-6}$ to 0.008 80km (50-mi) population: Dose-0.18 to 70 person/rem LCF- $9x10^{-5}$ to 0.28	Public Maximally Exposed Individual: Dose-0.01 to 16 rem LCF-$5x10^{-6}$ to 0.008 80km (50-mi) population: Dose-0.18 to 70 person/rem LCF- $9x10^{-5}$ to 0.28	Public Maximally Exposed Individual: Dose-0.01 to 16 rem LCF-$5x10^{-6}$ to 0.008 80km (50-mi) population: Dose-0.18 to 70 person/rem LCF- $9x10^{-5}$ to 0.28	Public Maximally Exposed Individual: Dose-0.01 to 16 rem LCF-$5x10^{-6}$ to 0.008 80km (50-mi) population: Dose-0.18 to 70 person/rem LCF- $9x10^{-5}$ to 0.28	Public Maximally Exposed Individual: Dose-0.01 to 16 rem LCF-$5x10^{-6}$ to 0.008 80km (50-mi) population: Dose-0.18 to 70 person/rem LCF- $9x10^{-5}$ to 0.28	Public Maximally Exposed Individual: Dose-0.01 to 16 rem LCF-$5x10^{-6}$ to 0.008 80km (50-mi) population: Dose-0.18 to 70 person/rem LCF-$9x10^{-5}$ to 0.28
			Likelihood of fire accident for the HEU Storage Mission lower than Alternative 1A by approximately a factor of 2 to 5.	Likelihood of fire accident for the HEU Storage Mission lower than Alternative 1A by approximately a factor of 2 to 5.		Likelihood of fire accident for the HEU Storage Mission lower than Alternative 1A by approximately a factor of 2 to 5.

TABLE 3.5–1.—*Summary of Environmental Consequences for the Y-12 Site-Wide Alternatives* [Page 29 of 29]

	Alternative 1		Alternative 2		Alternative 3	Alternative 4
Resource/ Material Categories	**1A No Action - Status Quo Alternative**	**1B No Action - Planning Basis Operations Alternative**	**2A Alternative 1B Plus Construct and Operate New HEU Materials Facility**	**2B Alternative 1B Plus Upgrade Expansion to Building 9215**	**Alternative 1B Plus Construct and Operate New Special Materials Complex**	**Preferred Alternative Alternative 1B Plus HEU Materials Facility and Special Materials Complex**
Operation: (Chemical)	**FIRES INVOLVING CHEMICALS:**	**FIRES INVOLVING CHEMICALS:**	**FIRES INVOLVING CHEMICALS:**	**FIRES INVOLVING CHEMICALS:**	**FIRES INVOLVING CHEMICALS:**	**FIRES INVOLVING CHEMICALS:**
Calculated Toxic Material Concentration Levels	Potentially expose between 80 and 190 workers to ERPG-2 concentrations of toxic materials. No exposures are expected off-site	Potentially expose between 80 and 190 workers to ERPG-2 concentrations of toxic materials. No exposures are expected off-site	No change from No Action - Status Quo Alternative or No Action - Planning Basis Operations Alternative.	No change from No Action - Status Quo Alternative or No Action - Planning Basis Operations Alternative.	Likelihood of chemical accidents for the new Special Materials Complex lower than Alternative 1A by approximately a factor of 2 to 5.	Likelihood of chemical accidents for the Special Materials Mission lower by approximately factor of 2 to 5.
	CHEMICAL RELEASE DUE TO LOSS OF CONTAINMENT:	**CHEMICAL RELEASE DUE TO LOSS OF CONTAINMENT:**			**CHEMICAL RELEASE DUE TO LOSS OF CONTAINMENT:**	**CHEMICAL RELEASE DUE TO LOSS OF CONTAINMENT:**
	Potentially expose between 80 and 310 workers to ERPG-2 concentrations or greater. No toxic gas release is expected to reach the public occupied areas.	Potentially expose between 80 and 310 workers to ERPG-2 concentrations or greater. No toxic gas release is expected to reach the public occupied areas.			Potential increase in the likelihood of exceeding ERPG-2 (or TEEL-2) concentrations at the Y-12 boundary if Special Materials Complex is located at Site 1.	Potential increase in the likelihood of exceeding ERPG-2 (or TEEL-2) concentrations at the Y-12 boundary if Special Materials Complex is located at Site 1.

Note: EMWMF - Environmental Management Waste Management Facility; SHPO - State Historic Preservation Officer.

3.6 PREFERRED ALTERNATIVE

Council on Environmental Quality (CEQ) NEPA regulations require that an agency identify its preferred alternative, if one or more exists, in the Draft EIS (40 CFR 1502.14 [e]). As discussed in "Forty Most Asked Questions Concerning CEQ's NEPA Regulations. (46 FR 18026, March 23, 1981 as amended), the preferred alternative is the alternative which the agency believes would fulfill its statutory missions and responsibilities giving consideration to economic, environmental, technical, and other factors. Consequently, to identify a preferred alternative, DOE is developing information on potential impacts, costs, technical risks, and schedule risks for the alternatives under consideration. This Final Y-12 SWEIS provides information on the potential environmental impacts. Cost, schedule, and technical analyses are also being prepared and will be considered in the identification of preferred alternatives.

DOE's preferred alternative (Alternative 4) is to construct and operate a new HEU Materials Facility and a new Special Materials Complex at Y-12. The preferred site for the HEU Materials Facility is Site A (West Portal Parking Lot). The preferred site for the Special Materials Complex is Site 1 (northwest of Building 9114 and on the north side of Bear Creek Road). The ROD will describe DOE's decisions for the Y-12 SWEIS proposed actions.

CHAPTER 4: AFFECTED ENVIRONMENT

The descriptions of the affected environment provide a basis for understanding the direct, indirect, and cumulative effects of the Y-12 proposed actions and alternatives. The scope of the discussion varies by resource to ensure that all relevant issues are included.

For land resources, geology and soils, biological resources, and cultural and paleontological resources, discussions of the Y-12 Site and ORR are included along with descriptions of the potential areas within the Y-12 Site that could be affected by the Y-12 SWEIS alternatives. This information provides a basis for understanding both direct effects and the overall resource base that could be affected by ancillary activities that may be defined in later stages of the Modernization Program (LMES 1999c).

Ambient conditions are described for air/noise and water resources. Discussions focus on air/noise conditions at the ORR and Y-12 Site boundary and the surface water bodies and groundwater aquifers that could be affected. This information serves as a basis for analyzing important air/noise and water quality parameters to obtain results that can be compared to regulatory standards.

Socioeconomic conditions are described for the counties and communities that could be affected by regional population changes associated with the Y-12 SWEIS proposed actions. The affected environment discussions include projections of regional growth and related socioeconomic indicators. The described region is large enough to account for growth related to direct project employment as well as secondary jobs that may be created by the proposed actions.

In addition to those natural and human environmental resources discussed above, the affected environment sections include a number of issues related to ongoing DOE activities at ORR and Y-12. These issues involve facility operations and site support infrastructure, intersite transportation of nuclear materials, waste management, and radiological and hazardous chemicals impacts during normal operation and from accidents. Where reasonably foreseeable changes to any of these factors can be predicted, they are discussed.

4.1 LAND USE

4.1.1 Land-Use Designations

Oak Ridge Reservation. The ORR consists of 13,943 ha (34,513 acres) and is located mostly within the corporate limits of the city of Oak Ridge, approximately 24 km (15 mi) west of the city of Knoxville. Approximately one-third of ORR is occupied by the facilities of Y-12, ORNL, and ETTP. All of this land is titled to the United States of America and under the jurisdictional control of DOE for administration and management. Figure 4.1.1–1 shows the location of ORR.

Ownership of ORR. Originally, the Federal Government acquired 23,664 ha (58,575 acres) of land between 1942 and 1947. However, 9,721 ha (24,062 acres) were transferred over the years with 25 percent (almost 2,408 ha [5,960 acres]) going to the city of Oak Ridge for developmental purposes. The transferred land included 109 ha (270 acres) for schools; 438 ha (1,083 acres) for utilities, drainage, and roads and streets; 596 ha (1,475 acres) for municipal properties; and 12 ha (29 acres) for public housing. Most of the remaining land tracts were conveyed to the State of Tennessee for health, forestry, agricultural research, and a biomedical graduate school (935 ha [2,315 acres]), private ownership (5,125 ha [12,686 acres]), and the Tennessee Valley Authority (TVA) (1,209 ha [2,992 acres]). Anderson County (11 ha [28 acres]), the town of Oliver Springs (4 ha [9 acres]), and Federal agencies (25 ha [63 acres]) also received land tracts (LMER 1999a, Hartman 1999). Land conveyed for private entities and homeowners totals 5,136 ha (12,692 acres). The reservation's boundaries, both past and present, are shown in Figure 4.1.1–2.

Source: DOE 1996e.

FIGURE 4.1.1–1.—*Oak Ridge Reservation, Tennessee, and Region.*

Source LMER1999a.

FIGURE 4.1.1–2.—*Original U.S. Department of Energy Land Purchase and Current Reservation Boundaries.*

As a result of a decision by the Secretary of Energy in 1979 allowing DOE to make financial assistance payments to the city of Oak Ridge for a 5-year period under the *Atomic Energy Community Act* of 1955, the city submitted a self-sufficiency plan which proposed that DOE sell land to the city for industrial/commercial development. This allowed direct transfer of excess land to the city at fair market price rather than turning it over to the General Services Administration for disposal. The self-sufficiency program ended; however, those parcels that were under review at the time were "grandfathered," thus permitting DOE to still consider transfer of land to the city of Oak Ridge should it become excess to the needs of DOE (LMER 1999a).

Current Land Use at ORR. DOE classifies land use on the ORR according to five categories: Institutional/Research, Industrial, Mixed Industrial, Institutional/Environmental Laboratory, and Mixed Research/Future Initiatives (LMER 1999b). Development on the ORR accounts for about 35 percent of the total acreage leaving approximately 65 percent of the Reservation undeveloped (DOE 1999b).

Land bordering ORR is predominantly rural, with agricultural and forest land dominating. The city of Oak Ridge has residential areas primarily along the northern and eastern boundaries. There are four residential areas along the northern boundary that have several houses within approximately 30 m (98 ft) of the ORR boundary. There are a few residences within Roane County that border the ORR to the west. The Clinch River, which confines the ORR to the south and southeast, forms a boundary between Knox County, Loudon County, and portions of Roane County.

Remote sensing data from 1994 showed 70 percent of the ORR in forest cover while 20 percent was transitional, consisting of old fields, agricultural areas, cutover forest lands, roadsides, and utility corridors (LMER 1999a). Less than 2 percent of ORR remains as open agricultural fields. Currently 234 ha (580 acres) of wetlands on the ORR provide water quality benefits, stormwater control, wildlife and rare species habitats, and landscape and biological diversity. About 1,414 ha (3,500 acres) are used as waste sites or are remediation areas (LMER 1999a).

Most of the ORR is designated a Tennessee Wildlife Management Area through a cooperative agreement between DOE and the Tennessee Wildlife Resources Agency (TWRA). The agreement provides protection of wildlife habitat and species as well as restoration of other wildlife habitat and species. Wildlife management is carried out under these agreements by TWRA in cooperation with ORNL's Environmental Sciences Division.

In 1980, DOE established the Oak Ridge National Environmental Research Park (Research Park) which includes approximately 8,000 ha (20,000 acres) of ORR. The Research Park is an ORNL user facility which serves as an outdoor laboratory for the study of present and future impacts on the environment stemming from the various missions at ORR. Major environmental field research areas within the Research Park include (LMER 1999a):

- Walker Branch Watershed
- Free-Air CO_2 Enrichment Facility
- Global Change Field Research Facility
- Bear Creek Valley Hydrology Field Sites
- Melton Branch Watershed Field Sites
- National Oceanic and Atmospheric Administration Field Research Facility
- Natural and Accelerated Bioremediation Field Research Center

In 1986, seven State Natural Areas were registered on the ORR through an agreement between DOE and TDEC (LMER 1999a). Qualification for this designation requires meeting specific criteria which may include existence of rare plant species, animal species, or community types on the premises. Figure 4.1.1–3 shows the research and forested areas within the ORR.

FIGURE 4.1.1–3.—*Research Areas and Forested Areas.*

Source: LMER 1999a.

On June 23, 1999, Secretary of Energy Bill Richardson set aside 1,214 ha (3,000 acres) of ORR as a conservation and wildlife management area in an agreement between DOE and TWRA. The proclamation calls for the land to be cooperatively managed for preservation purposes under a use permit. This area, called the Three Bend Scenic and Wildlife Management Refuge Area, is located in the ORR buffer zone on Freels, Gallaher, and Solway bends on the north shore of Melton Hill Lake in Anderson County. TWRA, in consultation with DOE, will prepare a cooperative agreement to serve as a natural resources management plan to establish guidelines for managing this area in the hopes to preserve and enhance its natural attributes.

Two major firearms ranges, along with their surface danger zones or buffer areas, encompass approximately 1,010 ha (2,500 acres) on ORR. The range areas, which are located at the south side of Bear Creek Road about 8 km (5 mi) west of Y-12, extend from the DOE ORR boundary on the west to Highway 95 on the east and from Bear Creek Road on the north to the Clinch River on the south. The eastern portion of the site is operated by DOE's Transportation Safeguards Division Southeastern Courier Section and consists of four individual live-fire ranges and associated support facilities. The western portion of the range site, formerly operated by LMES, is now operated for DOE by Wackenhut Services International (effective January 10, 2000) as a Central Training Facility and consists of an indoor range, five outdoor ranges, a shooting tower, three live-fire facilities, and assorted tactical facilities.

Federal statutes require each state, tribal, or local government to protect its citizens from releases of hazardous materials (40 CFR 301, 302, 304, and 355). Emergency planning zones spanning 8 km (5 mi) are defined around ORNL, ETTP, and Y-12. Each zone is then subdivided into emergency planning sectors, with each defined by easily recognizable terrain features (LMER 1999a).

Under an agreement with DOE and the State of Tennessee, the city of Oak Ridge transports municipal biosolids to approved sites on ORR and applies the material as a soil conditioner and fertilizer. The city of Oak Ridge has been applying biosolids at selected sites on ORR since 1983. Municipal biosolids are not considered RCRA waste but are regulated by EPA under 40 CFR 503 of the *Clean Water Act* regarding disposal, including risk-based, metal-loading criteria for the receiving soil. Since the application process is occurring on federally-owned land, DOE provides oversight of the process. However, daily operations, including permitting, disposal, sampling, and monitoring at each site, are the responsibility of the city of Oak Ridge. The application program currently utilizes a total of 65 ha (160 acres); approximately 20 ha (50 acres) have been closed due to self-imposed solids loading limits rather than exceeding metal or radionuclide limits (Bechtel Jacobs 1999). Table 4.1.1–1 shows all previously identified and approved sites on ORR along with the status of each.

Although ORR is not open to the public, opportunities for public use of numerous facilities and land areas do exist. The following are examples of land/facilities open to public use (LMER 1999a):

- New Bethel Church Interpretive Center (historical site)
- Walks and tours including Community Day, which allows public access to ORNL facilities and land areas such as Freels Bend/Solway Bend (bird-watching, wildflower walks, etc.)
- Ecological and Physical Sciences Study Center
- ORNL Graphite Reactor (National Historic Landmark)
- Clark Center Park (or Clark Center Recreation Area)
- George Jones Memorial Church
- ETTP Visitors Overlook and Y-12 Visitors Center
- North Boundary Road Greenway
- Gallaher Bend Greenway

DOE has also granted a license for TWRA to sponsor and manage hunting on the ORR. Figure 4.1.1–4 shows the locations of some of the public, educational, and recreational opportunities on ORR.

TABLE 4.1.1–1.—*Biosolids Application Sites*[a]

Site Name	Site No.	Total Acres On-site	Tons Allowed per Year	Total Tons[b] Life of Site	Total Tons to Date	Remaining Capacity in Tons	Years Remaining On-site
McCoy	1	20	Closed	Closed	Closed	Closed	Closed
Pine Plantation	2	20	Closed	Closed	Closed	Closed	Closed
High Pasture	2	25	94	1,250	483	767	8.2
Rogers	2	30	142	1,500	765	735	5.2
Scarboro	3	45	167	2,250	960	1,290	7.7
Upper Hayfield #1	3	25	93	1,250	540	710	7.6
Upper Hayfield #2	3	20	69	1,000	505	495	7.7
Future Site	4	N/A	N/A	N/A	N/A	N/A	N/A
Future Site	5	N/A	N/A	N/A	N/A	N/A	N/A
Future Site	6	N/A	N/A	N/A	N/A	N/A	N/A
Future Site	7	N/A	N/A	N/A	N/A	N/A	N/A
Site #8	8	12	Closed	Closed	Closed	Closed	Closed
Watson Road	9	60	134	3,000	929	2,071	15.4
Future Site	10	N/A	N/A	N/A	N/A	N/A	N/A
Cottonwoods	11	17	Closed	Closed	Closed	Closed	Closed
Future Site	12	N/A	N/A	N/A	N/A	N/A	N/A
Future Site	13	N/A	N/A	N/A	N/A	N/A	N/A
Future Site	14A	N/A	N/A	N/A	N/A	N/A	N/A
Future Site	14B	N/A	N/A	N/A	N/A	N/A	N/A
				Active Site Total Tonnage to Date: **4,182**			

[a] Information is based on COR *Sludge Application Site Monitoring Report in Appendix I.*
[b] Calculations are based on a maximum of 50 tons (dry wt) applied x the number of acres on the site.
Source: Bechtel Jacobs 1999.

FIGURE 4.1.1–4.—*Public, Educational, and Recreational Opportunities.*

Source: LMER 1999a.

4.1.2 Future Land Use and Leasing Agreements

Future land use of ORR will continue to incorporate the principles associated with ecosystem management. For the most part, these land uses will expand and build on current uses, not replace them. New future land uses include research facilities, environmental research and partnership areas, waste management facilities, future initiatives, transportation improvements, education and recreation, and land transfers and lease areas (LMER 1999a).

Future research facilities include:

- *Spallation Neutron Source (SNS).* Location requires approximately 45 ha (110 acres) which will encompass a new linear accelerator facility, user facilities, central utility building, support laboratories and shops, and a central office building as well as a 132,500-L (35,000-gal) fire water reservoir, electric service switchyard, and stormwater retention pond required to service the facility. As a result of the *Final Environmental Impact Statement for the Construction and Operation of the Spallation Neutron Source,* a ROD was issued for construction and operation where ORR, more specifically Chestnut Ridge, was selected as the site. Funding has been approved and construction is underway.

- *Joint Institute for Neutron Sciences.* Joint venture with the University of Tennessee, the State of Tennessee (the institute providing funding for the facility), and DOE for a user facility which would serve both the High Flux Isotope Reactor and the proposed SNS. The site would be integrated into the SNS campus. Funding has been approved and construction is underway.

- *Laboratory for Comparative and Functional Genomics.* Facility to house 50,000 mice in support of ORNL's mouse genetics mutagenesis. The laboratory would be adjacent to Life Sciences Division Building 1062 at the west end of ORR.

- *Oak Ridge Institute for Sciences and Education.* Future development and expansion for the Institute at Scarboro Operations Site, currently covering approximately 100 ha (247 acres).

- *ORNL Expansion.* Bethel Valley areas east and west of the central ORNL site are identified for future R&D use to include support and service facilities and would cover a total of 283 ha (700 acres).

- *Engineering Technology Complex.* Planned for the main Bethel Valley campus; more specifically, a privately-funded building, a state-funded building, and a DOE-funded parking lot and other Infrastructure between the 4000 and 6000 areas. The Complex Facilities would be leased. Construction is planned in the 2001-2002 time frame.

- *Fusion Materials Irradiation Facility.* Proposed to house a linear accelerator, a supply system for lithium targets, and an experimental complex for irradiation and handling test specimen assemblies. It would be used to address the technological problems associated with the development of fusion reactor materials. This project is still in the early planning stages without funding as of yet. However, plans to relocate the Fusion Energy Division to the 7600 area in the next 3-4 years would open up construction of a GPP funded office building in the 7600 area and modifications/additions to other facilities for preparation of relocation.

Source: LMER 1999a.

FIGURE 4.1.2–1.—*New Future Use at Oak Ridge Reservation.*

- *Melton Valley R&D Facilities (Ramsey Drive Site).* Approximately 16 ha (39 acres) adjoining the proposed Fusion Materials Irradiation Facility have been identified for future use. Specific facility designations are not yet determined (LMER 1999a).

New field research areas, in addition to that previously mentioned within the Research Park, include Bull Bluff watersheds, watershed manipulation experiments; Copper Ridge Research Area, forest nutrient dynamics; Freels Bend Research Area, agricultural research; Raccoon Creek Research Area, global change research; White Wing Research Area, biodiversity, global change, and fundamental ecological process research; Pine Ridge Experimental Catchments, expansion to Walker Branch watershed research; and Unexploded Ordnance Research and Demonstration Area, testing and validation methodology of locating unexploded ordnance (LMER 1999a).

Proposed waste management facilities, including the Environmental Management Waste Management Facility at East Bear Creek and the Transuranic Waste Packaging Facility at ORNL, are in various stages of planning or design/construction (LMER 1999a).

The following proposed transportation improvements have been proposed, or are under construction by the Tennessee Department of Transportation (DOT): I-75/I-40 connector, Highway 58 widening, and Bethel Valley Road/Illinois Avenue interchange (LMER 1999a). Figure 4.1.2–1 shows some of the proposed land uses for the ORR.

Also, the following are areas that have been identified by DOE that have recently been, or will soon be, leased or re-leased (LMER 1999b):

Public Areas:

- 3.5 ha (8.5 acre) parcel of Federal land near Wisconsin Avenue in Oak Ridge to the city of Oak Ridge for a park

Industrial Development:

- Parcel ED-1, located near the former K-25 Plant, was leased in April of 1998 to the Community Reuse Organization of East Tennessee, a private-sector organization established by DOE to lease underutilized facilities on ORR, for industrial development. The parcel is now known as the Horizon Center.

- Parcel ED-2, 6 ha (15 acres) leased to the Community Reuse Organization of East Tennessee in September of 1997

- 40 ha (100 acres) of Parcel 8, lease pending

- Tower Shielding Facility (10.5 ha [26 acres] leased in 1998 to BioNeutrics, Inc.)

- Boeing Property. Oak Ridge Properties has purchased approximately 492 ha (1,216 acres) from the Boeing Company at the former K-25 Plant and has proposed a mixed-use development plan which would include approximately 1,500 residential units including houses, apartments/condominiums, about 187 ha (450 acres) of industrial zoned property, and a shopping area (*Oak Ridge* 12/10/99, 12/17/99, and 01/04/00). The Boeing Property was rezoned from industrial to mixed-use in February 2000. The Oak Ridge Land Company has completed the acquisition of a 74-ha (182-acre) floodplain strip abutting the Boeing Property for use as a buffer zone and green space. DOE previously controlled the floodplain strip and prepared an EA on the transfer of the property prior to the sale of the parcel to the abutting landowner.

- DOE is considering leasing Parcel ED-3, an 187 ha (450 acre) piece of land located south of the former K-25 Site, to be developed for mixed use purposes. A buffer zone of approximately 615 ha (1,520 acres) would surround the site. The land would be transferred to the Community Reuse Organization of East Tennessee and leased to private companies.

Mobile Service Antenna Sites:

- Commercial service antennas proposed for three appropriate sites at ORR (attachment to existing structures when possible). BellSouth has erected a tower in the ETTP area while SprintCom has requested use of the Chestnut Ridge site (LMER 1999a).

Y-12. The Y-12 Area of Responsibility on the ORR covers a total of 2,197 ha (5,428 acres). The main area of Y-12 is largely developed and encompasses 328 ha (811 acres), with 255 ha (630 acres) fenced, (4 km [3 mi] long and 2 km [1 mi] wide), with approximately 580 buildings that house about 1 million m^2 (7.6 million ft^2) of laboratory, machining, dismantlement, and R&D areas (LMER 1999b). For the purposes of this SWEIS, the boundary of analysis includes a total of approximately 1,472 ha (3,638 acres). As a result of the site's defense support, manufacturing, and storage facilities, the land in the Y-12 area is classified in DOE's industrial category.

The Research Park surrounds the Y-12 SWEIS area. Areas outside the main plant site but within its area of responsibility are used primarily for a buffer area as well as for environmental restoration and waste management activities. There are limited forested areas within the Y-12 boundary. There are no wetlands located within the Y-12 fenced boundaries. Land outside the SWEIS area includes buffer for the Walker Branch watershed long-term research area and other environmental research sites.

There are a number of active waste management facilities within the Y-12 SWEIS area of analysis. Some of the major facilities include the following:

- Disposal Area Remedial Action (liquid storage) facility. Collection of contaminated groundwater as a result of cleanup efforts in Bear Creek Valley

- Above-Ground Low-Level Waste Storage Facility

- Industrial Landfill V. Nonhazardous, nonradioactive industrial solid waste

- Construction/Demolition Landfill VI. Construction and demolition debris

- Construction/Demolition Landfill VII. Additional storage of construction and demolition debris (SPAS 1988)

These facilities and more are discussed in detail in Section 4.11 and Appendix A.5, Waste Management Activities.

The environmental restoration Y-12 Project includes two areas that are located within the Y-12 SWEIS physical study area of analysis: the Bear Creek and UEFPC watersheds. The boundaries of the Bear Creek watershed extend west from a topographic high near the west end of the plant to the point where Bear Creek exits the valley near Highway 95. Release points within the Y-12 SWEIS area of analysis include the (former) S-3 Pond Site, Sanitary Landfill I, Boneyard/Burnyard, the Oil Landfarm, the Bear Creek Burial Grounds, and the Rust Spoil Area. These units were used in the past as the primary area for disposal of various types of hazardous and nonhazardous wastes generated at Y-12. The UEFPC watershed is bounded by the base of Pine Ridge to the north and by Chestnut Ridge to the south and extends westward, abutting the Bear Creek watershed, and eastward to the DOE property line (LMER 1999a). These watersheds are shown in Figure 4.1.2–2.

Some sludge land farming activity is conducted to the south of the Y-12 National Security Complex. Figures 4.1.2–3 and 4.1.2–4 present the locations of the sludge land farming sites and environmental restoration activities, respectively.

The ORR End Use Working Group has recommended the following land use for Y-12: "the western area of the Y-12 Plant is expected to remain controlled industrial property. As opportunity arises, national security activities should be concentrated in the western area to allow for the broadest possible use of the rest of the plant (PEC 1998)."

FIGURE 4.1.2–2.—*Watershed Areas on Oak Ridge Reservation.*

Source: LMER 1999a.

FIGURE 4.1.2–3.—*Sludge Land Application Sites.*

Source: Tetra Tech, Inc./SPAS 1998.

FIGURE 4.1.2–4.—*Active Waste Management Facilities and Environmental Restoration Projects.*

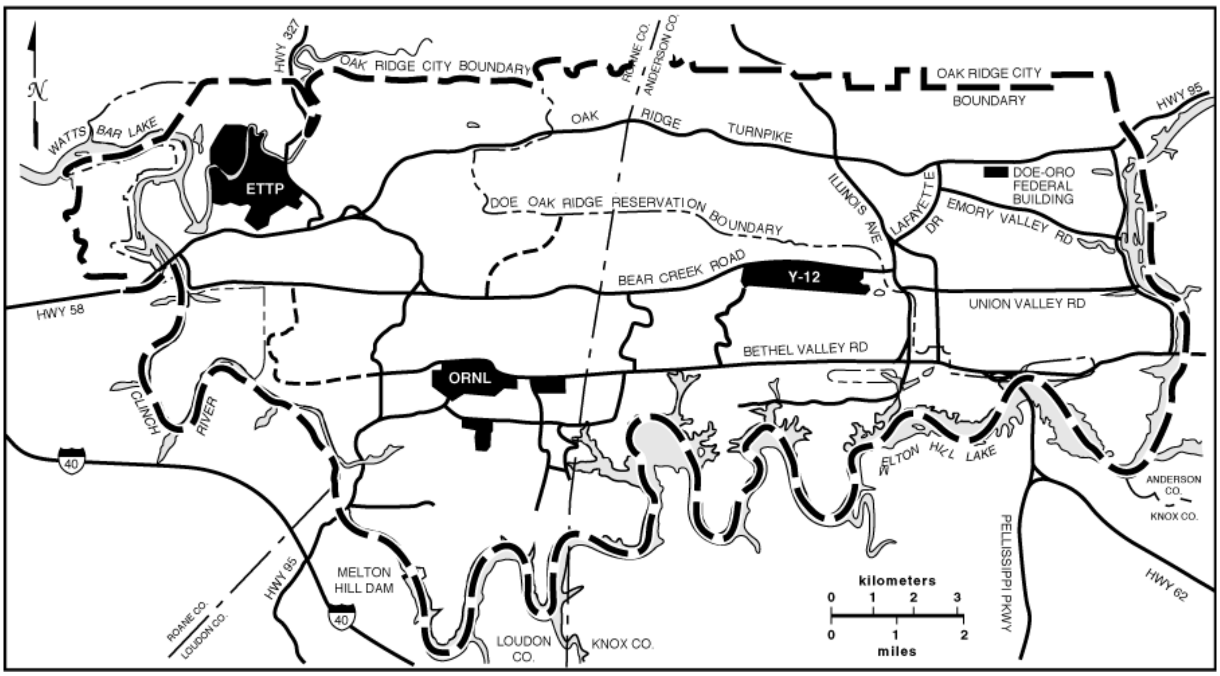
Source: Tetra Tech Inc./SPAS 1998.

4.2 TRANSPORTATION

4.2.1 On-site Traffic

Primary roads on the ORR serving Y-12 include Tennessee State Routes (SRs) 95, 58, 62, and 170 (Bethel Valley Road), and Bear Creek Road. Except for Bear Creek Road, all are public roads. Figure 4.2.1–1 schematically presents the on-site routes on the ORR serving the Y-12 Site.

Existing traffic on these on-site roads is presented in Table 4.2.1–1 along with designation of Level of Service (LOS).



Source: DOE 2000d.

FIGURE 4.2.1–1.—*Road Network at Y-12 Site.*

4.2.2 Off-site Traffic

Y-12 is located within 80 km (50 mi) of three interstate highways: I-40, I-75, and I-81. Interstate 40, an east-west highway, extends from North Carolina to California. Interstate 75 is a north-south highway extending from Michigan to Florida. Interstate 81 is a north-south interstate extending from New York to Tennessee. Interstate 81 connects with I-40 east of Knoxville while I-40 and I-75 connect west of Knoxville near the city of Oak Ridge. In addition, SR 61, SR 162, and U.S. 25W at Clinton also serve Y-12 transportation needs off-site.

4.2.3 Transportation of Materials and Waste

Various chemicals and other materials being used for Y-12 operations are transported by truck using the above-addressed roads (SRs 58, 62, 95, and 170; I-40, I-75, and I-81). LLW, hazardous waste, and municipal and solid wastes are being generated by Y-12 operations. LLW is being stored on-site in temporary storage facilities and would eventually be disposed off-site at a DOE Site. A detailed description of Y-12 waste treatment and storage capabilities can be reviewed in Appendix A.5.

4.2.4 Other Transportation

Rail transport is available to Y-12 but is not currently being used.

TABLE 4.2.1–1.—*Existing Average Daily Traffic Flows (Vehicles per Day) on Oak Ridge Reservation Serving Y-12*

Road	To	From	Average Daily Traffic Vehicles/Day	Level of Service[a]
SR 58	SR 95	I-40	11,600	B
SR 95	SR 62	SR 58	16,440	D
SR 95	SR 58	I-40	8,058	A
SR 62	SR 95	SR	28,320	E
East Bear Creek Rd.	Eastbound	-	12,490	C
West Bear Creek Rd.	Westbound	-	3,200	A
East Bethel Valley Rd.	Eastbound	-	10,000	C
West Bethel Valley Rd.	Westbound	-	6,440	A

[a] LOS designations: A(Free Flow); B (Free Flow with maneuverability slightly impeded); C (Stable Flow maneuverability noticeably restricted); D (Stable Flow, reduced speed, maneuverability limited); E (Near capacity, speeds are low but relatively uniform).
Source: TDOT 1998.

4.3 SOCIOECONOMICS

This section describes current socioeconomic conditions within a ROI where more than 90 percent of the ORR workforce resides. The ROI is a four-county area in Tennessee comprised of Anderson, Knox, Loudon, and Roane Counties. Figure 4.3–1 shows the surrounding counties influenced by ORR. In 1997, almost 40 percent of the ORR workforce resided in Knox County, 29 percent in Anderson County, 16 percent in Roane County, and 6 percent in Loudon County. The remaining 9 percent of the workforce resides in other counties across Tennessee, none of which are home to more than 3 percent of the workforce (DOE 1999f).

TABLE 4.3.1–1.—*Employment by Sector (Percent)*

Sector	1980	1990	1998
Services	19.1	27.5[a]	30.2[a]
Wholesale and Retail	21.1	25.3[a]	24.7[a]
Government (including Federal, State, local, and military)	20.3	15.6	13.7
Manufacturing	21.9	15.9	13.0
Farm	2.0	1.6	1.2
Construction	4.9	5.4	6.1
Finance, Insurance, and Real Estate	6.0	5.2	6.5
Transportation and Public Utilities	3.7	4.0	4.5
Agricultural Service, Forestry, and Other	0.3	0.6	0.9
Mining	0.7	0.4	0.2

[a] Percentage only includes Knox and Loudon Counties. Data for Roane and Anderson Counties not available.
Source: BEA 1999.

4.3.1 Employment and Income

The ORR ROI has historically been dependent on manufacturing and government employment. More recent trends show growth in the service and wholesale and retail trade sectors and a decline in manufacturing and government employment. Table 4.3.1–1 presents current and historical employment for the major sectors of the ROI economy.

The ROI labor force grew by almost 15 percent in the first half of this decade from 243,209 in 1990 to 279,275 in 1995. There was a slight decline in the labor force between 1995 and 1998 when it totaled 278,866. ROI employment grew from 231,822 in 1990 to 268,748 in 1995 and continued to grow despite the decline in the labor force and totaled 269,466 in 1998 (BLS 1999).

The ROI unemployment rate was 3.4 percent in 1998, the lowest level in over a decade, as shown in Table 4.3.1–2. Unemployment rates within the ROI ranged from a low of 3.1 percent in Knox County to a high of 5 percent in Roane County. The unemployment rate in Tennessee was 4.2 percent in 1998 (BLS 1999).

Source: LMER 1999a.

FIGURE 4.3–1.—*Location of Oak Ridge Reservation and Surrounding Counties.*

Per capita income in the ROI was $23,520 in 1997, a 35 percent increase from the 1990 level of $17,407. Per capita income in 1997 in the ROI ranged from a low of $19,564 in Roane County to a high of $24,688 in Knox County. The per capita income in Tennessee was $22,699 in 1997 (BEA 1999).

TABLE 4.3.1–2.—*Region of Influence Unemployment Rates (Percent)*

County	1990	1991	1992	1993	1994	1995	1996	1997	1998
Anderson	4.8	5.1	5.4	4.9	3.9	3.9	4.8	5.5	3.6
Knox	4.1	4.5	4.5	3.9	3.3	3.4	3.4	3.6	3.1
Loudon	5.7	7.0	5.6	4.6	3.9	4.0	3.9	4.6	3.2
Roane	8.3	8.2	8.5	5.7	4.4	5.8	5.3	7.3	5.0
ROI Total	4.7	5.0	5.0	4.3	3.6	3.6	3.6	4.3	3.4
Tennessee	5.3	6.7	6.4	5.7	4.8	5.2	5.2	5.4	4.2

Source: BLS 1999.

Y-12 employs approximately 8,900 workers, including DOE employees and multiple contractors. DOE has a significant impact on the economy of the ROI and Tennessee. As a whole, DOE employees and contractors number more than 13,700 individuals in Tennessee, primarily in the ROI. These jobs have a higher average salary than the statewide average, $40,000 compared to $25,695 (BEA 1999). DOE employment and spending generate additional benefits to the ROI and state economies through the creation of additional jobs in sectors providing support to DOE and its workers.

4.3.2 Population and Housing

Between 1960 and 1990, population growth in the ROI was slower than population growth in Tennessee as a whole. The ROI population increased at an average annual rate of 1 percent while the state population increased 1.2 percent annually. Between 1990 and 1998, ROI population growth increased 1.1 percent annually while the state population increased 1.4 percent annually. Loudon County experienced the fastest rate of population growth, averaging 3.1 percent annually between 1990 and 1998, while Anderson County population has increased an average of 0.5 percent annually (Census 1995, Census 1999). Population in all counties in the ROI is projected to continue to grow at a somewhat slower rate between 1998 and 2020, as shown in Table 4.3.2–1.

Knox County is the largest county in the ROI with a 1998 population of 366,846. Knox County includes the city of Knoxville, the largest city in the ROI. Loudon County is the smallest county in the ROI with a total population of 39,052. The city of Oak Ridge and the ORR are located in both Anderson and Roane Counties with 1998 populations of 71,116 and 50,026, respectively (Census 1999).

TABLE 4.3.2–1.—*Historic and Projected Population in the Region of Influence*

County	1960	1970	1980	1990	1998	2000	2010	2020
Anderson	60,032	60,300	67,346	68,250	71,116	72,502	76,000	79,275
Knox	250,523	276,293	319,694	335,749	366,846	374,616	404,666	432,866
Loudon	23,757	24,266	28,553	31,255	39,052	39,761	44,941	50,238
Roane	39,133	38,881	48,425	47,227	50,026	50,829	54,433	58,113
ROI	373,445	399,740	464,018	482,481	527,040	537,708	580,040	620,492
Tennessee	3,567,089	3,923,687	4,591,120	4,877,203	5,430,621	5,533,762	6,062,695	6,593,194

Source: Census 1995, Census 1999, BEA 1999.

TABLE 4.3.2–2.—*Region of Influence Housing Characteristics (1990)*

County	Total Number of Housing Units	Number of Owner-Occupied Units	Owner-Occupied Vacancy Rates (percent)	Median Value	Number of Occupied Rental Units	Rental Vacancy Rates (percent)	Median Monthly Contract Rent
Anderson	29,323	19,401	1.1	$55,100	7,983	9.3	$262
Knox	143,582	85,369	1.9	$63,900	48,270	8.4	$272
Loudon	12,995	9,428	1.7	$51,000	2,727	7.2	$190
Roane	20,334	14,102	1.4	$48,700	4,351	9.9	$194
ROI	206,234	128,300	NA	NA	63,331	NA	NA

Note: NA - Not applicable.
Source: Census 1992.

There were a total of 206,234 housing units in the ROI in 1990. A summary of ROI housing characteristics is shown in Table 4.3.2–2. Approximately 67 percent of these units were single family homes, 24 percent were multifamily units, and 8 percent were mobile homes. Approximately 7 percent of the housing units were vacant, although some vacant units were used for seasonal, recreational, or other occasional purposes. Rental vacancy rates ranged from 7.2 percent in Loudon County to 9.9 percent in Roane County while homeowner vacancy rates ranged from 1.1 percent in Anderson County to 1.9 percent in Knox County.

Owner-occupied housing units accounted for 62 percent of the total housing units while renter-occupied units accounted for approximately 31 percent (Census 1992).

In 1990, the median value of owner-occupied housing units ranged from $48,700 in Roane County to $63,900 in Knox County, while the median contract rent ranged from $190 in Loudon County to $272 in Knox County.

4.3.3 Community Services

Community services in the ROI include public schools, law enforcement, and medical services.

Eight public school districts with a total of 144 schools provide educational services for the approximately 78,000 students in the ROI. Higher education opportunities in the ROI include the University of Tennessee as well as several private colleges and two community colleges (HPI 1999a).

Law enforcement is provided by 20 municipal, county, and local police departments that employ over 1,500 officers and civilians. Security at Y-12 was provided by LMES employees until January 10, 2000, when the protective force and selected security work was contracted to Wackenhut Services, Inc. (HPI 1999b).

There are 13 hospitals in the ROI with a total of 2,833 beds. These hospitals operate at an average of 67 percent occupancy (AHA 1995). There are 1,525 doctors in the ROI with the majority (1,279) in Knox County (AMA 1996).

4.4 GEOLOGY AND SOILS

4.4.1 Physiography

ORR lies in the Valley and Ridge Physiographic Province of eastern Tennessee. The topography consists of alternating valleys and ridges that have a northeast-southwest trend, with most ORR facilities occupying the valleys. In general, the ridges consist of resistant siltstone, sandstone, and dolomite units, and the valleys, which resulted from stream erosion, consist of the less-resistant shales and shale-rich carbonates (DOE 1991b).

The topography within the ORR ranges from a low of 229 m (750 ft) above mean sea level (MSL) along the Clinch River to a high of 384 m (1,260 ft above) MSL along Pine Ridge. Within the ORR, the topographic relief between the valley floors and ridge crests is generally about 91 to 107 m (300 to 350 ft) (LMER 1999a).

4.4.2 Geology

ORR Geology. Several geologic formations are present in the ORR area. A geologic map and stratigraphic column of the area are shown in Figures 4.4.2–1 and 4.4.2–2, respectively. The Rome Formation, which is present north of Y-12 and forms Pine Ridge, consists of massive to thinly bedded sandstones interbedded with minor amounts of thinly bedded, silty mudstones, shales, and dolomites. In the ORR area, the stratigraphic thickness of the Rome Formation is uncertain because of the displacement caused by the White Oak Mountain Thrust Fault. The Conasauga Group, which underlies Bear Creek Valley, consists primarily of calcareous shales, siltstone, and limestone. The Knox Group, which is present immediately south of Y-12, can be divided into five formations of dolomite and limestone. All five formations have been identified at the ORR. The Knox Group, which underlies Chestnut Ridge, is estimated to be approximately 732 m (2,400 ft) thick. The Knox Group weathers to a thick, orange-red, clay residuum that consists of abundant chert and contains karst features (DOE 1991b).

Karst features are dissolutional features occurring in carbonate bedrock. Karst features represent a spectrum ranging from minor solutional enlargement of fractures to conduit flowpaths to caves large enough for a person to walk into. Numerous surface indications of karst development have been identified at ORR (Figure 4.4.2–3). Surface evidence of karst development includes sinking streams (swallets) and overflow swallets, karst springs and overflow springs, accessible caves, and numerous sinkholes of varying size. In general, karst appears most developed in association with the Knox Group carbonate bedrock, as the highest density of sinkholes occurs in this group (LMER 1999a).

ORR Seismology. The Oak Ridge area lies at the boundary between seismic Zones 1 and 2 of the Uniform Building Code, indicating that minor to moderate damage could typically be expected from an earthquake (Table 4.4.2–1). Since the New Madrid earthquakes of 1811 to 1812, at least 26 other earthquakes with a Modified Mercalli intensity, herein referred to as intensity, of III to VI have been felt in the Oak Ridge area, the majority of these having occurred in the Valley and Ridge Province. The Charleston, South Carolina, earthquake of 1886 had an intensity of VI at Oak Ridge, and an earthquake centered in Giles County, Virginia, in 1886 produced an intensity of IV to V at Oak Ridge. One of the closest seismic events to ORR occurred in 1930; its epicenter was 8 km (5 mi) from ORR (DOE 1996e). This earthquake had an estimated intensity of VII at the epicenter and an approximate intensity of V to VI in the Oak Ridge area. Maximum horizontal ground surface accelerations of 0.06 to 0.30 of acceleration due to gravity at ORR are estimated to result from an earthquake that could occur once every 500 to 2,000 years.

FIGURE 4.4.2–1.—*Geological Map of the Y-12 Site.*

Source: Sutton and Field (1995).

Source: DOE 1998b.

FIGURE 4.4.2–2.*—Generalized Stratigraphic in the Y-12 Characterization Area.*

An earthquake occurred in 1973 in Maryville, TN, 34 km (21 mi) southeast of ORR, and had an estimated intensity of V to VI in the Oak Ridge area (DOE 1996b). In 1987, a significant earthquake occurred approximately 48 km (30 mi) from ORR with an intensity of VI. In addition, since 1995, two earthquakes with an intensity of III and two earthquakes with an intensity of V occurred within 160 km (100 mi) of the ORR (NEIC 1999). In 1998, one earthquake that had an intensity of III occurred approximately 3 km (1.9 mi) from the ORR. There have been 13 earthquakes in the last 155 years that at their epicenter produced an intensity of VI and one of intensity VII within 166 km (100 mi) of ORR (NEIC 1999).

There is no volcanic hazard at ORR. The area has not experienced volcanism within the last 230 million years. Therefore, no present or future volcanic activity is expected (DOE 1996e).

Y-12 Seismology. Y-12 is cut by many inactive faults formed during the late Paleozoic Era (DOE 1996e). There is no evidence of capable faults in the immediate area of Oak Ridge, as defined by 10 CFR 100 (surface movement within the past 35,000 years or movement of a recurring nature within the past 500,000 years). The nearest capable faults are approximately 480 km (300 mi) west of ORR in the New Madrid Fault zone.

Y-12 Geology. Y-12 is located within Bear Creek Valley, which is underlain by Middle to Late Cambrian strata of the Conasauga Group (see Figure 4.4.2–1). The Conasauga Group consists primarily of highly fractured and jointed shale, siltstone, calcareous siltstone, and limestone in the site area. The upper part of the group is mainly limestone, while the lower part consists of mostly shale (LMER 1999a). This group can be divided into six discrete formations, which are, in ascending order, the Pumpkin Valley Shale, the Rutledge Limestone, the Rogersville Shale, the Maryville Limestone, the Nolichucky Shale, and the Maynardville Limestone. The thickness of each of these formations varies throughout the Conasauga Group. The bedrock at the Y-12 Site is adequate to support structures using standard construction techniques.

Bedrock in the Y-12 area is overlain by alluvium, colluvium, man-made fill, fine-grained residuum from the weathering of the bedrock, saprolite, and weathered bedrock. The overall thickness of these materials in the Y-12 area is typically less than 12 m (40 ft). In undeveloped areas of the Y-12, the saprolite (a transitional mixture of fine-grained residuum and bedrock remains) retains primary textural features of the unweathered bedrock, including fractures (HSW 1994).

Numerous dissolution and karst features are the primary geological features influencing Y-12 (see Figure 4.4.2–3). Y-12 is situated on carbonate bedrock such that groundwater flow and contaminant transport are controlled by solution conduits in the bedrock. These karst features, including large fractures, cavities, and conduits, are most widespread in the Maynardville Limestone, a formation underlying Y-12, and the Knox Group. These cavities and conduits are often connected and typically found at depths greater than approximately 33 m (100 ft) (DOE 1998b).

FIGURE 4.4.2–3.—*Geology and Karst Features.*

TABLE 4.4.2–1.—*The Modified Mercalli Intensity Scale of 1931, With Approximate Correlations to Richter Scale and Maximum Ground Acceleration*[a]

Modified Mercalli Intensity[b]	Observed Effects of Earthquake	Approximate Richter Magnitude[c]	Maximum Ground Acceleration[d]
I	Usually not felt	<2	negligible
II	Felt by persons at rest, on upper floors or favorably placed	2-3	<0.003 g
III	Felt indoors; hanging objects swing; vibration like passing of light truck occurs; might not be recognized as earthquake	3	0.003 to 0.007 g
IV	Felt noticeably by persons indoors, especially in upper floors; vibration occurs like passing of heavy truck; jolting sensation; standing automobiles rock; windows, dishes, and doors rattle; wooden walls and frames may creak	4	0.007 to 0.015 g
V	Felt by nearly everyone; sleepers awaken; liquids disturbed and may spill; some dishes break; small unstable objects are displaced or upset; doors swing; shutters and pictures move; pendulum clocks stop or start	4	0.015 to 0.03 g
VI	Felt by all; many are frightened; persons walk unsteadily; windows and dishes break; objects fall off shelves and pictures fall off walls; furniture moves or overturns; weak masonry cracks; small bells ring; trees and bushes shake	5	0.03 to 0.09 g
VII	Difficult to stand; noticed by car drivers; furniture breaks; damage moderate in well built ordinary structures; poor quality masonry cracks and breaks; chimneys break at roof line; loose bricks, stones, and tiles fall; waves appear on ponds and water is turbid with mud; small earthslides; large bells ring	6	0.07 to 0.22 g
VIII	Automobile steering affected; some walls fall; twisting and falling of chimneys, stacks, and towers; frame houses shift if on unsecured foundations; damage slight in specially designed structures, considerable in ordinary substantial buildings; changes in flow of wells or springs; cracks appear in wet ground and steep slopes	6	0.15 to 0.3 g
IX	General panic; masonry heavily damaged or destroyed; foundations damaged; serious damage to frame structures, dams and reservoirs; underground pipes break; conspicuous ground cracks	7	0.3 to 0.7g
X	Most masonry and frame structures destroyed; some well built wooden structures and bridges destroyed; serious damage to dams and dikes; large landslides; rails bent	8	0.45 to 1.5 g
XI	Rails bent greatly; underground pipelines completely out of service	9	0.5 to 3 g
XII	Damage nearly total; large rock masses displaced; objects thrown into air; lines of sight distorted	9	0.5 to 7 g

[a] This table illustrates the approximate correlation between the Modified Mercalli intensity scale, the Richter scale, and maximum ground acceleration.
[b] Intensity is a unitless expression of observed effects.
[c] Magnitude is an exponential function of seismic wave amplitude, related to the energy released.
[d] Acceleration is expressed in relation to the earth's acceleration due to earth's gravity (g).
Source: NEIC 1999.

4.4.3 Soils

ORR Soils. Bear Creek Valley lies on well to moderately well-drained soils underlain by shale, siltstone, and silty limestone. Developed portions of the valley are designated as urban land. Soil erosion from past land uses has ranged from slight to severe. Erosion potential is very high in those areas that have been eroded in the past with slopes greater than 25 percent. Erosion potential is lowest in the nearly flat-lying permeable soils that have a loamy texture. Additionally, shrink-swell potential is low to moderate and the soils are generally acceptable for standard construction techniques (DOE 1996e).

Y-12 Soils. Y-12 lies on soils of the Armuchee-Montevallo-Hamblen, the Fullerton-Claiborne-Bodine, and the Lewhew-Armuchee-Muskinghum associations. Soil erosion due to past land use has ranged from slight to severe. Wind erosion is slight and shrink-swell potential is low to moderate. Finer textured soils of the Armuchee-Montevallo-Hamblen association have been designated as prime farmland when drained (DOE 1993). The soils at the Y-12 Site are generally stable and acceptable for standard construction techniques.

4.5 HYDROLOGY

This section describes the surface and groundwater resources on the ORR in general and Y-12 specifically. Much of the information for the Y-12 water resources, particularly surface water and groundwater quality, are based on the results of recent CERCLA Remedial Investigations conducted in Bear Creek Valley (DOE 1997a) and UEFPC (DOE 1998b).

4.5.1 Surface Hydrology

ORR Surface Drainage Systems. The major surface water body in the immediate vicinity of the ORR is the Clinch River, which borders the site to the south and west. There are four major subdrainage basins on the ORR that flow into the Clinch River and are affected by site operations: Poplar Creek, East Fork Poplar Creek, Bear Creek, and White Oak Creek. Drainage from Y-12 enters both Bear Creek and EFPC; ETTP drains predominantly into Poplar Creek and Mitchell Branch; and ORNL drains into the White Oak Creek drainage basin (DOE 1992). Several smaller drainage basins, including Ish Creek, Grassy Creek, Bearden Creek, McCoy Branch, Kerr Hollow Branch, and Raccoon Creek, drain directly in to the Clinch River. Each drainage basin takes the name of the major stream flowing through the area. Within each basin are a number of small tributaries. The natural surface water bodies in the vicinity of ORR are shown in Figure 4.5.1–1.

Y-12 Surface Drainage Systems. Within the Y-12 area the two major surface water drainage basins are those of Bear Creek and EFPC. The upper reaches of EFPC drain the majority of the industrial facilities of Y-12. The in-plant portion of EFPC has been designated as UEFPC.

The natural drainage pattern of UEFPC has been radically altered by the construction of Y-12. The western portion of the creek flows underground through pipes and the remaining portion flows in a modified and straightened channel lined with riprap and concrete. Flow in UEFPC is derived partially from groundwater captured by the buried channels and funneled to the creek. In addition, outfalls into UEFPC add a combination of groundwater, storm water, and water generated by plant operations (e.g., basement sumps, treatment plant discharges). As a result of reduced operations and elimination of inadvertent direct discharges of contaminated water to UEFPC, flow in UEFPC decreased from 38-57 MLD (10-15 MGD) in the mid-1980s to about 9 MLD (2.5 MGD) in the mid-1990s. To improve downstream water quality (e.g., toxicity requirements, temperature), Y-12's 1995 National Pollutant Discharge Elimination System (NPDES) permit required supplementing flow in UEFPC by the addition of raw water from the Clinch River. Since mid-1996, water has been added to the western portion of the open channel in order to maintain flow of 26 MLD (7 MGD) at Station 17, just before the creek exits Y-12 on the east end.

Bear Creek Valley west of Y-12 is drained by Bear Creek. Bear Creek begins near the westernmost portion of Y-12 and flows west for approximately 8.3 km (5 mi). When Bear Creek reaches U.S. Highway 95, it turns north and flows through a water gap in Pine Ridge to its confluence with Lower EFPC just above its confluence with Poplar Creek. Bear Creek flow is maintained by inputs from tributary streams flowing in from the north (mostly) from Pine Ridge. Flow in Bear Creek is further supplemented by discharges from several springs at the base of Chestnut Ridge (entering Bear Creek from the south). The channel of Bear Creek is less modified than that of UEFPC but several short reaches have been relocated to accommodate construction (e.g., Bear Creek Road) at the west end of Y-12.

The Clinch River and connected waterways supply all raw water for ORR and provide potable water for Y-12, ORNL, and the city of Oak Ridge. The Clinch River has an average flow of 132 m^3/s (4,647 ft^3/s) as measured at the downstream side of Melton Hill Dam at mile 23.1. The average flow of Bear Creek near Y-12 is 0.11 m^3/s (3.9 ft^3/s). Prior to flow augmentation in UEFPC, the average flow in EFPC measured downstream of Y-12 was 1.3 m^3/s (45 ft^3/s). The average flow in EFPC has increased as flow augmentation raised the minimum flow rate to 0.3 m^3/s (11 ft^3/s) in the headwaters of UEFPC. Y-12 uses approximately 7,530 MLY (1,989 MGY) of water while ORR uses approximately twice as much (14,760 MLY [3,900 MGY]). The ORR water supply system, which includes the city of Oak Ridge treatment facility and the ETTP treatment facility, has a capacity of 44,347 MLY (11,716 MGY).

Clinch River water levels in the vicinity of ORR are regulated by a system of dams operated by TVA. Melton Hill Dam controls the flow of the Clinch River along the northeast and southeast sides of ORR. Watts Bar Dam, located on the Tennessee River downstream of the lower end of the Clinch River, controls the flow of the Clinch River along the southeast side of ORR.

TVA has conducted floodplain studies along Clinch River, Bear Creek, and EFPC (TVA 1991). Portions of Y-12 lie within the 100- and 500-year floodplains of EFPC; however, proposed SWEIS facilities are located outside the 500-year floodplain (Figure 4.5.1–2).

Surface Water Quality. The streams and creeks of Tennessee are classified by TDEC and defined in the State of Tennessee Water Quality Standards. Classifications are based on water quality, designated uses, and resident aquatic biota. The Clinch River is the only surface water body on ORR classified for domestic water supply. Most of the streams at ORR are classified for fish and aquatic life, livestock watering, wildlife, and recreation. White Oak Creek and Melton Branch are the only streams not classified for irrigation. Portions of Poplar Creek and Melton Branch are not classified for recreation.

At Y-12, there are six treatment facilities with NPDES-permitted discharge points to UEFPC. Y-12 is also permitted to discharge wastewater to the city of Oak Ridge Wastewater Treatment Facility. The water quality of surface streams in the vicinity of Y-12 is affected by current and past operations. Despite efforts to reroute discharge pipes and to treat all wastewater from the plant processes, wastewater discharges from Y-12 are a major influence on water quality and flow in UEFPC. Stormwater discharges, groundwater discharges (either directly to the stream channel or collected in building sumps and discharged to UEFPC) and wastewater discharges contribute specific contaminants to UEFPC. Surface water contaminants in UEFPC are summarized in Table 4.5.1–1 and include metals (particularly mercury and uranium), chlorinated solvents, and radionuclides (especially isotopes of uranium) (DOE 1998b). Water quality in Bear Creek is influenced significantly by a groundwater hydraulic connection either directly to Bear Creek or to tributaries to Bear Creek. Contaminants in Bear Creek, from multiple formerly used waste burial trenches and pits, include nitrate, metals (e.g., uranium), radionuclides (e.g., uranium isotopes, ^{99}Tc), and chlorinated organics and are summarized in Table 4.5.1–1 (DOE 1997a and LMES 1997b).

Source: Tetra Tech, Inc.

FIGURE 4.5.1–1.—*Y-12 Area Surface Water Features.*

FIGURE 4.5.1–2.—*100- and 500-year Floodplains for Y-12.*

Surface Water Rights and Permits. In Tennessee, the state's water rights are codified in the *Water Quality Control Act*. In effect, the water rights are similar to riparian rights in that the designated usages of a water body cannot be impaired. The only requirement to withdraw from surface water would be a U.S. Army Corps of Engineers (USACE) permit to construct intake structures.

TABLE 4.5.1–1.—*Surface Water Quality, Upper East Fork Poplar Creek (Station 8 to Station 17) During Flow Augmentation, and Lower Bear Creek (BCK-0.63)*

			Tennessee Water Quality Criteria			
					Recreation	
Parameter	UEFPC (mean concentration)	Bear Creek	Domestic Use	Fish and Aquatic Life	Organisms	Water and Organisms
Metals (mg/L)						
Mercury	0.00091	!	0.002	0.00169	0.00005	0.00005[b]
Uranium	0.015	0.031	!	!	!	!
Lithium	0.041	!	!	!	!	!
Copper	0.007	!	!	0.0177[c]	!	!
Zinc	0.045	0.003	!	0.117[c]	!	!
Nickel	0.021	!	0.1	1.418[c]	4.6	0.61
Organics (Fg/L)						
Chloroform	2.8	!	!	!	4700	57
Tetrachloroethene	3.9	!	5	!	88.5	8
Carbon Tetrachloride	4[a]	!	5	!	44	2.5
Radionuclides (pCi/L)						
Gross Alpha	6.8	12.5	!	!	!	!
Gross Beta	3.7	8.62	!	!	!	!
Gamma	28	!	!	!	!	!

[a] One sample.
[b] Based on consumption of water and organisms. Applied to waters designated for domestic and recreational uses.
[c] Based on total hardness of 100 mg/L.
Note: BCK - Bear Creek kilometer.
Source: DOE 1997a, DOE 1998b, LMES 1997b, TDEC 1999b.

4.5.2 Groundwater

ORR Hydrogeology. ORR is located in an area of sedimentary rocks of widely varying hydrological characteristics. Two geologic units on the ORR, designated as the Knox Group and the Maynardville Limestone of the Conasauga Group, both consisting of dolostone and limestone, constitute the Knox Aquifer. A combination of fractures and solution conduits in this aquifer control flow over substantial areas and relatively large quantities of water may move rapidly over relatively long distances. Active groundwater flow can occur at substantial depths in the Knox Aquifer (92 to 122 m [300 to 400 ft] deep). The Knox Aquifer is the primary source of groundwater to many streams (base-flow), and most large springs on the ORR receive discharge from the Knox Aquifer. Yields of some wells penetrating larger solution conduits are reported to exceed 3,784 LPM (1,000 GPM).

The remaining geologic units on the ORR (the Rome Formation, the Conasauga Group below the Maynardville Limestone, and the Chickamauga Group) are aquitards, which consist mainly of siltstone, shale, sandstone, and interbedded limestone and dolostone of low to very low permeability. Nearly all groundwater flow in the aquitards occurs through fractures similar to the flow mechanism dominant in the aquifers. However, the absence of solution-enlarged fractures in the aquitards limits flow to a system of smaller and less connected fractures. The typical yield of a well in the aquitards is less than 4 LPM (1 GPM) and the base flows of streams draining areas underlain by the aquitards are poorly sustained because of such low flow rates. In areas underlain by aquitards, the combination of topographic relief and a decrease in bedrock fracture density with depth, restrict groundwater flow to shallow depths of the saturated zone and groundwater discharges primarily to nearby surface waters within the ORR (DOE 2000d).

The Knox Aquifer and ORR Aquitards can each be divided into a shallow soil and regolith unit and a deeper bedrock unit. The shallow unit consists of manmade fill, alluvium, colluvium, residuum, and weathered bedrock. In undisturbed areas an active storm flow zone, roughly equivalent to the zone of plant roots, carries a large percentage of infiltrating precipitation toward surface water streams. The influence of manmade fill on groundwater flow within the shallow unit is particularly important in Y-12 where pre-existing UEFPC stream channels have been filled and act as preferential groundwater flow paths (DOE 1998b). The bedrock unit consists of sandstones, siltstones, shales, and carbonates where groundwater flow occurs in fracture and/or conduit systems.

Y-12 Hydrogeology. Y-12, bound on the north by Pine Ridge and on the south by Chestnut Ridge, is located near the boundary between the Knox Aquifer and the ORR Aquitards. ORR Aquitards underlie Pine Ridge and Bear Creek Valley, which contains the main plant area of Y-12 and the disposal facilities of western Bear Creek Valley. The Knox Aquifer underlies Chestnut Ridge and the stream channels of Bear Creek and UEFPC. Bedrock formations comprising the Aquitards are hydraulically upgradient of the Aquifer, which functions as a hydrologic drain in Bear Creek Valley. Fractures provide the principal groundwater flowpaths in both the Aquifer and Aquitards. Dissolution of carbonates in the Aquifer has enlarged fractures and produced solution cavities and conduits that greatly enhance its hydraulic conductivity relative to the Aquitards.

Groundwater at Y-12 has been divided into three hydrogeologic regimes: UEFPC, Bear Creek, and Chestnut Ridge. A surface water divide at the west end of Y-12 effectively separates the UEFPC and Bear Creek hydrogeologic regimes with groundwater flow directions generally to the west in the Bear Creek regime and toward the east in the UEFPC regime. Bedrock beneath these two regimes is predominantly the ORR Aquitards. The Chestnut Ridge hydrogeologic regime, although hydraulically connected to the other two regimes, is distinctive in being developed on the underlying Knox Aquifer. In Bear Creek Valley, depth to groundwater is generally 6 to 9 m (20 to 30 ft) but is as little as 2 m (7 ft) in the area of Bear Creek near Highway 95. On Chestnut Ridge, the depth to the water table is greatest (>30 m [100 ft] below ground surface) along the crest of the ridge, which is a groundwater flow divide and recharge area. Groundwater in the Chestnut Ridge hydrogeologic regime tends to flow from west to east with elements of radial flow from the ridge crest north into Bear Creek Valley and south toward the headwaters of tributaries draining into Bethel Valley.

Recharge occurs over most of the area but is most effective where overburden soils are thin or permeable. Groundwater flow in the Aquitard and the Aquifer is primarily parallel to bedding, which in the Aquitard may or may not coincide with the direction of maximum hydraulic gradient calculated from field measurements. Cross bedding flows occur along permeable zones formed by fractures. The northern tributaries to Bear Creek (those exposed in western Bear Creek Valley and buried beneath Y-12) are possibly surficial expressions of the cross-cutting features.

In the Aquitard, most groundwater flow occurs in a highly conductive interval near the bedrock/residuum interface (water table interval). Flow occurs above the water table in response to precipitation when flowpaths in the residual soils become saturated and rapidly transmit water laterally (stormflow) down slope toward springs and seeps in drainage features, and vertically (recharge) to the water table interval. Recharge to the water table interval promotes bedding-parallel groundwater flow toward discharge areas in nearby cross-cutting streams. Although most active groundwater flow occurs at depth less than 30 m (100 ft) below ground surface, contaminants in groundwater more than 61 m (200 ft) below ground surface in the Aquitard indicate permeable flowpaths at depth.

In the Aquifer, most groundwater flow occurs at shallow depths (i.e., <30 m [100 ft] below ground surface) in an extensively interconnected maze of solution conduits and cavities. Below the shallow karst network, fractures provide the primary flowpaths. Flow in the shallow karst network in the Aquifer is relatively rapid and during rainfall results in rapid discharge to surface streams. Groundwater from the deeper flow system (>30 m [100 ft] below ground surface) discharges along major gaining reaches of Bear Creek. In the main plant area of Y-12, the surface water drainage system has been drastically altered by construction. Despite the alterations, groundwater discharges continue to the buried tributaries and to pre-existing spring locations. Actively pumping basement sumps in several buildings within Y-12 locally influence groundwater flow directions by drawing water toward the pump and lowering the water table. Basement sumps also contribute discharge to UEFPC.

There are no Class I sole-source aquifers that lie beneath ORR. All aquifers are considered Class II aquifers (current potential sources of drinking water). Because of the abundance of surface water and its proximity to the points of use, very little groundwater is used at ORR. Only one water supply well exists on ORR; it provides a supplemental water supply to an aquatics laboratory during extended droughts.

Groundwater Quality. Groundwater samples are collected semiannually or annually from a representative number of the monitoring wells throughout ORR. Groundwater samples collected from the monitoring wells are analyzed for a standard suite of parameters and constituents, including trace metals, VOCs, radionuclides, inorganics, and field parameters. Background groundwater quality at ORR is generally good in the near surface aquifer zones and poor in the bedrock aquifer at depths greater than 300 m (984 ft) due to high total dissolved solids.

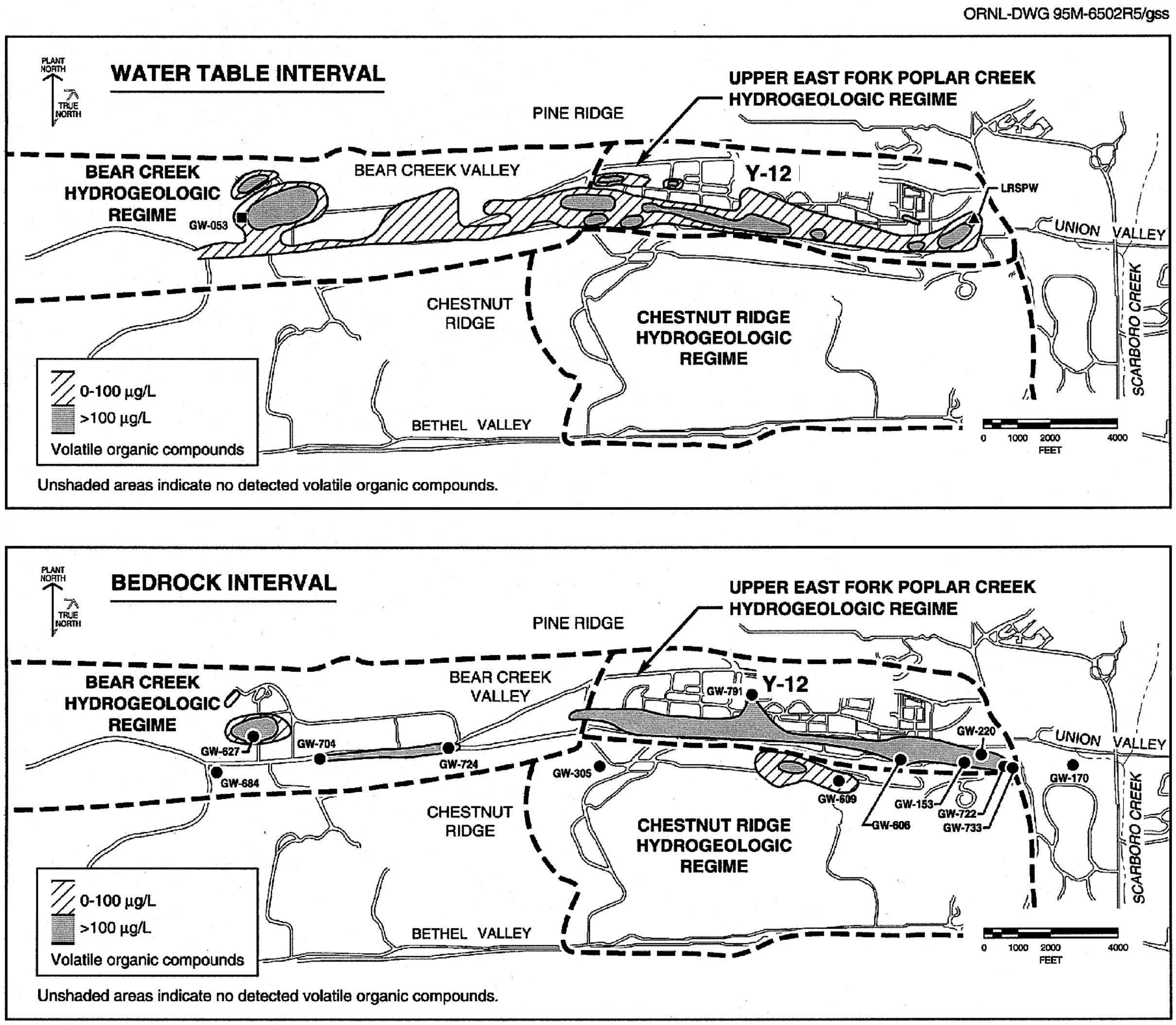
Groundwater in Bear Creek Valley west of Y-12 has been contaminated by hazardous chemicals and radionuclides (mostly uranium) from past weapons production waste disposal activities (DOE 1997a). The contaminant sources include past waste disposal facilities sited on Aquitard bedrock north of Bear Creek. Former disposal facilities include the S-3 Ponds, the Oil Landfarm, the Boneyard/Burnyard site, and the Bear Creek Burial Grounds, all closed since 1988. Each site was used for the disposal of waste chemicals including acids, solvents, oils, radioactive material (e.g., uranium), and wastewater containing dissolved metals and radionuclides. As a result, the aquifers below disposal sites often contain accumulations of the organic solvents (dense nonaqueous phase liquids) and the groundwater beneath and downgradient of the disposal facilities is contaminated with nitrate, solvents (e.g., PCE, TCE, DCE), radionuclides (e.g., uranium isotopes and ^{99}Tc), and metals (e.g., uranium, cadmium, strontium). The distribution of groundwater contamination in the Bear Creek hydrogeologic regime is illustrated in Figures 4.5.2–1 through 4.5.2–3.

Historical monitoring of groundwater in the UEFPC Y-12 area has been used to define an area of contamination that extends throughout Y-12 and off-site to the east into Union Valley. The groundwater contamination is the result of a comingling of releases from multiple sources within Y-12. The most widespread contaminant types are VOCs such as the solvents PCE, TCE, DCE, carbon tetrachloride, and chloroform; and fuel components such as benzene, toluene, ethylbenzene, and xylenes (BTEX). Other groundwater contaminants include nitrate, gross alpha activity (primarily uranium isotopes), gross beta activity (primarily uranium isotopes and ^{99}Tc). The most frequently detected metals are boron, beryllium, cobalt, copper, chromium, lead, lithium, mercury, manganese, nickel, and total uranium (DOE 1998b). The distribution of groundwater contamination in the UEFPC hydrogeologic regime is illustrated in Figures 4.5.2–1 through 4.5.2–3.

The Chestnut Ridge hydrogeologic area is dominated by several closed and operating disposal facilities including the closed Chestnut Ridge Security Pits, Chestnut Ridge Sediment Disposal Basin, United Nuclear Corporation Site, and five nonhazardous waste landfills. Groundwater monitoring data collected since the mid-1980s indicate limited groundwater contamination. Contaminants consist primarily of VOCs detected in scattered monitoring wells. The only definable VOC contaminant plume in groundwater is associated with the Chestnut Ridge Security Pits and extends approximately 792 m (2,600 ft) east of that facility. The distribution of groundwater contamination in the Chestnut Ridge hydrogeologic regime is illustrated in Figures 4.5.2–1 through 4.5.2–3.

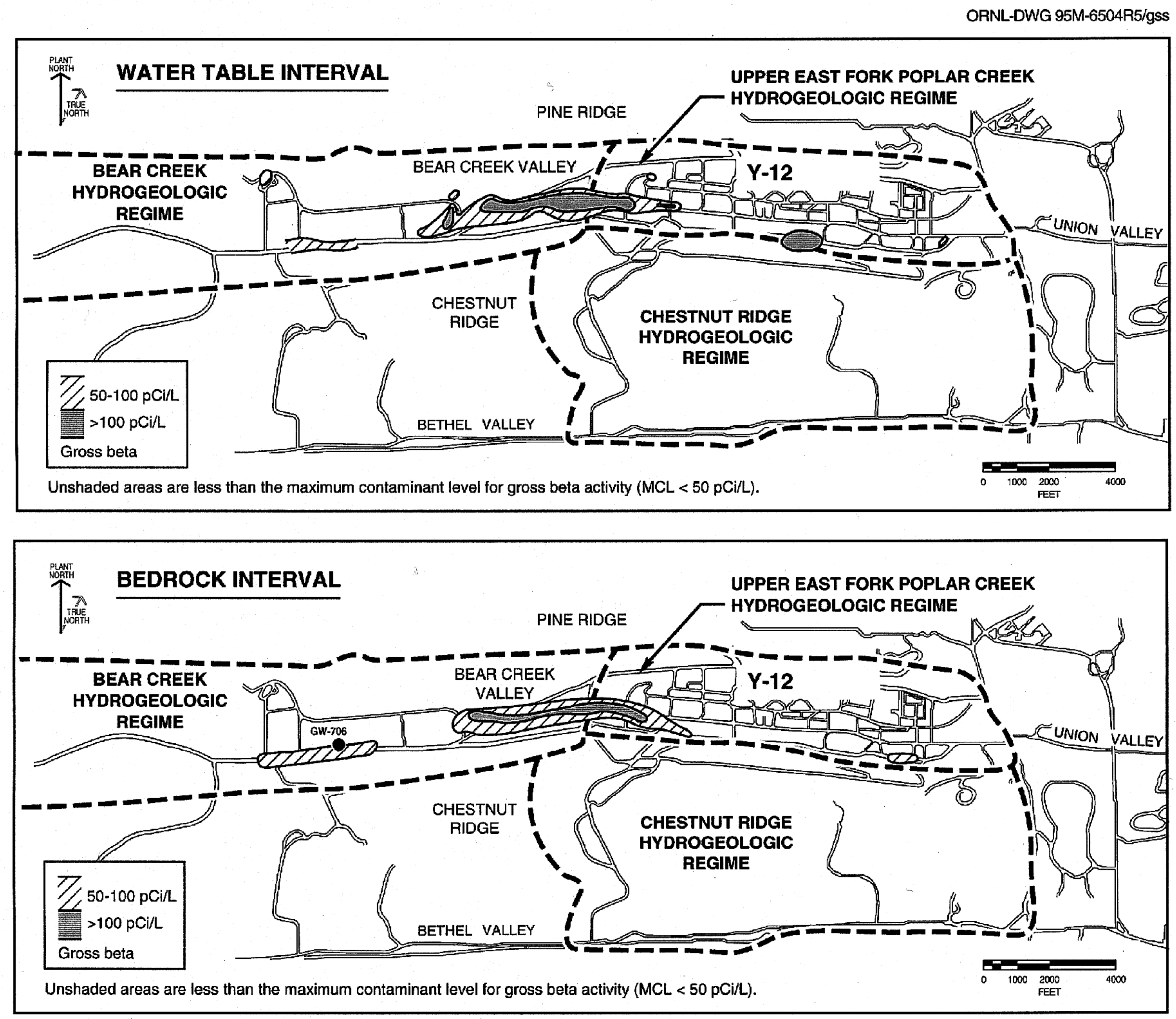
Groundwater Availability, Use, and Rights. Industrial and drinking water supplies in the area are primarily taken from surface water sources. However, single-family wells are common in adjacent rural areas not served by the public water supply system. Most of the residential supply wells in the immediate area of ORR are south of the Clinch River. Most wells used for potable water are located in the deeper principal carbonate aquifer (305 m [1,000 ft]), while the groundwater contamination at Y-12 is primarily found above a depth of approximately 84 m (276 ft), with the exception of VOC contamination at the east end of Y-12 which has been found to extend to 171 m (560 ft) below ground surface.

Groundwater rights in the State of Tennessee are traditionally associated with the Reasonable Use Doctrine (Van der Leeden 1990). Under this doctrine, landowners can withdraw groundwater to the extent that they must exercise their rights reasonably in relation to the similar rights of others.



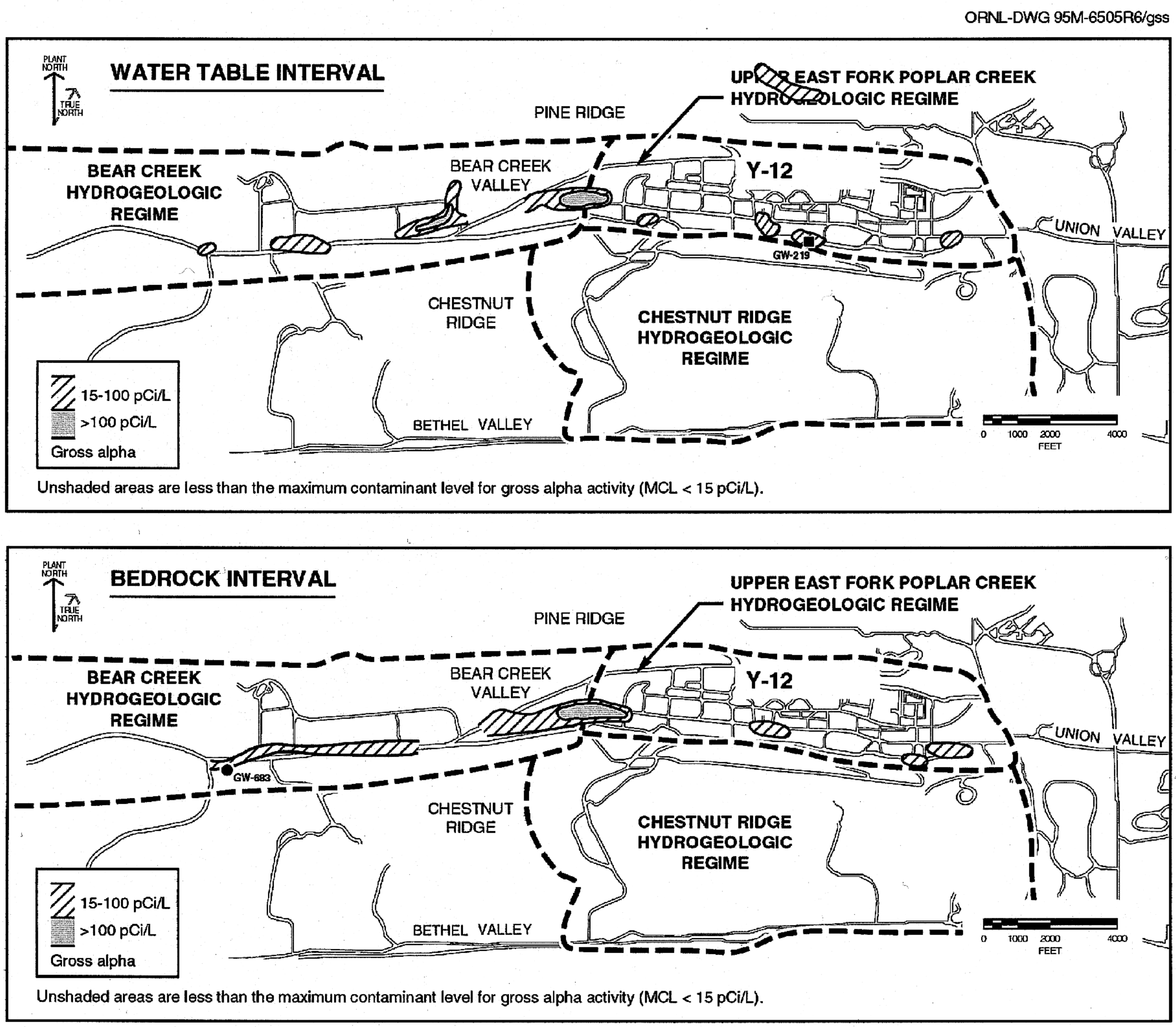
Source: DOE 2000d

FIGURE 4.5.2–1. — *Summed Volatile Organic Compounds in Groundwater.*



Source: DOE 2000d

FIGURE 4.5.2–2. —*Gross Alpha Activity in Groundwater at Y-12.*



Source: DOE 2000d

FIGURE 4.5.2–3. —*Gross Beta Activity in Groundwater at Y-12.*

4.5.3 Y-12 Liquid Release

Nonradiological Liquid Discharges. The *Clean Water Act* requires that EPA establish limits on the amounts of specific pollutants that may be discharged to surface waters. The standards, called effluent limitations, are written into NPDES permits issued to all municipal and industrial dischargers. The Y-12 National Security Complex, ORNL, and the ETTP are each required to monitor discharges at frequencies specified in their permits to ensure compliance with the NPDES effluent limitations.

The current Y-12 NPDES permit, issued on April 28, 1995, and effective on July 1, 1995, requires sampling, analysis and reporting at approximately 95 outfalls. Discharges to surface water allowed under the permit include storm drainage, cooling water, cooling tower blowdown, and treated process wastewaters, including effluents from wastewater treatment facilities. The effluent limitations contained in the permit are based on the protection of water quality in the receiving streams.

The permit emphasizes monitoring storm water runoff as well as biological, toxicological, and radiological monitoring. Currently, the Y-12 National Security Complex has outfalls and monitoring points in the following water drainage areas: EFPC, Bear Creek, and several unnamed tributatries on the south side of Chestnut Ridge. These creeks and tributatries eventually drain to the Clinch River (DOE 2000d). At Y-12, there are six treatment facilities with NPDES-permitted discharge points to UEFPC. Y-12 is also permitted to discharge wastewater to the city of Oak Ridge Wastewater Treatment Facility.

Radiological Liquid Discharges. At the Y-12 National Security Complex, a Radiological Monitoring Plan is in place to address compliance with DOE Orders and the NPDES permit. No discharge limits for radionuclides are set by the NPDES permit; however, the permit does require monitoring and reporting of results. Under the monitoring program, effluent monitoring is performed at three types of locations: (1) treatment facilities, (2) other point and area source discharges, and (3) instream locations. Radiological parameters monitored at the Y-12 National Security Complex in 1999 include the following:

- Uranium isotopes (^{238}U, ^{235}U, and ^{234}U, total uranium, and weight % of uranium ^{235}U)
- Fission and activation products (^{90}Sr, tritium, ^{99}Tc, and ^{137}Cs)
- Transuranic isotopes (^{241}Am, ^{237}Np, ^{238}Pu, and $^{239/240}$Pu)
- Other isotopes of interest (^{232}Th, ^{230}Th, ^{288}Th, ^{226}Ra and ^{228}Ra)

In 1999, the highest summed percentage of Derived Concentration Guidelines (DCGs) was from Bear Creek. Radium (^{228}Ra) was the major contributor of radioactivity in Bear Creek, contributing 5 percent of the total 9.3 percent of the sum of the percentage of the DCGs. The total mass of uranium and associated curies released from Y-12 at the easternmost monitoring station, Station 17 on UEFPC, and the westernmost monitoring station, at Bear Creek Kilometer (BCK 4.55), was 306 kg or 0.166 Ci.

The Radiological Monitoring Plan also addresses monitoring of the sanitary sewer. The Y-12 National Security Complex is permitted to discharge domestic wastewater to the city of Oak Ridge publicly owned treatment works. Studies of the potential sources of radionuclides discharging to the sanitary sewer have shown that levels of radionuclides are orders of magnitude below levels established in DOE Orders and are not thought to pose a safety or health risk. No single radionuclide in the Y-12 contribution to the sanitary sewer exceeded 1 percent of the DCG listed in DOE Order 5400.5. Summed percentages of DCGs calculated from the Y-12 contribution to the sewer are essentially zero.

Radiological monitoring of storm water also is required by the NPDES permit. Uranium is the dominant constituent and increases during storm flow, probably due to surface sources and increase groundwater flow (DOE 2000d).

4.6 BIOLOGICAL RESOURCES

This section describes the biological resources at ORR including terrestrial resources, wetlands, aquatic resources, and threatened and endangered species. Information for Y-12 is also provided.

4.6.1 Terrestrial Resources

Plant communities on the ORR are characteristic of the intermountain regions of central and southern Appalachia. Approximately 35 percent of the ORR has been developed since it was withdrawn from public access; the remainder of the site has reverted to or been planted with natural vegetation (LMER 1999a). Over 1,100 vascular plant species have been found on ORR (LMER 1999a). The vegetation of ORR has been categorized into seven plant communities (Figure 4.6.1–1). Pine and pine-hardwood forest and oak-hickory forest are the most extensive plant communities on ORR, while northern hardwood forest and hemlock-white pine-hardwood forest are the least common forest community types. Important conifers on the ORR include loblolly pine (*Pinus taeda*), shortleaf pine (*Pinus echinata*), Virginia pine (*Pinus virginiana*), and white pine (*Pinus strobus*). Important deciduous trees include white oak (*Quercus alba*), black oak (*Quercus velutina*), northern red oak (*Quercus rubra*), shagbark hickory (*Carya ovata*), pignut hickory (*Carya glabra*), sweetgum (*Liquidambar styraciflua*), tulip poplar (*Liriodendron tulipifera*), and American beech (*Fagus grandifolia*). Some additional representative plants are provided in Table 4.6.1–1.

Animal species found on the ORR include about 63 species of fish; 59 species of amphibians and reptiles; up to 260 species of migratory, transient, and resident birds; and 38 species of mammals (LMER 1999a). Representative amphibians and reptiles include American toad (*Bufo americanus),* eastern tiger salamander (*Ambystoma tigrinum),* five-lined skink (*Eumeces fasciatus),* eastern garter snake (*Thamnophis sirtalis),* rat snake (*Elaphe obsoleta),* and eastern box turtle (*Terrapene carolina).*

Some representative mammals on the ORR, particularly in less developed areas, include deer mouse (*Peromyscus maniculatus*), eastern chipmunk (*Tamias striatus*), eastern cottontail (*Sylvilagus floridanus),* eastern gray squirrel (*Sciurus carolinensis*), southern flying squirrel (*Glaucomys volans),* gray fox (*Urocyon cinereoargenteus*), hispid cotton rat (*Sigmodon hispidus),* Meadow vole (*Microtus pennsylvanicus),* opposum (*Didelphis virginiana),* raccoon (*Procyon lotor),* striped skunk (*Mephitis mephitis),* and white-tailed deer (*Odocoileus virginianus)* (Mitchell 1996). The white-tailed deer is a game species hunted on the ORR.

Some of the more common birds on the ORR, particularly in less developed areas, include mourning dove (*Zenaida macroura*), chimney swift (*Chaetura pelagica*), barn swallow (*Hirundo rustica*), blue jay (*Polioptila caerulea*), Carolina chickadee (*Parus carolinesis*), American crow (*Corvus brachyrhunchos*), Carolina wren (*Thryothus Iudovicianus*), American robin (*Turdus migratorius*), northern mockingbird (*Mimus polyglottos*), European starling (*Sturnis vulgaris*), red-eyed vireo (*Vireo olivaceus*), northern cardinal (*Cardinalis cardinalis*), indigo bunting (*Passerina cyanea*), eastern meadowlark (*Sturnella magna*), common grackle (*Quiscalus quiscula*), and house sparrow (*Passer domesticus*) (Mitchell, 1996; Sauer, 1997). The wild turkey (*Meleagris gallopavo)* is a game species hunted on the ORR. A variety of migratory birds has been found at ORR. Migrating birds present on site, as well as their nests and eggs, are protected by the *Migratory Bird Treaty Act*. The ORR has more species of breeding birds documented than any other single tract of land in Tennessee (Mitchell 1998). Table 4.6.1–2 contains a partial list of some of the potential breeding birds and their relative abundance on the ORR. A more detailed list is provided by Sauer et al. (1997).

Source: DOE 1996e

FIGURE 4.6.1–1 *Distribution of Plant Communities on the Oak Ridge Reservation.*

TABLE 4.6.1–1.—*Common and Scientific Names of Some of the Nonthreatened and Nonendangered Plants and Animals Occurring On or In the Vicinity of the ORR* [Page 1 of 2]

Common name	Scientific name	Common name	Scientific name
PLANTS		**FISH (continued)**	
American beech	*Fagus grandifolia*	Largemouth bass	*Micropterus salmonides*
Black oak	*Quercus velutina*	Sauger	*Stizostedion canadense*
Black willow	*Salix nigra*	Sunfish	*Lepomis spa*
Blueberry	*Vaccinium* sp.		
Box elder	*Acer negundo*	**AMPHIBIANS & REPTILES**	
Juneberry	*Aelanchier* sp.	American toad	*Bufo americanus*
Fescue	*Festuca* sp.	Bull frog	*Bufo catesbeiana*
Green ash	*Fraxinus pennsylvanica*	Eastern tiger salamander	*Amblystoma tigrinum*
Hazelnut	*Corylus americana*	Spring peeper	*Pseudacris triseriata*
Hop hornbeam	*Ostrya virginiana*	Five-lined skink	*Eumeces fasciatus*
Japanese honeysuckle	*Lonicera japonica*	Corn snake	*Elaphe guttata*
Jewelweed	*Impatiens capensis*	Eastern garter snake	*Thamnophis sirtalis*
Juneberry	*Amelanchier* sp.	Northern water snake	*Nerodia spiedon*
Loblolly pine	*Pinus taeda*	Rat snake	*Elaphe obsoleta*
Northern red oak	*Quercus rubra*	Eastern box turtle	*Terrapene carolina*
Pignut hickory	*Carya glabra*	Painted turtle	*Chrysemys picta*
Red bud	*Cercis canadensis*	**BIRDS**	
Reed canary grass	*Phalaris arundianaceae*	Wood duck	*Aix sponsa*
Rice cutgrass	*Leersia oryzoides*	Canada goose	*Branta canadensis*
Rusty viburnum	*Viburnum rudifulum*	Mourning dove	*Zenaida macroura*
Sedges	*Carex sp.*	Yellow-billed cuckoo	*Coccyzus americanus*
Shagbark hickory	*Carya ovata*	Chimney swift	*Chaetura pelagica*
Shortleaf pine	*Pinus echinata*	Barn swallow	*Hirundo rustica*
Silky dogwood	*Cornus amomum*	Blue jay	*Cyanocitta cristata*
Soft rush	*Juncus effusus*	American crow	*Corvus brachyrhynchos*
Sugar maple	*Acer sccharum*	Carolina chickadee	*Parus carolinesis*
Sweetgum	*Liquidambar styraciflua*	Tufted titmouse	*Parus bicolor*
Sycamore	*Platanus occidentalis*	Carolina wren	*Thryothus Iudovicianus*
Tulip poplar	*Liriodendron tulipifera*	Blue-gray gnatcatcher	*Polioptila caerulea*
Turnflower rush	*Juncuc biflorus*	Eastern bluebird	*Sialia sialis*
Virginia pine	*Pinus virginiana*	Wood thrush	*Hylocichla mustelina*
White oak	*Quercus alba*	American robin	*Turdus migratorius*
White pine	*Pinus strobus*	Northern mockingbird	*Mimus polyglottos*
FISH		Brown thrasher	*Toxostoma rufum*
Shad	*Clupeidae*	European starling	*Sturnus vulgaris*
Herring	*Clupeidae*	Red-eyed vireo	*Vireo olivaceus*
Common carp	*Cyprinus carpio*	Ovenbird	*Seiurus aurocapillus*
Catfish	*Ictaluridae*	Common yellowthroat	*Geothylpis trichas*
Bluegill	*Lepomis macrochirus*	Yellow-breasted chat	*Icteria virens*
Crappie	*Pomoxis spp*	Scarlet tanager	*Piranga olivacea*
Drum	*Aplodinotus grunniens*	Northern cardinal	*Cardinalis cardinalis*

TABLE 4.6.1–1.—*Common and Scientific Names of Some of the Nonthreatened and Nonendangered Plants and Animals Occurring On or In the Vicinity of the ORR* [Page 2 of 2]

Common name	Scientific name	Common name	Scientific name
BIRDS (Continued)		**MAMMALS**	
Indigo Bunting	*Passerina cyanea*	Deer mouse	*Peromyscus maniculatus*
Eastern Towhee	*Pipilo erthrophthalmus*	Eastern chipmunk	*Tamias striatus*
Field Sparrow	*Spizella pusilla*	Eastern cottontail	*Sylvilagus floridanus*
Song Sparrow	*Melospiza melodia*	Eastern gray squirrel	*Sciurus carolinensis*
Red-winged Blackbird	*Agelaius phoeniceus*	Eastern harvest mouse	*Reithrodontomys humulis*
Eastern Meadowlark	*Sturnella magna*	Gray fox	*Urocyon cinereoargenteus*
Common Grackle	*Quiscalus quiscula*	Hispid cotton rat	*Sigmodon hspidus*
Brown-headed Cowbird	*Molothrus ater*	Meadow vole	*Microtus pennsylvanicus*
American Goldfinch	*Carduelis tristis*	Mink	*Mustela vison*
House Sparrow	*Passer domesticus*	Norway rat	*Rattus norvegicus*
Wild turkey	*Meleagris gallopavo*	Opposum	*Didelphis virginiana*
Turkey Vulture	*Cathartes aura*	Raccoon	*Procyon lotor*
Red-shouldered hawk	*Buteo lineatus*	Shorttailed shrew	*Blarina brevicauda*
Broad-winged hawk	*Buteo platypterus*	Southern flying squirrel	*Glaucomys volans*
		Striped skunk	*Mephitis mephitis*
		White-footed mouse	*Peromyscus leucopus*
		White-tailed deer	*Odocoileus virginianus*

Sources: Mitchell et al. 1996; ORNL 1994; DOE 2000d.

Table 4.6.1–2.—*List of Potential Breeding Birds and Relative Abundance on the Oak Ridge Reservation* [Page 1 of 4]

Common Name	Scientific Name	Relative Abundance
Great Blue Heron	*Ardea herodias*	0.18
Green Heron	*Butorides virescens*	0.46
Black-crowned Night Heron	*Nycticorax nycticorax*	0.11
Yellow-crowed Night Heron	*Nycticorax violacus*	0.01
Canada Goose	*Branta canadensis*	0.94
Wood Duck	*Aix sponsa*	0.28
Mallard	*Anas platyrhynchos*	0.09
Black Vulture	*Coragyps atratus*	0.01
Turkey Vulture	*Cathartes aura*	0.48
Sharp-shinned Hawk	*Accipiter striatus*	0.03
Cooper’s Hawk	*Accipiter cooperii*	0.02
Red-shouldered Hawk	*Buteo lineatus*	0.49
Broad-winged Hawk	*Buteo platypterus*	0.19
Red-tailed Hawk	*Buteo jamaicensis*	0.07
American Kestrel	*Falco sparverius*	0.08
Ruffed Grouse	*Bonasa umbellus*	0.00
Northern Bobwhite	*Colinus virginianus*	8.05
Killdeer	*Charadrius vociferus*	3.02
American Woodcock	*Scolopax minor*	0.00
Rock Dove	*Columba livia*	4.78
Mourning Dove	*Zenaida macroura*	26.40
Black-billed Cuckoo	*Coccyzus erythropthalmus*	0.03
Yellow-billed Cuckoo	*Coccyzus americanus*	6.15
Eastern Screech-owl	*Otus asio*	0.04
Great Horned Owl	*Bubo virginianus*	0.07
Barred Owl	*Strix varia*	0.11
Common Nighthawk	*Chordeiles minor*	0.00
Chuck-will’s-widow	*Caprimulgus carolinensis*	0.24
Whip-poor-will	*Caprimulgus vociferus*	0.16
Chimney Swift	*Chaetura pelagica*	21.14
Ruby-throated Hummingbird	*Archilochus colubris*	0.51
Belted Kingfisher	*Ceryle alcyon*	0.58
Red-headed Woodpecker	*Melanerpes erythrocephalus*	0.00
Red-bellied Woodpecker	*Melanerpes carolinus*	4.41

Table 4.6.1–2.—*List of Potential Breeding Birds and Relative Abundance on the Oak Ridge Reservation* [Page 2 of 4]

Common Name	Scientific Name	Relative Abundance
Downy Woodpecker	*Picoides pubescens*	3.70
Hairy Woodpecker	*Picoides villosus*	0.40
Yellow-shafted Flicker	*Colaptes auratus*	2.96
Pileated Woodpecker	*Dryocopus pileatus*	3.44
Easter Wood-pewee	*Contopus virens*	4.62
Acadian Flycatcher	*Empidonax virescens*	3.90
Willow Flycatcher	*Empidonax traillii*	0.12
Least Flycatcher	*Empidonax minimus*	0.06
Easter Phoebe	*Sayornis phoebe*	5.41
Great Crested Flycatcher	*Myiarchus crinitus*	2.10
Easter Kingbird	*Tyrannus tyrannus*	2.33
Horned Lark	*Ermophila alpestris*	0.00
Purple Martin	*Progne subis*	4.06
Tree Swallow	*Tachycineta bicolor*	0.01
Northern Rough-winged Swallow	*Stelgidopteryx serripennis*	1.42
Bank Swallow	*Riparia riparia*	0.01
Cliff Swallow	*Hirundo pyrrhonota*	0.05
Barn Swallow	*Hirundo rustica*	18.33
Blue Jay	*Cyanocitta cristata*	15.09
American Crow	*Corvus brachyrhynchos*	37.45
Carolina Chickadee	*Parus carolinensis*	17.97
Tufted Titmouse	*Parus bicolor*	12.45
White breasted Nuthatch	*Sitta carolinensis*	2.93
Carolina Wren	*Thryothorus ludovicianus*	1628
Bewick’s Wren	*Thryomanes bewickii*	0.00
House Wren	*Troglodytes aedon*	0.14
Winter Wren	*Troglodytes troglodytes*	0.08
Blue-gray Gnatcatcher	*Polioptila caerulea*	6.32
Eastern Bluebird	*Sialia sialis*	6.09
Veery	*Catharus fuscescens*	0.77
Wood Thrush	*Hylocichla mustelina*	14.84
American Robin	*Turdus migratorius*	32.81
Gray Catbird	*Dumetella carolinensis*	2.46
Northern Mockingbird	*Mimus polyglottos*	14.79

Table 4.6.1–2.—*List of Potential Breeding Birds and Relative Abundance on the Oak Ridge Reservation* [Page 3 of 4]

Common Name	Scientific Name	Relative Abundance
Brown Thrasher	*Toxostoma rufum*	3.34
Cedar Waxwing	*Bombycilla cedrorum*	4.48
Loggerhead Shrike	*Lanius ludovicianus*	0.17
European Starling	*Sturnus vulgaris*	69.36
White-eyed Vireo	*Vireo griseus*	3.85
Solitary Vireo	*Vireo solitarius*	0.65
Yellow-throated Vireo	*Vireo flavifrons*	4.25
Red-eyed Vireo	*Vireo olivaceus*	24.68
Blue-winged Warbler	*Vermivora pinus*	0.14
Golden-winged Warbler	*Vermivora chrysoptera*	0.28
Norther Parula	*Parula americana*	1.37
Yellow Warbler	*Dendroica petechia*	1.61
Chestnut-sided Warbler	*Dendroica pensylvanica*	0.20
Black-throated Blue Warbler	*Dendroica caerulescens*	1.46
Black-throated Green Warbler	*Dendroica virens*	3.64
Blackburnian Warbler	*Dendroica fusca*	0.00
Yellow-throated Warbler	*Dendroica dominica*	5.24
Pine Warbler	*Dendroica pinus*	1.51
Prairie Warbler	*Dendrocia discolor*	0.79
Cerulean Warbler	*Dendroica cerulea*	1.29
Black & white Warbler	*Mniotilta varia*	3.37
American Redstart	*Setophaga ruticilla*	1.36
Prothonotary Warbler	*Protonotaria citrea*	0.00
Worm-eating Warbler	*Helmitheros vermivorus*	1.59
Swainson’s Warbler	*Limnothlypis swainsonii*	0.09
Ovenbird	*Seiurus aurocapillus*	9.26
Louisiana Waterthrush	*Seiurus motacilla*	1.67
Kentucky Warbler	*Oporornis formosus*	2.86
Common Yellowthroat	*Geothlypis trichas*	8.88
Hooded Warbler	*Wilsonia citrina*	5.87
Yellow-breasted Chat	*Icteria virens*	7.95
Summer Tanager	*Piranga rubra*	1.28
Scarlet Tanager	*Piranga olivacea*	7.41
Northern Cardinal	*Cardinalis cardinalis*	27.19

Table 4.6.1–2.—*List of Potential Breeding Birds and Relative Abundance on the Oak Ridge Reservation* [Page 4 of 4]

Common Name	Scientific Name	Relative Abundance
Rose-breasted Grosbeak	*Pheucticus ludovicianus*	0.10
Blue Grosbeak	*Guiraca caerulea*	2.03
Indigo Bunting	*Passerina cyanea*	35.31
Dickcissel	*Spiza americana*	0.01
Eastern Towhee	*Pipilo erythrophthalmus*	8.50
Chipping Sparrow	*Spizella passerina*	5.78
Field Sparrow	*Spizella pusilla*	7.42
Grasshopper Sparrow	*Ammodramus savannarum*	0.16
Song Sparrow	*Melospiza melodia*	31.21
Slate-colored Junco	*Junco hyemalis*	0.92
Red-winged Blackbird	*Agelaius phoeniceus*	19.57
Eastern Meadowlark	*Sturnella magna*	23.28
Common Grackle	*Quiscalus quiscula*	48.73
Brown-headed Cowbird	*Molothrus ater*	7.72
Orchard Oriole	*Icterus spurius*	2.28
Baltimore Oriole	*Icterus galbula*	0.08
House Finch	*Carpodacus mexicanus*	3.95
American Goldfinch	*Carduelis tristis*	8.25
House Sparrow	*Passer domesticus*	14.68

Source: Mitchell 1996; Sauer 1997.

The Oak Ridge Research Park covers approximately 8,094 ha (20,000 acres) at ORR and was established to provide potential land areas for environmental research, monitoring, and education and to demonstrate that energy technology can be compatible with a quality environment. As an ORNL User Facility, the Research Park is available for environmental research and education by DOE, other Federal agencies, industries, state, and other organizations, individuals, and academic institutions (LMER 1999a). The Walker Branch Watershed located partially within the Y-12 area has been used for long-term studies on hydrology, forest and stream ecology, and watershed biogeochemical studies since 1968 (SPAS 1998).

Within the fenced, developed portion of Y-12, grassy and devegetated areas surround the entire facility (see Figure 4.6.1–1). Buildings and parking lots dominate the landscape in Y-12, with limited vegetation present (ORNL 1992a). Fauna within the Y-12 area is limited by the lack of large areas of natural habitat. The two sites being considered for the proposed HEU Materials Facility are in previously disturbed areas containing a parking lot (Site A) or existing facilities (Site B). Adjacent land has also been previously disturbed to allow the construction of roads, structures, and utilities. As such, neither site is conducive to sustaining plant or animal populations, although birds and more mobile mammals may traverse the sites on a transient basis. Three sites are being considered for the proposed new Special Materials Complex. Site 1 is just north of the perimeter fence in a grassy and wooded area. The lower 50 percent of Site 1 is cleared and contains grass and non-native herbaceous plants (ORNL 1994). Site 2 and Site 3 are in previously disturbed areas of Y-12 containing structures, roads, and parking lots. Site 3 for the Special Materials Complex is the same location as Site B for the HEU Materials Facility. Neither Site 2 nor Site 3 is conducive to sustaining plant or animal populations, although birds and more mobile mammals may traverse the sites on a transient basis.

ORNL scientists monitor trace levels of radionuclides in hay, milk, eggs, and fish. The purpose of the monitoring is to evaluate potential radiation doses and to track trends in long-term accumulation of radionuclides (DOE 2000d). ORR conducts annual deer and turkey hunts, with the carcasses scanned at monitoring stations for radioactivity. Since hunts began in 1985, 2.2 percent of 7,472 deer taken (through 1999) have been retained due to radiological contamination (DOE 2000d).

A Biological Monitoring and Abatement Program was established in conjunction with the NPDES permit issued to Y-12 in 1992. The program includes toxicity monitoring, bioaccumulation studies, biological indicator studies, and ecological surveys. Toxicity testing and bioaccumulation studies indicate that the exposure of aquatic organisms in UEFPC to toxicants has been steadily decreasing as a result of remedial activities such as implementation of flow management and continuing mercury reductions at Y-12 (DOE 2000d). Continued radiation is still required to achieve a status of supporting state designated uses.

4.6.2 Wetlands

Approximately 235 ha (580 acres) of wetlands have been identified on ORR, with most classified as forested palustrine, scrub/shrub, and emergent wetlands. Known wetlands range in size from several square yards at small seeps to approximately 10 ha (25 acres) at the White Oak Lake. Only a small percentage of the wetlands on the ORR are greater than 0.4 ha (1 acre) in size, with larger ones typically associated with river embayments, other areas affected by fluctuating levels of the Clinch River reservoirs, or beaver ponds (LMER 1999a). A wetland survey for the Y-12 area has been performed using the USACE methodology (DOE 1987), and wetlands have been classified as palustrine, scrub/shrub, or emergent according to the U.S. Fish and Wildlife Service system (USFWS 1979, ORNL 1994, ORNL 1992a).

An emergent wetland was found at the eastern end of Y-12 at a seep by a small tributary of the EFPC, between New Hope Cemetery and Bear Creek Road. The wetland receives effluent from an NPDES outfall. Cardinal flower (*Lobelia cardinalis*), an obligate species, and jewelweed (*Impatiens capensis*), a facultative species, were observed there (ORNL 1994).

Eleven small wetlands were found north of Bear Creek Road in remnants of the UEFPC. Obligate species observed included black willow (*Salix nigra*) and cattail (*Typha latifolia*); facultative species included elderberry (*Sambuccus canadensis*) and dotted smartweed (*Polygonum punctatum*) (ORNL 1994).

A relatively undisturbed, forested, wetland was identified in the stream bottomland of Bear Creek North Tributary 1 between Bear Creek Road and the powerline right-of-way. Common species noted included sweetgum (*Liquidambar styraciflua*), red maple (*Acer rubrum*), green ash (*Fraxinus pennsylvanica*), and hazelnut (*Corylus americana*) (ORNL 1994).

Emergent and scrub/shrub wetlands were identified in the riparian area and in old pastures in the McCoy Branch bottomland along Chestnut Ridge between Bethel Valley Road and the McCoy Embayment west of Y-12. Common species included reed canary grass (*Phalaris arundinaceae*), soft rush (*Juncus effusus*); some green ash, black willow, and sycamore (*Plantanus occidentalis*) were observed along McCoy Branch and in depressions (ORNL 1994).

4.6.3 Aquatic Resources

Aquatic habitat on or adjacent to the ORR ranges from small, free-flowing streams in undisturbed watersheds to larger streams with altered flow patterns due to dam construction. These aquatic habitats include tailwaters, impoundments, reservoir embayments, and large and small perennial streams. Aquatic areas within the ORR also include seasonal and intermittent streams (DOE 1996e).

Sixty-four fish species have been collected on or adjacent to the ORR. The minnow family has the largest number of species and is numerically dominant in most streams (ORNL 1988). Fish species representative of the Clinch River in the vicinity of the ORR include shad and herring (Clupeidae), common carp (*Cyprinus carpio*), catfish and bullheads (Ictaluridae), bluegill (*Lepomis macrochirus*), crappie (*Pomoxis* spp.), and freshwater drum (*Aplodinotus grunniens*) (ORNL 1981b). The most important fish species taken commercially in the ORR area are common carp and catfish. Commercial fishing is permitted on the Clinch River downstream from Melton Hill Dam (TWRA 1995). Recreational species consist of crappie, largemouth bass (*Micropterus salmonides*), sauger (*Stizostedion canadense*), sunfish (*Lepomis* spp.), and catfish. Sport fishing is not permitted within the ORR.

4.6.4 Threatened and Endangered Species

Forty-five Federal- and state-listed threatened, endangered, and other special status species have been identified on the ORR (Table 4.6.4–1) (ORNL 1999). Fifteen of these species are Federal- and/or state-listed as threatened or endangered (DOE 1996; Mitchell 1996; ORNL 1999). A rare plant survey has been performed for the Y-12 area (ORNL 1992a). There are no federally listed threatened or endangered plant species at ORR. Only two Federal-listed animal species have been observed on the ORR. The bald eagle (*Haliaeetus leucocephalus*) forages on Melton Hill and Watts Bar Lakes. On July 6, 1999, the U.S. Fish and Wildlife Service (USFWS) requested public comments concerning a proposal to remove the bald eagle (*Haliaeetus leucocephalus)* from that agency's list of endangered and threatened wildlife (64 FR 36454, July 1999). However, that proposal does not change the current threatened designation provided the bald eagle by the USFWS and the State of Tennessee, nor protection afforded under the *Bald and Golden Eagle Protection Act* and the *Migratory Bird Treaty Act*. The final rule on this proposal has not been issued (64 FR 36454, July 1999). On August 25, 1999, the USFWS removed the American peregrine falcon (*Falco peregrinus anatum*) from that agency's list of endangered and threatened wildlife (64 FR 46542, August 1999). However, that decision does not affect the endangered designation provided by the State of Tennessee. The USFWS is still tracking this raptor as a species of concern.

The only federally threatened or endangered species that has been reported from Y-12 is a single dead federally endangered gray bat (*Myotis grisescens*). The specimen was turned over to USFWS. The USFWS is currently conducting analyses to determine the cause of death and any potential exposure to Y-12 site-related contaminants (USFWS 1999). Two surveys have been conducted, in part, to determine if gray bats are present on ORR. Neither survey detected gray bats, although several species of unprotected bats were collected (Webb 1990, ORNL 1997). USFWS records indicate that the federally endangered Indiana Bat (*Myotis sodalis*) may also be present in the vicinity of Y-12 SWEIS impact area (USFWS 1999c). However, this bat has not been observed at Y-12 or other parts of ORR, during previous surveys for protected and sensitive species (Mitchell 1996). No critical habitat for threatened or endangered species, as defined in the *Endangered Species Act* (50 CFR 17.11 and 17.12), exists on ORR.

The ORR also has four plant and two animal species that are designated as Federal species of concern: Appalachian bugbane (*Cimicifuga rubifolia*), butternut (*Juglans cinerea*), spreading false foxglove (*Aureolaria patula*), tall larkspur (*Delphinium exaltatum*), paddlefish (*Polyodon spathula*), and loggerhead shrike (*Lanius ludovicianus*). These former C2 species (i.e., species possibly appropriate for listing as protected) no longer receive protection under the *Endangered Species Act*. However, Federal agencies are encouraged to include them in NEPA environmental impact analyses.

State threatened and endangered species observed on the ORR include 11 plant, 1 mammal, and 3 raptor species (ORNL 1999). A number of rare or state-listed animals and plants are present in the vicinity of Y-12. A population of the Tennessee dace (*Phoxinus tennesseensis*) is found in Bear Creek which flows out of Y-12 into the EFPC. This species is classified as "deemed in need of management" by the State of Tennessee.

The only ORR population of mountain witch alder (*Fothergilla major*), a species with Tennessee-threatened status, is on a west-facing slope of the Walker Branch Watershed. Canada lily *(Lilium canadense*) and the tuberculed rein-orchid (*Platanthera flava* var. *herbiola*), two species with Tennessee-threatened status, are found in the Pine Ridge Wetlands. Ginseng (*Panax quinquifolius*), a Tennessee species of special concern, and whorled horsebalm (*Collinsonia verticillata*) considered rare by the Nature Conservancy are found in the Chestnut Ridge area. The tuberculed rein-orchid, ginseng, and whorled horsebalm are found in the Bear Creek Spring area. A recently described quillwort species (*Isoetes carolinia*) is present at the Quillwort Temporary Pond and may be rare enough to be Tennessee listed (LMES 1999).

TABLE 4.6.4–1.—*Federal- or State-Listed Threatened, Endangered, and Other Special Status Species Reported on the Oak Ridge Reservation*

	Common Name	Scientific Name	Status[a] Federal	Status[a] State
Mammals				
	Gray bat[b]	*Myotis grisescens*	E	E
	Indiana bat[c]	*Myotis sodalis*	E	E
	Southeastern shrew	*Sorex longirostris*	NL	NM
Birds				
	American peregrine falcon[d]	*Falco peregrinus anatum*	NL	E
	Anhinga[d]	*Anhinga anhinga*	NL	NM
	Bald eagle[d]	*Haliaeetus leucocephalus*	T (DL)	T
	Cerulean warbler[e]	*Dendroica cerulea*	C	NL
	Cooper's hawk[e]	*Accipter cooperii*	NL	NM
	Double-crested cormorant[d]	*Phalacrocorax auritus*	NL	NM
	Grasshopper sparrow[e]	*Ammodramus savannarum*	NL	NM
	Great egret[d]	*Casmerodius alba*	NL	NM
	Little blue heron[e]	*Egretta caerulea*	NL	NM
	Loggerhead shrike	*Lanius ludovicianus*	NL	NM
	Northern harrier[d]	*Circus cyaneus*	NL	NM
	Olive-sided flycatcher[d]	*Contopus borealis*	NL	NM
	Osprey	*Pandion haliaetus*	NL	T
	Sandhill crane[d]	*Grus canadensis*	NL	NM
	Sharp-shinned hawk[e]	*Accipiter striatus*	NL	NM
	Snowy egret	*Leucophoyx thula*	NL	NM
	Yellow-bellied sapsucker	*Sphyrapicus varius*	NL	NM
Amphibians				
	Four-toed salamander	*Hemidactylium scutatum*	NL	NM
Fish				
	Paddlefish	*Polyodon spathula*	SC	NL
	Tennessee dace[f]	*Phoxinus tennesseensis*	NL	NM
Plants				
	American ginseng[f]	*Panax quinquefolius*	NL	S-CE
	Appalachian bugbane[d]	*Cimicifuga rubifolia*	SC	T
	Branching whitlow-grass	*Draba ramosissima*	NL	S
	Butternut[f]	*Juglans cinerea*	SC	T
	Canada (wild-yellow) lily[f]	*Lilium canadense*	NL	T
	Carey's saxifrage[f]	*Saxifraga careyana*	NL	S
	Fen orchid[f]	*Liparis loeselii*	NL	E
	Golden seal[f]	*Hydrastis canadensis*	NL	S-CE
	Hairy sharp-scaled sedge	*Carex oxylepis var. pubescense*	NL	S
	Heavy sedge[f]	*Carex gravida*	NL	S
	Howe's sedge	*Carex howei*	NL	E
	Lesser lady's tresses	*Spiranthes ovalis*	NL	S
	Michigan lily[f]	*Lilium michiganense*	NL	T
	Mountain witch alder[f]	*Fothergilla major*	NL	T
	Northern bush honeysuckle[f]	*Diervilla lonicera*	NL	T
	Northern white cedar	*Thuja occidentalis*	NL	S
	Nuttall waterweed[f]	*Elodea nuttallii*	NL	S
	Pink lady's-slipper[f]	*Cypripedium acaule*	NL	E-CE
	Purple fringeless orchid[f]	*Platanthera peramoena*	NL	T
	Pursh's wild-petunia	*Ruellia purshiana*	NL	S
	River bulrush	*Scirpus fluviatilis*	NL	S
	Shining ladies-tresses	*Spiranthes lucida*	NL	T
	Small-headed sedge	*Juncus brachycephalus*	NL	S
	Spreading false foxglove[f]	*Aureolaria patula*	SC	T
	Tall larkspur[f]	*Delphinium exaltatum*	SC	E
	Three-parted violet	*Viola triparta* var. *triparta*	NL	S
	Tubercled rein-orchid[f]	*Platanthera flava var. herbiola*	NL	S
	White-topped sedge	*Rhynchospora colorata*	NL	S
	Whorled mountainmint	*Pycnanthemum verticillatum*	NL	E-P

[a] Status codes: C-Candidate; DL-proposed for delisting; E-endangered; NL-not listed; NM-in need of management; P-possibly extirpated; S-special concern in Tennessee; SC-Federal Species of Concern; T-threatened.
[b] Only one dead gray bat has been reported from the ORR. Not currently known to nest on the ORR.
[c] The Indiana bat has not been reported from the ORR although USFWS records suggest it may be present.
[d] Uncommon visitor or migrant. Not currently known to nest on the ORR.
[e] Summer
[f] Recent record of species occurrence on ORR.
Sources: 50 CFR 17.11; 50 CFR 17.12; DOE 1995a; 64 FR36454; 64 FR 46542; DOE 1990; ORNL 1993b; ORNL 1981b; ORNL 1984a; ORNL 1988; DOE 2000d; LMER 1999a; TDEC 1997; TDEC 1998; TWRC 1991a; TWRC 1991b.

4.7 AIR QUALITY AND CLIMATE/NOISE

The following sections describe the affected environment at Y-12 and the surrounding region with respect to meteorology and climatology, nonradiological air quality, and radiological air quality.

4.7.1 Meteorology and Climatology

The city of Oak Ridge lies in a valley between the Cumberland and Blue Ridge mountain ranges and is bordered on two sides by the Clinch River. The Cumberland Mountains are 16 km (10 mi) to the northwest while the Blue Ridge Mountains, which include the Great Smoky Mountains National Park, are 51 km (32 mi) to the southeast (DOE 2000d). The ROI specific to air quality is primarily the Bear Creek Valley for Y-12. This valley is bordered by ridges that generally confine facility emissions to the valley between the ridges.

The climate of the region may be broadly classified as humid continental. The Cumberland Mountains to the northwest help to shield the region from cold air masses that frequently penetrate far south over the plains and prairies in the Central United States during the winter months. During the summer, tropical air masses from the south provide warm and humid conditions that often produce thunderstorms. Anti-cyclonic circulation around high-pressure systems centered in the western Gulf of Mexico can bring dry air from the southwestern United States into the region, leading to occasional periods of drought (DOE 2000d).

The mean annual temperature for the Oak Ridge area is 14.7 EC (57.7 EF). The coldest month is usually January, with temperatures averaging about 2.9 EC (37.2 EF), occasionally dipping as low as –31 EC (–24 EF). July is typically the hottest month of the year, with temperatures averaging 25.4 EC (77.2 EF), occasionally reaching over 37.8 EC (100 EF). In the course of a year, the difference between the maximum and minimum daily temperatures averages 12.5 EC (22.5 EF). The 1999 average temperature was 14.8 EC (58.6 EF) (DOE 2000d).

Winds in the Oak Ridge area are controlled in large part by the valley-and-ridge topography. Prevailing winds are either up-valley (northeasterly) daytime winds or down-valley (southwesterly) nighttime winds. Wind speeds are less than 11.9 km/hr (7.4 mph) 75 percent of the time (Figure 4.7.1–1). Tornadoes and winds exceeding 30 km/hr (18.5 mph) are rare in the Oak Ridge area, although on February 21, 1993, a tornado did strike the east end of Y-12, uprooting trees but causing minimal damage to buildings and equipment. Air stagnation is relatively common in eastern Tennessee (about twice as common as in western Tennessee). An average of about two multiple-day air stagnation episodes occur annually in eastern Tennessee, to cover an average of about 8 days per year. August, September, and October are the most likely months for air stagnation episodes (DOE 2000d).

Source: Based on Y-12 Meteorological Tower MTG Data.

FIGURE 4.7.1–1.—*Wind Rose Data for Y-12.*

The 30-year annual average precipitation is 137.4 cm (54.1 in), including about 24.4 cm (9.6 in) of snowfall. Precipitation in 1999 was 126.2 cm (49.7 in). Precipitation in the region is greatest in the winter months (December through February). Precipitation in the spring exceeds the summer rainfall, but the summer rainfall may be locally heavy because of thunderstorm activity. The driest periods generally occur during the fall months, when high-pressure systems are most frequent (DOE 2000d).

4.7.2 Air Quality

Airborne discharges from DOE Oak Ridge facilities, both radioactive and nonradioactive, are subject to regulation by EPA, the TDEC Division of Air Pollution Control, and DOE Orders. Each ORR facility has a comprehensive air regulation compliance assurance and monitoring program to ensure that airborne discharges meet all regulatory requirements and therefore do not adversely affect ambient air quality. Common air pollution control devices employed at the three Oak Ridge facilities include exhaust gas scrubbers, baghouses, and other exhaust filtration systems designed to remove contaminants from exhaust gases before release to the atmosphere. Process modifications and material substitutions are also made to minimize air emissions. In addition, administrative control plays a role in regulating emissions (DOE 2000d).

4.7.2.1 *Nonradiological Air Quality*

Regional Air Quality

As directed by the *Clean Air Act* of 1970 (42 U.S.C. §7401), the EPA has set the National Ambient Air Quality Standards (NAAQS) for several criteria pollutants to protect human health and welfare (40 CFR 50). These pollutants include particulate matter less than 10 microns in diameter (PM_{10}), sulfur dioxide (SO_2), carbon monoxide (CO), nitrogen dioxide (NO_2), lead (Pb), and ozone (O_3). The nearest area not in attainment with the NAAQS is Atlanta, GA.

Nonradiological air quality is defined by the concentration of various pollutants in the atmosphere expressed in units of parts per million (ppm) or in micrograms per cubic meter. The standards and limits set by Federal and state regulations are provided in concentrations averaged over incremental time limits (e.g., 30 minutes, 1 hour, 3 hours). The averaging times shown in the tables in this section correspond to the regulatory averaging times for the individual pollutants.

TDEC implements and enforces the NAAQS and regulations on additional pollutants. In addition to the NAAQS, the TDEC has set standards for gaseous fluorides expressed as HF. Table 4.7.2–1 presents the NAAQS and Tennessee State ambient air quality standards. The EPA approved more restrictive ambient standards for ground-level ozone and particulate matter that became effective on September 16, 1997 (62 FR 38855). However, on May 14, 1999, in response to challenges filed by industry and others, a three-judge panel of the U.S. Court of Appeals for the District of Columbia Circuit issued a split opinion (2 to 1) on the these new clean air standards. The Court vacated the new particulate standard and directed EPA to develop a new standard, meanwhile reverting back to the previous PM_{10} standard. The revised ozone standard was not nullified; however, the judges ruled that the standard "cannot be enforced" (EPA 1999b). On October 29, 1999, the full U.S. Court of Appeals for the District of Columbia supported the lower court's decision with a split ruling. EPA intends to have the Justice Department take the case to the U.S. Supreme Court in 2001. Therefore, it is uncertain at this time when new ozone and particulate matter standards will become enforceable.

An area is designated by the EPA as being in attainment for a pollutant if ambient concentrations of that pollutant are below the NAAQS, or, in nonattainment if violations of the NAAQS occur. In areas where insufficient data are available to determine attainment status, designations are listed as unclassified.

Unclassified areas are treated as attainment areas for regulatory purposes. ORR is located in Anderson and Roane Counties in the Eastern Tennessee-Southwestern Virginia Interstate Air Quality Control Region (AQCR) 207. AQCR 207 is designated by EPA (40 CFR 81.343) as:

- "Better than national standards" for SO_2
- "Unclassifiable/attainment" for CO and O_3
- "Cannot be classified or better than national standards" for NO_2
- "Not designated" for lead

The ORR is designated a Class II area with respect to the *Clean Air Act's* (CAA) Prevention of Significant Deterioration (PSD) regulations (40 CFR 51.166). The PSD regulations provide a framework for managing the existing clean air resources in areas that meet the NAAQS. Areas designated PSD Class II have sufficient air resources available to support moderate industrial growth. A Class I PSD designation is assigned to areas that are to remain pristine, such as national parks and wildlife refuges. Little additional impact to the existing air quality is allowed with a Class I PSD designation. Industries locating within 100 km (62 mi) of Class I Areas are subject to very strict Federal air pollution control standards. The nearest Class I PSD Area is the Great Smoky Mountains National Park, approximately 56 km (35 mi) southeast of the ORR.

Air Quality Monitoring Data

The TDEC performs ambient air monitoring throughout the State of Tennessee and within the vicinity of the ORR. Concentration of regulated pollutants observed during 1999 at locations near the ORR are presented in Table 4.7.2–2. As the data indicate, no pollutant concentrations exceed the standards.

During 1999, ambient concentrations of mercury vapor were measured at four on-site monitoring stations at Y-12 (Figure 4.7.2–1). Outdoor airborne mercury vapor at Y-12 is primarily the result of vaporization from mercury-contaminated soils, fugitive (non-stack) emissions from former mercury-use area buildings, and releases from coal burning at the Y-12 Steam Plant. Table 4.7.2–3 presents the results of the mercury monitoring program at Y-12 (DOE 2000d). The observed concentrations of mercury vapor are well below the ACGIH threshold limit value of 25 $\mu g/m^3$.

TABLE 4.7.2–1.—*National Ambient Air Quality Standards and Tennessee Ambient Air Standards*

Pollutant	Averaging Time	NAAQS Standard	Tennessee Standard
Ozone (O_3)	1-hr	235 μg/m^3 / 0.12 ppm	235 μg/m^3 / 0.12 ppm
Carbon monoxide (CO)	8-hr	10,000 μg/m^3 / 9 ppm	10,000 μg/m^3 / 9 ppm
	1-hr	40,000 μg/m^3 / 35 ppm	40,000 μg/m^3 / 35 ppm
Nitrogen dioxide (NO_2)	Annual	100 μg/m^3 / 0.053 ppm	100 μg/m^3 / 0.053 ppm
Sulfur dioxide (SO_2)	Annual	80 μg/m^3 / 0.03 ppm	80 μg/m^3 / 0.03 ppm
	24-hr	365 μg/m^3 / 0.14 ppm	365 μg/m^3 / 0.14 ppm
	3-hr	--	1,300 μg/m^3 / 0.5 ppm
Particulate matter (PM_{10})	Annual	50 μg/m^3	50 μg/m^3
	24-hr	150 μg/m^3	150 μg/m^3
Lead	Calendar Quarter	1.5 μg/m^3	1.5 μg/m^3
Gaseous fluorides (as HF)	30-day	--	1.2 μg/m^3 / 1.5 ppb
	7-day	--	1.6 μg/m^3 / 2.0 ppb
	24-hr	--	2.9 μg/m^3 / 3.5 ppb
	12-hr	--	3.7 μg/m^3 / 4.5 ppb
Total Suspended Particulates (TSP)	24-hr	–	150 μg/m^3

Source: TDEC 1997.

TABLE 4.7.2–2.——*Tennessee Department of Environment and Conservation Ambient Air Monitoring Data for 1999 in the Vicinity of Y-12/Oak Ridge Reservation*

Pollutant	Averaging Time	TN standard (Fg/m^3)	Maximum concentration (Fg/m^3)				Nearest monitoring location
			1st	2nd	3rd	4th	
Sulfur dioxide (as SO_2)	3-hr 24-hr Annual	1,300 365 80	120 47.1 10.5	118 36.6 --	-- -- --	-- -- --	Anderson Co.
Total suspended particulates[a]	Annual geometric mean	260	107	87	77	77	Knox Co.
Particulate matter (≤10 Fm)[b]	24-hr Annual	150 50	46 25.4	41 --	40 --	39 --	Roane Co.
Carbon monoxide	1-hr 8-hr	40,000 10,000	12,712 4,466	7,329 4,352	-- --	-- --	Knox Co.
Ozone[b]	1-hr	235	228	210	206	202	Anderson Co.
Nitrogen dioxide (as NO_x)	Annual	100	15.1	--	--	--	Roane Co.
Lead[c]	Calendar quarterly mean	1.5	0.33	0.13	0.15	0.14	Roane Co.

[a] TDEC secondary standard. 1997 monitoring data.

[b] New standards may be applicable in the future; see discussion in section 4.7.2.1.

[c] 1998 monitoring data.

Source: TDEC 1998, TDEC 2000.

Source: DOE 2000d.

FIGURE 4.7.2–1.—*Locations of Ambient Air Monitoring Stations for Mercury Vapor and Uranium.*

TABLE 4.7.2–3.—*Results of Y-12 Ambient Air Mercury Monitoring Program*

Ambient Air Monitoring Site	Mercury Vapor Concentration (μg/m³)				
	1999 Average	1998 Average	1997 Average[a]	1996 Average[a]	1986-88 Average[a]
Station No. 2 (east end of Y-12)	0.0037	0.0048	0.0048	0.004	0.010
Station No. 8 (west end of Y-12)	0.0054	0.0074	0.0065	0.006	0.033
Bldg. 9422-13 (SW of Bldg. 9201-4)	0.021	0.044	0.032[b]	0.030	N/A[c]
Bldg. 9805-1 (SE of Bldg. 9201-4)	0.053	0.057	0.064[b]	0.058	0.099
Reference site (1988[d])	N/A	N/A	N/A	N/A	0.006
Reference site (1989[e])	N/A	N/A	N/A	N/A	0.005

[a] The American Conference of Governmental Industrial Hygienists 8-hour day, 40-hour work week standard equals 25 μg/m³.
[b] Data for period from January 1 through September 30, 1997.
[c] Site established in late 1995.
[d] Data for February 9 through December 31, 1988 at Rain Gage No. 2 on Chestnut Ridge in the Walker Branch Watershed.
[e] Data for January 1 through October 31, 1989 at Rain Gage No. 2 on Chestnut Ridge in the Walker Branch Watershed.
Source: DOE 2000d.

As the data indicate, annual average mercury vapor concentrations have declined in recent years when compared with concentrations measured from 1986 through 1988. Of the three sites operating since 1986, all three recorded significantly lower annual averages for mercury vapor concentration when compared with the 1986 through 1988 average. The decrease in ambient mercury recorded at Y-12 since 1989 is thought to be related to the reduction in coal burned at the Y-12 Steam Plant beginning in 1989 and to the completion prior to 1989 of several major engineering projects (e.g., New Hope Pond closure, the PIDAS, Reduction of Mercury in Plant Effluent, and Utility Systems Restoration).

In addition to the mercury vapor sampling stations, three low-volume uranium particulate monitoring stations were operated during 1999 by Y-12 (see Figure 4.7.2–1). Table 4.7.2–4 presents the uranium concentrations measured at monitoring stations during the first quarter of 1999. For 1999 the average 7-day concentration of uranium at the three monitored locations ranged from a low of 0.00002 μg/m³ at Stations 4, 5 and 8 to a high of 0.00038 μg/m³ at Station 4.

TABLE 4.7.2–4.—*Uranium Mass in Ambient Air at Y-12, First Quarter 1999*

Station	Number of Samples	7-day concentration (μg/m³)		
		Maximum	Minimum	Average
4	14	0.00038	0.00002	0.00008
5	2	0.00008	0.00002	0.00005
8	11	0.00020	0.00002	0.00008

Source: DOE 2000d.

TABLE 4.7.2–5.—*Actual vs. Allowable Air Emissions from the Oak Ridge Y-12 Steam Plant, 1999*

Pollutant	Emissions tons/yr (kg/yr)		Percentage of Allowable
	Actual	**Allowable**	
Particulate matter	23 (20,866)	1,118 (1,014,250)	2.1
Sulfur dioxide	2,354 (2,135,549)	20,803 (18,872,481)	11.3
Carbon monoxide	23 (20,866)	543 (492,610)	4.2
Nitrogen oxides	1,148 (1,041,466)	7,718 (7,001,770)	14.9
Volatile organic compounds	1.57 (1,424)	17 (15,422)	9.2

Source: DOE 2000d.

TABLE 4.7.2–6.—*Chemical Air Pollutant Emissions from Y-12 During 1999*

Pollutant	Emissions tons/yr (kg/yr)
Hydrochloric acid[a]	69.3 (62,867)
Lead[a,b]	0.0055 (.5)
Methanol[a]	15.3 (13,879)
Nitric acid[a]	15.3 (13,879)
Sulfuric acid	0.148 (134)

[a] *Superfund Amendments and Reauthorization Act* (SARA), Title III, Section 313 chemical.
[b] Lead is regulated as an ambient air pollutant.
Source: DOE 2000d.

Emissions

The release of nonradiological contaminants into the atmosphere at Y-12 occurs as a result of plant production, maintenance, and waste management operations and steam generation. Most process operations are served by ventilation systems that remove air contaminants from the workplace. TDEC has issued 36 individual air permits that cover Y-12 emission sources. The allowable level of air pollutant emissions from emission sources in 1999 was approximately 10,033 tons per year of regulated pollutants. The actual emissions are much lower than the allowable amount (DOE 2000d).

The level of pollutant emissions is expected to decline in the future because of the changing mission of Y-12 and downsizing of production areas. More than 90 percent of the pollutants are attributed to the operation of the Y-12 Steam Plant. Nonradiological airborne emissions of materials have been estimated and are provided in Tables 4.7.2–5 and 4.7.2–6.

Practices have successfully been implemented to minimize releases of ozone-depleting refrigerants to the atmosphere. Requirements for refrigeration-system and motor vehicle air-conditioner maintenance compliance are being met. The use of chlorofluorocarbon (CFC) refrigerants in chillers, direct expansion air conditioners, and process coolers will be eliminated, either by direct replacement with new equipment that operates with "ozone-friendly" refrigerants or by retrofit of existing equipment with new components to operate on "ozone-friendly" refrigerants (DOE 2000d).

4.7.2.2 *Radiological Air Quality*

Atmospheric emissions of radionuclides from DOE facilities are limited by EPA regulations found under National Emission Standards for Hazardous Air Pollutants (NESHAP), 40 CFR 61, Subpart H. The EPA effective dose equivalent (EDE) limit of 10 mrem per year to members of the public for the atmospheric pathway is also incorporated in DOE Order 5400.5, "Radiation Protection of the Public and the Environment." To demonstrate compliance with the NESHAP regulations, DOE annually calculates MEI and collective doses and a percentage of dose contribution from each radionuclide emitted using the CAP88 computer code. For 1999 all ORR facilities were in compliance with the Radiological NESHAP dose limit. Results of Y-12 compliance modeling are discussed under the radiological emissions section below. Details on the annual compliance modeling are also reported in the *Oak Ridge Reservation Annual Site Environmental Report* for 1999 (DOE/ORO/2100).

Air Quality Monitoring Data

The ORR maintains a perimeter air monitoring network of eight stations at the reservation perimeter and one at an off-site reference location. Surveillance of airborne radionuclides includes measurement of ambient levels of alpha-, beta-, and gamma-emitting radionuclides and tritium. Monitoring locations were selected based on atmospheric dispersion modeling which determined the locations most likely to be affected by routine releases from the Oak Ridge facilities.

Four of the eight stations are located in the vicinity of Y-12; these monitoring locations are shown in Figure 4.7.2–2. Station 40 monitors the east end of Y-12, and Station 37 monitors the overlap of Y-12, ORNL, and ETTP emissions. On-site Station 48 is located approximately 3 km (2 mi) to the southeast of Y-12. Station 46, which measures off-site impacts of emissions from Y-12, is located in the Scarboro Community of Oak Ridge. To provide an estimate of background radionuclide concentrations, an additional station is located at a site not affected by releases from the ORR. Reference samples are collected from Station 52 (Fort Loudon Dam) located approximately 24 km (15 mi) southwest of ORNL (not shown on Figure 4.7.2–2). Results of monitoring data collected at the various stations during 1999 are shown in Table 4.7.2–7.

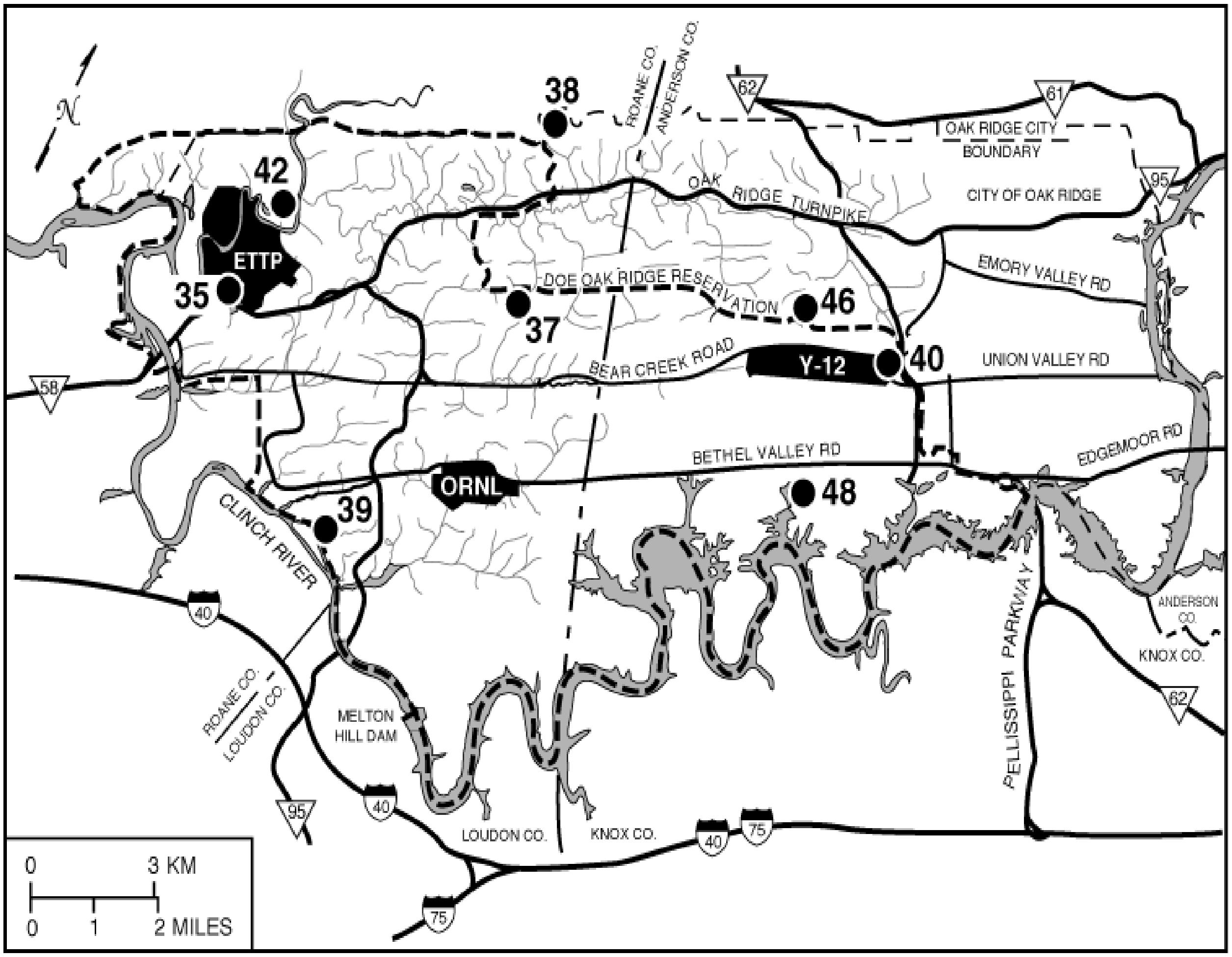
Radiological Emissions

NESHAP regulations for radiological emissions require continuous emission sampling of major sources (a "major source" is considered to be any emission point that potentially can contribute greater than 0.1 mrem/year EDE to an off-site individual). Of the 57 stacks at Y-12, 51 were active stacks and 6 were temporarily shut down during 1999. Forty-five of those stacks were considered to be major sources. Thus, at the end of 1999, 51 active stacks were being monitored at Y-12 (DOE 2000d).

The release of radiological contaminants, primarily uranium, into the atmosphere at Y-12 occurs almost exclusively as a result of plant production, maintenance, and waste management activities. An estimated 0.015 Ci (3.9kg) of uranium was released into the atmosphere in 1999 as a result of Y-12 activities.

For 1999, six emissions points at Y-12 were modeled; each of these points includes one or more individual sources of emissions. The total effective dose equivalent (TEDE) to the hypothetical MEI from Y-12 emissions was estimated at 0.53 mrem, which is 5.3 percent of the 10 mrem per year NESHAP standard. The MEI for Y-12 is located about 1,120 m (0.7 mi) north-northeast of the Y-12 release point. The atmospheric radionuclide contribution from ORNL and ETTP was estimated at 0.06 mrem and 0.1 mrem, respectively. The total in 1999 for all of ORR was 0.7 mrem. The collective (population) EDE due to Y-12 emissions was estimated at 4.5 person-rem, which is approximately 24 percent of the collective EDE for the entire ORR (DOE 2000d).

ORNL-DWG 92M-5318R2



Source: 2000d.

FIGURE 4.7.2–2.—*Locations of Oak Ridge Reservation Perimeter Air Monitoring Stations in the Vicinity of Y-12.*

TABLE 4.7.2–7.—*Radionuclide Concentrations at Oak Ridge Reservation Perimeter Air Monitoring Stations During 1998*[a, b]

Station	^{7}BC	^{137}Cs	^{40}K	^{3}H	^{90}Sr	^{234}U	^{235}U	^{238}U
35	4.4x10^{-14}	2.08x10-^{17}	2.60x10^{-16}	1.05x10^{-11}	2.05x10^{-17}	2.00x10^{-17}	1.53x10^{-18}	2.33x10^{-17}
37	5.0x10^{-14}	1.06x10^{-17}	2.80x10^{-16}	3.07x10^{-12}	2.70x10^{-16}	2.73x10^{-17}	6.87x10^{-19}	2.13x10^{-17}
38	4.7x10^{-14}	3.38x10^{-17}	6.10x10^{-16}	3.91x10^{-12}	2.07x10^{-17}	1.48x10^{-17}	1.13x10^{-18}	1.94x10^{-17}
39	3.5x10^{-14}	1.09x10^{-17}	6.50x10^{-16}	8.78x10^{-12}	1.11x10^{-16}	8.94x10^{-18}	7.73x10^{-19}	9.68x10^{-18}
40	4.8x10^{-14}	6.09x10^{-17}	4.20x10^{-16}	9.62x10^{-13}	4.63x10^{-17}	3.50x10^{-17}	1.04x10^{-18}	2.04x10^{-17}
42	5.0x10^{-14}		2.30x10^{-16}	3.57x10^{-12}	2.10x10^{-17}	2.19x10^{-17}	9.25x10^{-19}	2.51x10^{-17}
46	5.6x10^{-14}	2.07x10^{-17}	4.70x10^{-15}	3.53x10^{-12}	1.40x10^{-16}	2.77x10^{-17}	2.92x10^{-18}	2.37x10^{-17}
48	4.8x10^{-14}	2.72x10^{-17}	3.10x10^{-16}	2.85x10^{-12}	2.21x10^{-16}	2.06x10^{-17}	7.05x10^{-19}	1.86x10^{-17}
52[d]	5.4x10^{-14}	2.07x10^{-17}	2.10x10^{-15}	5.87x10^{-13}	1.85x10^{-17}	9.94x10^{-17}	2.04x10^{-18}	3.44x10^{-17}

[a] All values are mean concentration.
[b] Units are FCi/mL.
[c] Significant average at 95 percent confidence level.
[d] Reference location.
Source: DOE 2000d.

4.7.3 Noise

Major noise emission sources within Y-12 include various industrial facilities, equipment and machines (e.g., cooling systems, transformers, engines, pumps, boilers, steam vents, paging systems, construction and materials-handling equipment, and vehicles). Most Y-12 industrial facilities are at a sufficient distance from the site boundary so noise levels at the boundary from these sources would not be distinguishable from background noise levels.

EPA guidelines for environmental noise protection recommend an average day-night average sound level of 55 dBA as sufficient to protect the public from the effects of broadband environmental noise in typically quiet outdoor and residential areas (EPA 1974). Land-use compatibility guidelines adopted by the Federal Aviation Administration and the Federal Interagency Committee on Urban Noise indicate that yearly day-night average sound levels less than 65 dBA are compatible with residential land uses and levels up to 75 dBA are compatible with residential uses if suitable noise reduction features are incorporated into structures (14 CFR 150).

Sound-level measurements have been recorded at various locations within and near ORR in the process of testing sirens and preparing support documentation for the Atomic Vapor Laser Isotope Separation site. The acoustic environment along the Y-12 Site boundary in rural areas and at nearby residences away from traffic noise is typical of a rural location, with the day-night average sound level in the range of 35 to 50 dBA. Areas near the site within Oak Ridge are typical of a suburban area, with the average day-night sound level in the range of 53 to 62 dBA. The primary source of noise at the site boundary and at residences located near roads is traffic. During peak hours, the Y-12 worker traffic is a major contributor to traffic noise levels in the area.

The State of Tennessee has not established specific community noise standards applicable to Y-12. The city of Oak Ridge has specific acceptable sound levels at property lines. Maximum allowable noise limits for the city of Oak Ridge are presented in Table 4.7.3–1 (Oak Ridge 2000).

TABLE 4.7.3–1.—*City of Oak Ridge Maximum Allowable Noise Limits Applicable to Oak Ridge Reservation*

	Decibel Level dBA					
Adjacent Use			**7 a.m. - 10 p.m.**			**10 p.m. - 7 a.m.**
	L_{50}	**L_{10}**	**Maximum Limit**	**L_{50}**	**L_{10}**	**Maximum Limit**
Residential	65	70	80	55	50	75
			7 a.m. - 12 Midnight			**12 Midnight - 7 a.m.**
	L_{50}	**L_{10}**	**Maximum Limit**	**L_{50}**	**L_{10}**	**Maximum Limit**
Business	70	75	80	70	75	80
Residential	75	NA	80	75	NA	80

Notes: L_{10} - sound level, expressed in dBA, which is exceeded ten percent (%) of the time for a one-hour survey.
L_{50} - sound level, expressed in dBA, which is exceeded fifty percent (%) of the time for a one-hour survey.
Source: Oak Ridge 2000.

4.8 SITE FACILITIES AND SUPPORT ACTIVITIES

The main area of Y-12 is largely developed. It encompasses 328 ha (811 acres), with 255 ha (630 acres) fenced (4 by 2 km [3 by 1 mi]). Approximately 580 buildings house about 714,317 m^2 (7.6 million ft^2) of laboratory, machining, dismantlement, and R&D areas. Because of the site's defense support manufacturing and storage facilities, the land in the Y-12 area is classified in DOE's industrial category.

Many of the buildings used for Y-12 production processes were built during the 1940s for the plant's original mission of eletromagnetically separated isotopes of uranium. These buildings have been modified over the years to accommodate changing missions. The separation of lithium isotopes using column exchange technology was performed at one time in some of the buildings, but that process was discontinued in the 1960s.

Generally speaking, the Y-12 National Security Complex can be divided into three areas: the East End mission support area; the West End manufacturing areas; and the West End environmental area. East End shops are generally technical, administrative, and plant support function. The West End manufacturing area is generally considered an area inside the PIDAS fence. The area inside the PIDAS boundaries contains manufacturing and nuclear material storage facilities as well as technical and plant support operations and program management, product certification, quality control, product engineering and scheduling, maintenance, and utilities. The West End environmental area is managed by EM and contains tank farms, waste management treatment facilities, and storage areas; included are such facilities or areas as the Bear Creek Road Debris Burial Area, Rust Spoil Area, Liquid Organic Waste Storage Facility, Hazardous Chemical Disposal Area, Oil Landfarm, Oil Landfarm Contaminant Area, and Sanitary Landfill I.

In the following, a description of major DP and EM facilities located at Y-12 is provided. This is followed by a summary of site infrastructure. Appendix A provides detailed information concerning site facilities and utilities as well as the Y-12 Site facility planning and transition process, and major production processes.

4.8.1 Defense Programs Facilities

DP occupies around 427,350 m^2 (4.6 million ft^2) of facilities at the Y-12 National Security Complex. Of this total, approximately 223,000 m^2 (2.4 million ft^2) are in major manufacturing facilities while approximately 195,100 m^2 (2.1 million ft^2) are in support facilities. Forty-nine DP buildings are in surplus; most of these are small support structures that are not process contaminated. The long-term objective is to plan for the removal of these facilities when it becomes cost-effective or a compliance requirement mandates action. Another 11 facilities are planned to be surplus by 2008, assuming the availability of funding for downsizing. The remainder of the DP buildings are anticipated to have a continuing mission.

All Y-12 facilities used in processing and storage of HEU are located in the protected area of Y-12 surrounded by the PIDAS. Appendix Figure A.4.1–1 shows the locations of major DP facilities. Appendix Table A.4–1 provides an overview of the DP facilities. The following summarizes information on the major DP facilities located at Y-12.

4.8.1.1 *Building 9212 Complex*

The Building 9212 Complex includes Buildings 9212, 9818, 9815, 9980, and 9981. The largest, Building 9212, was constructed in the early 1940s. Over 100 operations or processes have been or are capable of being performed within the Building 9212 Complex. The primary missions performed in this Complex include the following:

- Casting of HEU metal (for weapons, reactor fuels, storage, and other purposes)
- Accountability of HEU from plant activities (quality evaluations, casting, storage)
- Recovery and processing of HEU to a form suitable for storage and/or future reuse and/or disposition (from plant activities, other DOE programs, and commercial scrap)
- IAEA sampling of surplus enriched uranium
- Packaging HEU for off-site shipment
- Preparation of special uranium compounds and metal for research reactor fuel

The Building 9212 Complex houses two major process areas: the Building 9212 Uranium Recovery Operations (also called Chemical Recovery operations) and the Metallurgical Operations. Operations in the 9212 Complex have resumed since the 1994 stand-down, except activities associated with Recovery Operations. Most of these remaining activities are expected to resume in FY 2002.

4.8.1.2 *Building 9206 Complex*

The Building 9206 Complex includes the primary Building 9206 and an immediately adjacent Building 9720-17. It is centrally located in Y-12 near the east end of the protected area. Building 9206 is a multistory facility constructed in the early 1940s. Contained in Building 9206 is an incinerator, which is currently permitted for burning combustible waste containing uranium. Building 9720-17, adjacent to the south side of Building 9206, was constructed in the 1950s.

Building 9206 has generally been reserved for intermediate enrichments (20 to 85 percent) of HEU. Its original design mission was to recover HEU from the electromagnetic separation process. In the mid 1950s, a UF_6 to UF_4 conversion facility using fluorine and hydrogen gas was installed to perform the same function. In the late 1960s Building 9206 underwent modifications to install denitration and fluid bed systems for the conversion of uranyl nitrate to UF_4. The mission of converting recovered uranyl nitrate from Savannah River back into metal was transferred to Building 9206 in 1973. The machining-turning cleaning process was installed in the mid-1980s for recycling intermediate enrichments of uranium turnings. In 1988 shipments of uranyl nitrate from Savannah River were stopped. A year later the weapon production rate was severely decreased. In 1993 decommissioning of Building 9206 began. Since that time, most of the processes have been shut down, some processes have been removed from the facility, and there are no current plans to resume operations in Building 9206.

4.8.1.3 *Building 9215*

The 9215 Complex consists of Buildings 9215 and 9998. Building 9998 is physically attached to the northeast corner of Building 9215. Building 9215 was constructed in the early 1940s, and Building 9998 was added shortly thereafter. Both buildings have been expanded and modified over the years. Included in Building 9215 is a Blister Area where HEU parts and scraps are packaged and shipped. The Blister Area was constructed in the 1970s and is configured as an “L”-shaped steel frame structure with cement block shear walls.

The mission of the 9215 Complex is to provide for storage and handling of HEU inventories, to aid in the dismantlement of nuclear weapons, to provide fabricated metal shapes as needed for the nuclear weapons stockpile maintenance, and to support nuclear programs at other U.S. and foreign facilities. Materials stored in Building 9215 are considered to be part of the backlog awaiting processing. Not all of the materials will be processed in Building 9215.

4.8.1.4 *Buildings 9204-2 and 9204-2E*

Building 9204-2 was built in 1943 and has been used to support nuclear weapons production since then. As a result of a major upgrade program, Lithium Process Replacement, some of the major processes and equipment were upgraded in the early 1990s. In addition, a portion of Building 9204-2 is being modified for storage of HEU materials.

Building 9204-2E, which comprises the major portion of the building partition, was built in 1971 to house weapon assemblies. Four current HEU activities at Building 9204-2E are as follows: (1) Assembly of new or replacement weapons; (2) quality certification of components and assemblies; (3) disassembly of retired weapons assemblies; and (4) storage of retired assemblies, subassemblies, and components. Assembly and disassembly operations areas, five vault-type rooms, and one vault are located in the Building 9204-2E. Most of the HEU is either metal pieces or weapons components.

4.8.1.5 *Building 9204-4*

Building 9204-4 press operations include the forming of depleted uranium, depleted uranium alloys, and nonradiological material. Building 9204-4 is a three-story structure that was built in 1943. Areas within Building 9204-4 can be functionally classified as follows: (1) quality evaluation of current weapons production programs and disassembly of obsolete weapons; (2) metalworking operations (forging, forming, heat treating) and grit blast cleaning of depleted uranium, depleted uranium alloys, and metals such as steel and aluminum: (3) a Bonded Storage Area (occupying approximately 929 m^2 [10,000 ft^2]) and vault-type room for storage of SNM (occupying approximately 557 m^2 [6,000 ft^2]); (4) radiography, ultrasonic, and other nondestructive testing; and (5) a plating area. The only active operational areas involving HEU within

Building 9204-4 are quality evaluation, assembly, and storage in the vault-type room and the Bonded Storage Area. The plating area, while shut down, contains residual materials. The Bonded Storage Area and the vault-type room are set aside for the storage of HEU in drums.

4.8.1.6 *Building 9720-12*

Building 9720-12 is a warehouse facility located in the western portion of Y-12. The mission of Building 9720-12 is to provide storage for items and materials that have been removed from the Material Access Areas. The western portion of the facility is used for storage of combustibles that contain recoverable amounts of enriched uranium. The storage area is also used for other hazardous materials including RCRA waste, and drums of beryllium.

4.8.1.7 *Building 9201-5*

Building 9201-5 is a multi-story structure that was constructed in the early 1940s. The building is a large production/processing facility previously used for depleted uranium and nonuranium processing. Three small storage areas for enriched uranium combustibles have been established on the third floor of the building. The building has several collocated operations, including lithium hydride storage and arc melt operations. The third floor storage area also includes miscellaneous parts, combustibles, and depleted uranium.

4.8.1.8 *Building 9720-5*

Building 9720-5 historically has been used as a warehouse for weapons-related materials and reactor fuel. The facility was built in 1944 and has since been renovated. The current mission is as an operating warehouse used for short- and long-term storage of materials, including high-equity uranium, weapons assemblies, reactor fuel, and low-equity materials awaiting recycling.

4.8.1.9 *Building 9995*

Building 9995, the Analytical Chemistry Laboratory was constructed in 1952 and is located within the Y-12 PIDAS area. The facility was designed for, and is currently used as, an analytical chemistry laboratory, providing analytical support for DP, Work-for-Others, and operation and maintenance contractor regulatory compliance programs. Building 9995 has had two major expansions since it was originally constructed. A south addition was added in 1969 that is currently used for analytical development, and an annex office area was added in 1981. Building 9995 is equipped with approximately 150 chemical fuming hoods with supporting HVAC systems that form the primary engineered safety feature. Most chemical fume hoods in the building are original equipment; limited hood upgrades have been performed and approximately 20 hoods were replaced in the mid-1980s with additional units having been added or replaced at various times during laboratory alteration projects.

4.8.1.10 *Buildings 9119, 9983, and 9710-3*

Building 9119 is an office building located in the western end of Y-12. The current mission of the building supports a variety of DP related organizations.

Building 9983 is a small wood frame storage building located next to Building 9711-1 in the eastern half of Y-12. Radiological control instrument calibrations are performed in Building 9983. Y-12 personnel use HEU calibration sources for calibration purposes and to store sources awaiting disposal.

Building 9710-3 is an office building constructed of noncombustible materials and is located in the eastern section of Y-12. This building houses the Protective Services Force which uses HEU calibration sources to test the portal monitors at Y-12.

4.8.1.11 *Building 9201-5W*

Building 9201-5W is used as a machine shop and performs machining, and support operations (including nondestructive testing and dimensional inspections) of depleted uranium, depleted uranium alloys, and nonradiological materials. Offices for shop supervision are provided on a mezzanine.

4.8.1.12 *Building 9201-5N*

Activities conducted in Building 9201-5N include eletroplating parts, machining of depleted uranium, and stainless steel parts, and dimensional inspection of parts. Barriers to exposure of workers or the public to radiation or chemical hazards or to releases of radioactive or toxic materials to the environment include hoods, and ventilation systems with HEPA filters. Ventilation exhaust stacks are monitored for radiological materials as appropriate. Currently, the majority of plating operations are inactive. The cyanide treatment facility is inactive.

4.8.1.13 *Buildings 9202 and 9203*

Building 9202 is a two-story R&D structure built in 1954. An addition, which houses a welding laboratory, was built in 1972. A small beryllium blank forming area is operated in the building. Building 9203 was built in 1944. Activities conducted in Building 9203 include development of processes for material characterization and for measurements, and instrumentation and controls.

4.8.1.14 *Building 9996*

Building 9996 is used as a tooling and material storage facility to support operations in immediately adjacent portions of Building 9212.

4.8.1.15 *Building 9201-1*

Building 9201-1, built in 1955, is a large, general machine shop with several areas containing machining equipment and controls. Nominal storage for in-process parts and materials and offices for supervision are also provided. The building is used as a general machine shop for nonuranium metal and graphite parts.

4.8.2 Waste Management Facilities

The majority of waste management facilities at Y-12 are operated under the EM Program, but some are managed by DP. Waste management facilities are located in buildings, or on sites, dedicated to their individual functions, or are collocated with other waste management facilities or operations. Active facilities for the storage and treatment of LLW, mixed-LLW, RCRA-hazardous and *Toxic Substance Control Act* (TSCA)-regulated waste as well as disposal facilities for non-hazardous waste are summarized in this section and in Appendix A.5. Many of the facilities are used for more than one waste stream.

The TDEC Division of Solid Waste Management (DSWM) regulates management of both hazardous and non-hazardous waste streams under RCRA. Facilities used to store or treat RCRA-hazardous waste at Y-12 are regulated by the DSWM as authorized by the EPA. These facilities may also be used to manage mixed waste (waste that are both RCRA-hazardous and radioactive). There are no facilities for the disposal of hazardous waste currently in operation at Y-12. Storage and physical treatment (e.g., shredding, compaction) of non-hazardous waste does not generally require a permit under RCRA. There are three landfills in operation for disposal of non-hazardous waste at Y-12. These disposal facilities are regulated by the TDEC DSWM as well.

TSCA-regulated waste that contains polychlorinated biphenyls (PCB) is managed at Y-12 in accordance with EPA regulations (40 CFR 761) and with a Federal Facilities Compliance Agreement (FFCA) for managing PCBs on the ORR (EPA 1997). Many requirements for the safe storage and handling of PCB-waste are similar to requirements for RCRA-hazardous waste. Therefore, PCB wastes and TSCA mixed waste (waste containing both PCBs and radioactivity) are often stored in facilities approved for RCRA-hazardous and mixed waste storage. Some Y-12 databases and reports group TSCA-regulated and RCRA-hazardous wastes together and refer to this grouping as hazardous waste.

DOE is authorized to manage radioactive waste that it generates under the *Atomic Energy Act of 1954.* Low-level radioactive waste (LLW) are generated during machining and other operations at Y-12. DOE stores, treats, and repackages, but does not dispose of LLW at Y-12. The majority of the LLW generated at Y-12 is otherwise uncontaminated scrap metal and machine turnings and fines. LLW at Y-12 is managed in accordance with DOE Orders (e.g., DOE Order 435.1), policy, and guidance related to management of radioactive waste. Management of this waste is not directly regulated by EPA or TDEC.

The following description of waste management facilities at Y-12 focuses on the facilities currently available for managing waste at Y-12 and not on facilities that are closed or inactive. The facilities are grouped by functional program area: storage, treatment, or disposal.

4.8.2.1 *Waste Storage at Y-12*

Information on these storage facilities is based on the following references: Bechtel Jacobs 2000, LMES 2000d, PAI 1996.

Storage for Mixed Waste Residues/Ash. Buildings 9212 and 9206 provide container storage areas for mixed waste residues or ash. A RCRA operating permit was issued on September 28, 1995 for these units.

The ash resulted from the burning of solvent- and uranium-contaminated solid wastes. The ash does not contain free liquids. Uranium-bearing solutions generated during the uranium recovery process (Building 9818) and laboratory analyses are also stored in these areas. These solutions, as well as the residues, are mixed (hazardous and radioactive) wastes and are being stored prior to further uranium recovery. Occasionally, uranium-bearing materials generated off-site may be stored in Buildings 9212 and 9206, prior to uranium recovery at Building 9212. Although a Phaseout/Deactivation Program Management Plan has been approved by DOE for Building 9206 and the recovery operations within this facility will no longer be operated, this building will continue to store hazardous and mixed waste for several years into the future.

Building 9212 Tank Farm. Building 9212 Tank Farm, a RCRA permit-by-rule facility, has never been placed in operation, but there are future plans to do so when Enriched Uranium Operations are restarted. The facility consists of three dikes containing four 37,854-L (10,000-gal) stainless-steel tanks that will eventually be used to collect nitrate waste from Building 9818 operations before being transferred to the West End Treatment Facility (WETF).

Liquid Storage Facility. The Liquid Storage Facility is a hazardous and mixed waste storage and pretreatment facility built during the Bear Creek Burial Ground closure activities. It is located in Bear Creek Valley approximately 3 km (2 mi) west of Y-12, and operates under RCRA permit-by-rule as materials from the facility are subsequently transferred to a NPDES-permitted facility. It collects, stores, and pre-treats groundwater and other wastewater received from the seep collection lift station, the DARA Solid Storage

Facility, tankers, polytanks, and a water collection/storage tank in the diked area to accommodate rainfall accumulation. Feed streams may contain oil contaminated with PCBs, VOCs, non-VOCs, and heavy metals. Most equipment is in an outdoor, containment area and includes two 284,000-L (75,000-gal) bulk water storage tanks, a 22,700-L (6,000-gal) oil storage tank; gravity separator, two filtering unit, composite monitoring station, and a tanker transfer station. Collected liquids are pre-treated by traveling through the gravity separator, filters, and composite monitoring station prior to entering bulk storage tanks. The wastewater is then transferred by tanker to the Groundwater Treatment Facility for further treatment.

Containerized Waste Storage Area. The Containerized Waste Storage Area (Buildings 9500-120, 9500-121, and 9500-149) consists of three concrete pads covering approximately 2,320 m^2 (24,800 ft^2). An impermeable dike for spill containment surrounds each pad. Closure of the Containerized Waste Storage Area was completed in 1999, and acceptance of the closure certificate by TDEC is expected in 2000.

PCB and RCRA Hazardous Drum Storage Facility. Building 9720-9 is a 1161 m^2 (12,500 ft^2), single-story, prefabricated metal building with slab on grade built in 1955. The facility provides a drum storage area for mixed and PCB waste, including an area for flammable waste. The building is used to store both RCRA and PCB mixed waste.

Container Storage Facility. Building 9720-12, a Container Storage Facility, also called the LLW Storage Areas, provides storage for mixed (hazardous and radioactive) waste residues, ash, and combustibles. It also contains some classified waste. A RCRA operating permit was issued on September 28, 1995. The ash is a product from burning solvent- and uranium-contaminated wastes. Unburned solvent- and uranium-contaminated solid wastes are also stored in Building 9720-12. The waste at Building 9720-12 contains no free liquids and is typically generated during the uranium recovery process. Some of this waste is also stored in Buildings 9212 and 9206, as described above.

Classified Waste Storage Facility. The Classified Waste Storage Facility (Building 9720-25) is a 1635-m^2 (17,600-ft^2), single-story building with masonry-bearing walls and a precast concrete roof system built in 1962. It provides storage for PCB-waste, LLW and mixed LLW, which is classified for national security purposes under provisions of the *Atomic Energy Act.* A RCRA operating permit was issued on September 28, 1995. The facility meets Y-12 security requirements for classified waste management and guidelines for the management of LLW and mixed LLW.

PCB Storage Facility. The PCB Storage Facility (Building 9720-28) provides storage capability for PCB waste, primarily PCB-containing ballasts. Building 9720-28 is a 335 m^2 (3,600 ft^2), single-story building with masonry-bearing walls and a structural steel roof built in 1984.

RCRA and Mixed Waste Staging and Storage Facility. The RCRA Staging and Storage Facility (Building 9720-31) is a 610-m^2 (6,571-ft^2), single-story building with masonry-bearing walls and a precast concrete roof system built in 1986. A RCRA permit was issued on September 28, 1995. Solid, liquid, and sludge wastes are prepared for off-site shipment at this facility. The facility consists of seven storage rooms and seven staging rooms, each with a separate ventilation system. The staging rooms house small containers that are packed with compatible materials and shipped. The storage rooms hold larger containers, such as 208-L (55-gal) drums.

Production Waste Storage Facility . The Production Waste Storage Facility (also a Container Storage Area, Building 9720-32) has not yet been used for storage, but future use is planned. The building is separated into two areas, a smaller one for ignitable RCRA waste, and a larger area for non-ignitable waste. Both areas have curbing and may be used for containerized liquids if stored on self-containing pallets. A RCRA operating permit for the facility was issued September 3, 1996 for storage of reactive and ignitable hazardous and mixed waste. The facility houses the non-destructive assay equipment for Y-12 and has a design capacity for storage of 616,968 gal (2,335 m^3).

Low-Level Waste Storage Pad. The Low-Level Waste Storage Pad, is located in the Sludge Handling Facility (Building 9720-44) that originally provided water filtration and sludge dewatering to support a storm sewer cleaning and relining project. The facility is currently being used to store containers of LLW sludge.

Liquid Organic Solvent Storage Facility. The Liquid Organic Waste Storage Facility (Building 9720-45, OD-10) is a 209-m^2 (2,250-ft^2) single-story pavilion with metal posts and roof panels, built in 1987. A RCRA permit was issued on September 30, 1994. It contains four 24,600 L (6,500 gal) and two 11,400 L (3,000 gal) stainless-steel tanks for storage of ignitable nonreactive liquids, including those contaminated with PCBs and uranium. In addition, a diked and covered storage area provides space for 40,000 L (10,600 gal) of containerized waste. The facility is set up to segregate various spent solvents for collection and storage. Major solvent waste streams are transferred to tanks until final disposition.

RCRA and PCB Container Storage Area. The RCRA and PCB Container Storage Area (Building 9720-58) is a 390 m^2 (4,200 ft^2), single-story, prefabricated metal building with metal wall panels built in 1987. It holds a RCRA permit issued on September 28, 1995. It is a warehouse facility used for staging prior to treatment or disposal of PCB- and RCRA- contaminated equipment (e.g., transformers, capacitors, and electrical switchgear) and non-reactive, non-ignitable RCRA, mixed and PCB waste.

Classified Container Storage Facility . The Classified Container Storage Facility (Building 9720-59, also a Production Waste Storage Facility) is a 1403 m^2 (15,105 ft^2), single-story, prefabricated metal building with metal wall panels. Building 9720-59 was issued a RCRA permit on September 3, 1995 and stores both RCRA and PCB wastes.

DARA Solid Storage Facility. The DARA Solid Storage Facility (Building 9720-60) provides 1,625 m^2 (17,500 ft^2) of storage space for PCB-, RCRA-, and uranium-contaminated soil. The facility has a synthetic liner for leachate collection and a leak detection system. Collected leachate is transferred to the Liquid Storage Facility for pretreatment. The DARA Solid Storage Facility is an interim status facility under RCRA, but is now being managed through the CERCLA process. No additional wastes are being added to the facility.

OD7 Waste Oil Storage Tank Area. Building 9811-1, houses three areas for storage of RCRA liquids (OD7, OD8, and OD9), and is an 81-m^2 (874-ft^2) single-story prefabricated metal building with metal wall panels, built in 1986. OD7 contains a diked storage area for tanks (permitted September 30, 1994). The OD7 contains four 114,000-L (30,000-gal) tanks, two 37,900-L (10,000-gal) tanks, and associated piping and pumps. The OD7 facility is now inactive, and there are no plans to use it in the future.

OD8 Waste Oil Solvent Drum Storage Facility. The Waste Oil Solvent Drum Storage Facility (Building 9811-1, OD8) was issued a RCRA permit on September 28, 1995. It has a capacity for 750, 208 L (55 gal) drums and a smaller number of Tuff tanks. RCRA waste oil/solvent mixtures containing various concentrations of chlorinated and nonchlorinated hydrocarbon solvents, uranium, trace PCBs, and water for specific chemical constituents are stored at OD8 in 208 L (55 gal) drums and 1,140 L (300 gal) Tuff tanks.

OD9 Waste Oil/Solvent Storage Facility. The Waste Oil/Solvent Storage Facility (Building 9811-1, OD9) is a RCRA-permitted (September 30, 1994) storage facility that houses LLW, mixed-LLW, and hazardous waste, including PCBs. It consists of a diked area supporting five 151,000 L (40,000 gal) tanks, a tanker transfer station with five centrifugal transfer pumps, and a drum storage area. Four tanks house PCB and RCRA wastes contaminated with uranium. A fifth tank is empty. A diked and covered pad furnishes space for 33 m^3 (1,165 ft^3) of containerized waste. The diked area contains additional space for a sixth 151,000-L (40,000-gal) tank.

Depleted Uranium Oxide Storage Vaults I and II. The Depleted Uranium Oxide Storage Vaults I and II (Buildings 9825-1 and -2 oxide vaults) are located on Chestnut Ridge northeast of Building 9213. The vaults are constructed of reinforced concrete and provide a retrievable storage repository for uranium oxide, uranium metal, and a blended mixture of uranium sawfines and oxide. The vaults contain a negative pressure exhaust system that operates during material entry. The exhaust is filtered and monitored prior to its release to the atmosphere. The facility uses forklift trucks, electric hoists, and a motorized drum dumper. Waste is no longer accepted in the vaults. Building 9809-1 is also being used as storage for drummed, depleted uranium oxide materials; it is a 111 m^2 (1,200 ft^2), single-story building with masonry bearing walls and a structural steel roof system built in 1990.

West Tank Farm. The West Tank Farm provides storage for mixed and LLW sludge and is associated with the WETF. It operates under RCRA permit-by-rule (see also Section 4.8.2.2, West End Treatment Facility). The West Tank Farm includes thirteen, 1.89 million L (500,000 gal) tanks. Six are utilized as process bioreactors, and three serve as holding tanks for an effluent polishing system. The remaining four tanks hold sludges that are RCRA-hazardous due to either listing or characteristics. Currently, one tank is empty and one is being emptied. In addition, three, 378,541 L (100,000 gal) tanks provide storage for radioactively contaminated calcium carbonate sludge generated as a result of West End Treatment Facility processes.

Oil Landfarm Soil Storage Facility. The Oil Landfarm Soil Storage Facility is a RCRA-interim status facility containing approximately 1377 m^3 (14,832 ft^3) of soil contaminated with PCBs and volatile organics (DOE 1993). The soil was excavated from the Oil Landfarm and Tributary 7 in 1989. The soil is contained in a covered, double-lined concrete dike with a leak-detection system. The leak-detection system will soon be modified to enhance detection capabilities.

Old Salvage Yard. The Old Salvage Yard, located at the west end of Y-12, contains both low-level uranium-contaminated and non-radioactive scrap metal. Most scrap currently sent to this area is contaminated. The Contaminated Scrap Metal Storage is an area within the Old Salvage Yard that is used to store uranium-contaminated scrap metal. Contaminated scrap is placed in approved containers and eventually will be transferred to the aboveground storage pads or shipped off-site for disposal. Non-contaminated scrap is sold when allowed.

Salvage Yard. The Salvage Yard is used for the staging and public sale of nonhazardous, non-radioactive scrap metal that has been approved by DOE for release. It consists of 3.2 enclosed ha (8 acre); 0.4 ha (1 acre) is paved. The New Salvage Yard provides accumulation and sorting space for the scrap metal. This facility is located west of Y-12 on the north side of Bear Creek Road, near the Bear Creek Burial Grounds.

4.8.2.2 *Treatment of Waste at Y-12*

Information on these treatment facilities is based on the following references: Bechtel Jacobs 2000, LMES 2000d, PAI 1996.

Central Pollution Control Facility. The Central Pollution Control Facility (Building 9623), a 1858 m^2 (20,000 ft^2) multistory structural steel building with masonry walls, began operation in 1985. The Central Pollution Control Facility operates under RCRA permit-by-rule and an NPDES permit issued in April 28, 1995. It is the primary facility for treatment of non-nitrated waste. It receives wastes that are acidic or caustic, oily mop water containing beryllium, thorium, uranium, emulsifiers, and cleansers. The facility can also destroy diluted quantities of cyanide in wastewater using ultraviolet oxidation. The Central Pollution Control Facility provides both physical and chemical processing, including oil/water separation, neutralization, precipitation, coagulation, flocculation, carbon adsorption, decanting, and filtration. Treated water is discharged to EFPC through an NPDES monitoring station or sent to the WETF for further processing. Sludge from the treatment processes is transferred to the West End Tank Farm. Spent carbon cartridges and filters are disposed of in commercial TSD facilities.

Plating Rinsewater Treatment Facility. The Plating Rinsewater Treatment Facility treats dilute, non-nitrate bearing, plating rinsewater contaminated primarily with chromium, copper, nickel, and zinc. In addition, the facility can remove chlorinated hydrocarbons. It is currently not maintained in operable status because the Plating Shop (Building 9401-2) that formerly produced most of Y-12's rinsewater has been deactivated. The facility's neutralization and equalization equipment are located outdoors in a diked basin. The remainder of the facility process is located in Building 9623 with the Central Pollution Control Facility.

Central Mercury Treatment System. The Central Mercury Treatment System (CMTS) is designed to treat mercury-contaminated sump water from former mercury use buildings. The CMTS was installed as part of the Y-12 Integrated Mercury Strategy Program to achieve compliance with regulations and guidance addressing mercury contamination in EFPC. Sump water from Buildings 9201-5, 9201-4, and 9204-4 is treated at the CMTS. The CMTS is located at the Central Pollution Control Facility. A new outfall (Outfall 551) is the discharge point where treated wastewater is discharged in conformance to NPDES monitoring guidelines.

West End Treatment Facility. The WETF (Building 9616-7) treats mixed-LLW- and LLW-contaminated wastewater generated by Y-12 production operations and other DOE-ORO activities meeting the facility waste acceptance criteria under a RCRA permit-by-rule. Treatment methods include hydroxide precipitation of metals, sludge settling and decanting, bio-denitrification, bio-oxidation, pH adjustment, degasification, coagulation, flocculation, clarification, filtration, and carbon adsorption. Wastewaters are primarily nitrate bearing and include the following: nitric acid wastes, mixed acid wastes, waste coolant solutions, mop water, and caustic wastes. Wastes are received at the WETF in 8,927 L (5,000 gal) tankers, 1136 L (300 gal) polytanks, drums, carboys, and small bottles. Detailed waste characterization documentation and jar tests are used to determine the treatment scheme for wastewater shipments. Treatment at WETF is performed in three processes: Head End Treatment, West Tank Farm biological treatment, and Effluent Polishing. The Head End Treatment System consists of waste receiving, hydroxide precipitation of heavy metals, sludge settling, and decanting. Biological treatment in the West Tank Farm consists of bio-denitrification, then bio-oxidation. The Effluent Polishing System consists of pH adjustment, degasification, coagulation, flocculation, clarification, filtration, carbon adsorption, and effluent discharge to the EFPC through an NPDES monitoring station.

Legacy mixed-LLW treatment sludges are presently being removed from sludge storage tanks at the West Tank Farm for off-site disposal. Currently generated mixed-LLW and LLW treatment sludges are being accumulated and concentrated for final characterization and disposal. Other treatment residuals, such as spent carbon and personal protective equipment, are being sent for immediate off-site disposal where feasible or otherwise characterized for on-site treatment or disposal.

Organic Handling Unit for Mixed Waste. The Organic Handling Unit (Building 9815) provides storage and treatment of organic solutions containing enriched uranium. The uranium level in the waste material arriving at the Organic Handling Unit is typically less than 400 ppm. These wastes are characterized as mixed hazardous and radioactive wastes. Occasionally, enriched uranium-contaminated wastes generated off-site may be treated at the Organic Handling Unit. An assay reduction process is used to dilute the ^{235}U isotope with ^{238}U isotope in such a manner that they cannot be easily separated chemically or physically. This is accomplished by first mixing depleted uranyl nitrate with the organic solution and then neutralizing the organic solution by adding sodium hydroxide or other acceptable material. Since uranyl nitrate solution is not readily soluble in most organic solutions, "extractant" may be added to the organic solution.

Cyanide Treatment Unit. The Y-12 Cyanide Treatment Unit (located in Building 9201-5N) provides storage and treatment of LLW and mixed-LLW solutions containing metallic cyanide compounds from spent plating baths and precious metal recovery operations or other areas; the unit's RCRA permit was issued on September 28, 1995. Treatment is by chemical oxidation and pH adjustment. The cyanide reduction process performed within the unit is currently performed in 208 L (55 gal) containers. After waste is treated at the Cyanide Treatment Unit, it is transferred to the WETF for further treatment, then discharged to the EFPC.

Biodenitrification Unit. The Biodenitrification Unit (Building 9818) has been in stand-down, but restart is anticipated. It is capable of treating nitrate-bearing, liquid mixed-LLW generated by enriched uranium recovery operations in Building 9212. The denitrification unit removes nitrates from the waste and also separates liquids and solids. The wastewater is then transferred to the WETF for further treatment, and the sludge is transferred to the West Tank Farm.

Uranium Recovery Operations. Uranium Recovery Operations (Building 9212) is a recovery process to increase production efficiency at Y-12. Liquid waste from the operation is transferred to the Biodenitrification Unit. The system is exempt from permitting requirements under RCRA.

Groundwater Treatment Facility. The Groundwater Treatment Facility (Building 9616-7) treats wastewater from the Liquid Storage Facility at Y-12 seepwater collected at East Chestnut Ridge waste piles to remove volatile organic compounds (VOCs), non-VOCs, and iron and elsewhere. It is part of the DARA program to treat groundwater contaminated with LLW and mixed-LLW that is collected from the Bear Creek Burial Grounds. The Groundwater Treatment Facility is located at the far west end of Y-12, in the same building as the WETF. This facility uses an air stripping operation to remove VOCs. In addition, carbon adsorption eliminates nonvolatile organics and PCBs. Precipitation and filtration are used to remove iron. After treatment, wastewater is sampled and recycled if additional processing is required. Wastewater that meets discharge specifications is pumped into the EFPC through a NPDES monitoring station.

East End Mercury Treatment System. The East End Mercury Treatment System (EEMTS) is designed to treat mercury-contaminated sump water from Building 9201-2, a former mercury use building constructed in the late 1940s and located in the eastern part of Y-12 on Second Street directly south of the North Portal parking lot. The EEMTS was installed as part of the Y-12 Integrated Mercury Strategy Program to achieve compliance with regulations and guidance addressing mercury contamination in EFPC. Sump water from Building 9201-2 is treated at the EEMTS. A new outfall (Outfall 550) is the discharge point where treated water is discharged in conformance to NPDES monitoring guidelines. Mercury-contaminated wastewater is pumped from building sumps located in the basement of Building 9201-2 to the treatment unit installed on the first floor. The water is treated there and released to EFPC through the NPDES Outfall 550. The EEMTS process consists of influent filtration, granular-activated carbon adsorption, and associated water transfer equipment.

Steam Plant Wastewater Treatment Facility. The Steam Plant Wastewater Treatment Facility treats wastewater from Steam Plant operations, demineralizers, and coal pile runoff. Treatment processes include wastewater collection/sedimentation, neutralization, clarification, pH adjustment, and dewatering. The treatment facility uses automated processes for continuous operation. All solids generated during treatment are nonhazardous and are disposed of in the sanitary landfill. The treated effluent is monitored prior to discharge to the Oak Ridge public sewage system.

Uranium Chip Oxidation Facility. The Uranium Chip Oxidation Facility (Building 9401-5) is a 348 m^2 (3,750 ft^2), single-story, prefabricated building with metal wall panels built in 1987. The facility thermally oxidizes depleted and natural uranium machine chips under controlled conditions to a stable uranium oxide. Upon arrival, chips are weighed, drained of machine coolant, placed into an oxidation chamber, and ignited. The oxide is transferred into drums and disposed of in an off-site commercial facility. The Uranium Chip

Oxidation Facility is not designed to treat uranium sawfines. Hence, sawfines are currently blended with uranium oxide and placed in storage as a short-term treatment method.

Waste Feed Preparation Facility. The Waste Feed Preparation Facility (Building 9401-4) is a 335 m^2 (3,600 ft^2), single-story, prefabricated building with metal wall panels built in 1984. This facility is no longer in operation. It was previously used to process and prepare solid LLW for volume reduction (compaction and repackaging) by an outside contractor or storage facility.

Steam Plant Ash Disposal Facility. The Steam Plant Ash Disposal Facility, Building 9401-4, is used to collect, dewater, and dispose of sluiced bottom ash generated during operation of the coal-fired Y-12 Steam Plant. To comply with environmental regulations for landfill operations, it includes a leachate collection system and a transfer system to discharge the collected leachate into the Oak Ridge public sewage system. The dewatered ash is disposed of in Landfill VI.

4.8.2.3 *Disposal of Waste at Y-12*

On-site waste disposal facilities in operation at Y-12 are limited to industrial and construction/ demolition landfills. None of the landfills accept, or plan to accept, RCRA-hazardous, TSCA-regulated, or radioactive waste. Waste that contains residual radioactive materials at levels below authorized limits established in accordance with DOE Order 5400.5 may be accepted for disposal. All DOE facilities may receive materials containing residual radioactivity of any radionuclide on material surfaces provided that they are below limits specified in DOE Order 5400.5. Current waste acceptance criteria (WAC) for the landfills include a ceiling for residual radioactivity of 35 pCi/gm for total uranium on a volumetric basis. Materials containing uranium and other radioisotopes with residual levels of radioactivity below DOE authorized limits on a volumeric basis are accepted for disposal on a case-by-case basis. DOE is now reevaluating existing WAC of 35 pCi/gm for total uranium for the on-site disposal facilities, as well as future acceptance of materials containing residual levels of other isotopes, in accordance with guidance for the release and control of property containing residual radioactive material under DOE Order 5400.5 (DOE 1995 and 1997). Review of the WAC should not alter the type or classification of wastes accepted at these landfills. An overview of previously used landfills is included in Appendix Table A.5.3-1 for background information. Information on the disposal facilities is based on the following references: Burns 1993, FWC 1995, MMES 1992, MMES 1995b, PAI 1996, and Schaefer 2000.

Industrial Landfill IV. Industrial Landfill IV is used for disposal of classified, non-hazardous industrial waste, for construction/demolition waste, and for approved special waste. Approximately 12 percent of the landfill's design capacity has been filled. It has a footprint of about 1.6 ha (4 acres).

Industrial Landfill V. Industrial Landfill V is used for disposal of unclassified, non-hazardous sanitary/industrial waste and for approved special waste. Approved special wastes have included asbestos materials, empty aerosol cans, materials contaminated with beryllium, glass, fly ash, coal pile runoff sludge, empty pesticide containers, and Steam Plant Wastewater Treatment Facility sludge. The landfill area is located on Chestnut Ridge near the eastern end of the Y-12 Site and serves Y-12, ORNL, ETTP, and other DOE prime contractors at Oak Ridge. The landfill is equipped with a liner and leachate collection system. Disposal of special waste is approved on a case-by-case basis by the State of Tennessee. Requests are filed with the state to provide disposal for additional materials as needed. The landfill is approximately 15 percent filled. The landfill has a footprint of almost 10.5 ha (26 acres) and is being constructed in phases as disposal capacity is needed.

Construction/Demolition Landfill VI. Construction/Demolition Landfill VI accepts unclassified, non-hazardous construction/demolition debris and approved special waste. Dewatered ash from the Y-12 Steam Plant is currently disposed of in Landfill VI. The facility has been constructed to 100 percent design capacity and has been in operation since 1993. It is approximately 93 percent filled and has a footprint of about 1.6 ha (4 acres).

Construction/Demolition Landfill VII. Construction/Demolition Landfill VII has been constructed and is on standby status. It will not be placed in service until Landfill VI has been filled to capacity. It has a footprint of slightly more than 12 ha (30 acres).

On-site Low-Level Waste Disposal Capability. Y-12 has no active disposal facility on-site for LLW or hazardous waste. All disposal activities at the Bear Creek Burial Grounds were terminated in 1993. These burial grounds were used to dispose of radiologically contaminated waste. Similar waste streams generated today are containerized and stored at Y-12 or are shipped off-site for disposal.

However, the Environmental Management Waste Management Facility that is currently under construction will provide a new disposal capability at ORR for various types of hazardous and radioactively-contaminated waste under certain conditions. This facility has only been approved to accept waste generated as a result of response actions to expedite cleanup of contamination that resulted from previous DOE and Atomic Energy Act operations on the ORR and that are conducted under CERCLA authorization (or in a few cases, under the Inactive Hazardous Substances Site Remedial Action Program [State Superfund] of the State of Tennessee).

The Environmental Management Waste Management Facility will use state-of-the-art disposal technologies, including lined cells with leachate collection capabilities. The WAC for the Environmental Management Waste Management Facility are still being developed and are subject to approval by DOE, EPA, and TDEC. It has a design capacity of 993,921 m^3 (1,300,000 yd^3). Section 3.2.2.2 describes the Environmental Management Waste Management Facility.

4.8.3 Site Infrastructure

An extensive network of existing infrastructure provides services to Y-12 activities and facilities. These are summarized in the following sections while more detailed information is provided in Appendix A.

4.8.3.1 *Roads and Railroads*

The Y-12 Site area contains 104 km (65 mi) of roads ranging from well-maintained paved roads to remote, seldom-used roads that provide occasional access. A 7-km (4-mi) rail spur from the CSX main line east of the city of Oak Ridge serves Y-12; DOE maintains an additional 5 km (3 mi) of rail at the Y-12 Site to serve on-site operations.

4.8.3.2 *Electrical Power*

Electric power is supplied by TVA and is distributed throughout the Y-12 Site via three 161-kV overhead radial feeders; these, in turn, feed eleven 13.8-kV distribution systems consisting of high-voltage transformers, switch gear, and 15-kV feeder cables; and the 13.8-kV feeders distribute power to approximately 400 distribution transformers located throughout the Y-12 Site. In addition, there is one 161-kV interconnecting overhead header. Some sections of the three lines are supported from suspension insulators on self-supporting steel towers; most sections, however, are supported on wooden-pole H-frame structures. Thirteen 13.8-kV distribution systems ranging in size from 20 MVA to 50 MVA are located within such buildings as 9201-1, 9201-2, 9201-3, 9204-4, 9201-4, 9201-5, 9204-1, and 9204-3. Each system consists of a high-voltage outdoor transformer with indoor switchgear, 15-kV feeder cables, power distribution transformers, and auxiliary substation equipment.

4.8.3.3 *Natural Gas*

Natural gas is used for furnaces, the Y-12 Steam Plant, and laboratories and is supplied via a pipeline from the East Tennessee Natural Gas Company at “C” Station located south of Bethel Valley Road near the eastern end of Y-12. A 36-cm (14-in), 125-psig line is routed from “C” Station to the southwest corner of the Y-12 perimeter fence. From this point, a 20-cm (8-in) line feeds the steam plant and a 15-cm (6-in) branch line serve the process buildings and laboratories in the east end of the Y-12 National Security Complex. The western end of the Y-12 National Security Complex, other than the Y-12 Steam Plant, is served by 10-cm (4-in) and 5-cm (2-in) headers that are fed from the steam plant line. In turn, two other pressure reducing stations, one at the steam plant and the other at Building 9202, reduce the gas pressure from 125 psig to 25 psig and 35 psig, respectively. The gas pressure is further reduced and the flow metered at each use point.

4.8.3.4 *Steam*

Heating and process steam is supplied from a Y-12 Steam Plant which was originally built in 1955 and upgraded and modernized several times since then. The Steam Plant operates 24 hours/day, 365 days/year. It includes four coal-fired boilers, each of which is rated at 200,000 lb/hr at 500EF and 235 psig. Steam is distributed throughout the plant at 235 psig through main headers ranging in size from 5 cm (2 in) to 46 cm (18 in) in diameter. Condensate is collected and returned to the Steam Plant using a similar network of pipes; a majority of the returned condensate is used as feed to the demineralized water system. Each boiler is capable of firing on either pulverized coal or natural gas and includes two coal pulverizers and four burners. Coal for the Steam Plant is purchased regionally, delivered by truck, and stored in a bermed area near the Steam Plant. Runoff from the coal pile is collected and treated in the Steam Plant Wastewater Treatment Facility prior to discharge to the sanitary sewer system. Natural gas is supplied from the Y-12 system through an 8-in-diameter, 125-psig underground main; a pressure reducing station reduces the pressure to 25 psig for use in the burners.

4.8.3.5 *Raw Water*

The source of raw water for the Y-12 National Security Complex and the city of Oak Ridge Filtration Plant is the Melton Hill Reservoir. Raw water is pumped approximately 2,743 m (9000 ft) from the reservoir to a 5.7 million L (1.5 million gal) storage tank and pumping station east of the plant. From the pumping station, raw water is pumped to a 91-MLD (24-MGD) filtration plant water system that also serves ORNL and the city of Oak Ridge. Separate underground piping systems provide distribution of raw and treated water within Y-12. Raw water is routed to Y-12 by two lines: a 41-cm (16-in) main from the booster station, installed in 1943, and a 46-cm (18-in) main from the 61-cm (24-in) filtration plant feed line. The raw water system has approximately 8 km (5 mi) of pipes with diameters ranging from 10 cm (4 in) to 46 cm (18 in). The primary use of the raw water is to maintain a minimum flow of 26 million L/day (7 MGD) in the EFPC.

4.8.3.6 *Treated Water*

Treated water is routed from the city of Oak Ridge Filtration Plant to Y-12 facilities by three lines: one 61-cm (24-in) main and two 41-cm (16-in) mains. The total treated water system contains approximately 31 km (19 mi) of pipe ranging in size from 3 cm (1 in) to 61 cm (24 in) in diameter. The treated water system supplies water for fire protection, process operations, sanitary sewerage requirements, and boiler feed at the steam plant. Treated water usage at Y-12 averages 16 MLD (4.2 MGD) or 5,822 MLY (1,538 MGY). Ownership and operation of the treated water system was transferred from DOE to the city of Oak Ridge in May 2000.

4.8.3.7 *Demineralized Water*

Demineralized water is used to support various processes at Y-12 that require high-purity water. A central system located in and adjacent to Building 9404-18 serves the entire plant through a distribution piping system. This system consists of feedwater storage, carbon filters, demineralizers, a deaerator, and demineralized water storage tanks. The primary source of feedwater is condensate return, which is cooled and stored in two storage tanks of 49,210 L and 113,562 L (13,000 gal and 30,000 gal) capacity. The secondary source of feedwater is softened water from the Steam Plant. Feedwater from the storage tanks is filtered, demineralized, deaerated, and stored until needed.

4.8.3.8 *Sanitary Sewer*

The Y-12 Site's sanitary sewer system was first installed in 1943 and expanded as the plant grew. Sewage from most buildings flows to a 46-cm (18-in) sewer main that leaves the east end of the plant near Lake Realty and connects to the city main near the intersection of Bear Creek and Scarboro roads. The current system capacity is approximately 1.5 MGD.

4.8.3.9 *Chilled Water*

The chilled water systems were renovated and upgraded during the mid-1990s. Most chillers that were more than 20 years old were replaced, and the newer chillers were inspected and renovated to eliminate the use of chlorofluorocarbons and to restore the chillers to optimal mechanical condition.

4.8.3.10 *Industrial Gases*

Industrial gases include compressed air, liquid nitrogen, liquid oxygen, liquid argon, helium, and hydrogen.

Compressed air is supplied by three different systems that use compressors and associated air-drying equipment located throughout the Y-12 National Security Complex. The high-pressure (110 psig) instrument air system serves specific production buildings in the west end of the Y-12 National Security Complex. The low-pressure (100 psig) system also serves the production facilities in addition to serving the production support buildings and ORNL facilities located at Y-12. The Y-12 air system (90 psig) serves those areas where air quality is not a concern. All three systems are supplied from the same set of compressors and are different only in the operating pressure and the cleanliness of the piping systems (i.e., the Y-12 air piping system contains legacy oil and moisture from previous operations).

Liquid nitrogen is normally delivered to Y-12 by trailer truck. The Y-12 nitrogen supply system consists of five liquid-nitrogen storage tanks, a bank of atmospheric vaporizers, a steam-to-nitrogen vaporizer, and hot-water vaporizers. Nitrogen is delivered to all production facilities and laboratories at 90-psig through a network of 5-cm (2-in), 8-cm (3-in) and 10-cm (4-in) pipes.

Liquid oxygen is delivered to Y-12 by truck. The oxygen supply system consists of one 914,460-scf, vacuum-insulated storage tank for liquid oxygen. Oxygen is generated by passing the liquid oxygen through two banks of atmospheric vaporizers that have a capacity of 5800 scfh, or 4.1 million scf/month. The gas pressure is reduced to 90 psig, metered, and distributed to production facilities through a 5-cm (2-in) overhead pipeline.

Liquid argon also is delivered to Y-12 by trailer truck. The Y-12 argon system consists of five vacuum-insulated liquid storage tanks and 12 atmospheric fin-type vaporizers. The storage tanks have a combined capacity of 116,351 L (30,737 gal.) equivalent to approximately 3.4 million scf of gas. Gas is distributed to production areas and laboratories through a network of 5-cm (2-in) and 8-cm (3-in) pipes.

The Y-12 National Security Complex receives and stores high-purity **helium** at 3,000 psig in a jumbo tube trailer. The helium facility at Building 9977-1 includes a jumbo tube trailer with a capacity of 160,000 scf. In addition, 36,000 scf of helium at 1800 psig is stored in a tube trailer and serves as emergency standby. The Building 9977-1 cylinder filling facility also houses the high pressure reducing station. Helium gas is distributed throughout Y-12 at 90 psig through a 5-cm (2-in) overhead pipeline.

The **hydrogen** supply at Y-12 is stored in Building 9977-2 in multi-cylinder tube trailers in open concrete block stalls. Four trailers are used on a rotating basis: one is in service, one is in ready standby, one is in emergency standby, and one is being refilled. Each trailer has a capacity of approximately 2,800 m^2 (30,000 scf), providing a total capacity of 8,400 m^2 (90,000 scf). Stored gas is pressurized at 2,000 psig. A two-stage pressure-reducing station delivers 50 psig gas through a meter. The hydrogen gas is then distributed through a 5-cm (2-in) overhead pipeline to Y-12 and laboratory facilities.

4.8.3.11 *Telecommunications*

The four basic telecommunications systems within the Y-12 National Security Complex are the Oak Ridge Federal Integrated Communications Network, the Cable Television Network (CATV), the unclassified Y-12 Intrasite Network, and the Y-12 Defense Programs Network (Y-12DPNet). The Oak Ridge Federal Integrated Communications Network consists of copper cable distributed throughout Y-12 and within all its buildings; this network is used for telephone, FAX, and special data and alarm circuits and is operated by USWest. The CATV network consists of coaxial cable that is run to selected sites within Y-12. This network has the ability to send and/or receive video among the Oak Ridge plants, buildings at a given site, and some off-site locations. The unclassified Y-12 Intrasite Network consists of a fiber-optic backbone network with fiber-optic connectivity to most buildings within Y-12; this network uses routed Ethernet service to separate Internet protocol sub-nets for each building. The Y-12 DPNET is the Classified Services Network and presently consists of a coaxial broadband network and a fiber-optic backbone network with fiber-optic connectivity to most buildings within the protected areas of Y-12.

4.9 VISUAL RESOURCES

The ORR landscape is characterized by a series of ridges and valleys that trend in a northeast-to-southwest direction. The vegetation is dominated by deciduous forest mixed with some coniferous forest. Much of the ORR's open fields (about 2,020 ha [5,000 acres]) have been planted in shortleaf and loblolly pine; smaller areas have been planted in a variety of deciduous and coniferous trees (DOE 1995c).

For the purpose of rating the scenic quality of Y-12 and surrounding areas, the Bureau of Land Management's (BLM) Visual Resource Management (VRM) Classification System was introduced into this analysis. Although this classification system is designed for undeveloped and open land owned by BLM, this is the only system of it's kind available for the analysis of visual resource management and planning activities. Currently, there is no BLM classification for Y-12, however, the level of development at the plant would be consistent with VRM Class IV which would be used to describe a highly developed are (see Glossary for definition of VRM classes). Most of the land surrounding the Y-12 site area would be consistent with VRM Class II and III; left to its natural state with little to moderate changes. Continued management of Y-12 land should focus on limiting construction and future plant activities to within current site boundaries, therefore, preserving the character of the surrounding landscape.

The viewshed, which is the extent of the area that may be viewed from the ORR, consists mainly of rural land. The city of Oak Ridge is the only adjoining urban area. Viewpoints affected by DOE facilities are primarily associated with the public access roadways, the Clinch River/Melton Hill Lake, and the bluffs on the opposite side of the Clinch River. Views are limited by the hilly terrain, heavy vegetation, and generally hazy atmospheric conditions. Some partial views of the city of Oak Ridge Water Treatment Plant facilities located at Y-12 can be seen from the urban areas of the city of Oak Ridge (DOE 1995c).

Y-12 is situated in Bear Creek Valley at the eastern boundary of the ORR. It is bounded by Pine Ridge to the north and Chestnut Ridge to the south. The area surrounding Y-12 consists of a mixture of wooded and undeveloped areas. Facilities at Y-12 are brightly lit at night making them especially visible. There are no visible day-time plumes over Y-12.

Structures at Y-12 are mostly low profile reaching heights of three stories or less. An exception are two meteorological towers erected in 1985 located on the east and west ends of the complex. The East tower, located in a field between Lake Reality and Scarboro Road, reaches a height of 100 m (328 ft). The tower is painted orange and white and is the only structure at Y-12 tall enough to require aviation beacons. The West tower is located on a slight rise across from the intersection of Old Bear Creek Road and Bear Creek Road. While this tower only reaches a height of 60 m (197 ft), it is actually higher in elevation than the East tower. These towers are used to measure and transmit meterological data to ETTP databases (Shelton 1999).

The Scarboro Community is the closest developed area located to the north of Y-12. However, as a result of their separation by Pine Ridge, Y-12 is not visible from the Scarboro Community.

4.10 CULTURAL AND PALEONTOLOGICAL RESOURCES

4.10.1 Cultural Resources

Cultural resources are those aspects of the physical environment that relate to human culture and society, and those cultural institutions that hold communities together and link them to their surroundings. The cultural resources present within the ORR region are complex because of the long prehistoric use of the area; the relocation of the Cherokee from villages during historic times; the presence of well-established settlements prior to acquisition by the Federal government; the continuity of traditional American folklife traditions; and the importance of ORR facilities in the history of nuclear research and production activities for World War II and the Cold War era. An extensive discussion of cultural resources of the ORR region can be found in the DOE-ORO Cultural Resource Management Plan (Souza 1997).

A short history of the human use of the area surounding the ORR and Y-12 is presented to provide a background for the discussion of cultural resources. The ROI for cultural resources is the ORR. The ROI defines the general resource base and relevant cultural and historical contexts for addressing impacts in the area of potential effects. An area of potential effects is the geographic area within which an action may cause changes in the character or use of an historic property (36 CFR Section 800.2[d]). The resources of the ROI provide a comparative basis for establishing the relative importance of resources in the area of potential effects and considering the intensity of potential impacts. The area of potential effects for this SWEIS is the Y-12 Site.

Regional Cultural History. Archaeologists and historians have developed a basic framework to describe changes observed in the cultural traditions of the region. Human occupation and use of the East Tennessee Valley between the Cumberland Mountains and the southern Appalachians is believed to date back to the Late Pleistocene, at least 14,000 years ago. Archaeologists have traditionally believed that these Paleo-Indian bands subsisted primarily by hunting the large game of that era and collecting wild plant foods. More recent research indicates that a more generalized subsistence strategy was probably practiced. In response to warmer and drier climatic conditions and the subsequent loss of Pleistocene megafauna, hunter-gatherers practiced a more diverse subsistence strategy by targeting smaller game and increasing their plant gathering activities. More sedentary adaptations on river terraces and floodplains and labor specialization occurred concurrently with the development and refinement of fishing gear and the exploitation of additional plant materials. Between 3000 and 900 B.C., larger, multifamily communities evolved and primitive horticulture first appeared. Trade goods such as marine shell, copper goods and soapstone bowls also are first found on sites dating to this period. The introduction of pottery and a continued pattern of multiseasonal settlement along river terraces, refinement of agricultural practices, and the use of a broader scope of food resources characterized the next 1,800 years.

During the Mississippian cultural periods (900 A.D. to historic times), larger scale, permanent communities developed first along the alluvial terraces and later on the second river terraces in rich bottomlands suitable for intensive agriculture. These expanding villages included multiple structures, storage pits and hearths, mounds, stockades, plazas, and semisubterranean earth lodges. Archaeological evidence reflects an increasingly complex and specialized society with a high degree of organization, which included the development of elite classes. Just prior to Euro-American contact in the late 17th century, however, there appears to have been a breakdown in the hierarchies and a scaling back of both village size and elaborate public structures. The first Euro-Americans to visit the region were French and English traders and trappers who were soon followed by permanent settlers. These newcomers introduced a variety of domesticated animals, fruit trees, food crops, beads, metal, glass, and other raw materials and derived products to the native inhabitants, now known as the Overhill Cherokee. After a series of conflicts, most of the Cherokee were forcibly relocated to the Oklahoma Territory in 1838. Small, close-knit, agricultural communities developed and continued until 1942 when 23,705 ha (58,575 acres) were purchased by the U.S. government as a military reservation. To contribute to the development of nuclear weapons for the war effort, three production facilities (including Y-12) and a residential townsite were built inside the reservation. New facilities were constructed on the ORR after the war and new missions continued through the Cold War period to the present.

Cultural Resource Types. For this SWEIS, cultural resources have been organized into the categories of prehistoric resources, historic resources, and traditional cultural properties and practices. These types are not exclusive and a single cultural resource may have multiple components. Prehistoric cultural resources refer to any material remains, structures, and items used or modified by people before the establishment of a Euro-American presence in the region in the 17th century. Examples of prehistoric cultural resources recorded on the ORR include villages, potential burial mounds, camps, quarries, and scatters of prehistoric artifacts, such as pottery shards, shell remains, or stone tool-making debris.

Historic cultural resources include the material remains and landscape alterations that have occurred since the arrival of Euro-Americans in the region. Examples of historic cultural resources in the ORR area include homestead and agricultural features, foundations, roads, scatters of historic artifacts, post–contact Cherokee sites, and buildings associated with the Manhattan Project.

Traditional cultural properties and practices refer to places or activities associated with the cultural heritage or beliefs of a living community that are important in maintaining cultural identity. Examples of traditional cultural properties may include natural landscape features; places used for ceremonies and worship; places where plants are gathered that are used in traditional medicines and ceremonies; places where artisan materials are found; places where traditional arts are practiced or passed on; and features of traditional subsistence systems. Impacts to the maintenance of traditional cultural practices are also considered in this SWEIS.

Cultural Resources of ORR and Y-12. Methods used to identify the presence of cultural resources and to determine eligibility vary among the resource types. Pedestrian surveys are used to locate archaeological resources and a separate excavation phase is often required to evaluate archaeological resources for National Register of Historic Places (NRHP) eligibility. Approximately 90 percent of the ORR has been surveyed, on a reconnaissance level, for prehistoric and historic archaeological resources. Less than 5 percent has been intensely surveyed. To date, over 44 prehistoric sites and 254 historic sites, including 32 cemeteries, have been recorded within the current boundaries of the ORR. Fifteen prehistoric sites and 35 historic archaeological resources are considered eligible for listing on the NRHP (Souza 1997).

Several archaeological surveys have been conducted at Y-12 in the past. Surveys are not currently required for activities that do not exceed the depth and extent of previous ground-disturbing activities (PA 1994). Outside of the developed Y-12 area, previously recorded and inventoried archaeological sites have been revisited and evaluated. Only one prehistoric archaeological site, a light scatter of artifacts, has been recorded in the Y-12 Site area. The remains of 16 pre-World War II structures and 7 historic period cemeteries have been identified. Of these, one pre-World War II structure (849A) has been determined eligible for the NRHP based on its early date of construction, current integrity, and its potential to contain undisturbed cultural features. A field review indicated that because of past disturbance the potential for discovery of NRHP-eligible archaeological resources was considered low. Likewise, remaining undisturbed areas are not considered likely locations for significant archaeological resources (DuVall and Associates 1999). It is assumed, however, that archaeological resources could exist in areas that have not yet been inventoried or that subsurface archaeological deposits may occur below shallow disturbances. Even in areas that have been inventoried, data collected on resource locations could be incomplete due to human error or conditions such as heavy vegetation cover, which can seriously affect the ability to see sites on the ground. Unidentified and unevaluated resources are treated as eligible until formal evaluation has been completed.

The survey of historic buildings and structures requires archival research to determine the role that the building may have played in historic events or its architectural significance, and field documentation to assess its current historical integrity. The NRHP has an additional eligibility requirement of "exceptional importance" that applies to properties less than 50 years old. All buildings and structures on the ORR have been surveyed and evaluated for NRHP eligibility. Of 254 pre-World War II buildings and structures evaluated, 35 were determined eligible for the NRHP as individual properties. Two concentrations of pre-war structures have also been designated as the Wheat Community and Gravel Hill Historic Districts. Surveys of World War II and post-World War II buildings encompassing the original Oak Ridge Townsite, ORNL, ETTP, the Oak Ridge Institute for Science and Education, and Y-12 have identified 5 Historic Districts with over 275 contributing structures, 1 designated and 2 proposed National Historic Landmark Properties, and over 25 individual buildings that have been determined eligible for listing on the NRHP. These properties are associated with the Manhattan Project or subsequent activities on the ORR. Other structures, and facility equipment of recent scientific significance that have been previously determined not eligible for listing on the NRHP due to their age or lack of historical context, may be reevaluated for future inclusion (Souza 1997).

All buildings and structures in Y-12 have been surveyed and evaluated. A historic district has been proposed which encompasses the original Y-12 Site and consists of 92 contributing buildings and structures. The properties in this district are considered significant for their association with the Manhattan Project, Y-12's development as a nuclear weapons components plant after World War II, early nuclear research, and the engineering merits of many of the properties. The proposed district includes buildings that appear to meet the criteria of "exceptional importance" required for listing properties that are less than 50 years old.

Two buildings in Y-12 have been proposed for National Historic Landmark status as individual properties. Building 9731 is the oldest facility completed at Y-12 and played a major part in the Manhattan Project. The prototype calutron was housed and operated in this building and the building was also the location of the original production of stabilized metallic isotopes used in nuclear medicine. Building 9204-3 (Beta-3) functioned as a uranium enrichment facility during World War II and is significant for its pioneering role in the nuclear research in enriched uranium and the separation of stabilized isotopes (Thomason 1999).

Traditional cultural properties and practices are identified through ethnographic and folklore studies, and through direct consultation and site visits with tribal or other traditional practitioners. Ancestors of the

Eastern Band of the Cherokee Indians and the Cherokee Nation of Oklahoma may be culturally affiliated with the prehistoric use of the ORR area. Procedures for consultation with the Cherokee regarding traditional cultural properties, religious use, excavation, and discovery of cultural items are in place. No Native American traditional use areas or religious sites are known to be present on the ORR or in the Y-12 Site area. Also, no artifacts of Native American religious significance are known to exist or to have been removed from the ORR or Y-12 (Souza 1997).

As noted in the discussion of historic resources, the ORR and the Y-12 Site areas contain numerous cemeteries associated with Euro-American use of the area prior to World War II. These resources are likely to have religious or cultural importance to descendants and the local community. No other traditional, ethnic, or religious resources have been identified on the ORR and Y-12 Site areas.

4.10.2 Paleontological Resources

Paleontological resources are the physical remains, impressions, or traces of plants or animals from a former geologic age. Paleontological resources are important mainly for their potential to provide scientific information on paleoenvironments and the evolutionary history of plants and animals. Impact assessments for paleontological resources are based on the research potential of the resource, the quality of the fossil preservation in the deposit, and on the numbers and kind of resources that could be affected. Resources with high research potential include deposits with poorly known fossil forms fossils which originate from areas that are not well studied, well-preserved terrestrial vertebrates, unusual depositional contexts or concentrations, or assemblages containing a variety of different fossil forms.

Paleontological Resources of ORR and Y-12. The ORR is underlain by bedrock formations predominated by calcareous siltstones, limestones, sandstones, siliceous shales, and siliceous dolostones. The majority of geologic units with surface exposures on the ORR contain paleontological materials. All of these paleontological materials consist of common invertebrate remains which are unlikely to be unique from those available throughout the East Tennessee region.

4.11 ENVIRONMENTAL MANAGEMENT

In the Waste Management PEIS (DOE 1997c), DOE evaluated the environmental impacts of alternatives for managing five waste types generated by defense and research activities at a variety of DOE sites around the United States including ORR. Of the five waste types evaluated, ORR manages the following four types: LLW, mixed-LLW, TRU waste, and hazardous waste. DOE decided on January 23, 1998, that ORR TRU waste would be sent to the Waste Isolation Pilot Plant (WIPP) in Carlsbad, NM. DOE decided on August 5, 1998, that the ORR would continue to ship hazardous waste offsite for treatment and disposal. DOE's perferred alternative for management of LLW and mixed-LLW was issued December 5, 1999 (64 FR 69241, December 10, 1999). For the management of LLW and mixed-LLW, DOE prefers regional disposal at the Hanford Site and Nevada Test Site. ORR would continue treatment of LLW and mixed LLW generated on-site including Y-12's. The ROD for LLW and mixed LLW treatment and disposal was consistent with those preferred alternatives and was issued on February 25, 2000 (65 FR 10061, February 25, 2000). Currently, Y-12 stores liquid LLW and mixed-LLW for treatment and disposal. Solid LLW is currently stored pending ORR availability of off-site disposal or planned on-site disposal facilities. Solid mixed-LLW is shipped to ETTP for incineration and off-site commercial vendors for treatment and disposal (DOE 1999i, DOE 1997c). Section 4.11.1 addresses the generation of waste from routine operations. Section 4.11.2 addresses the generation of waste from environmental restoration activities. Section 4.11.3 addresses the current status of Y-12's Pollution Prevention Program. The sections discuss the program's background and current elements, including details in areas of waste generation, waste facilities, administrative polices, assessments, technology transfer, recycling/reuse, treatment, and energy and water conservation.

4.11.1 Waste Generation from Routine Operations

The major waste types generated at Y-12 from routine operations include LLW, mixed-LLW, hazardous waste, and nonhazardous waste. Table 4.11.1–1 presents a summary of waste generation totals for routine operations at Y-12, ORNL, and ETTP during 1999. Other waste includes sanitary and industrial wastewater, PCBs, asbestos, construction debris, general refuse, and medical wastes. Y-12 and ETTP do not generate or manage high-level waste or TRU waste. In 1999, ORNL generated 0.3 m^3 (0.4 yd^3) of TRU waste during routine operations.

Low-Level Waste. Solid LLW, consisting primarily of radioactively contaminated scrap metal, construction debris, wood, paper, asbestos, filters containing solids, and process equipment is generated at Y-12. In FY 1999, Y-12 generated approximately 1,404 m^3 (2,909 yd^3) of LLW. Liquid LLW is treated in several facilities including the WETF (DOE 1996b). Y-12 is the largest generator of routine LLW at Oak Ridge.

TABLE 4.11.1–1.—*Summary of Waste Generation Totals by Waste Type in Kilograms (Cubic Meters)*[a] *for Routine Operations at Y-12, ORNL, and ETTP*

Waste Type	Y-12 (FY 1999)	ORNL (FY 1999)	ETTP (FY 1999)
Low-Level Waste	1.4 million (1,404)	0.3 million (294)	22,000 (22)
Mixed Low-Level Waste[b]	69,000 (69)	21,400 (21.4)	122,000 (122)
Hazardous Waste[b]	18,500 (18.5)	7,000 (7)	3,000 (3)
Sanitary/Industrial	7.3 million (7,295)	2 million (1,960)	219,000 (219)

[a]Assumes 1000 kilograms (1 metric ton) equals 1 cubic meter.
[b]Includes TSCA wastes.
Note: does not include wastewater volumes.
Source: DOE 2000e.

Mixed Low-Level Waste. Mixed waste and LLW subject to treatment requirements to meet Land Disposal Restrictions (LDRs) under RCRA are generated and stored at Y-12. DOE is under a State Commissioner's Order (October 1,1995) to treat and dispose of these wastes in accordance with milestones established in the *Site Treatment Plan for Mixed Waste on the Oak Ridge Reservation* (DOE 1997) and for DOE to comply with an FFCA that went into effect June 12, 1992. TSCA-regulated waste (containing PCBs) that is also radioactive waste is managed under a separate FFCA, first effective February 20, 1992 (EPA 1997, revised).

Hazardous Waste. RCRA-hazardous waste is generated through a wide variety of production and maintenance operations. The majority of RCRA-hazardous waste is in solid form. Some RCRA-hazardous waste is treated on-site and may then be disposed of as nonhazardous waste. The remaining hazardous waste is shipped off-site for treatment and disposal at either DOE, or commercially-permitted, facilities (LMES 1999a, DOE 1999b). Information of waste management facilities at Y-12 is presented in Section 4.8 and in Appendix A.

Other Waste Types. Industrial wastewater is discharged from several locations including the WETF. Sanitary wastewater is discharged to the city of Oak Ridge publicly owned treatment works. For a detailed discussion of wastewater discharges, see Section 4.5. PCBs are transported to permitted facilities for treatment and disposal. Medical wastes are autoclaved to render them noninfectious and are then sent to a Y-12 sanitary industrial landfill as are asbestos wastes and general refuse. Construction, demolition, and nonhazardous industrial materials are disposed of in a construction/demolition landfill for hazardous waste facilities at Y-12 (DOE 1996b).

Capacities. Excess treatment and disposal capacity exist both on-site and off-site for hazardous waste facilities at Y-12. While exceedances of 1-year storage limit are possible, routine shipments should be adequate to prevent such an occurrence. Treatment on-site and disposal capacity of mixed waste facilities is increasing. Storage capacities at Y-12 are not currently exceeded. Capacities for LLW are adequate. Details are provided in Appendix A.

4.11.2 Waste Generation from Environmental Restoration Activities

Environmental Restoration Waste. EPA placed ORR on the National Priorities List (NPL) on November 21, 1989. EPA Region IV and TDEC completed a Federal Facility Agreement (FFA) effective January 1, 1992. This agreement coordinated ORR inactive site assessment and remedial action. By 2006 greater than 95 percent of the current EM work scope will be completed with 99 percent of the planned risk reduction accomplished. Groundwater, surface water, and soil contamination will be remediated to a level consistent with future use of these sites as identified in the CERCLA and RCRA processes. Long-term surveillance, maintenance, and post-closure activities will continue past 2006 (DOE 2000d, DOE 1996b, DOE 1996c).

Environmental restoration wastes for Y-12, ORNL, and ETTP are presented in Table 4.11.2–1. Environmental restoration waste is primarily contaminated soils and liquids generated from monitoring wells, soil removal, and cleaning of environmental restoration equipment. Table 4.11.2–1 addresses LLW, mixed-LLW, hazardous waste, and sanitary/industrial waste.

TABLE 4.11.2–1.—*Summary of Cleanup/Stabilization Related Waste Generation by Waste Type in Kilograms (cubic meters)*[a] *in 1999*

Waste Type	Y-12	ORNL	ETTP
Low-Level Waste	500 (0.5)	0.5 million (465)	1.9 million (1,933)
Mixed Low-Level Waste[b]	0.7 million (740)	7,200 (7.2)	0.61 million (608)
Hazardous Waste[b]	7,400 (7.4)	9,100 (9.1)	3,500 (3.5)
Sanitary/Industrial	19,200 (19.2)	1.2 million (1,233)	0.2 million (204)

[a] Assumes 1,000 kilograms equals 1 cubic meter.
[b] Includes TSCA wastes.
Source: DOE 2000e.

4.11.3 Pollution Prevention

The *Pollution Prevention Act* of 1990 and the *Hazardous and Solid Waste Amendments* of 1984 enabled Federal agencies to implement the pollution prevention program. NEPA's original purpose, which was to promote efforts that will prevent or eliminate damage to the environment was complemented by both acts. This relationship was further strengthened in a 1993 memorandum from the CEQ, which recommended that Federal agencies incorporate pollution prevention principles, techniques, and mechanisms throughout their NEPA planning and decision making processes. To comply with the waste minimization requirements, DOE-ORO established a Pollution Prevention and Waste Minimization Program. This section provides detailed information regarding pollution prevention and waste minimization at Y-12. For completeness and comparison, information regarding pollution prevention and waste minimization at ORNL and ETTP has also been included.

EPA has published strategies and guidelines to help facilities meet regulatory requirements. The *Pollution Prevention Act* establishes an environmental protection hierarchy, with source reduction as the most desirable environmental management option. If pollution cannot be prevented at the source, then the following waste management options should be explored in order of preference: reuse, recycling, treatment, and disposal. Waste avoidance is accomplished by source reduction or the recycling of solid wastes regulated by RCRA. Pollution prevention complements the concept of waste avoidance by focusing on source reduction and other practices that reduce or eliminate pollutants through increased efficiency in the use of raw materials, energy, water, or other resources or protection of natural resources by conservation. Waste avoidance is an applied element of the pollution prevention process.

Y-12 Pollution Prevention Program. The Y-12 Pollution Prevention Program is consistent with DOE and other legal requirements and designed to eliminate or minimize pollutant releases to all media and incorporate a pollution prevention ethic into the facility. In 1999, Y-12 reported 38 pollution prevention projects accounting for approximately 8,283 m³ (8,283,000 kg) in waste reduction. The reported cost savings/avoidance was estimated at $2.4 million. In 1998, Y-12 reported 36 projects, 13,601 m³ (13,601,247 kg) of reduction, and a cost savings/avoidance of $3.6 million (DOE 2000e).

This program has been distinguished with several awards including the White House Closing the Circle Award in 1995. More recently, two awards for an innovative approach to environmental restoration work at Y-12 were selected for the 1998 Oak Ridge Operations Pollution Prevention Award and DOE's National Pollution Prevention Award, for work performed on the Chestnut Ridge Filled Coal Ash Pond Project (DOE 1999k). DOE-ORO received two National Pollution Prevention awards in 200; one for environmental preferability and one for complex wide achievement (DOE 2000a).

Source Reduction. Source reduction emphasizes the aspect of preventing and reducing the creation of wastes through process change, material substitution, and administrative policies. Efforts at Y-12 to reduce and eventually eliminate emissions and waste at the site have proven successful, shown by a decrease of LLW by more than 62 percent from 1993 to 1999. These reductions have meant significant savings on the cost of waste disposal as well as notable improvement to the environment. Table 4.11.3–1 shows waste reduction data for 1999 for ORR. Table 4.11.3–2 shows specific waste generation reduction measures for all waste types. Table 4.11.3–3 shows (for 1999), Y-12, ORNL and ETTP efforts.

TABLE 4.11.3–1.—*Reduction in Waste Volumes at ORR from Total Operations in Kilograms (cubic meters)*[a]

Waste Type	1999	% Reduction
Low-Level Waste	4.9 million (4,872)	78
Mixed Low-Level Waste	1.9 million (1,909)	89
Hazardous Waste	0.007 (71)	50
Sanitary Waste	15.7 million (15,656)	61
Total Waste Reduction	22.5 million (22,508)	
Y-12 Total Waste Reduction	8.3 million (8,283)	

[a]Assumes 1,000 kilograms equals 1 cubic meter.
Source: DOE 2000e.

Process Changes. Process changes (i.e., affirmative procurement, equipment or redesign procedural controls) were examined to ensure that wastes are avoided to an extent that is technically and economically feasible. In 1999, Y-12 began implementation of Affirmative Procurement Initiatives. The training and guidelines for all employees includes appropriate protocol for the purchase of the EPA-designated items, as well as appropriate protocol for making purchases (such as searching several databases before making outside purchases). The guidelines will also include steps to disposition materials when useful life has expired (DOE 2000e).

Material Substitution. Material substitution is the replacement of otherwise harmful chemicals with a more environmentally-friendly product which achieves the same level of efficiency. For example, since reducing the usage of solvents and cleaners containing CFCs by 98 percent, emissions have been reduced by 92 percent since 1992.

Administrative Policies. Y-12 management is committed to take appropriate action to support the objectives of the Pollution Prevention and Waste Avoidance Program by ensuring the availability of adequate personnel, budget, training, and materials. Administrative polices at Y-12 assure involvement of all employees in the facilities program through the implementation of a Pollution Prevention and Waste Avoidance team, employee incentives, program feedback, employee training, database tracking system, and cost allocation. Information sharing and benchmarking activities included the Y-12 Pollution Prevention staff presenting an exhibit at the TDEC Annual Hazardous and Solid Waste Management Conference. The exhibit highlighted pollution prevention initiatives at the site such as the award fee incentive program, project successes, and other recognition programs. The Y-12 Recycle Training and Procedure was revised to include a 12-minute video that outlines recycling initiatives at Y-12. A new informational brochure has also been prepared that provides recycling guidelines for plant recycling initiatives and activities (DOE 2000e).

TABLE 4.11.3–2.—*Pollution Prevention and Waste Avoidance Accomplishments at Y-12 in 1999*

Reduction Techniques	Specific Reduction Measures
Process Changes Affirmative Procurement	Inventory reduction Recycled materials purchased Disposition of material considered before purchase Content of hazards considered before products are purchased
Technical Redesign	Asbestos/Fibrous Waste Compactor Lathe modification eliminating LLW cutting fluid
Procedural Controls	Anion determination by microbore ion chromatography Implemented new oil preparation procedure Reduced analytical sample size
Maintenance Procedures	Consolidated waste oils from 8 storage tanks into 3 storage tanks using automated system Upgraded oiling system of various machines having excessive oil leaks
Material Substitution	Substituted lead-free wire for lead wire Filter substitution to acrylic, resin bonded, graded density cartridge filters to cotton string wound cartridge filters Switched to digital imaging from traditional photographs
Administrative Polices Pollution Prevention/Waste Avoidance Team	Progress Reports Set goals for reducing volume of wastes and other pollutants Performed waste stream assessments Member of Environmental ALARA Team
Employee Incentives	Conducted the 1999 Y-12 Pollution Solutions Award Program ORR Pollution Prevention Program receives award
Employee Training	Recycle Training revised
Database Tracking	Provided demonstration of the Oak Ridge Reservation Pollution Prevention Information Management System to the West Valley Nuclear Facility
Waste Characterization	RCRA Annual Report Evaluated 838 waste streams Eliminated a regulated waste oil stream Elimination of F-listed waste stream
Recycling and Reuse	Established plant swap shop database for surplus reusable material Welding rod and wire were sold/donated for reuse Antifreeze recycling Scrap Metal Removal CFC Management Fluorescent and incandescent bulb recycling Dry transformers recycled Computer donations Scrap non-precious metal recycling including lead Cardboard recycling Auto parts recycling including tires Coal ash reuse as fill material at the Y-12 landfill Lead acid battery recycle Wood recycling as mulch Paper and office material recycling including toner cartridges, mixed paper, file folders, and aluminum cans

Source: DOE 2000e.

TABLE 4.11.3–3.—*Summary of Pollution Prevention Activities at Y-12, Oak Ridge National Laboratory and East Tennessee Technology Park in 1999*

Site	Number of Pollution Prevention Projects	Waste Reduction (m^3)	Reported Savings (Thousands)
Y-12	38	8,283	$2,360
ORNL	10	18,707	$541
ETTP	25	4,278	$2,150

Source: DOE 2000e.

Recycling and Reuse. Waste reduction and elimination are promoted through the implementation of onsite and offsite recycling, reuse, and reclamation activities. In 1999, the cleanup/cleanout campaign sold various scrap metals to an outside vendor for cleaning and recycling. This eliminated the need to transfer the scrap and reduce mixed-LLW by approximately 700 m^3 (916 yd^3) for a reported cost savings/avoidance of nearly $300,000. The scope of the recycling program focuses on hazardous and office-generated waste.

Solid waste recycling features techniques used to reduce landfill usage including source reduction of waste streams wherever feasible and efforts to achieve total recycling of waste streams such as paper, aluminum, and scrap wood. The Y-12 recycling program was designed to support four major goals: (1) increase the longevity of the Y-12 landfill, (2) reduce costs to Y-12, (3) conserve energy and natural resources, and (4) comply with federal waste minimization regulations. Due to the success of the plant-wide paper and aluminum recycling program (98 percent of aluminum cans were recycled in 1995), additional waste streams have been identified and targeted for recycling. These streams include coal ash recycling, automotive recycling in the Y-12 garage, fluorescent bulbs, toner cartridges, and implementation of the Y-12 Swap Shop (DOE 2000e).

Assessments. Y-12 created a Pollution Prevention and Waste Avoidance team to coordinate and track a program that promotes the exchange of related information. In 1999, the Y-12 Program evaluated over 838 waste streams, of which 148 waste streams were generated in 1999. Of these 148 generating waste streams, 68 met reduction goal criteria. There were 35 pollution prevention projects identified covering 36 waste streams, and 77 waste streams will be evaluated in the future, some of which currently meet reduction goal criteria (DOE 2000e).

Technology Transfer. The purpose of technology transfer programs is to enhance the competitiveness of U.S. industries in the global economy. Technology transfer opportunities will also aid in reducing DOE's cost for maintaining nuclear competence by making on-site facilities available to U.S. industries.

To reduce future emissions and stabilize wastes to meet LDR standards, DOE technology transfer efforts include the development of DOE and/or commercially available technologies. Y-12 is partnering through the Oak Ridge Centers for Manufacturing Technology sponsored by DOE's Office of Technology Development to develop and implement technologies. These technologies are to facilitate compliance with current and future environmental laws, regulations, and agreements; minimize the generation of wastes; clean up DOE sites at less cost than current technologies; and ensure a trained work force is available. For example, researchers are currently investigating the potential to selectively extract uranium from contaminated soils from the uranium processing facility at Y-12.

Energy Conservation. The Y-12 energy management team reduced plant-wide energy use by 43.1 percent over a 13-year period and won a 1996 Renew America Award for its energy efficiency efforts (DOE 1996d).

Water Conservation. In 1994, 7.4 billion L (1.9 billion gal) of filtered water were consumed. By 1998, this decreased by 21 percent to 5.7 billion L (1.5 billion gal) of water.

4.12 OCCUPATIONAL AND PUBLIC HEALTH AND SAFETY/RADIATION

Current activities associated with routine operations at Y-12 have the potential to affect worker and public health. Air emissions from Y-12 can expose both groups to radioactive and nonradioactive materials. Liquid effluents discharged to nearby water bodies may affect downstream populations using the water for drinking water purposes and recreation. Additionally, workers are exposed to occupational hazards similar to those experienced at most industrial work sites.

The following discussion characterizes the human health impacts from current releases of radioactive and nonradioactive materials at Y-12. It is against this baseline that the potential incremental and cumulative impacts associated with the No Action – Planning Basis Operations Alternative and other alternatives can be compared and evaluated.

4.12.1 Public Health

Radiological. In 1999, the potential MEI dose from Y-12 operations was 2.1 mrem. Atmospheric releases from Y-12 operations results in a dose of 0.53 mrem. Waterborne releases, using worst-case EAEs for all pathways in a water-body segment, results in an MEI dose of 2.91 mrem. The DOE Order 5400.5 MEI dose standard for all pathways is 100 mrem per year. The standard for airborne releases is 10 mrem per year and applies to the sum of doses from all airborne pathways (inhalation, submersion in a plume, exposure to radionuclides deposited on the ground surface, and consumption of foods contaminated as a result of deposition of radionuclides). Both the airborne and all pathway EDEs for the MEI are significantly below these limits. Additionally, DOE standards include a limit of 4 mrem per year to the MEI from the drinking water pathway. Of the estimated MEI dose of 3.4 mrem per year, 0.9 is from the drinking water pathway which is well below the 4 mrem limit. Table 4.12.1–1 summarizes these doses to the MEI.

Based on 1990 census data, the population within 80 km (50 mi) of Y-12 was approximately 880,000. In 1999 the 50-year committed collective EDE to that population (i.e., the total dose received by an assumed 880,000 people) was 4.5 person-rem from atmospheric releases at Y-12 and 1.7 person-rem from waterborne releases. Based on a dose to risk conversion factor of 5.0 x 10^{-4} fatal cancers per person-rem (ICRP 1991), the collective EDE of 6.2 person-rem could result in less than one additional latent cancer death within the population. The collective dose is also presented in Table 4.12.1–1.

A more detailed discussion of sources of radiation exposure, calculating radiation doses, and estimating risk from exposure to radiation is presented in Appendix D, Human Health and Worker Safety.

TABLE 4.12.1–1.—*Potential Radiological Impacts to the Public Resulting from Normal Operation of Y-12*

Affected Environment	Individual Dose (mrem-year)	Percentage of Standard[a]	Collective Dose (person - rem)
Atmospheric releases	0.53[b]	5	4.5
Waterborne Releases			
Ingestion of drinking water	0.9[c]	9	1[d]
Ingestion of fish	2[c]	N/A	0.7[d]
Other uses	0.01[c]	N/A	0.006[d]
Totals	3.44	3	6.21

[a] Radionuclide NESHAP standard is 10 mrem per year from atmospheric releases. DOE Order 5400.5 radiological standard for atmospheric releases is 10 mrem per year, 4 mrem per year for the drinking water pathway, and 100 mrem per year from all exposure pathways.
[b] As calculated using CAP88.
[c] Maximum Potential exposure to the individual, based on modeled results of data collected from water samples from the Clinch River.
[d] Based on known concentrations of radionuclides discharged to the Clinch River-Poplar Creek system.
Source: DOE 2000d.

4.12.2 Worker Health

Radiological. One of the major goals of DOE is to keep worker exposures to radiation and radioactive material as low as reasonably achievable (ALARA). The purpose of an ALARA program is to minimize doses from both external and internal exposures. Such a program must evaluate individual and collective doses to ensure the minimization of both.

The average annual dose to an involved worker at Y-12 during 1999 was 35.6 mrem. The dose to the involved workforce of 3,949 radiation workers was estimated to be 140.7 person-rem. The individual and collective doses for the entire work force of 5,128 workers from 1990 to 1999 can be found in Table D.2.3.1–1 in Appendix D, Human Health and Worker Safety.

Workers exposed to radiation have a risk of 0.0004 per person-rem of contracting a fatal cancer (ICRP 1991 and NCRP 1993). Based on this dose to risk conversion factor, the entire exposed population of Y-12 radiation workers could expect to receive an additional 0.057 cancer deaths due to their 1999 exposure. Thus, as with the public, the annual radiation dose to Y-12 workers results in a calculated cancer fatality risk that is extremely small in comparison to the natural incidence of fatal cancer.

Y-12 worker doses have typically been well below DOE worker exposure limits. Table 4.12.2–1 lists the individual and collective doses for all radiation (involved) workers from 1990 to 2000, as presented in the Y-12 Dosimetry Records System database. Table 4.12.2–2 lists the individual collective doses for all monitored workers from 1990 to 2000 Monitored workers include radiation workers, nonradiation workers, and visitors.

Chemicals used at Y-12 that are of particular concern due to their extensive use in plant operations and the nature and the potential adverse health effects from exposure include mercury, beryllium, PCBs, polycyclic aromatic hydrocarbons, and volatile organic compounds. In addition to the risks from these chemicals, workers at Y-12 are at risk from potential industrial accidents, injuries, and illnesses due to everyday operations. Details on the consequences to worker exposures to workplace chemicals and to other potential sources of impacts to health and safety are discussed in Appendix D, Human Health and Worker Safety.

TABLE 4.12.2–1.—*Y-12 Radiological Worker Annual Individual and Collective Radiation Doses*

Year	Number of Radiological Workers	Average Individual Worker Dose (mrem)	Radiological Worker Collective Dose (person-rem)
1990	2,907	14.8	43.16
1991	3,050	7.3	22.27
1992	2,787	13.1	36.46
1993	2,701	6.8	18.48
1994	2,533	5.4	13.58
1995	2,924	3.1	9.10
1996	3,140	3.1	9.73
1997	3,552	2.96	10.51
1998[a]	3,563	11.4	40.61
1999[a]	3,949[b]	35.6	140.7
2000[c]	3,264	20.1	65.70

[a] 1998 and 1999 data reflect higher doses due to the use of a more conservative risk model in 1998 than that used in previous years and the restart of some uranium operations.
[b] Increase in worker numbers in 1999 is due to the inclusion of M-K Ferguson Company (previously a DOE prime contractor) as a Y-12 subcontractor.
[c] 2000 data reflect lower doses due to the use of the latest bio-kinetic modeling information provided by the ICRP.
Source: Y-12 1999b; Y-12 2001a.

TABLE 4.12.2–2.—*Annual Radiation Doses for All Monitored Y-12 Workers*

Year	Number of Monitored Workers	Average Individual Worker Dose (mrem)	Site Worker Collective Dose (person-rem)
1990	9,799	5.0	48.95
1991	10,824	2.7	29.60
1992	10,273	3.7	37.91
1993	9,995	2.1	20.52
1994	9,748	1.6	15.31
1995	9,327	1.1	10.27
1996	9,159	1.2	10.90
1997	4,758	2.2	10.69
1998[a]	5,128	8.0	41.24
1999[a]	5,451[b]	26.0	141.55
2000[c]	4,769	14.1	67.30

[a] 1998 and 1999 data reflect higher doses due to the use of progressively conservative risk assumptions associated with the ICRP 30 Dosimetry model.
[b] Increase in worker numbers in 1999 is due to the inclusion of M-K Ferguson Company (previously a DOE prime contractor) as a Y-12 subcontractor.
[C] 2000 data reflect lower doses due to the use of the latest bio-kinetic modeling information provided by the ICRP.
Source: Y-12 1999b; Y-12 2001a.

4.13 ENVIRONMENTAL JUSTICE

Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations," signed by President Clinton in February 1994, requires each Federal agency to formulate a strategy for addressing environmental issues in human health- and environment- related programs, policies, planning and public participation processes, enforcement, and rulemakings. The White House memorandum accompanying the Executive Order directs Federal agencies to "analyze the environmental effects . . . of Federal actions, including effects on minority communities and low income communities, when such analysis is required by NEPA."

Any disproportionately high and adverse human health effects on minority populations or low income populations that could result from the Y-12 alternatives being considered are assessed for an 80-km (50-mi) radius around the site, the area for which health effects are assessed. Any health effects resulting from discharge to water pathways would also be assessed for this area. Minority and low-income populations in this area are shown in Figures 4.13–1 and 4.13–2, respectively. Figure 4.13–3 shows the census tracts surrounding the ORR. Minority populations for these tracts are shown in Table 4.13–1, and low-income populations are shown in Table 4.13–2. Socioeconomic impacts associated with environmental justice concerns are assessed for the four-county ROI described in Section 4.3, Socioeconomics.

Approximately 880,000 people lived within a 80-km (50-mi) radius of ORR in 1990. Minorities compose 6.1 percent of this population. In 1990, minorities composed 24.1 percent of the population nationally and 17 percent of the population in Tennessee. There are no federally recognized Native American groups within 80 km (50 mi) of the Y-12 National Security Complex. The percentage of persons below the poverty level is 16.2 percent, which is slightly higher than the 1990 national average of 13.1 percent but much lower than the statewide figure of 30 percent (Census 1990).

The Scarboro Community is a primarily minority community located approximately 1 km (0.5 mi) north of Y-12. Several community health studies have been conducted on Oak Ridge and surrounding counties. The

Scarboro Community has been included in a number of epidemiological health studies conducted by an independent group overseen by the Tennessee Department of Health outlined in Appendix D. Mercury health studies have shown that one of the groups of greatest potential health risk from Y-12 elemental mercury releases between 1950 and 1982 was children in the Scarboro Community. Impacts of uranium releases to the air on the community between 1944 and 1995 were analyzed to determine if cancer risks from uranium releases are elevated for this community and other local communities. The analyses reported cancer screening indexes that were slightly lower than the investigators decision guide for carcinogens, but with a great deal of uncertainty. Other local community health studies have also been conducted in the area and are discussed in Volume II, Section D.6.

The Health Studies Report of PCB releases from the ORR prior to the early 1970's outlined in Appendix D concluded that some fishermen at the Clinch River and Watts Bar Reservoir have eaten enough fish from these sources to affect their health, including excess cancers, but estimates of how many have been affected are not possible at this time. Further studies were recommended, including studies of fish and turtle consumption, PCB blood levels in people consuming fish, PCB levels in core samples from the Clinch River and the Watts Bar Reservoir, PCB levels in the soils near EFPC, and PCB levels in cattle grazing near the creek. There are no populations in the area completely dependent on consumption of these fish from the Clinch River and the Watts Bar Reservoir for subsistence.

TABLE 4.13–1.—*Population Distribution by Race in Oak Ridge Census Tracts*

Tract	Total Population	White		Black		Other non-white		Hispanic[a]	
		Total	%	Total	%	Total	%	Total	%
201	2,767	1,620	58.5	951	34.4	196	7.1	19	0.7
202	6,260	5,820	93.0	228	3.6	212	3.4	124	2.0
203	4,395	4,107	93.4	232	5.3	56	1.3	39	0.9
204	4,544	4,231	93.1	251	5.5	62	1.4	93	2.0
205	3,932	3,625	92.2	257	6.5	50	1.3	26	0.7
206	2,735	2,478	90.6	158	5.8	99	3.6	72	2.6
301	2,567	2,438	95.0	71	2.8	58	2.3	64	2.5
Total	27,200	24,319	89.4	2,148	7.9	733	2.7	437	1.6

[a] Hispanic origin may be any race and is included in other totals.
Source: Census 1992.

TABLE 4.13–2.—*Oak Ridge Families Living Below Poverty Level, by Census Tract (1989)*

Census Tract	Number of Families Below Poverty Level	Percentage of Total Families in Census tract Below Poverty Level
201	142	20.9
202	68	3.8
203	59	4.4
204	95	7.0
205	195	17.6
206	0	0
301	9	1.1

Source: Census 1990.

Source: Census 1992.

FIGURE 4.13–1.—*Minority Population in the Region of Influence.*

Source: Census 1992.

FIGURE 4.13–2.—*Low Income Population in the Region of Influence.*

FIGURE 4.13–3.—*City of Oak Ridge Census Tracts.*

CHAPTER 5: ENVIRONMENTAL CONSEQUENCES

In accordance with CEQ regulations, the environmental consequences discussions provide the analytical detail for comparisons of environmental impacts associated with the various Y-12 Site-wide alternatives and proposed actions. Discussions are provided for each environmental resource and relevant issues that could be affected. For each resource or issue in Chapter 5, the impacts of two No Action scenarios for Y-12 operations are presented: (1) Status Quo, and (2) Planning Basis Operations. Analysis is also provided for each of the action alternatives for the Y-12 HEU Storage Mission (Alternative 2) and Special Materials Mission (Alternative 3). The potential combined impacts, if both the HEU Materials Facility and the Special Materials Complex are constructed, in addition to the Y-12 planning basis operations level impacts, are also included (Alternative 4).

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

The following discussion is a brief summary of the Y-12 No Action - Status Quo Alternative, No Action - Planning Basis Operations Alternative, and the alternatives for the HEU Storage Mission and Special Materials Mission.

Alternative 1A (No Action - Status Quo Alternative)

The No Action - Status Quo Alternative represents the current level of operations at Y-12 as reflected by the most recent monitoring data (1999) for the Y-12 Site and reported in the ASER issued in 2000. Although approximately 80 percent of the types of operations associated with DP's assigned mission were operational ready in 1999 (following the Y-12 stand-down in 1994), Y-12 was only operating at 30 percent capacity throughout most of that year. This operating level is used in the SWEIS as a basis for comparison of the impacts associated with the No Action - Planning Basis Operations Alternative and other action alternatives that reflect full Y-12 DP mission operations at required levels and recently approved projects by EM and ORNL at Y-12. The No Action - Status Quo Alternative is not considered reasonable for future Y-12 operations because it would not meet Y-12 mission needs and would not reflect DOE's decision in the SSM PEIS ROD (61 FR 68014) to maintain and downsize the DP missions including the weapons secondary and case component fabrication capability at Y-12.

Alternative 1B (No Action - Planning Basis Operations Alternative)

Under the No Action - Planning Basis Operations Alternative, Y-12 would continue facility operations at historical levels in support of assigned missions. The No Action - Planning Basis Operations Alternative reflects the implementation of the DOE decision in the SSM PEIS ROD (61 FR 68014) to maintain the DP national security mission at Y-12, but to downsize the Site consistent with reduced requirements. This includes: DP capabilities to produce and assemble uranium and lithium components, to recover uranium and lithium materials from the components fabrication process and disassembled weapons, to produce secondaries, cases, and related nonnuclear weapons components, to process and store enriched uranium and to supply enriched uranium, lithium, and other material products; EM activities at Y-12 related to environmental monitoring, remediation, deactivation and decontamination, and management of waste materials from past and current operations; Office of Science activities operated by ORNL at Y-12; and DP support of other Federal agencies through the Work-for-Others program, the National Prototype Center, and the transfer of highly specialized technologies to support the capabilities of the U.S. industrial base. The No

Action - Planning Basis Operations Alternative also includes activities to store surplus enriched uranium pending disposition in accordance with the S&D PEIS ROD (62 FR 3014).

Alternative 2 (No Action - Planning Basis Operations Plus HEU Storage Mission Alternatives)

This alternative includes the No Action - Planning Basis Operations Alternative plus a new HEU Storage Mission facility. There are two proposed options for the HEU Storage Mission at Y-12: (1) construct a new HEU Materials Facility at one of two potential candidate sites, and (2) construct an Upgrade Expansion to existing Building 9215. The preferred option is to construct and operate the new HEU Materials Facility, which would enable Y-12 to safely and securely store Categories I and II HEU, including canned subassemblies that contain HEU; HEU in metal and oxide forms in cans (part of the strategic reserve of excess inventories); and scrap metal that contains HEU awaiting recovery (Central Scrap Management Office scrap metal contaminated with HEU that is being returned from other DOE facilities and university programs).

Alternative 3 (No Action - Planning Basis Operations Plus Special Materials Mission Alternative)

This alternative includes the No Action - Planning Basis Operations Alternative plus a new Special Materials Complex at one of three candidate sites. The proposed action is to construct and operate a new Special Materials Complex which would enable Y-12 to ensure efficient production of adequate quantities of special materials for all anticipated scenarios considered for the enduring nuclear weapons stockpile while providing for worker health and safety. A key component of the proposed Special Materials Complex is the construction of a new Beryllium Facility to house all beryllium production operation at Y-12. Facility design would incorporate strategies that enhance the current administrative, safety and health controls, and personal protection equipment with engineered controls.

Alternative 4 (No Action - Planning Basis Operations Plus HEU Materials Facility Plus Special Materials Complex)

This alternative includes the No Action - Planning Basis Operations Alternative plus both a new HEU Materials Facility and a Special Materials Complex.

5.1 LAND USE

The land use resources analysis considers a ROI that includes the Y-12 area of responsibility, which covers 2,197 ha (5,428 acres), as well as the rest of the ORR (13,943 ha [34,513 acres]) and the adjoining properties of the city of Oak Ridge. The land use impacts of the No Action - Status Quo Alternative, No Action - Planning Basis Operations Alternative, and HEU Storage Mission and Special Materials Mission. Alternatives are compared with existing land use patterns, plans and policies.

5.1.1 Alternative 1A (No Action - Status Quo Alternative)

The main area of Y-12 (328 ha [811 acres]) is largely developed and because of the Site's defense support, manufacturing, and storage facilities, the land is classified in DOE's industrial use category. The land surrounding the main Y-12 area is used primarily for environmental restoration, waste management, and environmental field research activities. The No Action - Status Quo DOE missions activities at Y-12 are consistent with current land use plans, classifications, and policies. There would be no land use impacts over the 10-year planning period under the No Action - Status Quo Alternative.

5.1.2 Alternative 1B (No Action - Planning Basis Operations Alternative)

Under Alternative 1B (No Action - Planning Basis Operations Alternative), activities associated with DP, Environmental Remediation, NE, Nuclear Nonproliferation and National Security (NN), the Work-for-Others Program, and Technology Transfer would not change and therefore, would not affect local short-term or long-term land use. Ongoing downsizing of the Y-12 National Security Complex manufacturing and facility footprint may encourage more facilities to be declared surplus and recommended for D&D. If facilities declared surplus result in the reuse of the land and facilities for activities not related to weapons production operations, some local land use benefits may be realized.

Potential land use impacts from the Environmental Management Waste Management Facility and the ORNL NABIR Program Field Research Center component at Y-12 included in the No Action - Planning Basis Operations Alternative are described below.

Construction and operation of the Environmental Management Waste Management Facility at Y-12 could result in local short-term and long-term land use impacts from the commitment of the land for the disposal facility, and the potential benefit that local disposal capacity may impact the overall cleanup of ORR and resulting land use.

As discussed in Section 3.2.2.2, construction and operation of the new disposal facility would require clearing land within the Oak Ridge National Environmental Research Park (Research Park) (26 to 40 ha [64 to 99 acres]) and an increase of between 5 to 7 ha (12.4 to 17 acres) in the Y-12 West End Borrow Area. Construction, operation, and support activities in and around the facility could affect adjacent activities at the Research Park, such as research. Use of Research Park land for a disposal facility would represent a trade-off between current use of land for forest and use of land for waste disposal. The presence of the facility would influence the likelihood of that type of adjacent development likely, possibly increasing the chance of adjacent industrial development while decreasing the chance of extensive public use (e.g., recreation).

If local waste disposal capacity provided by the Environmental Management Waste Management Facility encourages cleanup of industrial sites, local land use benefits could be realized. The permanent commitment of land for the new facility (9 to 18 ha [22 to 44 acres]) may be at least partially affected by the cleanup and associated improvement or reuse of the land at individual CERCLA sites; however, these indirect potential benefits are uncertain and cannot be quantified. The overall beneficial or adverse impact, if any, depends on actions taken at those individual sites and on the willingness of future occupants to locate to these areas.

Potential impacts to Research Park environmental resources would be minimized by the buffer provided by the restricted area around the new Environmental Management Waste Management Facility and by use of best management practices including sufficient controls during cell operation. Following closure, much of the disturbed area would gradually be allowed to return to its natural forested state. No development of the cell or restricted area would be permitted, providing some future long-term habitat preservation and allowing environmental research to continue.

The Field Research Center component of the NABIR Program at Y-12 (see Section 3.2.2.6) is not expected to result in short-term or long-term land use impacts. The entire length of Bear Creek, from its beginning within the proposed contaminated area through the background area outside the Y-12 SWEIS analysis area, is designated as an Aquatic Natural Area. In addition, much of the land adjacent to the field research areas has been designated part of the Research Park. A portion of the contaminated area is contained within the Research Park. Activities needed to support site characterizations, to obtain research-quality samples, and in-situ research within the approximately 4 ha (10 acres) resource area would not impact or interfere with these designated areas. Any ongoing research projects in areas considered part of the Research Park or Field Research Center Research Area would be avoided.

The only intrusion expected to impact existing land use would be the placement of trailers to support activities near the location of discrete research areas within the Field Research Center. In all areas, trailers would be part of an already developed area and would be compatible with the immediate surroundings.

Activities under this alternative are consistent with recommendations made by the Oak Ridge End Use Working Group (PEC 1998) as well as the planned and proposed projects for the site appearing in the *Oak Ridge Reservation Site Development and Facilities Utilization Plan 1990 Update* (DOE 1991a).

5.1.3 Alternative 2 (No Action - Planning Basis Operations Plus HEU Storage Mission Alternatives)

Alternative 2A (No Action - Planning Basis Operations Plus Construct and Operate a New HEU Materials Facility)

The new HEU Materials Facility, described in Section 3.2.3.2, would be compatible and consistent with the current land use at Y-12 and would not change the current industrial use classification that exists at both Site A and Site B (see Section 3.2.3.2 for a description of Sites A and B). Construction of and future operations at the HEU Materials Facility are consistent with recommendations made by the Oak Ridge End Use Working Group (PEC 1998) as well as the planned and proposed projects for the site addressed in the *Oak Ridge Reservation Site Development and Facilities Utilization Plan 1990 Update* (DOE 1991a).

Impacts to land surrounding the new facility would be limited to the lay-down areas for construction. The lay-down area for construction of Site A would be north of Bear Creek Road, just west of the new parking lot being constructed as part of the project (see Figure 3.2.3–3). The Site would be sufficiently graded and developed to accommodate a number of temporary construction trailers, storage buildings, and storage yards. A security fence would surround the Site. A smaller lay-down area would be located in the parking lot area next to the construction site to accommodate daily work activities. The lay-down area for the construction of Site B would be in the S-3 Parking Lot (see Figure 3.2.3–5). During construction, temporary parking spaces would be developed in the west tank farm area and just south of old Post 17 to replace the parking spaces lost due to the construction lay-down area. Appropriate traffic control and coordination measures would be implemented during construction activities to minimize Field Research Center worker access impacts to the NABIR program activities at Y-12.

Once the construction of the new facility Site A is complete, the lay-down area would be re-graded and seeded after removal of any soil that may have been contaminated with construction-related materials. Once the construction of the new facility at Site B is complete, the lot will be paved and the spaces will be relined for its original parking purposes.

Construction for the HEU Materials Facility would occur outside the current PIDAS for both Site A and Site B. Upon completion of the project, the PIDAS would be extended to surround the new facility. The No Action - Planning Basis Operations Alternative plus the Construction and Operation of the HEU Materials Facility would potentially disturb up to 5 ha (12.4 acres) during construction (both Sites), and result in a potential permanent land requirement of up to 33 ha (82 acres) for operations (both Sites), a small percentage of Y-12 undeveloped land. Appropriate measures would be implemented to minimize research worker access impacts to Field Research Center activities by any new Y-12 facility security requirement.

When the new HEU Materials Facility is completed and HEU currently stored at Y-12 is relocated to the new facility, the current HEU storage facilities could be declared surplus, reused for other support activities, or recommended for D&D. The final disposition of these facilities would be determined by the Y-12 Facility Transition Process described in Appendix A.1.2. This could result in the reuse of the land and facilities for activities not related to weapons production operations possibly allowing some local land use benefits. Specific usage of these facilities may change but the overall industrial use classification would remain the same.

Alternative 2B (No Action - Planning Basis Operations Plus Upgrade Expansion of Building 9215)

Impacts on land use as a result of the expansion of Building 9215 (see Section 3.2.3.3) would be minimal under this alternative since the current usage of the proposed construction site is limited to temporary facilities and trailers, which would be demolished or salvaged prior to initiation of construction activities. The expansion would require approximately 0.8 ha (2 acres), west of Building 9212 and 9998 and north of 9215, to accommodate construction activities as well as the current expansion footprint of approximately 0.4 ha (1 acre). Impacts to land surrounding the expansion site would be limited to the lay-down areas for construction. The lay-down area would be the S-3 Parking Lot and would be developed as described above. Once the expansion is complete, the lot would be paved and the spaces would be relined for its original parking purposes. The construction and operation of the Upgrade Expansion to Building 9215 plus the No Action - Planning Basis Operations Alternative would disturb up to 52 ha (128 acres) during construction, and result in a potential permanent land requirement of up to 29.5 ha (72 acres) for operations.

The expansion to Building 9215 would be compatible and consistent with the current land use at Y-12 and would not change the current industrial use classification that exists for the Y-12 Site. Construction and HEU storage operations within the expansion are consistent with recommendations made by the Oak Ridge End Use Working Group (PEC 1998) as well as the planned and proposed projects for the site addressed in the *Oak Ridge Reservation Site Development and Facilities Utilization Plan 1990 Update* (DOE 1991a).

5.1.4 Alternative 3 (No Action - Planning Basis Operations Plus Special Materials Mission Alternative)

No Action - Planning Basis Operations Plus Construct and Operate a New Special Materials Complex

Site 1 covers a total of 8 ha (20 acres) of land to the north of Bear Creek Road. There are no permanent or temporary structures located on the Site. Approximately 50 percent has already been cleared and the remaining 50 percent is covered with trees. The 0.8-ha (2-acre) construction lay-down area located to the east of the Site consists of a mixture of cleared and wooded land with no temporary or permanent structures. Surrounding development is limited to Building 9114 to the southeast while woodland extends to the north and northwest up to the DOE-ORR boundary.

There would be a change in land use for both the Site and the temporary construction lay-down area, but no change in the industrial use classification of the area. Following completion of construction, the construction lay-down area would be regraded and incorporated into the landscape design of the Special Materials Complex. Construction of the Special Material Complex at Site 1 would be outside the Y-12 PIDAS. The proposed area is still within the recommended development area for this type of activity and would be consistent with recommendations made by the Oak Ride End Use Working Group (PEC 1998) as well as the planned and proposed projects for the site addressed in the *Oak Ridge Reservation Site Development and Facilities Utilization Plan 1990 Update* (DOE 1991a).

Site 2 covers approximately 5 ha (12.4 acres) of land currently used as a Scrap Metal Yard for Y-12 and is located southeast of Building 9114 and east of the westernmost portion of the PIDAS. The construction lay-down area for the project would be located at the S-3 Parking Lot. Temporary parking spaces would be provided in the west tank farm area to mitigate the lost parking used by the new construction lay-down area. Appropriate traffic control and coordination measures would be implemented during construction activities to minimize Field Research Center worker access impacts to the NABIR program activities at Y-12. Once the new Special Materials Complex is complete, the lot would be paved and relined for original parking purposes. Construction of the Special Materials Complex and future operations at Site 2 would be consistent and compatible with ongoing activities at Y-12, would not change the current industrial use classification for the area, and is consistent with recommendations made by the Oak Ridge End Use Working Group (PEC 1998) as well as the planned and proposed projects for the site addressed in the *Oak Ridge Reservation Site Development and Facilities Utilization Plan 1990 Update* (DOE 1991a).

Site 3 is the same location as Site B under the new HEU Materials Facility construction alternative and covers approximately 5 ha (12.4 acres). The 0.8 ha (2 acre) construction lay-down area for the construction at Site 3 would be in the S-3 Parking Lot. A temporary parking lot would be developed in the west tank farm area and just south of old Post 17 during construction of the Special Materials Complex. Once the construction of the new Special Materials Complex at Site 3 is complete, the S-3 Parking Lot would be paved and the spaces would be relined for original parking purposes. Appropriate traffic control and coordination measures would be implemented during construction activities to minimize Field Research Center worker access impacts to the NABIR program activities at Y-12. Construction of the Special Materials Complex and future operations at Site 3 would be consistent and compatible with on-going operations at Y-12, would not change the current industrial use classification for the area, and are consistent with recommendations made by the Oak Ridge End Use Working Group (PEC 1998) as well as the planned and proposed projects for the site addressed in the *Oak Ridge Reservation Site Development and Facilities Utilization Plan 1990 Update* (DOE 1991a).

The No Action - Planning Basis Operations plus the construction and operation of the Special Materials Complex would potentially disturb up to 59 ha (146 acres) (Site 1) and 56 ha (138 acres) (Sites 2 and 3) during construction, and result in a permanent land requirement of up to 33 ha (82 acres) for operations, a small percentage of available undeveloped Y-12 land. Appropriate measures would be implemented to minimize research worker access impacts to Field Research Center activities by any new Y-12 facility security requirement.

When the new Special Materials Complex is completed, the facilities currently used for the mission at Y-12 could be declared surplus, reused for other support activities, or recommended for D&D. The final disposition of these facilities would be determined by the Y-12 Facility Transition Process described in Appendix A. This could result in reuse of the land and facilities for activities not related to weapons production operations, possibly allowing some local land use benefits. Specific usage of these facilities may change, but the overall industrial use classification would remain the same.

5.1.5 Alternative 4 (No Action - Planning Basis Operations Plus HEU Materials Facility Plus Special Materials Complex)

Construction and operation of the HEU Materials Facility and the Special Materials Complex, when combined with the No Action - Planning Basis Operations activities, would result in land use impacts from temporary disturbance and the permanent commitment of land for new facilities. Construction activities would disturb up to 64 ha (158 acres). Appropriate traffic control and coordination measures would be implemented during construction activities to minimize Field Research Center worker access impacts to the NABIR program activities at Y-12. New facilities and support operations (i.e., Y-12 West End Borrow Area) would require the permanent use of a total of 26 to 37 ha (64 to 91 acres) of land. Only 18 to 29 ha (44 to 72 acres) would be land that did not have existing structures prior to construction. Appropriate measures would be implemented to minimize research worker access impacts to Field Research Center activities by any new Y-12 facility security requirement. The siting of the proposed new facilities (i.e., Environmental Management Waste Management Facility, the Field Research Center, the HEU Materials Facility, and the Special Materials Complex) would be consistent with ORR and Y-12 land use plans and policies, and consistent with the recommendations of the Oak Ridge End Use Working Group (PEC 1998) as well as the planned and proposed projects for the site addressed in the *Oak Ridge Reservation Site Development and Facilities Utilization Plan 1990 Update* (DOE 1991a).

5.2 TRAFFIC AND TRANSPORTATION

Three major interstate highways (I-40, I-75, and I-81) and other state routes (SR 61, SR 62, and US 25W at Clinton) provide off-site access for traffic to and from the Y-12 Site. Primary roads on the ORR serving Y-12 include SRs 95, 58, 62, and 170 (Bethel Valley Road), and Bear Creek Road. In its analysis of impacts, DOE examined the potential for the various alternatives to affect local traffic patterns. To accomplish this, DOE reviewed the roadways that serve Y-12 and the surrounding Oak Ridge area and then used projections based on changes in worker population and construction activities to determine how traffic patterns could be affected.

DOE also performed an analysis of transportation of materials to and from the Y-12 National Security Complex for each alternative to determine incident-free impacts and accident impacts of material transportation, including vehicular accident impacts. The transportation-related impact evaluation includes the calculation of:

- Incident-free radiological doses and corresponding potential latent cancer fatalities (LCFs) to the transportation crew and public from radiation exposure
- Dose risks due to transportation accidents
- Traffic fatalities that are independent of the cargo
- LCFs due to vehicle emissions

Appendix A.6 gives a detailed discussion of the methodology, models, and analyses for transportation impacts. To estimate these impacts, DOE determined the types of material that would be shipped and the origin and destination of the shipments. Radiological consequences were calculated using the RADTRAN computer program (SNL 1992). Nonradiological impacts were estimated using unit risk factors (SNL 1986), which express the risk per kilometer traveled and were developed from national statistics for high accident-related deaths. The unit risk factors used in this SWEIS are presented in Table 5.2–1 and include the risk of a LCF from vehicle emissions and the risk of traffic fatalities.

5.2.1 Alternative 1A (No Action - Status Quo Alternative)

Primary roads on the ORR serving Y-12 include SRs 95, 58, 62, and 170 (Bethel Valley Road), and Bear Creek Road. All are public roads except Bear Creek Road which traverses the ORR. The traffic statistics associated with the No Action - Status Quo Y-12 missions are presented in Section 4.2, Table 4.2.1–1. Average daily traffic on ORR and area roads serving Y-12 ranges from 3,200 vehicles per day on West Bear Creek Road (LOS A) to 28,320 vehicles per day on SR 62 from SR 170 to SR 95 (LOS E). Major off-site area roads for long-distance transport of materials and waste include I-40, I-75, and I-81. There would be no change in traffic or transportation impacts over the 10-year planning period under the No Action - Status Quo Alternative.

TABLE 5.2–1.—*Nonradiological Unit-Risk Factors for Truck Transport*

Exposure	Rural	Suburban	Urban
Nonoccupational Latent Fatalities (fatalities/km)	&	&	1.0×10^{-7}
Nonoccupational Fatalities (fatalities/km)	5.3×10^{-8}	1.3×10^{-8}	7.5×10^{-9}
Occupational Fatalities (fatalities/km)	1.5×10^{-8}	3.7×10^{-9}	2.1×10^{-9}

Source: SNL 1986.

5.2.2 Alternative 1B (No Action - Planning Basis Operations Alternative)

The No Action - Planning Basis Operations Alternative includes continuation of the present Y-12 missions as well as the construction and operation of the Environmental Management Waste Management Facility and implementation of the Field Research Center activities. The Field Research Center activities would result in a slight increase in traffic on those routes needed by staff members and researches who travel to and from research locations within ORNL. However, because the number of people associated with this project is relatively small, DOE does not expect significant impacts on traffic from the Field Research Center activities. Some interruption of normal traffic flow might occur as a result of drilling rigs and on-site field trailer transport. This activity would be of short duration and would not result in long-term impacts. The construction and operation of the Environmental Management Waste Management Facility could result in some traffic increases. During the construction of the disposal facilities, the commuting workforce would result in a maximum of an additional 75 vehicles per day on Bear Creek Road. This workforce represents less than 1 percent of the total workforce on ORR, and the majority of construction workers would be from the existing workforce. This would have a negligible impact to Y-12 Site traffic and LOS on area roads.

Waste transportation to the disposal facility during operation would be at a maximum rate of 20 trucks per day. Most waste would originate and terminate within boundaries of the Y-12 Site and ORR; therefore, no appreciable change in use of public roads off-site is expected. In addition, up to eight truckloads per day of leachate would be transported to the ORR Technology Park Central Neutralization Facility. These additional vehicles could result in minor traffic delays to Y-12 workers, but no overall decrease in LOS or increased likelihood of on-site traffic accidents is expected.

TABLE 5.2.2–1.—*Annual Incident-Free Doses to Crew and Public and Accident Risk to Public Under Alternative 1B (No Action - Planning Basis Operations Alternative)*

Material Type	Incident-Free Doses (person-rem)				Accident Risk to Public* (person-rem)
	Crew	Offlink	Onlink	Stop	
Radioactive Materials	13.3	0.95	9.8	164.4	183.1
Radioactive Waste	1.4	0.08	0.9	11.3	11.3

*Probability weighted dose due to an accident.
Note: Offlink-Exposure of members of the public who reside adjacent to routes of travel, Onlink-Exposure of members of the public sharing the right-of-way.
Source: Appendix D based on SNL 1992.

Under the No Action - Planning Basis Operations Alternative, transportation activities for the shipment of materials, wastes, and chemicals are projected to be the same as described under the No Action - Status Quo Alternative based on expected operational levels. A detailed analysis of transportation activities is presented in Appendix A.6.

The calculated incident-free radiological doses to crew and public, and the accident risk (probability weighted dose due to an accident) to the public due to annual radiological shipments for Y-12 under Alternative 1B (No Action - Planning Basis Operations Alternative) are presented in Table 5.2.2–1. The impacts for the No Action - Planning Basis Operations Alternative in terms of incident-free LCFs, LCFs due to radiological accident risk, latent fatalities due to exposure to potential vehicle emissions, and traffic fatalities are presented in Table 5.2.2–2.

The risk due to radiation exposure during incident-free transportation of all waste to the Environmental Management Waste Management Facility is estimated to be 0.001 LCF for local truck transport. Risk from exposure to radiation materials that resulted from releases during a transportation accident is estimated to be 7.0×10^{-7} LCF for local truck transport. The risk of traffic fatalities due to a transportation accident is estimated to be 0.3 for local truck transport.

TABLE 5.2.2–2.—*Annual Transportation Impacts for Y-12 Operations Under Alternative 1B (No Action - Planning Basis Operations Alternative)*

Material Type	Latent Cancer Fatalities					Traffic Fatalities	LCFs due to vehicle emissions
	Incident-Free				Accident Risk		
	Crew	Offlink	Onlink	Stop			
Radioactive Materials	5.3×10^{-3}	4.8×10^{-4}	4.9×10^{-3}	0.082	0.092	0.150	4.8×10^{-3}
Radioactive Wastes	5.6×10^{-4}	4.0×10^{-5}	4.5×10^{-4}	5.7×10^{-3}	5.7×10^{-3}	0.017	4.0×10^{-4}
Nonradioactive Wastes & Chemicals	&	&	&	&	&	0.010	4.2×10^{-4}

Note: Offlink-Exposure of members of the public who reside adjacent to routes of travel, Onlink-Exposure of members of the public sharing the right-of-way.
Source: Appendix D based on SNL 1982.

5.2.3 Alternative 2 (No Action - Planning Basis Operations Plus HEU Storage Mission Alternatives)

Alternative 2A (No Action - Planning Basis Operations Plus Construct and Operate a New HEU Materials Facility)

Under this alternative, construction related impacts to local traffic could occur as the new HEU Materials Facility is being built. During peak construction, an estimated 220 workers would be needed for the new facility. Assuming the daily increase in worker traffic is 75 percent of the estimated peak construction workforce, approximately 165 additional vehicles per day are expected. An additional eight trucks per day during the peak construction phase would be anticipated from concrete and steel trucks. DOE expects these construction-related transportation impacts to be temporary, localized to the general construction area, and minor since most construction traffic would occur during off-peak traffic periods. Appropriate traffic control and coordination measures would be implemented during construction activities to minimize Field Research Center worker access impacts to the NABIR program activities at Y-12. The operation of the HEU Materials Facility Plus the No Action - Planning Basis Operations Alternative would potentially add an additional 34 vehicles per day on area roads. Appropriate measures would be implemented to minimize research worker access impacts to Field Research Center activities by any new Y-12 facility security requirement. There will be no additional worker traffic associated with the HEU Materials Facility operations because existing workforce would be used.

The existing inventory of stored HEU would be relocated to the new HEU Materials Facility or the Building 9215 Addition. There would be a one-time transportation risk associated with the relocation of the stored uranium to this new facility. It is anticipated that the relocation would be completed within one year and require an estimated 3,000 on-site truck trips using SSTs. The transportation impacts are based on the total relocation of the materials.

The incident-free radiological risk to the transport crew, based on the calculated dose of 8.7×10^{-2} person-rem, is estimated to be 3.5×10^{-5} LCF. The incident-free radiological risk to the Y-12 population including the handlers, based on the calculated dose of 0.14 person-rem, is estimated to be 7.0×10^{-4} LCF. The risk to the Y-12 population due to radiation release during an accident is estimated to be 7.5×10^{-5} LCF. The risk to the public due to traffic fatalities is calculated to be 1.3×10^{-4}.

After the transfer of the existing inventory of stored HEU material is complete, DOE expects that the routine shipment and receipt of various materials and waste would be comparable to that under Alternative 1B (No Action - Planning Basis Operations Alternative). Therefore, no appreciable change in transportation impacts from the No Action - Status Quo Alternative is expected.

Alternative 2B (No Action - Planning Basis Operations Plus Upgrade Expansion of Building 9215)

Under this alternative, construction related impacts to local traffic could occur as the Upgrade Expansion is being constructed. An estimated 220 workers would be required during peak construction for the Building 9215 expansion. Assuming the daily increase in worker traffic is 75 percent of the estimated peak construction workforce, approximately 165 additional vehicles per day are expected. An additional three trucks per day during the peak construction phase would be anticipated from concrete and steel trucks. Appropriate traffic control and coordination measures would be implemented during construction activities to minimize Field Research Center worker access impacts to the NABIR program activities at Y-12. DOE expects these construction-related transportation impacts to be temporary, localized to the general construction area, and not significant since most construction traffic would occur during off-peak traffic periods. The operation of the Upgrade Expansion to Building 9215 plus the No Action - Planning Basis Operations Alternative would potentially add an additional 34 vehicles per day on area roads. Appropriate measures would be implemented to minimize research worker access impacts to Field Research Center activities by any new Y-12 facility security requirement. There will be no additional worker traffic associated with the Upgrade Expansion of Building 9215 because existing workforce would be used. During operation of the upgraded facility, DOE expects that the routine shipment and receipt of various materials and waste would be comparable to that under the No Action - Status Quo Alternative. Therefore, no appreciable change in transportation impacts from the No Action - Status Quo Alternative is expected.

5.2.4 Alternative 3 (No Action - Planning Basis Operations Plus Special Materials Mission Alternative)

No Action - Planning Basis Operations Plus Construct and Operate a New Special Materials Complex

Under this alternative, short-term construction related impacts to local traffic impacts could occur as the new facilities are being built. An estimated 210 workers would be required during peak construction for the Special Materials Complex. Assuming the daily increase in worker traffic is 75 percent of the estimated peak construction workforce, approximately 157 additional vehicles per day are expected. An additional five trucks per day during the peak construction phase (lasting approximately 1 year) would be anticipated from concrete and steel trucks. Appropriate traffic control and coordination measures would be implemented during construction activities to minimize Field Research Center worker access impacts to the NABIR program activities at Y-12. The No Action - Planning Basis Operations Alternative combined with the operation of the Special Materials Complex would potentially add an additional 34 vehicles per day on area roads. Appropriate measures would be implemented to minimize research worker access impacts to Field Research Center activities by any new Y-12 facility security requirement. There will be no additional worker traffic associated with the Special Materials Complex because the existing workforce would be used. DOE expects these worker transportation impacts to be temporary, localized to the general construction area, and not significant since most construction traffic would occur during off-peak traffic periods. No change in area road LOS is expected.

5.2.5 Alternative 4 (No Action - Planning Basis Operations Plus HEU Materials Facility Plus Special Materials Complex)

Construction of the HEU Materials Facility and the Special Materials Complex when combined with the No Action - Planning Basis Operations Alternative would result in an additional 420 vehicles per day on area roads. This would represent approximately a 3 percent increase in traffic on East Bear Creek Road (if all traffic entered the Y-12 Site from that one road) and would not be expected to change the existing LOS C rating. DOE expects these worker and construction traffic impacts to be minor since most construction traffic would occur during off-peak traffic periods. Appropriate traffic control and coordination measures would be implemented during construction activities to minimize Field Research Center worker access impacts to the NABIR program activities at Y-12. There will be no additional operations worker traffic associated with the HEU Materials Facility and the Special Materials Complex because existing workforce would be used.

Operations traffic under this alternative would result in approximately 34 additional vehicles per day on area roads and would have no impact on the LOS of area roads. Appropriate measures would be implemented to minimize research worker access impacts to Field Research Center activities by any new Y-12 facility security requirement.

5.3 SOCIOECONOMICS

Socioeconomic impacts are addressed in terms of both direct and indirect impacts. Direct impacts are changes in Y-12 employment and expenditures expected to take place under each alternative and include both construction-phase and operation-phase impacts. Indirect impacts include the impacts to ROI businesses and employment resulting from changes in DOE purchase or nonpayroll expenditures, as well as the impacts to ROI businesses and employment that result from changes in payroll spending by affected Y-12 employees. The total economic impact to the ROI is the sum of direct and indirect impacts. Both the direct and indirect impacts are estimated for the ROI described in Section 4.3. The direct impacts estimated in the socioeconomic analysis are based on project summary data developed by DOE in cooperation with Y-12 contractors and their representatives. Direct employment impacts represent actual increases or decreases in Y-12 staffing; they do not include changes in staffing due to reassignment of the existing workforce at Y-12. Total employment and earnings impacts were estimated using Regional Input-Output Modeling System (RIMS II) multipliers developed specifically for the Y-12 ROI by the U.S. Bureau of Economic Analysis. These multipliers are based on national input-output tables developed by BEA and adjusted to reflect the regional industrial structure and trading patterns. These tables show the distribution of the inputs purchased and the outputs sold for each industry. Multipliers are used with information on initial changes in output, earnings, and employment associated with the proposed project to estimate the total impact of the project on regional output, earnings, and employment.

The importance of the actions and their impacts is determined relative to the context of the affected environment. Projected baseline conditions in the ROI, as presented in Section 4.3, Socioeconomics, provide the framework for analyzing the importance of potential socioeconomic impacts that could result from implementation of any of the new facility construction alternatives. Baseline employment and population represent socioeconomic conditions expected to exist in the ROI through 2025. Each HEU Storage Mission or Special Materials Mission alternative is expected to generate short-term increases in employment and income as a result of construction and longer-term decreases as a result of reductions in the Y-12 workforce.

5.3.1 Alternative 1A (No Action - Status Quo Alternative)

The ROI where more than 90 percent of the ORR workforce resides is a four-county area in Tennessee comprised of Anderson, Knox, Loudon, and Roane counties. In 1997, almost 40 percent of the ORR workforce resided in Knox County, 29 percent in Anderson County, 16 percent in Roane County, and 6 percent in Loudon County. The remaining 9 percent of the workforce resides in other counties across Tennessee, none of which is home to more than 3 percent of the workforce (DOE 1999f).

ROI employment grew from 231,822 in 1990 to 268,748 in 1995, and continued to grow totaling 269,466 in 1998. The ROI labor force totaled 278,866 in 1998. The ROI unemployment rate was 3.4 percent in 1998. The unemployment rate in Tennessee was 4.2 percent in 1998 (BLS 1999). Per capita income in the ROI was $23,520 in 1997, while the per capita income in Tennessee was $22,699 (BEA 1999). Y-12 employs approximately 8,900 workers, including DOE employees and contractors. As a whole, DOE employees and contractors number more than 13,700 in Tennessee, primarily in the ROI.

Between 1990 and 1998, ROI population growth increased 1.1 percent annually while the state population increased 1.4 percent annually. Population in all counties in the ROI is projected to continue to grow at a somewhat slower rate between 1998 and 2020. Knox County is the largest county in the ROI with a 1998 population of 366,846. Loudon County is the smallest county in the ROI with a total population of 39,052.

There would be no change in the regional economic characteristics or the population of the ROI over the 10-year planning period under Alternative 1A (No Action - Status Quo Alternative).

5.3.2 Alternative 1B (No Action - Planning Basis Operations Alternative)

Under this alternative, there would be no substantial change in the 8,900 person Y-12 Site workforce to resume uranium operations and other stand-down operations at Y-12. Therefore, there would be no change in the No Action - Status Quo Alternative regional economic characteristics or the population of the ROI.

Potential socioeconomic impacts from the Environmental Management Waste Management Facility and the Field Research Center included under Alternative 1B (No Action - Planning Basis Operations Alternative) are described below.

The socioeconomic impacts associated with the workforce required for construction, operation, and closure of the Environmental Management Waste Management Facility would not adversely affect nor would it benefit the region's economic conditions. The workforce would vary with project phases. For the high-end waste volume scenario, an average of about 75 workers per year would be needed during construction, peaking at 100 workers in FY 2000-2001. This peak, projected to occur during Phase II construction of the cell with Phase I still in operation, represents an increase of less than 1 percent of the current total ORR workforce. This workforce would likely be drawn from the local labor market, resulting in minimal influx of workers to the area. The 25 workers estimated to be needed for operation of the on-site disposal facility would also likely be drawn from the local workforce.

The workforce for the Field Research Center is anticipated to be small: a construction workforce of up to ten and a staff of up to six individuals during operations, some of whom would be part-time employees of the Field Research Center. Researchers from ORNL, other national laboratories, universities, and other research institutions would visit the Field Research Center to conduct experiments and collect samples. The numbers of visitors at any one time would be small, but could be as many as 24 on occasion. Visiting staff and scientists would contribute in a beneficial manner to the local economy by staying in local hotels and using local services. There would be no negative impact to the socioeconomics of the Oak Ridge area as a result of ORNL Field Research Center activities.

5.3.3 Alternative 2 (No Action - Planning Basis Operations Plus HEU Storage Mission Alternative)

Alternative 2A (No Action - Planning Basis Operations Plus Construct and Operate a New HEU Materials Facility)

For the construction of the HEU Materials Facility at Site A or Site B construction activities would require approximately 220 workers (see Table 3.2.3–1), generating a total of 460 jobs (220 direct and 240 indirect) in the ROI during the peak year of construction, an increase of 0.1 percent in ROI employment. This would increase total ROI income by approximately $12 million, approximately 0.2 percent of ROI income. These changes would be temporary, lasting only the duration of the 4-year construction period. The existing ROI labor force could likely fill all of the jobs generated by the increased employment and expenditures. Therefore, there would be no impacts to the ROI's population or housing sector. Because there would be no change in the ROI population, there would be no change to the level of community services provided in the ROI.

Operation of the HEU Materials Facility at any of the sites would not result in any change in workforce requirements. As shown in Table 3.2.3–2, the facility would require a workforce of 100 during the first year transition period and approximately 30 for normal operation at Sites A or B. The additional workers in the first year (e.g, 70 workers) would be primarily security forces related to the movement of the material. The facility would be staffed by the existing Y-12 workforce. Therefore, there would be no change from baseline Y-12 Site employment and no impacts to ROI employment, income, or population.

The No Action - Planning Basis Operations Alternative plus the construction of a new HEU Materials Facility would require a total of approximately 330 construction workers. A total of 690 jobs (330 direct and 360 indirect) would be generated. This would increase No Action - Status Quo Alternative ROI employment by approximately 0.2 percent. Total No Action - Status Quo Alternative ROI income would increase by approximately $17.8 million, or 0.1 percent.

The new HEU Materials Facility would be operated by the existing Y-12 workforce. Therefore, the only impacts during operation would be from the No Action - Status Quo Alternative, as discussed in Section 5.3.2.

Alternative 2B (No Action - Planning Basis Operations Plus Upgrade Expansion of Building 9215)

Impacts from construction-related activities for the Upgrade Expansion of Building 9215 would be the same as for Alternative 2A (No Action - Planning Basis Operations Plus Construct and Operate a New HEU Materials Facility).

As shown in Table 3.2.3–4, operation of the facility would require a workforce of 100 for the first year transition period and 49 for normal operations. The facility would be staffed by the existing Y-12 workforce. Therefore, there would be no change from No Action - Planning Basis Operations Y-12 Site employment and no impacts to ROI employment, income, or population.

Because construction and operations employment requirements for the Upgrade Expansion of Building 9215 would be similar to the requirements to construct and operate a new HEU Materials Facility, the impacts from the Upgrade Expansion of Building 9215 plus the No Action - Planning Basis Operations would be similar to the impacts from the construction and operation of a new HEU Materials Facility plus the No Action - Planning Basis Operations Alternative.

5.3.4 Alternative 3 (No Action - Planning Basis Operations Plus Special Materials Mission Alternative)

No Action - Planning Basis Operations Plus Construct and Operate a New Special Materials Complex

Construction of the Special Materials Complex at Site 1, Site 2, or Site 3 would require 210 workers at the peak of construction (see Table 3.2.4–1), generating a total of 440 jobs (210 direct and 230 indirect) in the ROI, an increase of 0.1 percent in current ROI employment. This would increase total ROI income by approximately $12 million, approximately 0.2 percent of ROI income. These changes would be temporary, lasting only the duration of the 3.5-year construction period. The existing ROI labor force could fill all of the jobs generated by the increased employment and expenditures. Therefore, there would be no impacts to the ROI’s population or housing sector. Because there would be no change in the ROI population, there would be no change to the level of community services provided in the ROI.

Operations of the Special Materials Complex at the sites would not result in any change in workforce requirements. As shown in Table 3.2.4–2, the facilities would require a workforce of 36 for normal operations. The facilities would be staffed by the existing Y-12 workforce. Therefore, there would be no change from the No Action - Status Quo Alternative Y-12 Site employment and no impacts to ROI employment, income, or population.

The No Action - Planning Basis Operations plus the construction of a new Special Materials Complex would result in a total of approximately 320 construction workers. A total of 670 jobs (320 direct and 350 indirect) would be generated. This would increase ROI employment by approximately 0.2 percent. Total No Action - Status Quo ROI income would increase by approximately $17.2 million, or 0.1 percent.

The new Special Materials Complex would be operated by the existing Y-12 workforce. Therefore, the only impacts during operation would be from the No Action - Planning Basis Operations activities, as discussed in Section 5.3.2.

5.3.5 Alternative 4 (No Action - Planning Basis Operations Plus HEU Materials Facility Plus Special Materials Complex)

The construction periods of the HEU Materials Facility and the Special Materials Complex could overlap with the construction activities included under the No Action - Planning Basis Operations. In that case, there would be a greater construction workforce at Y-12 at one time, resulting in a greater increase in ROI employment, and income in any one year. The peak construction employment could reach approximately 540 direct employees, generating a total of 1,130 jobs (540 direct and 590 indirect). This would be an increase of approximately 0.4 percent in No Action - Status Quo Alternative ROI employment and would result in an increase in ROI income of almost $30 million, or 0.2 percent. These changes would be temporary, lasting only the duration of the construction period. The existing ROI labor force could likely fill all of the jobs generated by the increased employment and expenditures. Therefore there would be no impacts to the ROI's population or housing sector. Because there would be no change in the ROI population, there would be no change to the level of community services provided in the ROI.

Because both the HEU Materials Facility and the Special Materials Complex would be staffed by the existing Y-12 workforce during operations, there would be no change from the No Action - Status Quo Alternative Y-12 workforce and no impacts to ROI employment, income, or population.

5.4 GEOLOGY AND SOILS

The geology and soils analysis considers a ROI which includes the Y-12 area of analysis as well as the rest of the ORR. Impacts to these resource areas were determined by assessing potential changes in existing geology and soils that could result from construction activities and operations under each of the alternatives.

5.4.1 Alternative 1A (No Action - Status Quo Alternative)

Y-12 is located within Bear Creek Valley, which is underlain by Middle to Late Cambrian strata of the Conestoga Group. The Conestoga Group consists primarily of highly fractured and jointed shale, siltstone, calcareous siltstone, and limestone in the Site area. The bedrock at the Y-12 Site is adequate to support structures using standard construction techniques. Bedrock in the Y-12 area is overlain by alluvium, colluvium, man-made fill, fine-grained residuum from the weathering of the bedrock, saprolite, and weathered bedrock. The overall thickness of these materials in the Y-12 area is typically less than 12 m (40 ft).

Bear Creek Valley lies on well to moderately-well-drained soils underlain by shale, siltstone, and silty limestone. Y-12 lies on soils of the Armuchee-Montevallo-Hamblen, the Fullerton-Claiborne-Bodine, and the Lewhew-Armuchee-Muskinghum associations. Soil erosion due to past land use has ranged from slight to severe. Wind erosion is slight and shrink-swell potential is low to moderate. The soils at the Y-12 Site are generally stable and acceptable for standard construction techniques. Because no new construction or land disturbing activities are expected under the No Action - Status Quo Alternative no impacts to soils and geology are anticipated.

The Oak Ridge area lies at the boundary between seismic Zones 1 and 2 of the Uniform Building Code, indicating that minor to moderate damage could typically be expected from an earthquake. Y-12 is cut by many inactive faults formed during the late Paleozoic Era (DOE 1996e). There is no evidence of capable faults in the immediate area of Oak Ridge, (surface movement within the past 35,000 years or movement of a recurring nature within the past 500,000 years) as defined by the NRC's "Reactor Site Criteria" (10 CFR 100). The nearest capable faults are approximately 480 km (300 mi) west of the ORR in the New Madrid Fault zone. No change in seismic related impacts are expected.

5.4.2 Alternative 1B (No Action - Planning Basis Operations Alternative)

Under the No Action - Planning Basis Operations Alternative, activities associated with DP, NE, NN, Work-for-Others Program, or Technology Transfer would not discernibly affect local short-term or long-term geologic or soil resources. No new construction or land disturbing activities are expected during the 10-year planning period for these missions. On-going Environmental Remediation activities would employ best management practices. All soil disturbing activities would be performed in accordance with RCRA and CERCLA regulations, and project plans/procedures.

Construction and operation of the Environmental Management Waste Management Facility at Y-12 could result in minimal local short-term soil impacts. Since the site where the Environmental Management Waste Management Facility would be constructed is within an existing waste management/industrial area, no adverse geologic impacts are expected.

As discussed in Section 3.2.2.2, construction and operation of the new disposal facility would require clearing land within the Research Park and the Y-12 West End Borrow Area. Construction, operation, and support activities could lead to a possible temporary increase in erosion as a result of stormwater runoff and wind action.

Impacts to geologic or soil resources from the Field Research Center component of the NABIR Program at Y-12 are expected to be minor. Soils within the project contamination area are previously disturbed and, therefore, impacts to soils would be minimal. Activities would disturb these soils only in areas where drilling, boring, or well installation would occur. Additional contamination would be minimal with current waste management procedures.

5.4.3 Alternative 2 (No Action - Planning Basis Operations Plus HEU Storage Mission Alternatives)

Alternatives 2A and 2B (No Action - Planning Basis Operations Plus Construct and Operate a New HEU Materials Facility or Upgrade Expansion of Building 9215)

Construction and operation of a new HEU Materials Facility at Site A, Site B, or the Upgrade Expansion of Building 9215 would have no impact on geological resources, and the hazards posed by geological conditions are expected to be minor.

Slopes and underlying foundation materials are generally stable at Y-12. Landslides or other nontectonic events are unlikely to affect Site A, Site B, or the expansion site for Building 9215. Sinkholes are present in the Knox Dolomite, but it is unlikely that they would impact the project, as the Knox Dolomite is not present in the Y-12 site area.

Based on the seismic history of the area, a moderate seismic risk exists at Y-12. This should not impact the construction and operation of the HEU Materials Facility at either Site A, Site B, or the expansion site for Building 9215. The foundation soils are not susceptible to liquefaction during or after seismic events. All new facilities and building expansions would be designed to withstand the maximum expected earthquake-generated ground acceleration in accordance with DOE Order 420.1, *Facility Safety*, and accompanying safety guidelines.

During construction activities, excavation of spoil, limestone, and shale bedrock would occur. There is sufficient capacity to either stockpile these materials or dispose of them during the construction at Site A, Site B, or the expansion site for Building 9215. Soil disturbance from new construction would occur at building, parking, and construction lay-down areas, and lead to a possible temporary increase in erosion as a result of storm water runoff and wind action. Soil loss would depend on the frequency of storms; wind velocities; size and location of the facilities with respect to drainage and wind patterns; slopes, shape, and area of ground disturbance; and the duration of time the soil is bare. A small volume of spoil, limestone, and shale bedrock may be excavated during the construction process. However, this material could be stockpiled for use as fill.

Existing soil contamination found in the Site B project area is due to past waste handling practices. The contamination includes volatile organic compounds (VOCs), metals, and radionuclides from nearby former S-3 Ponds and the Y-12 Scrap Metal Yard (DOE 1998b). The potential for additional soil contamination from project activities at Site A, Site B, or Building 9215 would be minimized by current waste management procedures. These procedures are based on current Federal, state, and local regulations that regulate the hazardous material releases that could impact soil resources. In addition, the potential for soil contamination during the movement of HEU from existing Y-12 storage facilities to a new facility would be minimal due to required safe transportation and packaging practices.

5.4.4 Alternative 3 (No Action - Planning Basis Operations Plus Special Materials Mission Alternative)

No Action - Planning Basis Operations Plus Construct and Operate a New Special Materials Complex

Construction and operation of a new Special Materials Complex would have no impact on geological resources; hazards posed by geological conditions are expected to be minimal. Site 1 is an undisturbed area and impacts to soil resources would be greater in this area. Soil disturbance at Site 1 from new construction would alter the soil profile. Sites 2 and 3 are previously disturbed areas and the impacts to soils from construction would be minimal.

Slopes and underlying foundation materials are generally stable at Y-12. Landslides or other nontectonic events are unlikely to affect Site 1, 2, or 3. Sinkholes are present in the Knox Dolomite, but it is unlikely that they would impact the project, as the Knox Dolomite is not present in the Y-12 Site area.

Based on the seismic history of the area, a moderate seismic risk exists at Y-12. This should not impact the construction and operation of the Special Materials Complex at either Site 1, 2, or 3. The foundation soils are not susceptible to liquefaction. All new facilities and building expansions would be designed to withstand the maximum expected earthquake-generated ground acceleration in accordance with DOE Order 420.1, *Facility Safety*, and accompanying safety guidelines.

During construction activities, excavation of spoil, limestone, and shale bedrock would occur. There is sufficient capacity to either stockpile these materials or dispose of them during construction at Site 1, 2, or 3. Soil disturbance from new construction would occur at construction lay-down areas, altering the soil profile, and leading to possible temporary erosion as a result of stormwater runoff and wind action. Initial soil disturbance will also occur at Site 1 altering the soil profile and leading to possible temporary increase in erosion. Soil loss would depend on the frequency of storms; wind velocities; size and location of the facilities with respect to drainage and wind patterns; slopes, shape, and area of ground disturbance; and the duration of time the soil is bare.

The potential for soil contamination from the project activities at Site 1, 2, or 3 would be minimal under current waste management procedures. These procedures are based on current Federal, state, and local regulations that regulate hazardous material releases that could impact soil resources.

5.4.5 Alternative 4 (No Action - Planning Basis Operations Plus HEU Materials Facility Plus Special Materials Complex)

Construction of the HEU Materials Facility and the Special Materials Complex, when combined with the No Action - Planning Basis Operations, would have minimal impact on geological resources; the hazards posed by geological conditions are expected to be minor.

Based on the seismic history of the area, a moderate seismic risk exists at Y-12. This should not hinder the construction and operation of the proposed new facilities (i.e., the HEU Materials Facility and the Special Materials Complex). All new facilities and building expansions would be designed to withstand the maximum expected earthquake-generated ground acceleration in accordance with DOE Order 420.1, *Facility Safety*, and accompanying safety guidelines.

During construction activities, there is sufficient capacity to either stockpile the materials excavated or dispose of them. Soil disturbance from new construction would occur at building, parking or construction lay-down areas, and lead to possible temporary increase in erosion as a result of stormwater runoff and wind action. Soil loss would depend on the frequency of storms; wind velocities; size and location of the facilities with respect to drainage and wind patterns; slopes, shape, and area of ground disturbance; and the duration of time the soil is bare.

Soils within the proposed project areas, with the exception of Site 1, are previously disturbed, and therefore, impacts to soils would be minimal. The potential for additional soil contamination from the project activities would be minimal under current waste management procedures. These procedures are based on current Federal, state, and local regulations that regulate the hazardous material releases that could impact soil resources.

5.4.6 Mitigation

Potential impacts to soil resources would be minimized by the design features and the buffer provided by the restricted area around the new Environmental Management Waste Management Facility. Best management practices would include sufficient controls of surface water drainage during construction and cell operation to minimize soil erosion. Following closure, much of the disturbed area would gradually return to its natural state. Any contaminated sediment soils collected in storm drainage basins would be disposed of in accordance with site-specific management plans.

5.5 HYDROLOGY

Potential impacts to surface water for each alternative include:

- Changes in surface water quality due to runoff or contamination releases from specific land areas
- Stormwater control measures
- Water requirements for construction and operation of proposed projects compared with the capacity of the existing water supply resource (Clinch River) and the capacity of the water supply system

Impacts to groundwater conditions include:

- Pathways through which groundwater contamination could occur
- The types and levels of existing groundwater contamination

A qualitative assessment of water quality impacts from wastewater (sanitary and process), stormwater runoff, and soil erosion is identified and described in the following sections. Proposed candidate sites for new facilities are compared with the 500-yr floodplain (see Figure 4.5.1-2).

5.5.1 Surface Hydrology

5.5.1.1 *Alternative 1A (No Action - Status Quo Alternative)*

Y-12 Surface Drainage Systems. The major surface water body in the immediate vicinity of the ORR, the Clinch River, borders the Site to the south and west. Within the Y-12 area the two major surface water drainage basins are those of Bear Creek and East Fork Poplar Creek (EFPC). The upper reaches of EFPC drain the majority of the industrial facilities of Y-12. The in-plant portion of EFPC has been designated as Upper East Fork Poplar Creek (UEFPC). The natural drainage pattern of the UEFPC has been radically altered by the construction of Y-12. Portions of Y-12 lie within the 100- and 500-year floodplains of EFCP; however, proposed alternative facilities are located outside the 500-year floodplain (see Figure 4.5.1-2).

As a result of reduced operations and elimination of inadvertent direct discharges of contaminated water to UEFPC, flow in UEFPC decreased from 38 to 57 MLD (10 to 15 MGD) in the mid-1980s to about 9 MLD (2.5 MGD) in the mid-1990s. Since mid-1996, water has been added to the western portion of the open channel in order to maintain flow of 26 MLD (7 MGD) at Station 17. Raw water usage has still remained well within historic water use levels and well below Y-12 capacity. No change in the UEFPC water flow from current levels is expected during the 10-year planning period under the No Action - Status Quo Alternative. Therefore, no change in UEFPC impacts is expected.

Bear Creek Valley west of Y-12 is drained by Bear Creek. Bear Creek flow is maintained by inputs from tributary streams flowing in from the north (mostly) from Pine Ridge. The channel of Bear Creek is less modified that of UEFPC, but several short reaches have been relocated to accommodate construction (e.g., Bear Creek Road) at the west end of Y-12. No change in Bear Creek Valley surface water flows is expected.

The Clinch River and connected waterways supply all raw water for the ORR and provide potable water for Y-12. Y-12 uses approximately 5,822 MLY (1,538 MGY) of water. The ORR water supply system, which includes the city of Oak Ridge treatment facility and the ETTP treatment facility, has a capacity of 44,347 MLY (1,716 MGY). No impacts to Clinch River water resources is expected during the 10-year planning period under the No Action - Status Quo Alternative.

The streams and creeks of Tennessee are classified by TDEC and defined in the State of Tennessee Water Quality Standards. The Clinch River is the only surface water body on ORR classified for domestic water supply. Most of the streams at ORR are classified for fish and aquatic life, livestock watering, wildlife, and recreation. At Y-12, there are six treatment facilities with NPDES-permitted discharge points to UEFPC. The current Y-12 NPDES permit, issued on April 28, 1995, and effective on July 1, 1995, requires sampling, analysis, and reporting at approximately 95 outfalls. Discharges to surface water allowed under the permit include storm drainage, cooling water, cooling tower blowdown, and treated process wastewaters, including effluents from wastewater treatment facilities. The effluent limitations contained in the permit are based on the protection of water quality in the receiving streams. Y-12 is also permitted to discharge wastewater to the city of Oak Ridge Wastewater Treatment Facility. The water quality of surface streams in the vicinity of Y-12 is affected by current and past operations. No additional adverse impacts to surface water quality are expected under the No Action - Status Quo Alternative.

5.5.1.2 *Alternative 1B (No Action - Planning Basis Operations Alternative)*

The source of water for activities at Y-12 is the Clinch River. Under Alternative 1B (No Action - Planning Basis Operations Alternative), surface water usage at Y-12 would increase slightly from the No Action - Status Quo Alternative (15.9 MLD to 20.2 MLD [4.2 MGD to 5.3 MGD]) due to the resumption of enriched uranium operations and other stand-down operations. This would represent a 25 percent increase in treated water use. Infrastructure maintenance and repairs planned as part of normal Y-12 activities would continue. Other programs, particularly the Environmental Restoration Program, would continue to address surface water contamination sources and, over time, improve the quality of water in both UEFPC and Bear Creek, the two surface waterbodies most directly impacted by activities at Y-12.

The new Environmental Management Waste Management Facility in eastern Bear Creek Valley is included under the No Action - Planning Basis Operations Alternative. The selection of a preferred site and evaluation of the environmental impact have been presented in the *Record of Decision for the Disposal of Oak Ridge Reservation Comprehensive Environmental Response, Compensation, and Liability Act of 1980 Waste, Oak Ridge, Tennessee* (DOE 1999j). Potential short-term impacts to surface water resources could result from sediment loading to surface waterbodies or migration of contaminants. Land clearing and construction activities would expose varying areas depending on the ultimate size of the facility. Best management practices, including standard erosion controls such as siltation fences and buffer zones of natural riparian vegetation, during construction activities would minimize the potential impacts to surface water resources. Vegetation preserved in the riparian zone (adjacent to tributaries) would serve as a filter strip for eroded soil, help prevent stream banks from eroding or slumping, and moderate water temperatures through shading. Grass would be planted in cleared areas to minimize the time that soils are exposed, stabilize the soil, and control erosion. Some impacts to surface water would be expected. Tributary NT-4 would be rerouted and partially eliminated during construction at the East Bear Creek Valley Site. Construction and rerouting of NT-4 would impact some areas of wetland (approximately 0.4 ha [1 acre]) which will be mitigated as part of a wetlands mitigation plan for all CERCLA activities in Bear Creek Valley (DOE 1999j).

Sediment detention basins would control surface water runoff from uncontaminated areas of the waste cell. These basins would prevent increased sediment discharge to the streams and even out discharge during storms. A perimeter ditch would be constructed around the waste cell to prevent surface run-on and direct the water to the sediment basins before release to local streams.

Potentially contaminated runoff from the disposal cell, water used for decontamination, water from the leachate detection/collection system, and other wastewater would be collected in storage tanks. This water would be sampled and transported to an appropriate treatment facility, as required. The potential for impact to surface water resources from the migration of contaminants from the disposal cell in groundwater would be exceedingly low because of engineered and active controls. Little or no overall short-term impacts to surface water resources would be expected with the exception of direct impacts to any water course or wetlands displaced or eliminated by construction.

The new disposal cell would be designed, constructed and maintained to prevent releases that could adversely affect surface water quality in the long term. After the period of active institutional controls, erosion of the cell could eventually expose waste, resulting in release to surface water; however, the cell is designed to resist erosion with minimal maintenance, and only extensive erosion would breach containment. Contaminant releases to groundwater from leachate migrating from the cell are unlikely but could also eventually impact surface water quality.

The No Action - Planning Basis Operations Alternative also includes activities of the Field Research Center at the Y-12 Site. The Field Research Center includes use of an area of contaminated groundwater near the headwaters of Bear Creek Valley (in the vicinity of the former S-3 Ponds). Activities of the Field Research Center include small area studies in support of developing in-situ groundwater remediation technologies. As part of these studies, minor ground-surface disturbances may occur such that surface runoff to Bear Creek would be controlled by standard construction practices (e.g., silt fencing). This is particularly important in the headwaters of Bear Creek Valley where near surface soils often contain contaminants (DOE 1997a).

The primary activities of the Field Research Center at Y-12 comprise subsurface injections of possible treatment additives into the groundwater at the contaminated area. Additives may include small quantities of nontoxic tracers, nutrients, electron donors (e.g., glucose, acetate, molasses) or acceptors (e.g., oxygen, sulfate), and microorganisms. Although only small volume injections are planned, it is possible that the groundwater additives might pass through the subsurface and reach the surface waters of Bear Creek. However, previous experiences with larger tracer injections near Bear Creek (DOE 1997a, LMER 1999c) and close monitoring of environmental conditions at the contaminated area suggest that the impacts to surface waters are predictable and would be minor.

5.5.1.3 *Alternative 2 (No Action - Planning Basis Operations Plus HEU Storage Mission Alternatives)*

Alternatives 2A and 2B (No Action - Planning Basis Operations Plus Construct and Operate a New HEU Materials Facility or Upgrade Expansion of Building 9215)

Y-12 surface water withdrawals and discharges would not increase substantially during construction of the HEU Materials Facility whether at construction Sites A or B or during Upgrade Expansion of Building 9215.

Construction water requirements are very small and would not raise the average daily water use for Y-12. During construction, stormwater control and erosion control measures would be implemented to minimize soil erosion and transport to UEFPC. Neither of the proposed construction sites (Sites A or B) or the Upgrade Expansion Site (Building 9215) is located within either the 100-year or 500-year floodplains.

HEU storage operations, whether located in a new HEU Materials Facility or in the upgraded/expanded Building 9215, would require an estimated 550,000 L to 720,000 L (146,000 GPY to 190,000 GPY), a small percentage of the No Action - Status Quo Alternative Y-12 water usage of approximately 5,822 MLY (1,538 MGY).

The No Action - Planning Basis Operations Alternative plus the operation of the HEU Materials Facility or the Upgrade Expansion of Building 9215 would increase water use requirements by approximately 140 MLY (37 MGY) from the 5,822 MLY (1,538 MGY) water use under No Action - Status Quo. This represents an increase of approximately 2.5 percent. Sufficient excess water capacity exists to accommodate the additional 140 MLY (37 MGY). No adverse impacts to surface water resources or surface water quality are expected because all discharges would be maintained to comply with NPDES permit limits.

5.5.1.4 *Alternative 3 (No Action - Planning Basis Operations Plus Special Materials Mission Alternative)*

No Action - Planning Basis Operations Plus Construct and Operate a New Special Materials Complex

Surface water withdrawals and discharges would not increase substantially during construction of the Special Materials Complex. Construction water requirements are very small and would not raise the average daily water use for Y-12. During construction, stormwater control and erosion control measures would be implemented to minimize soil erosion and transport to surface water (UEFPC). None of the proposed sites (Sites 1, 2, or 3) are located within either the 100-year or 500-year floodplains (see Figure 4.5.1-2).

Operations of the Special Materials Complex would require an estimated 59 MLY (15.5 MGY) (approximately 53 MLY [14 MGY] for cooling tower make-up water and 6 MLY [1.5 MGY] for processes). This would be approximately 1 percent of No Action - Status Quo Y-12 Site water usage of 5,822 MLY (1,538 MGY). This water use would potentially be offset by the vacating of operations in existing special materials operations facilities. No adverse impacts to surface water or surface water quality are expected because all discharges would be monitored to comply with the NPDES permit limits.

The No Action - Planning Basis Operations Alternative plus the operation of the Special Materials Complex would increase water use requirements by approximately 197 MLY (52 MGY) from the 5,822 MLY (1,538 MGY) water use under No Action - Status Quo. This represents an increase of approximately 3.5 percent. Sufficient excess water capacity exists to accommodate the additional 197 MLY (52 MGY). No adverse impacts to surface water resources or surface water quality are expected because all discharges would be monitored to comply with NPDES permit limits.

5.5.1.5 *Alternative 4 (No Action - Planning Basis Operations Plus HEU Materials Facility Plus Special Materials Complex)*

Under the alternative, surface water withdrawals and discharges for operations would increase slightly. Water requirements would increase by approximately 197 MLY (52 MGY) from the 5,822 MLY (1,538 MGY) water usage under the No Action - Status Quo Alternative. This represents an increase of 3.5 percent. Historical water used by Y-12 has been on high or 8,328 MLY (2,200 MGY). Sufficient excess water capacity exists to accommodate the additional 197 MLY (52 MGY) increase. No adverse impacts to surface water or surface water quality are expected because all discharges would be maintained to comply with the NPDES permit limits.

5.5.2 Groundwater

5.5.2.1 *Alternative 1A (No Action - Status Quo Alternative)*

Y-12, bound on the north by Pine Ridge and on the south by Chestnut Ridge, is located near the boundary between the Knox Aquifer and the ORR Aquitards. ORR Aquitards underlie Pine Ridge and Bear Creek Valley, which contains the main Site area of Y-12 and the disposal facilities of western Bear Creek Valley.

Groundwater at Y-12 has been divided into three hydro geologic regimes: UEFPC, Bear Creek, and Chestnut Ridge. A surface water divide at the west end of Y-12 effectively separates the UEFPC and Bear Creek hydro geologic regimes with groundwater flow directions generally to the west in the Bear Creek regime and toward the east in the UEFPC regime.

In Bear Creek Valley, depth to groundwater is generally 6 to 9 m (20 to 30 ft) but is as little as 2 m (7 ft) in the area of Bear Creek near Highway 95. On Chestnut Ridge, the depth to the water table is greatest (greater than 30 m [100 ft] below ground surface) along the crest of the ridge, which is a groundwater flow divide and recharge area. Recharge occurs over most of the area but is most effective where over burden soils are thin or permeable. Although most active groundwater flow occurs at a depth less than 30 m (100 ft) below ground surface, contaminants in groundwater more than 61 m (200 ft) below ground surface in the Aquitard indicate permeable flowpaths at depth. In the main site area of Y-12, the surface water drainage system has been drastically altered by construction.

There are no Class I sole-source aquifers that lie beneath ORR. Because of the abundance of surface water and its proximity to the points of use, very little groundwater is used at ORR. No change in groundwater use is expected during the 10-year planning period under the No Action - Status Quo Alternative.

Groundwater in Bear Creek Valley west of Y-12 has been contaminated by hazardous chemicals and radionuclides (mostly uranium) from past weapons production waste disposal activities (DOE 1997a). The contaminant sources include past waste disposal facilities sited on Aquitard bedrock north of Bear Creek. Former disposal facilities include the S-3 Ponds, the Oil Land farm, the Boneyard/Burnyard Site, and the Bear Creek Burial Grounds, all closed since 1988.

Historical monitoring of groundwater in the UEFPC Y-12 area has been used to define an area of contamination that extends throughout Y-12 and east into Union Valley. The groundwater contamination is the result of a commingling of releases from multiple sources within Y-12. The most widespread contaminant types are VOCs, such as solvents PCE, TCE, DCE, carbon tetrachloride, and chloroform; and fuel components such as benzene, toluene, ethylbenzene, and xylenes. Other groundwater contaminants include nitrate, gross alpha activity (primarily uranium isotopes), gross beta activity (primarily uranium isotopes and ^{99}Tc). The most frequently detected metals are boron, beryllium, cobalt, copper, chromium, lead, lithium, mercury, manganese, nickel, and total uranium (DOE 1998b).

The Chestnut Ridge hydrogeologic area is dominated by several closed and operating disposal facilities including the closed Chestnut Ridge Security Pits, Chestnut Ridge Sediment Disposal Basin, United Nuclear Corporation Site, and five nonhazardous waste landfills. Groundwater monitoring data collected since the mid-1980s indicate limited groundwater contamination. Contaminants consist primarily of VOCs detected in scattered watering wells.

No change in groundwater impacts are expected during the 10-year planning period for Alternative 1A (No Action - Status Quo Alternative), because of discharge compliance measures and on-going remediation and monitoring.

5.5.2.2 *Alternative 1B (No Action - Planning Basis Operations Alternative)*

Under this alternative, all water would be taken from the Clinch River, with no plans for withdrawal from groundwater resources. All process, utility, and sanitary wastewater would be treated prior to discharge into UEFPC in accordance with NPDES permits. Minimal impact to groundwater quality is expected from Y-12 Site mission activities, except as noted below.

As described in Section 5.5.1, the Environmental Management Waste Management Facility in eastern Bear Creek Valley is included in the No Action - Planning Basis Operations Alternative (see Section 3.2.1.2 for a description of the new facility). The selection of a preferred site and evaluation of the environmental impact has been presented in the *Record of Decision for the Disposal of Oak Ridge Reservation Comprehensive Environmental Response, Compensation, and Liability Act of 1980 Waste, Oak Ridge, Tennessee* (DOE 1999j). The engineered disposal cell is the key element of the Environmental Management Waste Management Facility. The disposal cell would be designed to comply with requirements for disposal of RCRA-hazardous waste and low level radioactive waste. The cell design includes a multi-layer basal liner with a double leachate collection/detection system to isolate the waste from groundwater and a multi-layer cap to reduce infiltration and subsequent leachate production. The cell design also includes a clay-fill geologic buffer up to 3-m (10-ft) thick below the basal liner to provide added groundwater protection. Groundwater monitoring would begin during construction activities to establish a baseline database for comparison with post-operational monitoring data.

Groundwater resources could be degraded by contaminant releases during construction and operation of the surface or disposal cell that migrate to groundwater. Contaminant sources include construction materials (e.g., concrete and asphalt), spills of oil and diesel fuel, releases from transportation or waste handling accidents, and accidental releases of leachate from the disposal cell. Compliance with an approved erosion and sedimentation control plan and a spill prevention, control, and countermeasures plan would mitigate potential impacts from surface spills. Engineered controls and active controls, including the leachate collection system, would drastically reduce the potential for impact to groundwater resources that could result from contaminant migration from the disposal cell. Construction and operation of the disposal cell would result in few or no overall short-term impacts to groundwater resources.

In the long-term, the design, construction, and maintenance of the new disposal facility would prevent or minimize contaminant releases to groundwater. These control elements would include a multi-layer cap to minimize infiltration, synthetic and clay barriers in the cell liner, a geologic buffer, and institutional controls that would include monitoring and groundwater use restrictions. If releases were detected during the period of active institutional controls, mitigative measures would be implemented to protect human health and the environment. Long-term impacts to groundwater quality resulting from the disposal cell are expected to be insignificant.

As described in Section 5.5.1, research activities of the Field Research Center at the Y-12 Site would focus on injections of additives to the groundwater at both the background and contaminated areas. The intent of the research activities is to evaluate in-situ remediation methods. Although the additives would modify the chemistry of the groundwater in the immediate study area, injections of additives would be so small that impacts would be limited to the immediate study areas. Previous experience with larger tracer studies in Bear Creek Valley suggests that the impacted area of the injections can be predicted.

Groundwater would be extracted in the Field Research Center contaminated area at Y-12 as part of characterization-related hydraulic tests. However, groundwater extractions associated with major hydraulic tests would collect no more than 76,000 L (20,000 gal) of groundwater per year (DOE 2000b). Sampling activities in years with no major hydraulic testing would collect no more than 7,600 L (2,000 gal) of groundwater. All extracted groundwater would be collected and treated in on-site facilities prior to surface water discharge to meet existing NPDES permit limits.

5.5.2.3 *Alternative 2 (No Action - Planning Basis Operations Plus HEU Storage Mission Alternatives)*

Alternatives 2A and 2B (No Action - Planning Basis Operations Plus Construct and Operate a New HEU Materials Facility or Upgrade Expansion of Building 9215)

All water for construction and operation of the HEU Materials Facility would be taken from the Clinch River as part of the normal water uses at Y-12. Some groundwater may be extracted during construction activities at either construction site (Sites A or B) or during the Upgrade Expansion of Building 9215 to remove water from excavations. Appropriate construction techniques would be implemented to minimize the seepage of groundwater into excavation sites. Therefore, dewatering is expected to be minimal and a short-term activity. No impact on groundwater (direction or flow rate) in the NABIR project area would be expected from constructing the HEU Materials Facility at Site A or B. Based on the results of the Remedial Investigation of UEFPC (DOE 1998b), groundwater extracted from excavations at Site A and in the area of the Upgrade Expansion of Building 9215 probably would not be contaminated. Groundwater extracted from excavations at Site B would probably be contaminated with VOCs, metals, and radionuclides from the nearby former S-3 ponds and the Y-12 Scrap Metal Yard (DOE 1998b). Construction at Site B may require plugging and abandonment of groundwater monitoring wells. The monitoring wells should be replaced as part of the long-term monitoring program for remediation of that portion of Y-12. Minimal impacts to groundwater quality are expected because, regardless of site, extracted groundwater would be collected and treated in on-site treatment facilities to meet the discharge limits of the NPDES permit prior to release to surface water; no plans exist for routine withdrawal from groundwater resources; as a storage facility there would be no process water; and utility and sanitary wastewater would be treated prior to discharge into UEFPC in accordance with the existing NPDES permits.

5.5.2.4 *Alternative 3 (No Action - Planning Basis Operations Plus Special Materials Mission Alternative)*

No Action - Planning Basis Operations Plus Construct and Operate a New Special Materials Complex

All water for construction and operation of the Special Materials Complex would be taken from the Clinch River as part of the normal water uses at Y-12. Some groundwater may be extracted during construction activities to remove water from excavations. Appropriate construction techniques would be implemented to minimize the seepage of groundwater into excavation sites. Therefore, dewatering is expected to be minimal and a short-term activity. No impact on groundwater (direction or flow rate) in the NABIR project area would be expected from constructing the Special Materials Complex at Site 1, 2, or 3. Based on the historical site use and the results of the Remedial Investigation of the UEFPC (DOE 1998b), groundwater extracted from excavations at Site 1 probably would not be contaminated. Construction at Site 1 would probably require plugging and abandonment of several groundwater-monitoring wells in the area. The monitoring wells have not been sampled recently and are not part of any routine groundwater monitoring program at Y-12. Groundwater extracted from excavations at Sites 2 and 3 would be the same as that described for the HEU Materials Facility Site B. The groundwater is contaminated with VOCs, metals, and radionuclides from the nearby former S-3 Ponds and the Y-12 Scrap Metal Yard (DOE 1998b). Construction at either Sites 2 or 3 would require plugging and abandonment of groundwater monitoring wells. The monitoring wells should be replaced as part of the long-term monitoring program for remediation of that portion of Y-12. Minimal impacts to groundwater quality are expected because, regardless of site, extracted groundwater would be collected and treated in on-site treatment facilities to meet the discharge limits of the NPDES permit prior to release to surface water; utility and sanitary wastewater would be treated prior to discharge into the UEFPC in accordance with the existing NPDES permits; and no plans exist for routine withdrawal from groundwater resources to support either construction or operation of the Special Materials Complex.

5.5.2.5 *Alternative 4 (No Action - Planning Basis Operations Plus HEU Materials Facility Plus Special Materials Complex)*

Under this alternative, all water requirements would be taken from the Clinch River. No groundwater would be used for construction or operations of facilities. Some groundwater may be extracted during construction, from excavation and field research activities. No impact on groundwater (direction or flow rate) in the NABIR project area would be expected from constructing the HEU Materials Facility or the Special Materials Complex at any of the candidate sites. Depending on the construction site, extracted groundwater may be contaminated with VOCs, metals, and radionuclides. Minimal impacts to groundwater and groundwater quality are expected because extracted groundwater would be collected and treated in on-site treatment facilities to meet discharge limits of the NPDES permit prior to release to surface water; no plans exist for routine withdrawal from groundwater resources; and utility and sanitary wastewater would be treated prior to discharge into UEFPC in accordance with the existing NPDES permits.

5.6 BIOLOGICAL RESOURCES

This analysis focuses on Y-12 and the area within the SWEIS study area boundary (see Figure 1.1.3–1). Potential impacts are assessed based on the degree to which various habitats or species could be affected by Y-12 proposed actions and alternatives. Where possible, impacts are evaluated with respect to Federal and state protection regulations and standards.

Impacts to wildlife are evaluated in terms of disturbance, displacement, or loss of wildlife. Impacts are assessed based on proximity of wetlands to Y-12 current mission operations, the proposed construction and operation of new facilities, and any related discharge. A list of species potentially present at Y-12 was obtained from USFWS was used in the process of assessing whether Y-12 current mission operations or proposed new facilities would impact any plant or animal under Section 7 of the *Endangered Species Act* (USFWS 1999c).

5.6.1 Alternative 1A (No Action – Status QuoAlternative)

Biological resources at Y-12 include terrestrial resources, wetlands, aquatic resources, and threatened and endangered (T&E) species.

Within the fenced, developed portion of Y-12, grassy and devegetated areas surround the entire facility. Buildings and parking lots dominate the landscape in Y-12, with limited vegetation present (ORNL 1992a). Fauna within the Y-12 area is limited by the lack of large areas of natural habitat. Impacts on terrestrial resources are minimal.

A Biological Monitoring and Abatement Program was established in conjunction with the NPDES permit issues to Y-12 in 1992. The program includes toxicity monitoring, bioaccumulation studies, biological indicator studies, and ecological surveys. Toxicity testing and bioaccumulation studies indicate that the exposure of aquatic organisms in UEFPC to toxicants has been steadily decreasing as a result of remedial activities such as implementations of flow management and continuing mercury reductions at Y-12 (LMER 1999a).

Existing impacts to biological resources would continue and are not expected to increase during the 10-year planning period under Alternative 1A (No Action - Status Quo Alternative) because no new construction or implementation of new processes or missions is expected. The mitigation measures discussed in Section 5.6.6 are intended to minimize the impacts to biological resources that might occur during operation activities associated with this alternative.

5.6.2 Alternative 1B (No Action - Planning Basis Operation Alternative)

Under Alternative 1B (No Action - Planning Basis Operation Alternative), most current Y-12 mission operations would continue as described in Section 3.2.2. Existing impacts to biological resources described under the No Action - Status Quo Alternative would not change because resumption of enriched uranium and other operations still in stand-down mode would not involve new construction, or new processes or emissions. Two activities included under the No Action - Planning Basis Operations Alternative, however, would result in potential impacts to biological resources. The Environmental Management Waste Management Facility and the Field Research Center are described in Sections 3.2.2.2 and 3.2.2.6, respectively.

The Environmental Management Waste Management Facility will be constructed at the East Bear Creek Valley Site just west of the Y-12 Site main area, immediately south of Pine Ridge, and located between tributaries NT-3 and NT-5 well north of Bear Creek (DOE 1999j).

Impacts to terrestrial biotic resources would result primarily from land clearing and result in the loss of grassland and old-field successional regimes that provide browse and cover, as well as the loss of mixed-hardwood/conifer forests (see Figures 3.2.2–7 and 3.2.2–9). Clearing of forest at the selected site, use of the haul road, and the Y-12 West End Borrow pit would increase forest fragmentation. Consequently, some small animal dislocation and reduction in abundance could be expected. Large animals would be largely excluded from controlled areas by access control fences. The presence of surrounding forested areas would somewhat reduce the impact that clearing would have on habitat continuity and biological diversity.

The Environmental Management Waste Management Facility site contains suitable habitat for several sensitive plant and animal species. The Remedial Investigation/Feasibility Study (RI/FS) provides a detailed discussion of these species(DOE 1998a). Forest clearing would directly impact portions of Habitat Area 2 and could directly impact the western portions of RA5 and the eastern portions of NA28, depending on the exact design and size of the cell (See Figure 3.2.2–7). Habitat Area 2 hosts the Tennessee endangered species pink lady slipper. NA28, Eastern Bear Creek Rein-Orchid Wetland, hosts a small population of the Tennessee threatened species tuberculed rein-orchid. RA5, Quillwort Temporary Pond, hosts Carolina quillwort and may be an important amphibian breeding site. While best management practices, including various engineering and administrative controls, would reduce potential impacts to these areas, noise, the loss of adjacent forest habitat, and possibly dust and exhaust emissions may impact the adjacent sensitive resources. The disposal facility construction site would be surveyed for the presence of listed species before construction and the USFWS and TWRA consulted. Impact mitigation plans would be developed.

Since construction would require rerouting of 330 m (1,000 ft) of NT-4, the associated wetland (approximately 0.4 ha [1 acre] in size) would be impacted by potential construction-related sediment and loss of adjacent wooded areas. A programmatic wetlands mitigation plan covering all activities in Bear Creek Valley will be included as part of the remedial action work plan, a post-ROD document. This includes mitigation of wetlands impacted by the new disposal facility as well as other activities in Bear Creek Valley (DOE 1999j).

The Field Research Center would be located within 80 ha (200 acres) of the Bear Creek Valley. However, most portions of the Field Research Center contaminated area within the Y-12 Site area would involve plots less than 0.4 ha (1 acre) in size. Where possible, these research test plots would be located in areas where site clearing and past construction have occurred or past construction activities have already changed the predominate landscape (see Figure 3.2.2–10). Therefore, few terrestrial species would be affected by the project (DOE 2000b). In the event that previously unknown sensitive resources were discovered during planning activities (e.g., site plan evaluations or site design construction), efforts to avoid impacts would be conducted and specific reserved sites would be away from sensitive resources.

The USFWS has indicated that the gray bat (*Myotis grisescens*) and Indiana bat (*Myotis sodalis*) might live near the proposed Field Research Center (USFWS 1999b). Although EFPC and Bear Creek Valley offer riparian habitat suitable for these species, neither species was captured in mist net surveys conducted specifically for bats in the EFPC (DOE 2000b). In February 2000, ORNL completed an assessment and evaluation of potential roosting and foraging habitats for the gray and Indiana bats (DOE 2000b). The assessment concluded that the Field Research Center would not adversely affect either bat species. Also, since no proposed or designated critical habitats are present on the Site, none would be affected. The USFWS concurred with this conclusion in a letter dated February 10, 2000 (DOE 2000b).

Much of the proposed contaminated area and background area for the Field Research Center is situated either in the riparian zone of Bear Creek or adjacent to it. The Tennessee dace (*Phoxinus tennesseensis*), a minnow, listed by the TWRA as a species in need of management is the only aquatic protected or special status species likely to occur in the proposed site area. Although Bear Creek is still considered impaired, recent research has indicated an improvement in species diversity within the upper reaches of this body of water. The small scale of disturbance required for Field Research Center research plots in the contaminated area should preclude impact to this species (DOE 2000b). While it is not anticipated that Field Research Center related activities would have any impact on aquatic resources, the sensitive status of the Tennessee dace in Bear Creek makes it likely that additional measures to protect the species might be required if a specific research plot is chosen in proximity to Bear Creek. Any such additional measures would be determined and documented during the project's environmental review process. Other evaluations could include conducting and monitoring activities to determine the pre-existing condition of specific reaches of Bear Creek in proximity to selected research plots. Periodic monitoring by ORNL of aquatic and benthic resources within adjacent reaches might be conducted to determine if Field Research Center activities would result in impact to the Tennessee dace or its forage base (DOE 2000b).

The mitigation measures discussed in Section 5.6.6 are intended to minimize the impacts to biological resources that might occur during construction and operation activities associated with this alternative.

5.6.3 Alternative 2 (No Action - Planning Basis Operations Plus HEU Storage Mission Alternatives)

Alternative 2A (No Action - Planning Basis Operations Plus Construct and Operate a New HEU Materials Facility)

Under this alternative, potential impacts to biological resources from the construction and operation of a new HEU Materials Facility would be minimal because both candidate sites (Site A is the Y-12 West Portal Parking Lot; Site B is located at the Y-12 Scrap Metal Yard) are located in areas of Y-12 that have been previously disturbed. Some dislocation of small urban type species (i.e., rodents) could be expected because of the presence of humans.

In conjunction with the construction and operation of a new HEU Materials Facility, other ancillary actions would include the temporary use of construction staging or "lay-down" areas, a parking lot, and utility relocation. In the case of Site A, a construction staging area would occupy about 0.8 ha (2 acres) of land north of Bear Creek Road. A 200-space parking lot would be built to replace the parking spaces lost to the proposed HEU Materials Facility, if it is located at Site A. The new parking lot would be an expansion of the existing Polaris Parking Lot, which is also located north of Bear Creek Road, just northwest of the HEU Materials Facility Site. A short stretch of Bear Creek Road could be relocated and a new lane added. In the case of Site B, the S-3 Parking Lot would be used as a construction staging area. New parking space would not be required, except on a temporary basis for construction workers. The temporary lot, about 0.8 ha (2 acres), would be developed in the west tank farm area just south of old Post 17. The construction and operation of an HEU Materials Facility at either Site A or Site B would require the relocation of utilities. Section 3.2.3.2 provides details of the potential utility relocation requirements.

The location of ancillary actions associated with the HEU Materials Facility candidate site, as described above, is in previously disturbed or heavily industrialized portions of the Y-12 Site that do not contain habitats sufficient to support a biologically diverse species mix. Some dislocation of small urban type species (i.e., rodents) could be expected because of the presence of humans.

The forest vegetation on the northwest side of Bear Creek Road has been cleared approximately one-quarter to one-half the distance up the side of Pine Ridge. The cleared areas are now maintained in grass and other nonnative herbaceous species. Kudzu has covered some of the steep slopes. EFPC tributary streams originate on the lower slopes of Pine Ridge in the altered areas. All of the tributaries have had large portions of their lower reaches piped and/or filled. Those sections of the stream bottoms not filled or piped have been filled with rock. Emergent wetlands and scrub/shrub wetlands have been identified in the stream bottom remnants. Three wetlands identified in the Wetland Survey of Selected Areas in the Oak Ridge Y-12 Area of Responsibility report prepared in 1997 (ORNL 1997a) could be potentially impacted or altered by ancillary actions associated with Site A (see Figure 3.2.3–3). The construction staging area and parking lot could either eliminate the wetland or result in a temporary increase of sedimentation from construction activities. Each of these wetlands is surrounded on three or four sides by grass that is regularly mowed. All the wetlands are and dominated by black willow, rice cutgrass, seedbox, and dotted smartweed.

The mitigation measures discussed in Section 5.6.6 are intended to minimize the impacts to biological resources that might occur during construction and operation activities associated with this alternative.

Alternative 2B (No Action - Planning Basis Operations Plus Upgrade Expansion of Building 9215)

The 0.8 ha (2 acres) of land required for the Upgrade Expansion of Building 9215 would occupy a parcel of land located west of Buildings 9212 and 9998 and north of Building 9215. The parcel is currently occupied by trailers and temporary facilities within the heavily industrialized portion of the Y-12 Site. The parcel does not contain habitat sufficient to support a biologically diverse species mix. There would be no impacts to biological resources.

The mitigation measures discussed in Section 5.6.6 are intended to minimize the impacts to biological resources that might occur during construction and operation activities associated with this alternative.

5.6.4 Alternative 3 (No Action - Planning Basis Operations Plus Special Materials Mission Alternatives)

No Action - Planning Basis Operations Plus Construct and Operate a New Special Materials Complex Facility

Under this alternative, a new Special Materials Complex would be constructed at Site 1, Site 2, or Site 3 (Site 3 is the same as HEU Materials Facility Site B). Sites 2 and 3 are located in lightly developed areas of Y-12 that have been previously disturbed and contain minimal biological resources. The impact associated with ancillary actions, construction of parking lots, and construction staging areas would be the same as described under Alternative 2A. In the case of Site 2, only temporary parking would be needed during construction. Sites 2 and 3 do not have the habitat to support a biologically diverse species mix. Some dislocation of small animals could be expected.

However, Site 1 is located in an approximately 8-ha (20-acre) area north of Bear Creek Road and in relatively close proximity to wetlands K and L identified in a wetland survey for Y-12 (ORNL 1994). Construction of the Special Materials Complex at Site 1 would eliminate up to 4 ha (10 acres) of vegetation. Vegetation on the remainder of the Site has been previously removed to accommodate the power line corridor and past Y-12 support activities. Vegetation in cleared areas consists of grass and nonnative herbaceous species (ORNL 1994).

The mitigation measures discussed in Section 5.6.6 are intended to minimize the impacts to biological resources that might occur during construction and operation activities associated with this alternative.

5.6.5 Alternative 4 (No Action - Planing Basis Operations Plus HEU Materials Facility Plus Special Materials Complex)

Under this alternative, current operations would continue in conjunction with the construction of the HEU Materials Facility and the Special Materials Complex. The impacts of this alternative represent the sum of the impacts described in Sections 5.6.2, 5.6.3, and 5.6.4 above.

No adverse impacts to federally-listed T&E species are anticipated as discussed in Section 5.6.2. Depending on the final design and size of the Environmental Management Waste Management Facility, potential impacts could occur to the Tennessee endangered species pink lady slipper in Habitat Area 2, and the Tennessee threatened species tuberculed rein-orchid in the Eastern Bear Creek Rein-Orchid Wetland.

Activities associated with the Environmental Management Waste Management Facility, Field Research Center activities, and construction and operation of the HEU Materials Facility and Special Materials Complex is anticipated to disturb natural habitat as discussed above during land cleaning activities for new facilities. If the HEU Materials Facility is constructed at Site A, potential impacts may occur to three man-made wetlands approximately 0.4 ha (1 acre) in size. Additionally, construction of the Environmental Management Waste Management Facility would require rerouting of 330 m (1,000 ft) of NT-4, and the associated wetland, approximately 0.4 ha (1 acre) in size, would be impacted by potential construction related sediment and loss of adjacent wooded areas.

The mitigation measures discussed in Section 5.6.6 are intended to minimize the impacts to biological resources that might occur during construction and operation activities associated with this alternative.

5.6.6 Mitigation

For any of the alternatives discussed in Sections 5.6.1 through 5.6.5, potential impacts to terrestrial plant and animal species and wetland areas would be mitigated to avoid or minimize potential impacts. Proposed construction sites would be surveyed for the presence of special status species before construction begins, and mitigation actions would be developed, if appropriate, in consultation with the USFWS and TWRA. Appropriate runoff and siltation controls would be implemented to minimize potential impacts during construction and operation to adjacent wetland areas. Following construction, temporary structures would be removed and the sites reclaimed.

5.7 AIR QUALITY/NOISE

Airborne discharges from Y-12 facilities are subject to regulation by the EPA, TDEC Division of Air Pollution Control, and DOE Orders. Y-12 has a comprehensive air regulation compliance assurance and monitoring program to ensure that airborne discharges meet all regulatory requirements and therefore do not adversely affect ambient air quality. Common air pollution control devices employed include exhaust gas scrubbers, baghouses, and other exhaust filtration systems designed to remove contaminants from exhaust gases before their release to the atmosphere. Process modifications and material substitutions are also made to minimize air emissions.

5.7.1 Nonradiological Air Quality

The assessment of nonradiological air emissions at Y-12 is used to demonstrate compliance with the National Ambient Air Quality Standards (NAAQS) and the rules of Tennessee Department of Environment and Conservation (TDEC) (TDEC 1999a) for criteria pollutants and guidelines for chemical concentrations. Nonradiological air quality impacts were determined by modeling site emissions of criteria and chemical pollutants from the applicable Y-12 mission facility operations. These site-specific emissions were modeled in accordance with the guidelines presented in the EPA Guideline on Air Quality Models (40 CFR 51, Appendix W) using the EPA-recommended Industrial Source Complex model, Version 3 (EPA 1995b) as the most appropriate model to perform the air dispersion modeling analysis from stationary continuous emission sources.

Nonradiological airborne discharges from Y-12 facilities consist of those criteria and chemical pollutant emissions from the Y-12 Steam Plant and chemical emissions that are specific to the alternative under consideration.

Section 176 (c)(1) of the *Clean Air Act* (CAA) requires Federal agencies to assure that their actions conform with applicable implementation plans (in most cases the State implementation plan) for achieving and maintaining the NAAQS for the criteria pollutants, ozone, sulfur dioxide, nitrogen dioxide, carbon monoxide, lead, and particulate matter with an aerodynamic diameter less than or equal to 10 microns (PM_{10}). In 1993, the EPA issued general conformity regulations (40 CFR 93, Subpart B) that included procedures and criteria for determining whether a proposed Federal action would conform with the state implementation laws. In the first phase, a conformity review is undertaken to establish whether conformity regulations would apply to a proposed action/alternatives. If such a review determines the proposed action/alternatives is in an attainment area, the action/alternative is exempt from conformity requirements. The Y-12 Site associated with the proposed alternatives lies within an attainment area for all criteria pollutants. Consequently, no further reviews of the proposed action/alternatives are required under the CAA general conformity requirements (DOE 2000c).

Criteria Pollutants Impact Analysis Methodology

Y-12 is classified as a Major Source having the potential to emit 90,720 kg (100 tons) per year or more of regulated air pollutants in accordance with *Rules of the TDEC Chapter* 1200-3-9-.02(11)(b)(14)(ii). Allowable emissions at the Y-12 Steam Plant are greater than 90,720 kg (100 tons) per year of regulated air pollutants for particulates, sulfur oxides, and nitrogen oxides.

Maximum concentrations of the six criteria pollutants included in the primary and secondary NAAQS (40 CFR 50) were assessed, including carbon monoxide (CO), lead (Pb), nitrogen dioxide (NO_2), PM_{10}, sulfur dioxide (SO_2), and ozone (O_3). Gaseous fluorides such as HF, included in the *Rules of TDEC*, were also assessed. Ambient air monitoring data were used to supplement modeled pollutant concentrations for those pollutants for which no emission data were available.

Chemical Emissions Impact Analysis Methodology

In accordance with *Rules of the TDEC Chapter* 1200-3-9.02(11)(b)(14)(i), Y-12 is classified as a major source under Section 112 of the CAA; that is, Y-12 has a potential to emit 9,000 kg (10 tons) per year or more of a hazardous air pollutant (HAP) which has been listed in Section 112(b) of the CAA, or 22,500 kg (25 tons) or more of combined HAPs. For example, Y-12 emits greater than 9,000 kg (10 tons) per year of methanol and greater than 22,500 kg (25 tons) per year for a mixture of HAPs such as benzene, hydrochloric acid, hydrogen fluoride (hydrofluoric acid), toluene, etc., where no one pollutant exceeds the 9,000 kg (10 ton) single pollutant threshold (LMES 1997a).

Chemical pollutant concentrations were compared with human health guidelines derived from occupational exposure limits and concentrations corresponding to cancer risks of 10^{-8} risk levels in lieu of established regulatory ambient air quality standards. The chemicals were categorized into two groups, noncarcinogenic chemicals and carcinogenic chemicals, to address the differences in health effects. Each group was evaluated using a screening technique comparing each chemical's estimated emission rate to a health-risk based Threshold Emission Value (TEV). Current dose-to-risk conversion factors and the "best available technology" were used in assessing impacts to human health (Appendix D). Consistent with the human health impacts assessment methodology, appropriate health risk values were used in the chemical process to derive chemical-specific TEVs. Because of different health effects (noncarcinogenic and carcinogenic), two methods were applied to derive chemical-specific TEVs. Chemicals that failed the screening process were assessed in more detail. This approach is consistent with EPA guidance and focuses detailed analyses only on those chemicals of concern that have the potential to cause adverse health effects. Appendix Section E.3 describes in detail the screening methodology used for both noncarcinogenic and carcinogenic chemical emissions.

5.7.1.1 *Alternative 1A (No Action - Status Quo Alternative)*

The following describes the impacts of the No Action - Status Quo Alternative at Y-12 and the surrounding region with respect to nonradiological air quality.

Airborne discharges from DOE Oak Ridge facilities, both radioactive and nonradioactive, are subject to regulation by EPA, the TDEC Division of Air Pollution Control, and DOE Orders. Each ORR facility has a comprehensive air regulation compliance assurance and monitoring program to ensure that airborne discharges meet all regulatory requirements and therefore do not adversely affect ambient air quality.

The TDEC performs ambient air monitoring throughout the State of Tennessee and within the vicinity of the ORR. Concentration of regulated pollutants observed during 1999 at locations near the ORR indicate that no pollutant concentration exceeds the standards.

The observed concentrations of mercury vapor at Y-12 under the No Action - Status Quo Alternative are well below the ACGIH threshold limit value of 25 Fg/m^3. Annual average mercury vapor concentrations have declined in recent years when compared with concentrations measured from 1986 through 1988. The decrease in ambient mercury recorded at Y-12 since 1989 is thought to be related to the reduction in coal burned at the Y-12 Steam Plant beginning in 1989 and to the completion prior to 1989 of several major engineering projects (e.g., New Hope Pond closure, the PIDAS, Reduction of Mercury in Plant Effluent, and Utility Systems Restoration).

Under the No Action - Status Quo Alternative (for 1999), the average 7-day concentration of uranium at the three Y-12 monitored locations ranged from a low of 0.00002 Fg/m^3 at Station 5 and 8 to a high of 0.00038 Fg/m^3 at Station 4.

The release of nonradiological contaminants into the atmosphere at Y-12 occurs as a result of site production, maintenance, and waste management operations and steam generation. TDEC has issued over 36 air permits that cover Y-12 emission sources. The allowable level of air pollutant emissions from emission sources in 1999 under the No Action - Status Quo Alternative was approximately 10,033 tons per year of regulated pollutants. The actual emissions are much lower than the allowable amount (DOE 2000d).

The level of pollutant emissions is expected to decline in the 10-year planning period under Alternative 1A (No Action - Status Quo Alternative) because of the reduced activity levels of Y-12, consolidation efforts, and downsizing of production areas. More than 90 percent of the pollutants under the No Action - Status Quo Alternative are attributed to the operation of the Y-12 Steam Plant. The nonradiological air quality for the criteria pollutants under this alternative is represented by the Y-12 Steam Plant operating at the calculated heat input capacity of 522 million Btu/hr. This heat input capacity represents the actual fuel consumption (coal and natural gas) on February 6, 1996, the coldest day in the last 5 years according to local meteorological data. The calculated criteria pollutant emissions based upon this Y-12 Steam Plant operation are assumed to represent a reasonable upper limit for estimating criteria pollutant concentrations at or beyond the site boundary.

Concentrations of chemical pollutants during normal operations are represented by chemical emissions from the combustion of coal by the Y-12 Steam Plant at the calculated heat input capacity of 522 million Btu/hr and estimates of chemical concentrations based upon the conservative assumption that 100 percent of the chemicals purchased during 1999 are released to the atmosphere from Y-12 facilities. Nonradiological airborne emissions of materials for Y-12 under the No Action - Status Quo Alternative have been estimated and are provided in Chapter 4, Tables 4.7.2–5 and 4.7.2–6.

5.7.1.2 *Alternative 1B* (*No Action - Planning Basis Operations Alternative*)

Criteria Pollutants

The nonradiological air quality for criteria pollutants at Y-12 under Alternative 1B (No Action - Planning Basis Operations Alternative) was represented by the Y-12 Steam Plant emissions using Alternative 1A (No Action - Status Quo Alternative) as a baseline. This is due to the fact that more than 90 percent of the criteria pollutants from Y-12 can be attributed to the operation of the Y-12 Steam Plant (DOE 1999k). The No

Action - Planning Basis Operations Alternative provides for Y-12 to operate at planned mission and workload levels.

Emissions from the Y-12 Steam Plant vary throughout the year depending on the demand for steam. To assess the maximum impact to air quality from operation of the Y-12 Steam Plant, the emission rates associated with operation of the facility at the calculated heat input capacity input of 522 million Btu/hr was used as input to the ISC3 model (see Appendix E). The calculated heat input capacity of 522 million Btu/hr represents actual fuel consumption on February 6, 1996, the coldest day in the last 5 years according to local meteorological data.

Maximum background concentrations of criteria pollutants from Tennessee air quality monitors located in Anderson, Knox, and Roane counties are presented in Table 5.7.1–1. These background concentrations represent concentrations from all nearby sources including the Y-12 Steam Plant. The modeled pollutant concentrations from the Y-12 Steam Plant emissions were added to the background concentrations for the respective pollutant to calculate the percent of standard. The maximum modeled criteria pollutant concentrations do not occur at the location of the monitor for which background concentrations are presented. Therefore, not only do the background concentrations contain contributions from the Y-12 Steam Plant, but the maximum modeled and background concentrations occur at different locations. In addition, the Y-12 Steam Plant emissions are based upon the maximum daily facility operation in the last 5 years, which used twice the average annual rate for use of natural gas at the Steam Plant. The sum of the modeled and background concentrations therefore overestimates the cumulative pollutant concentrations resulting from the background and modeled Y-12 Steam Plant concentrations.

As shown in Table 5.7.1–1, all criteria pollutant concentrations are below the national and TDEC standards. As discussed above, the criteria pollutant concentrations listed in Table 5.7.1–1 represent a conservative bounding case for Alternative 1B (No Action - Planning Basis Operations Alternative). DOE therefore believes that no adverse direct or indirect air quality impacts are expected for criteria pollutants from activities associated with continuation of Y-12 missions under the No Action - Planning Basis Operations Alternative.

Chemical Emissions

The combustion of coal produces emissions of HAPs as well as criteria pollutants. The Y-12 Steam Plant noncarcinogenic HAP emissions are presented in Table 5.7.1–2. The emission rates are based upon operation of the facility at the calculated heat input capacity of 522 MBtu/hr, AP-42 emission factors for pulverized coal boilers (uncontrolled HAP emissions) (EPA 1995a), and the baghouse efficiency (99 percent) except for mercury, for which no emission controls were assumed.

Noncarcinogenic chemical emissions from Y-12 operations were also evaluated. An annual chemical concentration was calculated for the Y-12 Site boundary while an 8-hr concentration was calculated for evaluation of impacts to the on-site worker. A 1 gram per second emission rate was modeled from a stack located centrally within the Y-12 complex of facilities. Appendix Table E.3.1–1 presents the stack parameters used in the modeling analysis of Y-12 facility operations.

The noncarcinogenic HAP emission rates for the Y-12 Steam Plant and for Y-12 operations were compared with the respective TEVs as discussed in Appendix Section E.3. If the HAP emission rates were greater than the respective TEV, then the chemical concentration was considered a chemical of concern; conversely, if the concentration was less then the TEV, then the chemical was not considered a threat to public health.

TABLE 5.7.1–1.—*Modeled Criteria Pollutant Concentrations from the Y-12 Steam Plant Under Alternative 1B (No Action - Planning Basis Operations Alternative)*

Pollutant	Averaging Time	NAAQS Standard (Fg/m³/ppm)	Tennessee Standard (Fg/m³/ppm)	Maximum Concentration (Fg/m³/ppm)	Background Concentration (Fg/m³/ppm)	Percent of Standard
Ozone (O_3)	1-hour	235/0.12	235/0.12	NA	228/0.116[a]	97
Carbon Monoxide (CO)	8-hour	10,000/9	10,000/9	2.52/0.002	4,466/39	45
	1-hour	40,000/35	40,000/35	4.3/0.004	12,712/11.1	32
Nitrogen Dioxide	Annual	100/0.053	100/0.53	9.1/0.005	15.1/0.008	24
Sulfur Dioxide (SO_2)	Annual	80/0.03	80/0.03	20.7/0.008	10.5/0.004	39
	24-hour	365/0.14	365/0.14	174.6/0.07	47.1/0.018	61
	3-hour	1,300/0.5	1,300/0.5	523.8/0.02	120/0.046	50
Particulate Matter (PM_{10})	Annual	50 Fg/m³	50 Fg/m³	0.2 Fg/m³	25.4	51
	24-hour	150 Fg/m³	150 Fg/m³	1.5 Fg/m³	46	32
Lead	Calendar Quarter	1.5 Fg/m³	1.5 Fg/m³	NA	0.33 Fg/m³	22
Gaseous Fluorides Expressed as (HF)	30-day	–	1.2/1.5	NA	NA	NA
	7-day	–	1.6/2.0	NA	NA	NA
	24-hour	–	2.9/3.5	0.72/0.0009	NA	25
	12-hour	–	3.7/4.5	NA	*NA*	*NA*

[a] Maximum 1-hour ozone concentration for 1999 from Tennessee air quality monitor located in Anderson County at Freels Bend Study Area Melton Lake.
Note: NA - Not Available.
Source: LMES 1997a, 40 CFR 50, TDEC 1999a.

Table 5.7.1–2.—*Y-12 Facility Operations Maximum Boundary and On-Site Noncarcinogenic Hazardous Air Pollutant Chemical Concentrations*

CAS Number	Chemical	Maximum Boundary Concentration (Fg/m³)	Maximum On-site Concentration (Fg/m³)
007440-48-4	Cobalt and Compounds	3.31×10^{-2}	58.8
007439-92-1	Lead Compounds	3.43×10^{-2}	61.0
007439-97-6	Mercury	1.99×10^{-2}	35.4
000101-68-8	Methylene Bisphenyl Isocyanate	9.82×10^{-2}	175

Note: CAS - Chemical Abstracts Service Registry Number.
Source: LMES 1997a.

The screening results for the Y-12 Steam Plant are included in Appendix Table E.3.1–2 and show that none of the four noncarcinogenic HAP emissions (chromium, lead, manganese, and mercury) exceeded the TEV and therefore are not chemicals of concern. The screening results for Y-12 operations, shows that 4 of the 60 evaluated noncarcinogenic HAPs exceed the TEV. Table 5.7.1–2 presents the maximum annual Y-12 Site boundary and on-site maximum 8-hr concentrations representing exposure to the general public and on-site worker, respectively, for those noncarcinogenic HAPs that exceed the screening criteria. The human health impacts of these HAPs are discussed in Section 5.12.

Carcinogenic chemicals released from the Y-12 Steam Plant from burning coal and from Y-12 operations were screened according to the criteria discussed earlier and described in Appendix Section E.3. The results of the screening analysis for the Y-12 Steam Plant are presented in Appendix Table E.3.2–1. For arsenic, beryllium, and nickel, the calculated emission rate is greater than the TEV. The site boundary carcinogenic chemical concentrations from the Y-12 Steam Plant are presented in Table 5.7.1–3, and the human health impacts of these concentrations are evaluated in Section 5.12.

Y-12 operations, in general, are also expected to result in the release of carcinogenic HAPs. Screening was performed on 16 carcinogenic HAPs from Y-12 operations as presented in Appendix Table E.3.2–3. The results of the screening indicate that one carcinogenic HAP (cadmium and cadmium compounds) from Y-12 exceeds the respective TEV. An annual chemical concentration was calculated for the Y-12 Site boundary while an 8-hr concentration was calculated for evaluation of impacts to the on-site worker. Maximum concentrations of cadmium and its compounds for Y-12 Site boundary and on-site locations are presented in Table 5.7.1–4. The human health impacts of these concentrations are discussed in Section 5.12.

Other Activities at the Y-12 Site

In addition to operation of the existing facilities at the Y-12 Site, other activities could affect air quality at Y-12, including the construction and operation of the Environmental Management Waste Management Facility (see Section 3.2.2.2) and the use of Y-12 for the Field Research Center activities (see Section 3.2.2.6). The construction of the Environmental Management Waste Management Facility could have short-term adverse impacts due to fugitive dust emissions with a large portion being due to earth-moving activities and traffic on non-paved roads. The fugitive dust emissions during the construction period could exceed TDEC fugitive dust emissions standards within a few hundred to approximately 1,400 meters of the construction activities if no dust control measures were implemented. However, engineered controls, such as the application of water or chemical dust suppressants and seeding of soil piles and exposed soils, would be implemented to minimize fugitive dust emissions. Based on the activities and the dust control measures, DOE expects that dust emissions at the Y-12 Site boundary would be below the PM_{10} NAAQS at the DOE boundary and only negligible levels of airborne dust would be expected at the nearest residential area.

TABLE 5.7.1–3.—*Y-12 Steam Plant Maximum Boundary Hazardous Air Pollutant Carcinogenic Chemical Concentrations*

Building Number	CAS Number	Chemical	Maximum Boundary Concentration
Y-9401-3	7440-38-2	Arsenic	3.40×10^{-5}
Y-9401-3	7440-41-7	Beryllium	5.10×10^{-5}
Y-9401-3	7440-02-0	Nickel	8.14×10^{-4}

Note: CAS - Chemical Abstracts Service Registry Number.
Source: LMES 1997a.

Table 5.7.1–4.—*Y-12 Facility Operations Maximum Boundary and On-Site Carcinogenic Hazardous Air Pollutant Chemical Concentrations*

CAS Number	Chemical	Maximum Boundary Concentration (Fg/m³)	Maximum On-site Concentration (Fg/m³)
007440-43-9	Cadmium & Cadmium Compounds	1.42×10^{-5}	2.52×10^{-2}

Note: CAS - Chemical Abstracts Service Registry Number.
Source: LMES 1997a.

Drilling and associated sampling actions of the Field Research Center would not produce significant amounts of fugitive dust. It is expected that these activities would generate much less dust than normal farming practices (which is negligible) in the surrounding Oak Ridge area. Because of the larger number of existing wells and existing research support infrastructure at ORNL, it is anticipated that minimal land disturbance would be required.

Operation of the Field Research Center would use standard, construction best management practices to mitigate any airborne releases. Common measures include application of water for dust suppression and to control fugitive emissions during drilling and other activities. It is anticipated that these and other construction/drilling management practices should adequately control fugitive emissions of radionuclides and any other air pollutants. These actions are not expected to generate criteria pollutants that would not be adequately accounted for by the estimates presented above for the No Action - Planning Basis Operations Alternative. It is anticipated that the Field Research Center activities would result in no additional radiological contaminants being released into the atmosphere. Final project plans would be evaluated for applicability of these best management practices and the requirements of any permits would be complied with if required.

Other substances, which could be released into the air at the Field Research Center, include oxygen, hydrogen, nitrogen, and methane. None of these are regulated under state or Federal air regulations. Groundwater collected during the research activities would not be expected to contain pollutants that would volatize into the air. No adverse impacts to air quality would be expected from Field Research Center activities.

5.7.1.3 *Alternative 2 (No Action - Planning Basis Operations Plus HEU Storage Mission Alternatives)*

Alternative 2A (No Action - Planning Basis Operations Plus Construct and Operate a New HEU Materials Facility)

Two potential sites have been proposed for the construction of the HEU Materials Facility: Site A and Site B. Site A (approximately 4 ha [10 acres] in size) is in the Y-12 West Portal Parking Lot, just north of Portal 16 located approximately 300 m (1,000 ft) from the Y-12 Site boundary. Site B, similar in size to Site A, is located in the Y-12 Scrap Metal Yard approximately 760 m (2,500 ft) from the Y-12 Site boundary.

Fugitive dust emissions would result from construction of the new facilities at Sites A or B. Demolition at Site B of Structures 9831, 9720-15, 9814, 9819, 9420, 9420-1, 9627, and 9626 would result in slightly more fugitive dust emissions at Site B compared to Site A.

Emissions during construction at these two sites would be associated with land clearing, drilling, ground excavation, earth moving, and construction of the facility itself. Dust emissions often vary substantially from day to day, depending on the level of activity, the specific operation, and the prevailing meteorological conditions. A large portion of the emissions would result from construction equipment traffic over temporary roads at the construction site. Construction at either site would result in dust emissions that may have a temporary adverse impact on local air quality.

Based on the size of the construction site and the expected construction activities, the 24-hr PM_{10} standard may be exceeded by uncontrolled fugitive dust emissions. Effective control measures commonly used to reduce fugitive dust emissions include wet suppression, wind speed reduction using barriers, vehicle speed, and chemical stabilization. Chemical stabilization alone could reduce emissions by up to 80 percent (EPA 1998). Necessary control measures would be applied to ensure that PM_{10} concentrations remain below applicable standards. The extent of land disturbance and construction equipment-related activity is expected to be less under this alternative than for the Environmental Management Waste Management Facility construction under Alternative 1B (No Action - Planning Basis Operations Alternative). Previous analysis indicates that fugitive dust emissions from the Environmental Management Waste Management Facility would not exceed applicable standards when dust suppression methods are used, and DOE therefore expects that construction of the new HEU Materials Facility would result in similarly low impacts (DOE 1998).

Impacts from operation of a new HEU Materials Facility would not depend on site location. No criteria or toxic pollutants would be generated from the new facility itself. Additional steam-generated heat would be required from the Y-12 Steam Plant; however, because of the conservative assumptions used in Alternative 1A (No Action - Status Quo Alternative), the additional heating requirements for the new HEU Materials Facility would not change the level of emissions estimated for Alternative 1B (No Action - Planning Basis Operations Alternative). Depending on the reuse of vacated HEU storage facilities (shutdown, cold standby, or reuse for some other Y-12 support activity), the additional heating requirement for the new facility could be offset by a reduction in heating requirements for the old facilities.

Alternative 2B (No Action - Planning Basis Operations Plus Upgrade Expansion of Building 9215)

The new addition to Building 9215 would have minimal impact to air quality at Y-12. Construction of the expanded facility would generate fugitive dust that would be mitigated with appropriate control measures similar to that described above for construction activities at Sites A and B to ensure that PM_{10} concentrations remain below applicable standards. Because of the smaller construction area (approximately 2 acres), the type of structure proposed, and the construction activities expected with building the new addition, potential fugitive dust emissions would be less than what would be expected for constructing the new HEU Materials Facility at Site A or Site B.

Operation of the new storage addition to Building 9215 would require additional steam generated by the Y-12 Steam Plant for heating. No criteria or toxic pollutant emissions would be generated from the new building expansion itself. Because of the conservative assumptions used in Alternative 1A (No Action - Status Quo), DOE believes that the additional heating requirements for the building expansion would not change the level of emissions estimated for Alternative 1B (No Action - Planning Basis Operations). Depending on the reuse of vacated HEU storage facilities (shutdown, cold standby, or reuse for some other Y-12 support activity), the additional heating requirement for the upgraded facility could be offset by a reduction in heating requirements for the old facilities.

5.7.1.4 *Alternative 3 (No Action - Planning Basis Operations Plus Special Materials Mission Alternative)*

No Action - Planning Basis Operations Plus Construct and Operate a New Special Materials Complex

Three potential sites are considered for the new Special Materials Complex. Site 1 consists of 8 ha (20 acres) and is located northwest of Building 9114 and on the north side of Bear Creek Road approximately 1,700 ft from the Y-12 Site boundary. Site 2 consists of approximately 8 ha (12.4 acres) and is located at the Y-12 Scrap Metal Yard inside the PIDAS approximately 762 m (2,500 ft) from the Y-12 Site boundary. Site 3 consists of approximately 8 ha (12.4 acres) and is located at the Y-12 Scrap Metal Yard west of the PIDAS approximately 2,500 ft from the Y-12 Site boundary.

Fugitive dust emissions would result from construction at any of the sites. Additional fugitive dust would be generated if Sites 2 or 3 were selected due to demolition of structures 9720-16 and 9720-24 at Site 2 and demolition of structures 9831, 9720-15, 9814, 9819, 9420, 9420-1, 9627, and 9626 at Site 3.

Emissions during construction at any of these three sites would be associated with land clearing, drilling, ground excavation, earth moving, and construction of the facility itself. Dust emissions often vary substantially from day to day, depending on the level of activity, the specific operation, and the prevailing meteorological conditions. A large portion of the emissions would result from construction equipment traffic over temporary roads at the construction site. Construction at the selected site would result in dust emissions that may have a temporary adverse impact on local air quality.

Based on the size of the construction site and the expected construction activities, the 24-hr PM_{10} standard may be exceeded by uncontrolled fugitive dust emissions. Effective control measures commonly used to reduce fugitive dust emissions include wet suppression, wind speed reduction using barriers, vehicle speed, and chemical stabilization. Chemical stabilization alone could reduce emissions by up to 80 percent (EPA1998, Supplement E to AP-42). Necessary control measures would be applied to ensure that PM_{10} concentrations remain below applicable standards. The extent of land disturbance and construction equipment-related activity is expected to be less under this alternative than for the Environmental Management Waste Management Facility activities included under Alternative 1B (No Action - Planning Basis Operations Alternative). Previous analysis indicates that fugitive dust emissions from the Environmental Management Waste Management Facility would not exceed applicable standards when dust suppression methods are used, and DOE therefore expects that construction of the New Special Materials Complex would result in similarly low impacts (DOE 1998a).

Emissions from the beryllium operations in the new Beryllium Facility would be exhausted through a newly designed 99.5 percent pre-filtration system prior to passing through a HEPA filtration system. This should further reduce beryllium emissions below those currently estimated under the No Action - Status Quo Alternative (modeled as 1 gram per year in Appendix E for conservatism). Impacts from operation of the new Special Materials Complex would not depend on site location.

In addition to beryllium emissions, approximately 380 L (100 gal) of acetonitrile emissions are expected from purification operations. Table 5.7.1–5 presents the modeled boundary and on-site concentrations from these emissions. The risk to human health from these pollutants is presented in the human health and worker safety section (Section 5.12).

TABLE 5.7.1–5.—*Maximum Boundary and On-Site Chemical Concentrations from Special Materials Complex Operations*

CAS Number	Chemical	Total Kilograms	Emissions (g/yr)	Emissions Rate (g/s)	Maximum Boundary Concentration (Fg/m³)		Maximum On-site Concentration (Fg/m³)	
					8-hr	**Annual**	**8-hr**	**Annual**
000075-05-8	Acetonitrile	297.42	2.97×10^5	4.19×10^{-2}	1.88	1.61×10^{-2}	29.1	1.68

Source: Appendix E.

5.7.1.5 *Alternative 4 (No Action - Planning Basis Operations Plus HEU Materials Facility Plus Special Materials Complex)*

Fugitive dust emissions would result from construction of the HEU Materials Facility and the Special Materials Complex. Demolition of structures at Site B for the HEU Materials Facility and Sites 2 and 3 for the Special Materials Complex would result in additional fugitive dust emissions.

Emissions during construction at potential sites would be associated with land clearing, drilling, ground excavation, earth moving, and construction of the facilities themselves. Dust emissions would vary substantially from day to day, depending on the level of activity, the specific operations, and the prevailing meteorological conditions. A large portion of the emissions would result from construction equipment traffic over temporary roads at the construction sites. Construction at the related sites would result in dust emissions that may have a temporary adverse impact on local air quality. Because the schedule for construction of the Special Materials Complex would fall after the completion of the major portion of the HEU Materials Facility, the potential fugitive dust emissions would not be additive. Necessary control measures would be applied to ensure that PM_{10} concentrations remain below appropriate standards.

No criteria pollutant emissions would be generated from the HEU Materials Facilities or the Special Materials Complex facilities themselves. Because of the conservative assumptions used in Alternative 1A (No Action - Status Quo Alternative), DOE believes that the additional heating requirements for the new facilities would not change the level of emissions estimated for Alternative 1B (No Action - Planning Basis Operations Alternative). Depending on the reuse of vacated facilities (shutdown, cold standby, or reuse for some other Y-12 support activity), the additional heating requirement for the new facilities could be offset by a reduction in heating requirements for the old facilities.

Other hazardous emissions (i.e., beryllium and acetronitrile) associated with various operations of the new Special Materials Complex would be the same as described in Section 5.2.1.4.

5.7.2 Radiological Impacts

Radiological discharges to the atmosphere would occur as a result of the operation of facilities at Y-12. To analyze the impacts of these emissions by alternative, DOE identified the facilities with the potential for radiological emissions and then estimated the amount of emissions that could result based on the projected use of the facilities.

After determining the emissions rates, the CAP88 computer code was used to estimate radiological doses to the MEI, the populations surrounding Y-12, and Y-12 workers. The CAP88 code is a Guassian plume dispersion model used to demonstrate compliance with the radionuclide NESHAP (40 CFR 61). Y-12 specific parameters including meteorological data, source characteristics, and population data were used to estimate the radiological doses. Detailed information on the CAP88 dispersion modeling is presented in Appendix E.4.

5.7.2.1 *Alternative 1A (No Action - Status Quo Alternative)*

The release of radiological contaminants, primarily uranium, into the atmosphere at Y-12 under Alternative 1A (No Action - Status Quo Alternative) occur almost exclusively as a result of Y-12 production, maintenance, and waste management activities. An estimated 0.015 Ci (3.9 kg) of uranium was released into the atmosphere in 1999 as a result of Y-12 activities.

The radiological doses to the MEI and the population surrounding Y-12 were calculated using the CAP88-PC model. The detailed input parameters used for the No Action - Status Quo Alternative for Y-12 are presented in the Radionuclide NESHAP report (DOE 2000d).

Under the No Action - Status Quo Alternative for 1999, six emissions points at Y-12 were modeled; each of these points included one or more individual sources of emissions. The total effective dose equivalent (TEDE) to the hypothetical MEI from Y-12 emissions was estimated at 0.53 mrem, which is 5.3 percent of the 10 mrem per year NESHAP standard. The MEI for Y-12 is located about 1,120 m (0.7 mi) north-northeast of the Y-12 release point. The atmospheric radionuclide contribution from ORNL and ETTP was estimated at 0.06 mrem and 0.1 mrem, respectively. The total in 1999 for all of ORR was 0.7 mrem. The collective (population) EDE due to Y-12 emissions was estimated at 4.5 person-rem, which is approximately 24 percent of the collective EDE due to emissions from the entire ORR (DOE 2000d).

5.7.2.2 *Alternative 1B (No Action - Planning Basis Operations Alternative)*

Under Alternative 1B (No Action - Planning Basis Operations Alternative), the annual enriched uranium emissions and other effluents for the period 2001-2010 was assumed to be 65 percent of the 1987 levels (see Section 3.1.2), an increase from Alternative 1A (No Action - Status Quo Alternative) emissions.

The radiological doses to the MEI and the population surrounding Y-12 were calculated using the CAP88-PC model. The detailed input parameters used for the No Action - Planning Basis Operations Alternative for Y-12 are presented in Appendix E.4. The TEDE received by the hypothetical MEI for Y-12 was conservatively calculated as 4.5 mrem/yr for the No Action - Planning Basis Operations Alternative. The dose is below the NESHAP standard of 10 mrem/yr. The MEI is located 1,120 m (3,675 ft) north-northeast of the Y-12 release point. The collective EDE to the population residing within 80 km (50 mi) of Y-12 for Alternative 1B (No Action - Planning Basis Operations Alternative) was calculated to be 33.7 person-rem. The risk to human health associated with the above doses is discussed in the human health section (see Section 5.12). The uranium emission for the No Action - Planning Basis Operations Alternative includes all the emissions from the storage of HEU in existing facilities.

The nonradiological air quality for criteria pollutants under the No Action - Status Quo and No Action - Planning Basis Operations Alternative is represented by the Y-12 Steam Plant operating at the calculated heat input capacity of 522 million Btu/hr. This heat input capacity represents the actual fuel consumption (coal and natural gas) on February 6, 1996, the coldest day in the last 5 years according to local meteorological data. The calculated criteria pollutant emissions based upon this Y-12 Steam Plant operation are assumed to represent a reasonable upper limit for estimating criteria pollutant concentrations at or beyond the Site boundary.

Concentrations of chemical pollutants during normal operations are represented by chemical emissions from the combustion of coal at the Y-12 Steam Plant at the calculated heat input capacity of 522 million Btu/hr and estimates of chemical concentrations based upon the conservative assumption that 100 percent of the purchased chemicals during 1998 are released to the atmosphere from Y-12 facilities.

The collective population doses (person-rem) from air emissions for all the workers (radiological and nonradiological) for Alternative 1A (No Action - Status Quo Alternative) and Alternative 1B (No Action - Planning Basis Operations Alternative) are given in Table 5.7.2–1.

The summary of the radiological doses to the workers for the No Action - Status Quo and No Action - Planning Basis Operations Alternatives for each operation and Y-12 as a whole is presented in Appendix E.4.2. The risk to human health associated with the above doses is discussed in the human health section (Section 5.12).

TABLE 5.7.2–1.—*Radiological Doses for Collective Y-12 Workers*

Operations	Alternative 1A No Action - Status Quo (person-rem)	Alternative 1B No Action - Planning Basis Operations (person-rem)
Enriched Uranium[a]	3.14	5.71
Depleted Uranium	1.78	2.59
Assembly/Disassembly/Quality Evaluation	1.28	1.86
Product Certification	1.2	1.83
Analytical Services	1.30	2.09

[a] Includes HEU Storage.
Source: Appendix D and Y-12 1999b.

5.7.2.3 *Alternative 2 (No Action - Planning Basis Operations Plus HEU Storage Mission Alternatives)*

The construction and operation of either the new HEU Materials Facility (Alternative 2A) or the Upgrade Expansion to Building 9215 (Alternative 2B) would result in some radiological emissions. The current design for either option calls for appropriately sized filtered HVAC systems. In addition, the facilities would not have airborne uranium emissions under routine operations because material would be contained in appropriate storage containers. Therefore, DOE believes that the radiological emissions for Alternative 2 (No Action - Planning Basis Operations Plus HEU Storage Mission Alternatives) would be the same as Alternative 1B (No Action - Planning Basis Operations Alternative). Until a final Safety Analysis Report has been completed for the new facilities, the actual radiological emissions will not be known. However, based on the new facility design and expected operations, these radiological emissions from HEU storage could be lower than the current radiological impacts described under the No Action - Status Quo Alternative. For purposes of analysis, DOE has assumed that the impacts under Alternative 2A (No Action - Planning Basis Operations Plus Construct and Operate a New HEU Materials Facility) and Alternative 2B (No Action - Planning Basis Operations Plus Upgrade Expansion of Building 9215) would remain unchanged from the No Action - Planning Basis Operations Alternative impacts (i.e., 4.5 millirem per year for the MEI, and 33.7 person-rem for the off-site population). The collective dose to the workers (35) under the No Action - Planning Basis Operations Alternative for the existing HEU Storage Mission is 1.16 person-rem. The collective dose to workers due to relocation of existing stored HEU to the new HEU storage facility is 5.25 person-rem. The collective dose to workers (14) during normal operations due to storage of HEU in the HEU Materials Facility is 0.29 person-rem. The risk to human health associated with the above doses is addressed in the human health section (Section 5.12).

5.7.2.4 *Alternative 3 (No Action - Planning Basis Operations Plus Special Materials Mission Alternative)*

The proposed Special Materials Complex would not contribute to the radioactive emissions at Y-12 as the facilities do not handle radioactive materials. Radiological impacts would be the same as described in Section 5.7.2.2 under Alternative 1B (No Action - Planning Basis Operations Alternative).

5.7.2.5 *Alternative 4 (No Action - Planning Basis Operations Plus HEU Materials Facility Plus Special Materials Complex)*

Under this alternative, the collective dose to workers at Y-12 would be the same as Alternative 1B (No Action - Planning Basis Operations Alternative) and shown in Table 5.7.2–1. There would be a slight decrease in HEU storage mission worker collective dose from 1.16 person-rem to 0.46 person-rem if the HEU Materials Facility were constructed and operated. This reduction is due to the decrease in number of workers from 35 under the No Action - Planning Basis Operations Alternative to 14 workers for the new HEU Materials Facility. The overall collective Y-12 worker dose however would not change from the 59.48 person-rem shown in Table D.2.3–5 because of the increased production levels and radiological emissions associated with enriched uranium operations. The Special Materials Complex is a non-rad facility and does not handle radioactive materials.

The MEI and population dose within 80 km (50 miles) of the Y-12 Site under this alternative would be the same as those for Alternative 1B (No Action - Planning Basis Operations Alternative). The conservatively estimated dose received by the hypothetical MEI is 4.5 mrem/yr which is below the NESHAP standard of 10 mrem/yr. The collective population dose would be 33.7 person-rem. This would be a substantial increase from Alternative 1A (No Action - Status Quo Alternative) dose to the MEI and population of 0.53 mrem/yr and 4.5 person-rem, respectively. The increase is due to the Y-12 enriched uranium and other stand-down operations resuming to planned and required workload levels under Alternative 1B (No Action - Planning Basis Operations Alternative).

5.7.3 Noise

The process of quantifying the effects of sound begins with establishing a unit of measure that accurately compares sound levels. The physical unit most commonly used is the decibel (dB). The decibel represents a relative measure or ratio to a reference pressure. The reference pressure is a sound approximating the weakest sound that a person with very good hearing can hear in an extremely quiet room. The reference pressure is 20 micropascals, which is equal to 0 (zero) dB.

A-weighted sound levels (dBA) are typically used to account for the response of the human ear. A-weighted sound levels represent adjusted sound levels that are made according to the frequency content of the sound. Figure 5.7.3–1 presents a comparison of decibel levels of everyday events with the threshold of human audibility.

5.7.3.1 *Alternative 1A (No Action - Status Quo Alternative)*

Major noise emission sources within Y-12 include various industrial facilities, equipment and machines (e.g., cooling systems, transformers, engines, pumps, boilers, steam vents, paging systems, construction and materials-handling equipment, and vehicles). Most Y-12 industrial facilities are at a sufficient distance from the Site boundary so noise levels at the boundary from these sources would not be distinguishable from background noise levels.

The acoustic environment along the ORR Site boundary in rural areas and at nearby residences away from traffic noise is typical of a rural location, with the day-average sound level in the range of 35 to 50 dBA. Areas near the site within the city of Oak Ridge are typical of a suburban area, with the average day-night sound level in the range of 53 to 62 dBA. The primary source of noise at the Site boundary and at residences located near roads is traffic.

No change in noise impacts is expected during the 10-year planning period under Alternative 1A (No Action - Status Quo Alternative).

TABLE 5.7.3–1.—*Permissible Noise Exposure*

Duration Per Day, hours	Sound Level dBA Slow Response
8	90
6	92
4	95
3	97
2	100
1.5	102
1	105
0.5	110
0.25 or less	115

Note: When the daily noise exposure is composed of two or more periods of noise exposure of different levels, their combined effect should be considered, rather than the individual effect of each. Exposure to impulsive or impact noise should not exceed 140 dB peak sound pressure level.

5.7.3.2 *Alternative 1B (No Action - Planning Basis Operations Alternative*)

The No Action - Planning Basis Operations Alternative includes Y-12 mission operations at planned levels, which would represent baseline background noise levels typical of industrial facilities ranging from 50 to 70 dBA. Manufactured noise generated in and around the Y-12 surrounding area includes traffic, generators, air conditioners, and ventilation systems. Under the No Action - Planning Basis Operations Alternative, Y-12 would not experience an appreciable change in traffic noise from the No Action - Status Quo Alternative because the number of workers is not expected to increase. On-site operational noise sources would increase due to increased operation levels from the No Action - Status Quo Alternative. Non-traffic noise sources are located at a sufficient distance from off-site receptors so the contribution to off-site noise levels would continue to be below off-site background levels.

Industrial and construction activities are another source of noise. Some of these activities could affect the occupational health of Y-12 personnel, but measures are in effect to ensure that hearing damage to personnel does not occur. These measures include regulations contained within the *Noise Control Act of 1972* (42 U.S.C.§4901), *Contractor Industrial Hygiene Program* (DOE Order 5480.10), and *Occupational Noise Exposure* (29 CFR 1910.95).

For Y-12 personnel, protection against effects of noise exposure is provided when the sound levels exceed those shown in Table 5.7.3–1 when measured on the A scale of a standard sound level meter at slow response. When employees are subjected to sound exceeding those listed in Table 5.7.3–1, feasible administrative or engineered controls are used. If such controls fail to reduce sound levels within the levels of the table, personal protective equipment (e.g., ear plugs) is provided and used to reduce sound levels within the levels of the table.

Continued compliance measures would be taken to ensure that hearing damage to personnel does not occur. Noise from traffic sources in and around Y-12 would continue unchanged under the No Action - Planning Basis Operations Alternative.

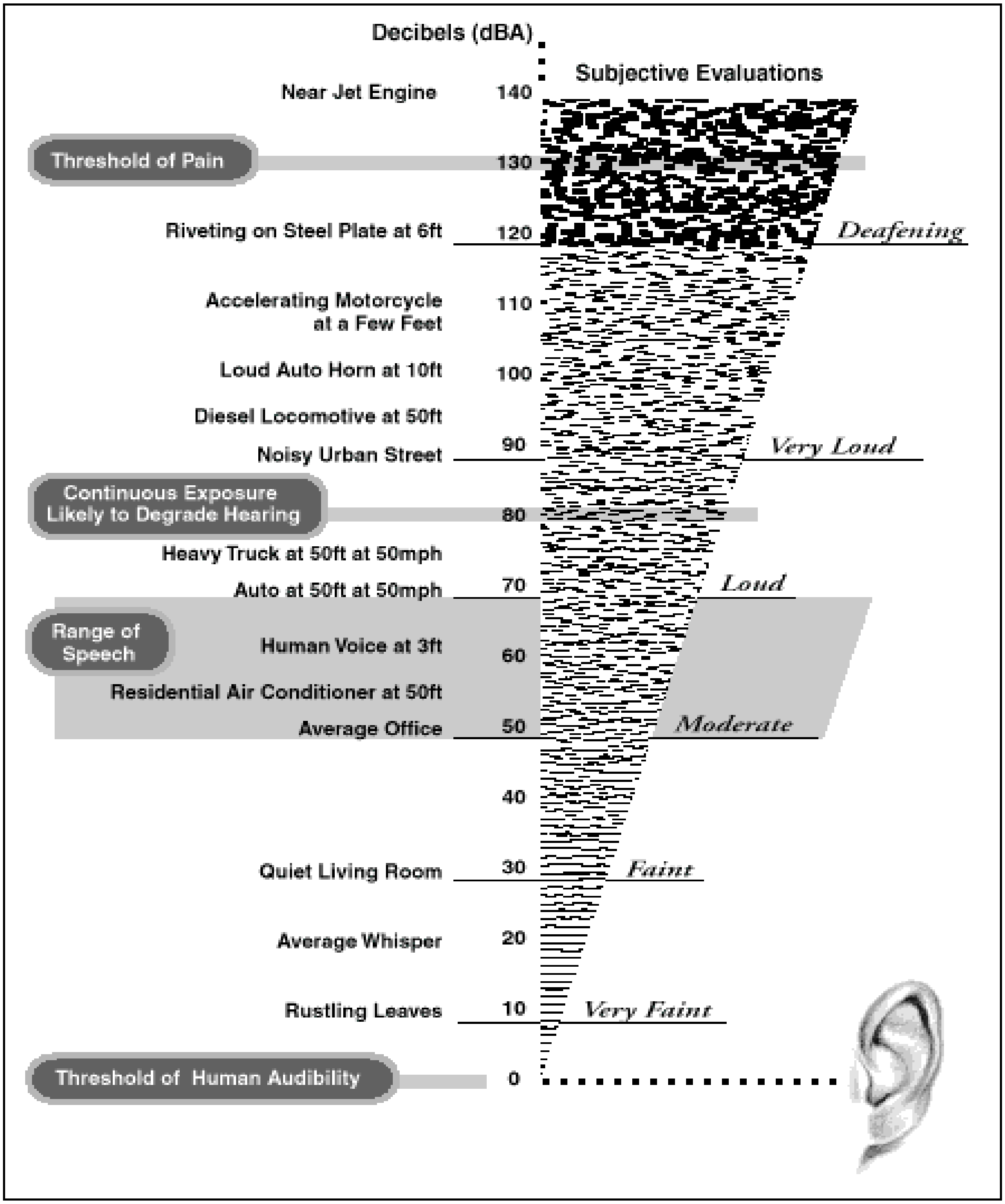
5.7.3.3 *Alternatives 2 and 3 (No Action - Planning Basis Operations Plus HEU Storage Mission and Special Materials Mission Alternatives*)

The on-site and off-site acoustical environments may be impacted during construction and operation of the proposed HEU Materials Facility and the Special Materials Complex. Construction activities would generate noise produced by heavy construction equipment, trucks, power tools, and percussion from pile drivers, hammers, and dropped objects. In addition, traffic and construction noise is expected to increase during construction on-site and along off-site local and regional transportation routes used to bring construction material and workers to the site. The levels of noise would be representative of levels at large-scale building sites. Table 5.7.3–2 describes peak attenuated noise levels expected from operation of construction equipment.

Relatively high and continuous levels of noise in the range of 89 to 108 dBA would be produced by heavy equipment operations during the site preparation phase of construction. However, after this time, heavy equipment noise would become more sporadic and brief in duration. The noise from trucks, power tools, and percussion would be sustained through most of the building construction and equipment installation activities on the proposed facility site. As construction activities reach their conclusion, sound levels on the proposed facility site would decrease to levels typical of daily facility operations (50 to 70 dBA). These construction noise levels would contribute to the ambient background noise levels for the duration of construction, after which ambient background noise levels would return to pre-construction levels.

Sites A and B for the HEU Materials Facility are approximately 520 and 760 m (1,700 and 2,500 ft), respectively, from the Y-12 Site boundary. Sites 1, 2, and 3 for the Special Materials Complex are 305 m (1,000 ft), 760 m (2,500 ft) and 760 m (2,500 ft), respectively, from the Y-12 Site boundary. Peak attenuated noise levels from construction of these facilities would be below background noise levels (53 to 62 dBA) at off-site locations within the city of Oak Ridge as shown in Table 5.7.3–2.

Operation of the HEU Materials Facility and the Special Materials Complex would generate some noise, caused particularly by site traffic and mechanical systems associated with operation of the facility (e.g., cooling systems, transformers, engines, pumps, paging systems, and materials-handling equipment). In general, sound levels are expected to be characteristic of a light industrial setting within the range of 50 to 70 dBA and would be within existing No Action - Status Quo levels. Effects upon residential areas are attenuated by the distance from the facility, topography, and by a vegetated buffer zone.



Source: DOE 1999c.

FIGURE 5.7.3–1.—*Decibel Levels Compared to the Threshold of Human Audibility.*

TABLE 5.7.3–2. —*Peak Attenuated Noise Levels (in dBA) Expected from Operation of Construction Equipment*

Source	Peak Noise Level	Distance from Source						
		15 m (50 ft)	30 m (100 ft)	61 m (200 ft)	100 m (400 ft)	305 m (1,000 ft)	518 m (1,700 ft)	762 m (2,500 ft)
Heavy trucks	95	84-89	78-83	72-77	66-71	58-63	54-59	50-55
Dump trucks	108	88	82	76	70	62	58	54
Concrete mixer	108	85	79	73	67	59	55	51
Jackhammer	108	88	82	76	70	62	58	54
Scraper	93	80-89	74-82	68-77	60-71	54-63	50-59	46-55
Bulldozer	107	87-102	81-96	75-90	69-84	61-76	57-72	53-68
Generator	96	76	70	64	58	50	46	42
Crane	104	75-88	69-82	63-76	55-70	49-62	45-48	41-54
Loader	104	73-86	67-80	61-74	55-68	47-60	43-56	39-52
Grader	108	88-91	82-85	76-79	70-73	62-65	58-61	54-57
Dragline	105	85	79	73	67	59	55	51
Pile driver	105	95	89	83	77	69	65	61
Forklift	100	95	89	83	77	69	65	61

Note: 1ft = 0.305 m
Source: Golden et al. 1980.

5.7.3.4 *Alternative 4 (No Action - Planning Basis Operations Plus HEU Materials Facility Plus Special Materials Complex)*

Construction related noise impacts under Alternative 4 (No Action - Planning Basis Operations Plus HEU Materials Facility Plus Special Materials Complex) would result from relatively high and continuous levels of noise in the range of 89 to 108 dBA. Because of the distance between construction sites and locations relative to Y-12 facilities cumulative noise impacts to the Y-12 employee population would be mitigated to acceptable levels (approximately 70 dBA). Noise impacts to Y-12 workers would be further mitigated by the buildings in which employees were working. However, the number of Y-12 workers exposed to increased construction noise levels under this alternative would be larger (basically the west end of Y-12) than under Alternative 1B (No Action - Planning Basis Operations Alternative), Alternative 2 (No Action - Planning Basis Operations Plus HEU Storage Mission Alternative), or Alternative 3A (No Action - Planning Basis Operations Plus Construct and Operate Special Materials Complex). Potential construction activity locations under the alternative are at sufficient distance from the ORR boundary and the city of Oak Ridge to result in no change to background noise levels at these areas.

5.8 SITE FACILITIES AND SUPPORT ACTIVITIES

Changes to site facilities and support activities were assessed by comparing the support requirements of the No Action - Planning Basis Operations Alternative (continue Y-12 mission operations) and the proposed HEU Storage Mission Alternatives and Special Materials Mission Alternative with the existing Y-12 No Action - Status Quo Alternative and Y-12 Site infrastructure capacities and facilities. These assessments focus upon electrical power, fuel requirements, and water usage. Projections of electricity availability, site development plans, and other Y-12 mid- and long-range planning documents were used to project Site infrastructure conditions for the evaluated alternatives. In addition, facilities that could be surplus to DP due to construction of new facilities were identified.

5.8.1 Alternative 1A (No Action - Status Quo Alternative)

The site facility and support requirements for this alternative are taken to be the same as those utilized during the most recent year when uranium operations were in stand-down and complete figures were available (i.e., 1999). Table 5.8.1-1 shows these requirements compared to the capacity of the Y-12 Site. The Site capacity in all cases is appreciably larger than requirements under the No Action - Status Quo Alternative. No adverse impacts are expected from operations under the No Action - Status Quo Alternative.

5.8.2 Alternative 1B (No Action - Planning Basis Operations Alternative)

Alternative 1B (No Action - Planning Basis Operations Alternative) would not result in major upgrades or new construction to DP facilities or operations. Under this alternative, DP and most site program missions would be performed in existing facilities. This alternative would require additional energy usage above that used under Alternative 1A (No Action - Status Quo Alternative) during 1999, principally due to the restart of uranium and other operations which were suspended in 1994. Table 5.8.2-1 shows the projected annual resource requirements for the No Action - Planning Basis Operations Alternative compared to usage under the No Action - Status Quo Alternative for the Y-12 Site.

5.8.3 Alternative 2 (No Action - Planning Basis Operations Plus HEU Storage Mission Alternatives)

Alternative 2A (No Action - Planning Basis Operations Plus Construct and Operate a New HEU Materials Facility)

Under this alternative, a new HEU Materials Facility would be built on either candidate Site A or Site B as described in Section 3.2.3.2. Appropriate measures would be implemented to minimize research worker access impacts to Field Research Center activities by any new Y-12 facility security requirement. HEU materials storage operations currently located in Buildings 9204-2, 9204-2E, 9204-4, 9215, 9720-5, and 9998 (shown in Figure 5.8.3–1) would be relocated to the new facility regardless of which site is selected. Areas in these buildings vacated by HEU storage operations would be available for other uses or could be declared as excess.

If the new facility is constructed at Site A, electrical and water utilities would be relocated and a sanitary sewer main would be extended to the new facility from a point just west of Building 9703-11. A new comprehensive storm sewer system would be provided with capacity for a 100-year storm; and the system would also accommodate the simultaneous failure of two 5.7 million L (1.5 million gal) water tanks on the south side of Pine Ridge.

If the new facility is constructed at Site B, Buildings 9831, 9720-15, 9814, 9819, 9429, 9420-1, 9626, and 9627 would be demolished. In addition, existing utilities would need to be relocated, including steam and condensate lines that serve the Y-12 WETF and Building 9114; overhead electrical lines, and a 143.8-kV line that runs along Old Bear Creek Road. New utilities would be extended to the new facility from existing tie points. Appropriate traffic control and coordination measures would be implemented during construction activities to minimize Field Research Center worker access impacts to the NABIR program activities at Y-12.

TABLE 5.8.1–1.—*Y-12 Site Energy and Resource Requirements—Alternative 1A (No Action - Status Quo Alternative)*

Resource	Units	Alternative 1A No Action - Status Quo Usage (1999)	Y-12 Site Capacity
Electrical energy	MWh/yr	357,900	1,752,000
Natural gas	m^3/yr	2,750,000	As needed
Coal	t/yr	64,350	As needed
Steam[a]	kg/hr @ 250 psi	83,900	363,000
Raw water	L/day	17,900,000	20,820,000
Treated water	L/day	15,950,000	26,500,000
Demineralized water	L/day	7,400	545,110
Sanitary sewer	L/day	2,880,000	5,680,000
Compressed air	m^3/min	296	595
Nitrogen	m^3/yr	5,465,000	33,980,000
Oxygen	m^3/yr	94,000	1,388,000
Helium	m^3/yr	63,150	As needed (5,550 m^3 Storage)
Hydrogen	m^3/yr	8,774	As needed (2,550 m^3 Storage)

[a] Average steam load.
Source: BWXT 2001a, LMES 1999d, LMES 2000a.

TABLE 5.8.2–1.—*Y-12 Site Energy and Resource Requirements—Alternative 1B (No Action - Planning Basis Operations Alternative)*

Resource	Units	Alternative 1A No Action - Status Quo Usage (1999)	Alternative 1B No Action - Planning Basis Usage
Electrical energy	MWh/yr	357,900	565,710
Natural gas	m^3/yr	2,750,000	3,965,000
Coal	t/yr	64,350	81,000
Steam[a]	kg/hr @ 250 psi	83,900	103,000
Raw water	L/day	17,900,000	17,900,000
Treated water	L/day	15,950,000	20,200,000
Demineralized water	L/day	7,400	16,880
Sanitary sewer	L/day	2,880,000	2,650,000
Compressed air	m^3/min	296	420
Nitrogen	m^3/yr	5,465,000	8,380,000
Oxygen	m^3/yr	94,000	116,400
Helium	m^3/yr	63,150	67,110
Hydrogen	m^3/yr	8,774	10,100

[a] Average steam load.
Source: BWXT 2000a, LMES 2000a, LMES 1999d.

Alternative 2B (No Action - Planning Basis Operations Plus Upgrade Expansion of Building 9215)

Under this alternative, a new two-story addition would be added to the north end of Building 9215 (see Section 3.2.2.3). HEU materials storage operations currently located in Buildings 9204-2, 9204-2E, 9204-4, 9215, 9720-5, and 9998 (shown in Figure 5.8.3–1) would be relocated to the new storage addition of Building 9215. Areas in these buildings vacated by HEU storage operations would be available for other uses or could be declared as excess.

Construction of the new addition to Building 9215 would not involve removing any major permanent structures since the proposed site is occupied by trailers and temporary facilities. Existing on-site utilities and infrastructure would be tied into the new facility with minimal relocation and modification necessary.

Table 5.8.3–1 shows the construction-related estimated resource requirements for HEU Storage Mission Alternatives. These requirements are small when compared to No Action - Status Quo or No Action - Planning Basis Operations usage and are well within existing Y-12 Site capacity.

Source: Tetra Tech, Inc./LMES 2000b.

FIGURE 5.8.3–1.—*Potentially Affected Facilities Due to Construction of Highly Enriched Uranium Materials Facility or Building 9215 Expansion*.

TABLE 5.8.3–1.—*HEU Storage Mission Alternatives Construction Requirements*

Requirements	New HEU Materials Facility	Upgrade Building 9215
Materials/Resource		
Electrical energy (MWh)	5,000	5,000
Concrete (m^3)	25,100	7,650
Steel (t)	2,100	1,100
Liquid fuel and lube oil (L)	568,000	265,000
Treated Water (L)	7,571,000	5,678,000
Land (ha)	5	1

Source: LMES 2000b.

Table 5.8.3–2 shows the long-term utility usage and resource requirements for the No Action - Planning Basis Operations Alternative along with the projected utility usage and resource requirements for the HEU Storage Mission Alternatives. The projected requirements in this table account only for the new facilities and do not account for potential reductions in utility usage or resource requirements due to demolition or reduced use of excess facilities. Because the existing utility and resource capacity at the Y-12 Site is sufficient to accommodate any projected changes resulting from the operation of a new storage facility, DOE expects no adverse impact on utilities or infrastructure due to the implementation of this alternative.

TABLE 5.8.3–2.—*Annual Operation Requirements for the Alternative 1B (No Action - Planning Basis Operations Alternative) and the HEU Storage Mission Alternatives*

Requirements	Alternative 1A No Action - Status Quo	Alternative 1B No Action - Planning Basis Operations	Alternative 2A HEU Materials Facility	Alternative 2B Upgrade Building 9215	Combined Alternative s 1B and 2A
Electrical energy (MWh)	357,900	565,710	5,900	10,900	571,610
Treated Water (L/day)	15,950,000	20,200,000	1,510	1,975	20,202,200

Source: BWXT 2001a, LMES 2000a, LMES 2000b.

5.8.4 Alternative 3 (No Action - Planning Basis Operations Plus Special Materials Mission Alternative)

No Action - Planning Basis Operations Plus Construct and Operate a New Special Materials Complex

Under this alternative, a new facility would be constructed to fulfill the Special Materials Mission at one of three candidate sites as discussed in Section 3.2.4.2. Special Materials Operations currently located in Buildings 9202, 9731, 9201-5, 9201-5N, 9995, 9404-11, 9204-2, (shown in Figure 5.8.4–1) would be relocated to the new facility regardless of which site is selected. Y-12 storm sewer system, and water, electrical, and other utilities would be extended from within the Protected Area of Y-12. Appropriate traffic control and coordination measures would be implemented during construction activities to minimize Field Research Center worker access impacts to the NABIR program activities at Y-12. When completed, the new facility would have no overhead utilities. Appropriate measures would be implemented to minimize research worker access impacts to Field Research Center activities by any new Y-12 facility security requirement.

Source: Tetra Tech, Inc./LMES 2000b.

FIGURE 5.8.4–1. ***Potentially Affected Facilities Due to Construction of Special Materials Complex.***

If Site 2 is selected, Buildings 9720-16, 9720-24, 9720-53, 9824-1, and 9824-2 would be demolished. As with Site 1, a comprehensive storm sewer system would be installed, and utilities would tie into existing systems at Y-12.

If Site 3 is selected, Buildings 9831, 9720-15, 9814, 9819, 9420, 9420-1, 9626, and 9627 would be demolished. In addition, several trailers would be moved from the site. As with Sites 1 and 2, a comprehensive storm sewer system would be installed, and utilities would tie into existing systems at Y-12.

Table 5.8.4–1 shows the construction-related estimated resource requirements for the proposed new Special Material Complex for the three candidate sites. These requirements are small when compared to usage under the No Action - Planning Basis Operations or No Action - Status Quo Alternative and are well within existing Y-12 Site capacity.

TABLE 5.8.4–1.—*Special Materials Complex Construction Requirements*

Requirements	Site 1	Site 2	Site 3
Materials/Resource			
Electrical energy (MWh)	8,000	8,000	8,000
Concrete (m^3)	13,800	14,500	14,500
Steel (t)	3,000	3,200	3,200
Liquid fuel and lube oil (L)	984,200	1,582,300	1,582,300
Industrial gases (m^3)	5,700	5,700	5,700
Treated Water (L)	5,700,000	5,700,000	5,700,000
Land (ha)	8	5	5

Source: LMES 2000c.

TABLE 5.8.4–2.—*Annual Operation Requirements Special Materials Complex Annual Operation Requirements*

Requirements	Alterative 1A No Action - Status Quo	Alternative 1B No Action - Planning Basis Operations	Alternative 3 New Special Materials Complex	Combined Usage
Electrical energy (MWh)	357,900	565,710	30,400	596,110
Steam kg/hr	83,900	103,000	3,262	106,300
Demineralized Water (L/day)	7,400	16,880	5,393	22,270
Industrial gas				
Helium (m^3)	63,150	67,110	14,725	81,840
Oxygen (m^3)	94,000	116,400	396	116,800
Nitrogen gas (m^3)	5,465,000	8,380,000	1,500,800	9,881,000
Treated Water (L/day)	15,950,000	20,200,000	228,600	20,430,000

Source: BWXT 2001a, LMES 2000a, LMES 2000c.

Table 5.8.4–2 shows the long-term utility usage and resource requirements for Alternative 1B (No Action - Planning Basis Operations) along with the projected utility usage and resource requirements for the proposed new Special Materials Complex. The projected requirements in this table account only for the new facilities and do not account for potential reductions in utility usage or resource requirements due to demolition or reduced use of excess facilities. Because the existing Y-12 Site utility and resource capacity is sufficient to accommodate any projected changes resulting from the operation of a new Special Materials Complex, DOE expects no adverse impact on utilities or Y-12 infrastructure due to implementing this alternative.

5.8.5 Alternative 4 (No Action - Planning Basis Operations Plus HEU Materials Facility Plus Special Materials Complex)

Construction and operation of the new HEU Materials Facility and the Special Materials Complex when combined with No Action - Planning Basis Operations would not have an appreciable impact on the utility usage and resource availability at the Y-12 Site. These combined values are shown in Table 5.8.5–1 which shows that they are all within the Y-12 Site capacities shown on Table 5.8.1–1. Appropriate traffic control and coordination measures would be implemented during construction activities to minimize Field Research Center worker access impacts to the NABIR program activities at Y-12. Appropriate measures would be implemented to minimize research worker access impacts to Field Research Center activities by any new Y-12 facility security requirement.

TABLE 5.8.5–1.—*Y-12 Site Energy and Resource Requirements—No Action - Planning Basis Operations Plus the HEU Storage Mission and Special Materials Mission*

Resource	Units	Alternative 1B No Action - Planning Basis Operations Usage	Alternative 4 Combined Usage
Electrical energy	MWh/yr	565,710	602,050
Natural gas	m^3/yr	3,965,000	3,965,000
Coal	t/yr	81,000	81,000
Steam[a]	kg/hr @ 250 psi	103,000	106,300
Raw water	L/day	17,900,000	17,900,000
Treated water	L/day	20,200,000	20,430,000
Demineralized water	L/day	16,880	22,300
Sanitary sewer	L/day	2,650,000	2,650,000
Compressed air	m^3/min	420	420
Nitrogen	m^3/yr	8,380,000	9,881,000
Oxygen	m^3/yr	116,400	116,800
Helium	m^3/yr	67,110	81,835
Hydrogen	m^3/yr	10,100	10,100

[a] Average steam load.
Source: LMES 2000a, LMES 1999b, LMES 2000c.

5.9 VISUAL RESOURCES

The visual resources analysis considers a ROI which includes those lands from which the Y-12 National Security Complex is visible (the viewshed). Impacts to the ROI include those associated with changes in the existing landscape character resulting from construction activities and operations under the No Action - Planning Basis Operations, HEU Storage Mission, and Special Materials Mission Alternatives.

5.9.1 Alternative 1A (No Action - Status Quo Alternative)

Y-12's heavily industrialized development is consistent with BLM's VRM Class IV which has been designated for the SWEIS analysis. Structures at Y-12 are mostly low profile reaching heights of three stories or less, with the expectation of the East and West meteorological towers. Viewpoints affected by DOE facilities are primarily associated with the public access roadways, the Clinch River/Melton Hill Lake and the bluffs on the opposite side of Clinch River. Views are limited are limited by the hilly terrain, heavy vegetation, and generally hazy atmospheric condition. Y-12 missions activities under the No Action - Status Quo Alternative are consistent with BLM's VRM Class 5 classification for developed areas of ORR. There are no impacts to visual resources expected under Alternative 1A (No Action - Status Quo Alternative).

5.9.2 Alternative 1B (No Action - Planning Basis Operations Alternative)

Under Alternative 1B (No Action - Planning Basis Operations Alternative), activities associated with DP, Environmental Remediation, Fissile Materials, NE and Nonproliferation, Work-for-Others Program, and Technology Transfer would not affect local short-term or long-term visual resources.

Potential impacts to visual resources from the Environmental Management Waste Management Facility and the ORNL NABIR Program Field Research Center component included under the No Action - Planning Basis Operations Alternative are described below.

Construction and operation activities associated with the Environmental Management Waste Management Facility at the Y-12 Site would be visible from Bear Creek Road, Chestnut Ridge, and Pine Ridge. Since Bear Creek Road is not a public thoroughfare and both Chestnut Ridge and Pine Ridge are restricted within the ORR boundary and accessible only by dirt road or by foot, there should be no short-term visual impacts to the public. Since the site where the Environmental Management Waste Management Facility would be constructed is within an area currently used for waste management, no adverse visual impacts are expected.

If in the future, portions of ORR along Bear Creek Road are released by DOE, the most likely land use would be industrial. Given the industrial nature of the existing nearby DOE facilities and the probable future land use, the new disposal cell construction and operations would be generally consistent with visual impacts expected from other ORR and Y-12 Site land use.

After closure, the disposal facility would remain visible for the foreseeable future, although re-establishment of the forest would provide some visual buffer. The closed cell would be a flat-topped, low mound. Should institutional controls lapse, external reforestation of the cell area would reduce the contrast of the facility with the surrounding woodland, but the man-made form of the facility would remain distinctive.

The Field Research Center component of the ORNL NABIR Program at Y-12 (see Section 3.2.1.7) could result in short-term visual impacts.

Activities supporting the Field Research Center Site, including characterizations, obtaining research quality samples, and conducting in-situ research, could result in short-term visual impacts to aesthetic resources as a result of machinery used on the Site. These activities would involve drill rigs and support vehicles. There would also be an increase in site personnel. Visual/aesthetic resources at the contaminated area include waste management areas as well as storage yards for scrap metal and other materials. The only visual intrusion anticipated due to Field Research Center research would be the placement of a support trailer and the temporary placement of drilling rigs and other equipment near specific research sites in the contaminated background area. Efforts would be made to place trailers and equipment in areas previously disturbed to limit the potential for visual impacts. No long-term visual impacts are expected from Field Research Center activities.

5.9.3 Alternative 2 (No Action - Planning Basis Operations Plus HEU Storage Mission Alternatives)

Alternative 2A (No Action - Planning Basis Operations Plus Construct and Operate a New HEU Materials Facility)

Construction of a new HEU Materials Facility will include an earthern berm which would cover the structure with cribbing walls on the North and West sides. The facility design calls for a single-story storage structure which is similar to the heights of surrounding facilities at both Site A and Site B. Adverse visual impacts associated with construction activities (dust, equipment exhaust, etc.) would be short-term and limited to the construction lay-down area and the immediate construction site of the new facility. Due to its industrial surroundings, the new HEU Materials Facility would not alter the visual character of the Y-12 National Security Complex, and long-range views would not be adversely affected.

Alternative 2B (No Action - Planning Basis Operations Plus Upgrade Expansion of Building 9215)

Under this alternative, the existing Building 9215 would be expanded to accommodate a two-story addition that would be similar to the heights of surrounding facilities. Adverse visual impacts associated with construction activities (dust, equipment exhaust, etc.) would be short-term and limited to the construction lay-down area and the immediate construction site of the new Building 9215 addition. Due to its industrial surroundings, the new addition would not alter the visual character of the Y-12 National Security Complex and long-range views would not be adversely affected.

5.9.4 Alternative 3 (No Action - Planning Basis Operations Plus Special Materials Mission Alternative)

No Action - Planning Basis Operations Plus Construct and Operate a New Special Materials Complex

The Special Materials Complex would consist of a number of processing operations and support facilities requiring approximately 5 to 8 ha (12.4 to 20 acres) of land. These facilities would range in height from one- to three-story buildings. Construction lay-down areas for each Site would be located within or near the designated facility Site (see Figure 3.2.4–3).

Site 1 for the proposed new Special Materials Complex is an 8-ha (20-acre) area which is currently a 50/50 mixture of previously cleared and wooded vacant land. There are no structures currently located on this Site. The construction of the Special Materials Complex would affect the visual appearance of Site 1, however, its construction is consistent with the existing VRM IV Classification which has been designated for the SWEIS analysis. Short-term visual impacts associated with construction activities (dust, equipment exhaust, etc.) would be limited to the construction lay-down area and the immediate construction site of the new facilities. Following construction activities, the construction lay-down area would be regraded and incorporated into the landscape design of the Special Materials Complex. The maximum height of the buildings within the Special Materials Complex would be approximately three stories, which is comparable to existing facilities within the Y-12 Site area. Visibility of Site 1 outside the ORR is restricted by surrounding Chestnut and Pine Ridges. The Special Materials Complex would have minimal effect on the overall viewshed.

Site 2 is approximately 5 ha (12.4 acres) and is located in the area of the Y-12 Scrap Metal Yard. Site 3 is the same location as Site B under Alternative 2A (No Action - Planning Basis Operations Plus Construct and Operate a New HEU Materials Facility). The construction lay-down area for Site 2 and Site 3 would be located on the existing S-3 Parking Lot. Adverse visual impacts associated with construction activities (dust, equipment exhaust, etc.) would be short-term and limited to the construction lay-down area and the immediate construction site of the new facilities. Following construction activities, this area would be repaved and the spaces would be relined for its original parking purposes. Construction of the Special Materials Complex at either Site 2 or Site 3 would not change the existing VRM IV Classification which has been designated for the SWEIS analysis and surrounding facilities. Since the maximum height of the buildings within the Special Materials Complex would be approximately three stories, which is comparable to existing facilities with the Y-12 Site area, there would be minimal effect on the overall viewshed.

Alternative 4 (No Action - Planning Basis Operations Plus HEU Materials Facility Plus Special Materials Complex)

Visual impacts resulting from construction of the HEU Materials Facility and the Special Materials Complex when combined with the No Action - Planning Basis Operations Alternative would be limited to short-term effects from activities in the immediate area of the proposed construction sites and lay-down areas. No long-term visual impacts are expected under this alternative. The HEU Material Facility and the Special Materials Complex would stand no more than the three-story average height of the surrounding Y-12 facilities. Facility design features would be incorporated to limit adverse visual impacts. Following construction activities, landscape previously disturbed would be returned to its natural state or incorporated into the new facility overall landscape setting. Construction of these facilities wold be consistent with BLM's VRM IV Classification which has been designated for the SWEIS analysis. Given the industrial nature of the surrounding facilities and probable future land use, construction and operation of these new facilities would be consistent with visual impacts from other ORR and Y-12 Site land use.

5.10 CULTURAL AND PALEONTOLOGICAL RESOURCES

Potential impacts to cultural resources are assessed by applying the criteria of adverse effect as defined in 36 CFR 800.5[a]. An adverse effect is found when an action may alter the characteristics of a historic property that qualifies it for inclusion in the National Register of Historic Places (NRHP) in a manner that would diminish the integrity of the property's location, design, setting, workmanship, feeling, or association. Some examples of adverse effect to cultural resources include: physical destruction or damage; alterations not consistent with the *Secretary of the Interior's Standards for Rehabilitation and Guidelines for Rehabilitating Historic Buildings* (DOI 1990a); relocation of a property; isolation and restriction of access; introduction of visible, audible, or atmospheric elements out of character with the resource; neglect resulting in deterioration; or transfer, lease or sale of historic properties without adequate protections. Adverse effects may include reasonably foreseeable effects caused by the action that may occur later in time, be farther removed in distance, or be cumulative. Activities conducted under the alternatives considered are measured against the criteria of adverse effect to determine the potential for and intensity of impacts to cultural resources.

While DOE, as the Federal agency, makes the determination of adverse effect, consultation with the State Historic Preservation Officer (SHPO) and other parties is required regarding the application of the criteria of adverse effect and in mitigation efforts to avoid or reduce any impacts. For certain activities specifically outlined in the Cultural Resources Management Plan (CRMP), DOE-ORO may apply the criteria of adverse effect without consultation, but if there is an adverse effect, there must be consultation with the SHPO and other parties to resolve the adverse effect (36 CFR 800.6, Souza 1997).

5.10.1 Alternative 1A (No Action - Status Quo Alternative)

The Y-12 area includes a proposed historic district which encompasses the original Y-12 Site and consists of 92 contributing buildings and structures. Two buildings in the Y-12 National Security Complex have been proposed for National Historic Landmark status as individual properties. Much of Y-12 has been disturbed by past activities and the potential for discovery of archaeological resources eligible for listing on the NRHP is considered low. The remaining undisturbed areas are not considered likely locations for significant archaeological resources (DuVall and Associates 1999). One pre-World War II structure has been determined eligible for listing on the NRHP. No Native American traditional use areas or religious sites are known to be present in the Y-12 area and no artifacts of Native American religious sigificance are known to exist have or to have been removed from the Y-12 area (Souza 1997). Seven cemeteries associated with Euro-American use of the area prior to World War II are likely to have religious or cultural importance to descendants and the local community. No other traditional, ethnic or religious resources have been identified in the Y-12 area.

Under the No Action - Status Quo Alternative, some NRHP-eligible properties in the proposed historic district would continue to be actively used for DOE mission activities. The historic significance of the district is related to its association with the Manhattan Project, development as a nuclear weapons component plant within the overall post-World War II government sponsored scientific movement, early nuclear development activities, the engineering merits of many of the structures, and for its contributions to science. The continued use of these buildings in a mission compatible with their historic role would have a positive impact on the integrity of the historic properties present.

Some historic buildings, which are not currently being used in current missions activities, may be subject to the potential adverse effects of building abandonment and demolitions. Alternative 1A (No Action - Status Quo Alternative), however, would minimize the need for mission-related demolitions and modifications of historic buildings and the need for new construction. Historic buildings may also benefit from passive preservation, although ongoing minor impacts due to aging would continue. The remote possibility of encountering unanticipated cultural resources during construction would be minimized.

5.10.2 Alternative 1B (No Action - Planning Basis Operations Alternative)

Alternative 1B (No Action - Planning Basis Operations Alternative) is the continuation of historical Y-12 missions operations at planned and required workload levels in existing facilities. No new major DP facility upgrades, modifications, or infrastructure improvements other than routine maintenance are included to accomplish the nuclear weapons complex support missions. However, included in this alternative is the Field Research Center and Environmental Management Waste Management Facility project activities as described in Section 3.2.2.

Under the No Action - Planning Basis Operations, NRHP- eligible properties in the proposed historic district encompassing the Y-12 National Security Complex would continue to be actively used for DOE mission activities. Planned production activities associated with assigned nuclear weapons support missions would contribute to the preservation of this aspect of the historical integrity of the district more than Alternative 1A (No Action - Status Quo Alternative). The continued use of these buildings in a mission compatible with their historic role would have a positive impact on the integrity of the historic properties present. This alternative would minimize potential adverse impacts of building abandonment, modifications, demolitions, and new construction of the action alternative. Ongoing minor impacts due to aging of historic structures would continue.

The potential for impacts to cultural resources resulting from the Field Research Center activities and the development of the Environmental Management Waste Management Facility waste disposal cell has been assessed in consultation with the SHPO. No impacts to cultural resources are anticipated (DOE 1999j, DOE 2000b). Although there are no known archaeological resources in the project areas, there would be a remote possibility of encountering buried cultural resources during ground-disturbing activities. Procedures for addressing the unanticipated discovery of cultural resources, including human remains and Native American cultural items, are outlined in the CRMP (Souza 1997). Compliance with these procedures addresses the requirements of applicable Federal and state laws and regulations with regard to unanticipated discoveries.

5.10.3 Alternative 2 (No Action - Planning Basis Operations Plus HEU Storage Mission Alternatives)

Alternative 2A (No Action - Planning Basis Operations Plus Construct and Operate a New HEU Materials Facility)

Site A. The Site A alternative includes the construction of a new HEU Materials Facility in the West Portal Parking Lot area with construction laydown north of Bear Creek Road. The planned removal of temporary structures, changes to utility and fence infrastructure, and facility construction would occur in the vicinity of the proposed Y-12 National Historic District. No structures which are contributing elements of the district or that have individual historic significance would be demolished or removed. The planned location, height, and style of the new construction would not be expected to impact the setting of the district as a whole or individual historic properties.

Ground-disturbing activities associated with removal of current utility infrastructure and the construction of the new facility and utility infrastructure could impact previously undisturbed areas. Although no significant archaeological resources are known to occur in the Y-12 Site area, there would be a possibility of encountering buried cultural resources during ground-disturbing activities. Procedures for addressing the unanticipated discovery of cultural resources, including human remains and Native American cultural items, are outlined in the CRMP (Souza 1997). Compliance with these procedures addresses the requirements of applicable Federal and state laws and regulations with regard to unanticipated discoveries.

Upon completion of the new HEU Materials Facility, NRHP- eligible buildings (9204-2, 9204-2E, 9204-4, 9215, 9720-5, and 9998) would no longer be used for the HEU storage mission. Depending on the disposition of these historic properties, there could be impacts associated with moving the HEU storage mission from these buildings. Potential impacts include changes in the character of the properties' use, the physical destruction of historic properties, and the neglect of properties leading to deterioration. If adverse effects on historic properties could result from the change of mission or subsequent disposition of these buildings, the SHPO must be consulted regarding the application of the criteria of adverse effect and in mitigation efforts to avoid or reduce any impacts in accordance with 36 CFR 800.

Site B. The Site B alternative includes the construction of a new HEU Materials Facility at the current location of the Y-12 Scrap Metal Yard. Equipment laydown would be at the S-3 Ponds Parking Lot and temporary parking lots would be developed in the West Tank Farm area and south of old Post 17. Several trailers and structures would be removed or torn down. The planned demolition of structures, environmental clean-up activities, changes to utility infrastructure, and facility construction would occur in the vicinity of the proposed Y-12 National Historic District. No structures which are contributing elements of the proposed district or that have individual historic significance would be demolished or removed. The planned location, height, and style of the new construction would not be expected to impact the setting of the district as a whole or individual historic properties.

Ground-disturbing activities associated with environmental cleanup of the Y-12 Scrap Metal Yard, new utility infrastructure, and facility construction could impact previously undisturbed areas. Although no significant archaeological resources are known to occur in the Y-12 Site area, there would be a possibility of encountering buried cultural resources during ground-disturbing activities. Procedures for addressing the unanticipated discovery of cultural resources, including human remains and Native American cultural items, are outlined in the CRMP (Souza 1997). Compliance with these procedures addresses the requirements of applicable Federal and state laws and regulations with regard to unanticipated discoveries.

Upon completion of the new HEU Materials Facility, NRHP- eligible buildings (9204-2, 9204-2E, 9204-4, 9215, 9720-5, and 9998) would no longer be used for the HEU Storage Mission. Depending on the disposition of these historic properties, there could be impacts associated with moving the HEU Storage Mission from these buildings. Potential impacts include changes in the character of the properties' use, the physical destruction of historic properties, and the neglect of properties leading to deterioration. If adverse effects on historic properties could result from the change of mission or subsequent disposition of these buildings, the SHPO must be consulted regarding the application of the criteria of adverse effect and in mitigation efforts to avoid or reduce any impacts in accordance with 36 CFR 800.

Alternative 2B (No Action - Planning Basis Operations Plus Upgrade Expansion of Building 9215)

Actions proposed under this alternative include the construction of a two-story addition to the north end of Building 9215 to address long-term HEU storage requirements. Building 9215 is eligible for inclusion on the NRHP as a contributing element of the proposed Y-12 National Historic District for its historical association with the post-World War II government-sponsored scientific movement and early nuclear development. The property, which was constructed in 1956, also meets the criteria of "exceptional significance" required for listing properties less than 50 years old (Thomason 1999).

The expansion of Building 9215 under this alternative would be a major alteration of this historic property. If the proposed modifications are consistent with the *Secretary of the Interior's Standards for Rehabilitation and Guidelines for Rehabilitating Historic Buildings* (DOI 1990a) and the SHPO concurs, this alteration would not have an adverse effect on this historic building. This facility was renovated and enlarged in 1970, 1976, and 1986, and has had minor upgrades and modifications several times since construction (Thomason 1999). Since active facilities must constantly evolve if they are to continue making scientific or engineering advances, change is part of the historic significance of this kind of property. The proposed modifications could result in the positive impact of allowing the continued use of the facility in a mission closely aligned with its historic role. The SHPO and other parties must be consulted regarding the application of the criteria of adverse effect and in mitigation efforts to avoid or reduce any impacts in accordance with 36 CFR 800.

The proposed site for construction of the addition is currently occupied by trailers and temporary buildings. No structures which are contributing elements of the proposed Y-12 National Historic District or that have individual historic significance would be demolished or removed. Ground-disturbing activities associated with site preparation, new utility infrastructure, and facility construction could impact previously undisturbed areas. Although no significant archaeological resources are known to occur in the Y-12 Site area, there would be a possibility of encountering buried cultural resources during ground-disturbing activities. Procedures for addressing the unanticipated discovery of cultural resources, including human remains and Native American cultural items, are outlined in the CRMP (Souza 1997). Compliance with these procedures addresses the requirements of applicable Federal and state laws and regulations with regard to unanticipated discoveries.

Upon completion of the new HEU storage addition to Building 9215, some NRHP- eligible buildings (9204-2, 9204-2E, 9204-4, 9720-5, and 9998) would no longer be used for the HEU storage mission. Depending on the disposition of these historic properties, there could be impacts associated with moving the HEU storage mission from these buildings. Potential impacts include changes in the character of the properties' use, the physical destruction of historic properties, and the neglect of properties leading to deterioration. If adverse effects on historic properties could result from the change of mission or subsequent disposition of these buildings, the SHPO must be consulted regarding the application of the criteria of adverse effect and in mitigation efforts to avoid or reduce any impacts in accordance with 36 CFR 800.

5.10.4 Alternative 3 (No Action - Planning Basis Operations Plus Special Materials Mission Alternative)

This alternative includes the No Action - Planning Basis Operations Alternative that continues the use of existing buildings for Special Materials Operations or the construction of a Special Materials Complex on one of three sites currently under consideration.

No Action - Planning Basis Operations Plus Construct and Operate a New Special Materials Complex

Site 1. The Special Materials Complex Site 1 alternative includes the construction of a new Special Materials Complex northwest of Building 9114 and north of Bear Creek Road. The Site is currently unoccupied and would not require removal of any structures. Portions of the Site have been disturbed by past construction lay-down activities but approximately 50 percent of the Site is a wooded slope which appears to be relatively undisturbed. Because use of this Site would probably involve ground disturbance in an undisturbed area and may involve disturbance exceeding the depth and extent of previous ground disturbances the DOE-ORO would consult with SHPO and other parties to determine whether an archaeological survey is warranted. If a survey is conducted, any resources found would be evaluated for NRHP-eligibility and the effects determined in consultation with the SHPO and other parties. Even if no resources are found during a survey, there would be a remote possibility of encountering buried cultural resources during ground-disturbing activities. Procedures for addressing the unanticipated discovery of cultural resources, including human remains and Native American cultural items, are outlined in the CRMP (Souza 1997). Compliance with these procedures addresses the requirements of applicable Federal and state laws and regulations with regard to unanticipated discoveries.

The Special Materials Complex construction would occur in the vicinity of the proposed Y-12 National Historic District. The planned location, height, and style of the new construction would not be expected to impact the setting of the district as a whole or individual historic properties.

Upon completion of the Special Materials Complex, NRHP-eligible buildings (9201-5, 9202, 9731, and 9995) would no longer be used for the Special Materials Mission. Depending on the disposition of these historic properties, there could be impacts associated with moving this mission from these buildings. Potential impacts include changes in the character of the properties' use, the physical destruction of historic properties, and the neglect of properties leading to deterioration. If adverse effects on historic properties could result from the change of mission or subsequent disposition of these buildings, the SHPO must be consulted regarding the application of the criteria of adverse effect and in mitigation efforts to avoid or reduce any impacts in accordance with 36 CFR 800.

Site 2. The Special Materials Complex Site 2 alternative includes the construction of a new Special Materials Complex in the Y-12 Scrap Metal Yard area. No structures which are contributing elements of the Y-12 Site National Historic District or that have individual historic significance would be demolished or removed. The planned location, height, and style of the new construction would not be expected to impact the setting of the district as a whole or individual historic properties.

Ground-disturbing activities associated with removal of current utility infrastructure, environmental restoration activities and the construction of the new facility and utility infrastructure could impact previously undisturbed depths. Although no significant archaeological resources are known to occur in the Y-12 Site area, there would be a possibility of encountering buried cultural resources during ground-disturbing activities. Procedures for addressing the unanticipated discovery of cultural resources, including human remains and Native American cultural items, are outlined in the CRMP (Souza 1997). Compliance with these procedures addresses the requirements of applicable Federal and state laws and regulations with regard to unanticipated discoveries.

Upon completion of the Special Materials Complex, NRHP-eligible buildings (9201-5, 9202, 9731, and 9995) would no longer be used for the Special Materials Mission. Depending on the disposition of these historic properties, there could be impacts associated with moving this mission from these buildings. Potential impacts include changes in the character of the properties' use, the physical destruction of historic properties, and the neglect of properties leading to deterioration. If adverse effects on historic properties could result from the change of mission or subsequent disposition of these buildings, the SHPO must be consulted regarding the application of the criteria of adverse effect and in mitigation efforts to avoid or reduce any impacts in accordance with 36 CFR 800.

Site 3. The Special Materials Complex Site 3 (Southwest) alternative includes the construction of the Special Materials Complex at the current location of the Y-12 Scrap Metal Yard. The potential impacts associated with the use of this Site are the same as described for Alternative 2A (No Action - Planning Basis Operations Plus Construct and Operate a New HEU Materials Facility) Site B. Potential impacts associated with moving the Special Materials Mission from NRHP- eligible buildings (9201-5, 9202, 9731, and 9995) would be the same as described for Sites 2 and 3.

5.10.5 Alternative 4 (No Action - Planning Basis Operations Plus HEU Materials Facility Plus Special Materials Complex)

Construction of both the HEU Materials Facility and Special Materials Complex and continued support of assigned missions under the No Action - Planning Basis Operations Alternative could result in greater impacts to cultural resources than building one or the other facility. Potential impacts vary by site location and specific actions planned, but it is expected that no significant impacts would result, or that adequate mitigation measures would be developed to reduce any impacts to a level of non-significance. No structures which are contributing elements of the Y-12 National Historic District or that have individual historic significance would be demolished or removed for the construction. The storage expansion of Building 9215 is the only major alteration of a historic property under consideration among the alternatives. If both facilities are built there would be more ground disturbing among the alternatives; there would also be more activities associated with site preparation, new utility infrastructure, and facility construction which could result in the unanticipated discovery of cultural resources. There could be impacts associated with the disposition of many cultural resources. There could be impacts associated with the disposition of many historic properties when these mission operations are moved from existing buildings into the new facilities.

Potential impacts include changes in the character of the properties' use, the physical destruction of historic properties, and the neglect of properties leading to deterioration.

5.10.6 Mitigation Measures

The DOE-ORO, the Advisory Council for Historic Preservation, and the Tennessee SHPO entered into a Programmatic Agreement for the management of cultural resources at the ORR (DOE 1994c). This Programmatic Agreement mandated the preparation of a CRMP to provide detailed compliance procedures for future undertakings including preconstruction planning, consultation and documentation responsibilities, excluded actions, unanticipated discoveries, and avoidance of adverse effects (Souza 1997). The CRMP is currently used, although it is in draft form awaiting final approval and publishing. Therefore, provisions are in place to identify and resolve any potential adverse effects to cultural resources that may result from actions planned under the No Action - Planning Basis Operations, HEU Storage Mission, and Special Materials Mission Alternatives under consideration. These provisions allow a large measure of discretion to the DOE-ORO in addressing the cultural resource issues unique to this kind of facility and emphasize early planning to avoid, reduce, and mitigate the adverse effects of undertakings. The CRMP does, however, require consultation for all undertakings which may have an adverse effect on historic properties.

The DOE-ORR has notified the Tennessee SHPO that undertakings resulting from the alternatives under consideration may have an adverse effect on historic properties. After review of the documentation provided, the SHPO agreed that there may be an adverse effect and requested further consultation (see Appendix C). Whether there would be impacts, and the context and intensity of these potential impacts, is dependent on the alternative(s) selected and the specific actions planned. It is expected that either no significant impacts would result, or that adequate mitigation measures would be developed to reduce any impacts to a level of nonsignificance.

Measures to minimize the potential adverse effects to unanticipated archaeological resources could include:

- Providing basic information to workers involved in ground-disturbing activities regarding the recognition of archaeological resources and Native American cultural items and the procedures to be followed upon discovery

- Assuring that discovery procedures detailed in Sections 5.1.6 and 5.4.2 of the CRMP are implemented in all applicable cases (Souza 1997). These procedures address the responsibilities of DOE-ORO under 36 CFR 800.13, 43 CFR 10.4, Section 3(d)(1) of *Native American Graves Protection and Repatriation Act* of 1990 and the State of Tennessee burial laws Tennessee Code Annotated (TCA) 11-6-116, 39-17-311 and TCA 39-17-312.

Measures to minimize the adverse effect of aging on historic properties could include:

- Providing information to responsible parties regarding maintenance of historic buildings in accordance with the *Secretary of the Interior's Standards for Rehabilitation and Guidelines for Rehabilitating Historic Buildings* (DOI 1990a)

- Developing a building maintenance plan for the Y-12 National Historic District to address the issues of care for historic structures and ongoing aging issues

Measures to minimize the potential adverse effect of changes in the character of the use of historic properties could include:

- Consideration of upgrades and rehabilitation to allow continued use of the facility

- Consideration of the reuse of the facility for other similar mission-related activities

Measures to minimize the adverse effect of the physical destruction of historic properties by removal or demolition of buildings could include:

- Consideration of upgrades and rehabilitation in lieu of removal

- Salvage of architectural or scientific/engineering elements

- Detailed recording of the structures to the standards of the Historic American Buildings Survey or the Historic American Engineering Record (DOI 1990b) prior to removal (when all other mitigations are determined to be infeasible)

If a large number of individual contributing elements to the district are considered for removal, such that the integrity of the district as a whole would be threatened, DOE should consider entering into a Memorandum of Agreement for this specific action to identify the programmatic approach to mitigate this impact.

Measures to minimize the potential adverse effect of neglect or abandonment of historic properties could include:

- Consideration of the reuse and/or rehabilitation of the property for support or other functions

- The development of a maintenance and security plan to ensure that buildings are not allowed to deteriorate when not in use

Measures to minimize any potential adverse effects of the modification of historic structures such as Building 9215 could include:

- Designing building modifications that are consistent with the *Secretary of the Interior's Standards for Rehabilitation and Guidelines for Rehabilitating Historic Buildings* (DOI 1990a)

- Consideration of changes in project design to avoid the adverse impacts of modification

- Salvage of architectural or scientific/engineering elements

- Detailed recording to the standards of the Historic American Buildings Survey or the Historic American Engineering Record (DOI 1990b) prior to modifying the facility (when all other mitigations are determined to be infeasible)

5.10.7 Paleontological Resources

Impacts to paleontological resources are considered significant if scientifically important resources are disturbed or damaged. Scientific importance for paleontological resources is based on the research potential of the resource, the quality of the fossil preservation in the deposit and on the numbers and kind of resources that could be affected. Resources with high research potential include deposits with poorly known fossil forms; fossils which originate from areas which are not well studied; well-preserved terrestrial vertebrates; unusual depositional contexts or concentrations; or assemblages containing a variety of different fossil forms. Paleontological materials in the Y-12 Site area consist of common invertebrate remains which are unlikely to be unique from those available throughout the East Tennessee region.

No scientifically important paleontological resources have been identified in the Y-12 Site area. Actions contemplated for the alternatives under consideration would require minor or no ground disturbance of previously undisturbed areas. It is unlikely that any scientifically important paleontological resources would be impacted by the No Action - Planning Basis Operations, HEU Storage Mission, or Special Materials Mission Alternatives.

DOE has identified no potential impacts to paleontological resources and, therefore, no mitigation actions are required.

5.11 WASTE MANAGEMENT AND POLLUTION PREVENTION

Waste streams currently generated at the Y-12 National Security Complex may be broadly grouped to include: LLW, mixed LLW, hazardous waste, and sanitary/industrial (nonhazardous) waste. These waste streams would continue to be generated by implementation of each of the alternatives, however, quantities and relative proportions of the waste would vary by alternative. Waste generated during routine operations, under the No Action - Status Quo and No Action - Planning Basis Operations Alternatives (Section 5.11.1), during implementation of the alternatives for the two missions (Section 5.11.2), and as a result of pollution prevention efforts and mitigation measures in relation to the alternatives (Section 5.11.3) are discussed here.

Some waste generated by activities at Y-12 are not included in this discussion. Many of the facilities at Y-12 are already considered surplus and will be subject to D&D. Per agreement among the DOE, the State of Tennessee and the EPA, D&D of facilities on the ORR will be primarily addressed as removal actions through the CERCLA process because they are often contaminated and present a risk to human health and the environment. This agreement allows DOE and the regulators to prioritize D&D of these facilities based on the level of risk posed by the facility and available funding. Waste generated by D&D of these surplus facilities under the Environmental Restoration Program is not associated with the alternatives being considered in this EIS and is, therefore, not discussed here. Other environmental restoration waste generated at Y-12 that is also addressed through the CERCLA process (Section 1.3) is not considered here. Per DOE's 1994 Secretarial policy on NEPA, the CERCLA process is relied upon for NEPA review, and NEPA values are incorporated into CERCLA documentation for these actions. CERCLA waste streams are, however, included in a discussion of cumulative impacts (Chapter 6).

As noted in Section 4.8.2.3, wastes containing residual radioactive materials below approved authorized limits are currently disposed at the on-site sanitary/industrial landfill and construction/demolition landfills. Potential radiological impacts to on-site workers and off-site members of the public must be evaluated during the development of such authorized limits per DOE Order 5400.5 and associated guidance (DOE 1995, DOE 1997). Requirements for the approval of authorized limits for any specified waste stream at these facilities include analyses demonstrating that: (1) the potential radiation dose to workers or the public would be as far below 25 mrem/yr as reasonably achievable (and typically below 1 mrem/yr); (2) groundwater would be protected in accordance with the Site Groundwater Protection Program and applicable Federal and state regulations (40 CFR 131.11 and *Rules of the TDEC Chapter 1200-4-3*); and (3) any future release of the landfill property would not be expected to require future remediation under DOE Order 5400.5 requirements. These requirements are designed to provide reasonable assurance that potential radiological impacts from residual radioactive materials below authorized limits at these facilities would be neglible. DOE is currently re-evaluating authorized limits for disposal of materials containing residual radioactivity at Y-12 disposal facilities. This is not expected to alter the type of wastes accepted at the Y-12 landfills and will not be discussed further in this section.

Implementation of an alternative for the HEU Storage Mission or the Special Materials Mission could result in associated D&D of facilities currently used to perform these missions or the disturbance of previously contaminated environmental media. The potential impacts from generation of D&D and environmental restoration waste directly associated with implementation of the alternatives for these two missions are included in this section of the EIS. D&D can range from performing a simple radiological survey to completely dismantling and removing a radioactively contaminated facility. The potential reuse of a facility or the outcome of its disposition must be known to predict waste volumes for its D&D, but could be conservatively bounded by a demolition scenario and discussed on a relative basis.

5.11.1 Waste Generated During Routine Operations Under Alternative 1A (No Action - Status Quo Alternative) and Alternative 1B (No Action - Planning Basis Operations Alternative)

Under both No Action Alternatives, Y-12 would continue to generate and manage waste at the Site. Mixed LLW and LLW in solid form are currently stored on-site pending treatment and storage. Disposal of radioactive waste generated at Y-12 has been restricted by either a lack of on-site facilities or by administrative barriers to approval of transporting and disposing of radioactive waste off site since on-site disposal ceased in the 1980s. As a result, significant quantities of LLW and mixed LLW have accumulated in storage at Y-12. Limited quantities of accumulated, legacy mixed LLW and LLW are being shipped off site for treatment and disposal because some approvals have been obtained to use existing DOE or licensed-commercial facilities. The bulk of the waste remains stored at Y-12. DOE must meet milestones to disposition mixed LLW as set forth in an ORR Site Treatment Plan for Mixed Waste as mandated by a State Commissioner's Order and to comply with the *Federal Facilities Compliance Act* (FFCA). Liquid LLW and mixed LLW are either treated on site and disposed of, or treated and subsequently managed as solids (Appendix A.5.11).

Recently, DOE issued a ROD covering treatment and disposal of mixed LLW and LLW (65 FR 10061, February 25, 2000) as one of a series of RODs for the Waste Management PEIS. In the ROD, DOE decided to continue minimum treatment of LLW generated at ORR on-site and dispose of the LLW at the Nevada Test Site. For management of mixed LLW, DOE decided to treat the mixed LLW generated at ORR on-site and dispose of the mixed LLW at the Nevada Test Site. Adverse impacts related to storage of legacy mixed LLW and LLW are expected to be reduced as the goals for legacy waste set forth under the Site Treatment Plan and the ROD are met (by FY 2006).

No new adverse impacts to the environment are anticipated from the generation of hazardous and sanitary/industrial waste by continuing current operations at No Action - Status Quo levels or by bringing them up to No Action - Planning Basis Operations levels. RCRA-permitted units for the storage and treatment of hazardous waste would continue to operate in support of routine operations at Y-12. Adequate permitted and approved off-site facilities are available to meet any additional treatment requirements and for disposal of the hazardous waste. Sanitary and process waste liquids would continue to be treated by the city of Oak Ridge sewage treatment plant or Y-12 treatment facilities. Current facilities have a combined capacity to handle approximately 10 times the liquid waste volumes generated by current operations. The resultant solids would be disposed of with other nonhazardous waste in existing, permitted landfills with an adequate capacity to handle projected waste volumes. Landfill V, a sanitary/industrial landfill at Y-12, would continue to accept general refuse and asbestos, medical (non-infectious), and other special waste as approved on a case-by-case basis by the state regulatory authorities. Landfills VI and VII are permitted for disposal of construction and demolition waste and have ample disposal capacity for well beyond the 10-year planning period (Appendix A, Table A.5.11.3–1).

5.11.1.1 *Alternative 1A (No Action - Status Quo Alternative)*

Waste streams and volumes generated during routine operations under the No Action - Status Quo Alternative, (1999 baseline year) are presented in Table 5.11.2–1. No changes would be anticipated in activities that generate waste or management practices over the 10-year planning period for Alternative 1A (No Action - Status Quo Alternative). This alternative is provided for comparison only to the No Action - Planning Basis Operations, HEU Storage Mission, and Special Materials Mission Alternatives.

5.11.1.2 *Alternative 1B (No Action - Planning Basis Operation Alternative)*

Waste streams and volumes generated during routine operations under Alternative 1B (No Action - Planning Basis Operations Alternative) are presented in Table 5.11.2–1. Few changes are anticipated in waste generation and management over the 10-year planning period under this alternative. On-going pollution prevention and waste minimization activities could result in further reductions in waste generation and thus, lower the annual generation rates of LLW and non-hazardous waste when compared to 1999 No Action - Status Quo levels. Slight increases in the generation of hazardous and mixed waste could still result as some operations are restarted or ramped up. Environmental restoration activities that would cause temporary increases in waste generation levels are not included with the waste from routine operations that are being discussed in this section.

5.11.2 Waste Generated by the Alternatives for the HEU Storage Mission and the Special Materials Mission

Differences in waste generation between the HEU Storage Mission and Special Materials Mission alternatives are primarily related to waste generated by construction and D&D activities that would be temporary in nature (3 to 5 years). Waste generated from routine activities could also differ between the alternatives as a result of differences between building and process efficiencies, as well as from ongoing pollution prevention efforts at Y-12 (Section 4.11).

The volumes of waste generated during routine operations for Alternatives 2A, 2B, and 3 are presented in Tables 3.2.3–2, 3.2.3–4, and 3.2.4–2 and summarized for all alternatives (2A, 2B, 3 and 4) in Table 5.11.2–1. The anticipated volumes of construction waste generated by implementation of Alternatives 2A, 2B, and 3 are presented in Tables 3.2.3–1, 3.2.3–3, 3.2.4–1, 3.2.4–3, and 3.2.4–4 and summarized for action alternatives (2A, 2B, 3, and 4) in Table 5.11.2–2.

TABLE 5.11.2–1.— *Summary of Annual Waste Generation During Routine Operations at Y-12 by Alternative*

Waste Type	Alternative 1A No Action - Status Quo	Alternative 1B No Action - Planning Basis Operations	HEU Storage Mission: Alternative 2				Special Materials Mission: Alternative 3		Combined Alternatives: Alternative 4	
	Status Quo 1999	Planning Basis Operations	New HEU Facility 2A	2A plus Planning Basis	Building 9215 Expansion 2B	2B plus Planning Basis Operations	New Special Materials Complex	Special Materials Complex plus Planning Basis Operations	New HEU Facility + New Special Materials	New HEU Facility + New Special Materials + Planning Basis Operations
Low-level total										
Liquid m^3 (gal)	1,000 (264,172)	1,118.8 (295,556)	0.8 (200)	1,119.6 (295,756)	0.6 (160)	1,119.4 (295,716)	none	1,118.8 (295,556)	0.8 (200)	1,119.6 (295,756)
Solid m^3 (yd^3)	1,404 (1,836)	2,099 (2,745)	119.3 (156)	2,218 (2,901)	119.3 (156)	2,218 (2,901)	0.8 (1)	2,100 (2,746)	120 (157)	2,219 (2,902)
Total m^3	2,404	3,218	120	3,338	120	3,338	1	3,219	121	3,339
Mixed low-level										
Liquid m^3 (gal)	22.5 (5,944)	936.8 (247,477)	none	936.8 (247,477)	none	936.8 (247,477)	none	936.8 (247,477)	none	936.8 (247,477)
Solid m^3 (yd^3)	69 (90)	162 (212)	none	162 (212)	none	162 (212)	none	162 (212)	none	162 (212)
Total m^3	91.5	1,099	0	1,099	0	1,099	0	1,099	0	1,099
Hazardous										
Liquid m^3 (gal)	3.3 (872)	810.4 (2,748)	2.5 (660)	12.9 (3,408)	2.5 (660)	12.9 (3,408)	12.5 (3,302)	22.9 (6,000)	15 (3,962)	25.4 (6,710)
Solid m^3 (yd^3)	1.85 (24)	26.1 (34.2)	1.5 (2)	27.7 (36.2)	1.5 (2)	27.7 (36.2)	9.2 (12)	35.3 (46.2)	10.7 (14)	36.9 (48.2)
Total m^3	21.8	37	4	41	4	41	22	58	26	62
Sanitary/industrial										
Liquid m^3 (gal)	1,406 (371,426)	2,318 (612,298)	781.3 (206,400)	3,099 (818,698)	1273.6 (336,450)	3,591 (948,748)	932.7 (246,400)	3,251 (858,698)	1,714 (452,800)	4,032 (1,065,098)
Solid m^3 (yd^3)	7,295 (9,541)	8,883 (11,619)	178.9 (234)	9,062 (11,853)	178.9 (234)	9,062 (11,853)	175.1 (229)	9,058 (11,848)	354 (463)	9,239 (12,082)
Total m^3	8,701	11,201	960	12,161	1,453	12,653	1,108	12,271	2,068	13,269

Source: LMES 1999a, LMES 2000b, LMES 2000c.

TABLE 5.11.2–2 —*Summary of Waste Generation from Construction[a] and Associated Decontamination and Decommissioning[b] (D&D) Activities During Implementation of the Action Alternatives in Cubic Meters*

Waste Type	**HEU Storage Mission: Alternative 2**		**Special Materials Complex Mission: Alternative 3**			**Combined Alternatives: Alternative 4**
	New facility Sites A and B	Building 9215 expansion	New facility Site 1	New facility Site 2	New facility Site 3	New HEU Facility + New SMC (upper limit)
Low-level						
Construction Liquid Solid Total	 0	 0	 0	 0	 0	 0
D&D estimate	10,542	2,103	45,580	45,580	45,580	56,122
Mixed low-level						
Construction Liquid Solid Total	 0 22707[c] (29700), Site B 0	 0	 0	 0 46867[c] (61300) 0	 0 22707[c] (29700) 0	 0 69574 (90999) 0
D&D estimate	0	0	0	0	0	0
Hazardous						
Construction Liquid Solid Total	 3 (800) 38.2 (50) 41.2	 1.1 (300) 15.3 (20) 16.4	 11.4 (3000) 107 (140) 118.4	 11.4 (3000) 107 (140) 118.4	 11.4 (3000) 107 (140) 118.4	 14.4 (3804) 145.2 (190) 159.6
D&D estimate	7,196	1,439	30,840	30,840	30,840	38,036
Nonhazardous						
Construction Liquid Solid Total	 14347 (3970000) 3823 (5000) 18851	 14347 (3970000) 3058 (4000) 17405	 1448 (382400) 917.4 (1200) 2365.4	 1448 (382400) 3420[d] (4470) 4866	 1448 (382400) 3445[d] (4500) 4888	 15995 (4172598) 7268 (9506) 23717
D&D estimate	1,680	336	7,200	7,200	7,200	8,880

[a] Waste generated by construction and site preparation activities, including contaminated soils eligible for disposal as CERCLA waste.
[b] Waste generated by complete decontamination and decommissioning of existing building (9215) or facilities (special materials complex).
[c] Waste from excavation of contaminated soil at site.
[d] Uncontaminated demolition waste from site preparation.

Source: LMES 2000b and LMES 2000c, DOE 1996e**.**

5.11.2.1 *Alternative 2 (No Action - Planning Basis Operations Plus HEU Storage Mission Alternatives)*

Alternative 2A (No Action - Planning Basis Operations Plus Construct and Operate a New HEU Materials Facility)

Under this alternative, waste would be generated as a result of facility construction and potentially as a result of D&D of the old facility. D&D waste volumes for complete demolition of the current HEU storage facility (Building 9206) were estimated from information provided in the SSM PEIS (DOE 1996c) and are shown in Table 5.11.2–2. Waste generated by site preparation for the facility would not differ between Sites A and B with the exception of 22,707 m^3 (29,700 yd^3) of mixed LLW at Site B (Table 5.11.2–1). This waste would be generated by the excavation and removal of soil contaminated by past practices at the Site and has been characterized in other CERCLA documentation. Site A would also require site preparation, but the excavated materials are not anticipated to be contaminated and would not be mixed LLW.

Waste would also be generated by routine operations under this alternative. A conservative estimate of anticipated waste for Alternative 2A (No Action - Planning Basis Operations Plus Construct and Operate a New HEU Materials Facility) was developed by estimating waste generation through operation of a new HEU Materials Facility and then adding it to Alternative 1B (No Action - Planning Basis Operations Alternative) (Table 5.11.2–1).

Alternative 2B (No Action - Planning Basis Operations Plus Upgrade Expansion of Building 9215)

Under this alternative, waste would be generated from construction of an addition to the facility and partial demolition of Building 9215. Liquid waste volumes would be the same as for new facility construction, but approximately 20 percent less nonhazardous waste would be generated by the construction activities. No mixed LLW would be generated as a result of construction. D&D waste generation would be only a small percent (estimated as 20 percent) of the D&D waste that would be generated from demolition under the alternative to construct a new facility, as shown in Table 5.11.2–2.

Waste would also be generated by routine operations under this alternative. A conservative estimate of anticipated waste was developed by estimating waste generation through operation of an expanded HEU storage facility and then adding it to Alternative 1B (No Action - Planning Basis Operations Alternative) (Table 5.11.2–1).

The relatively minor differences in waste generation between operation of a new HEU Materials Facility and operation of an expanded, existing facility are due too increased efficiencies expected from the new facility.

5.11.2.2 *Alternative 3 (No Action - Planning Basis Operations Plus Special Materials Mission Alternative)*

No Action - Planning Basis Operations Plus Construct and Operate a New Special Materials Complex

Under this alternative, waste would be generated as a result of facility construction and potentially as a result of D&D of the old facility. D&D waste volumes for complete demolition of the current Special Materials Operations facilities were estimated from information provided in the SSM PEIS (DOE 1996c) and are shown in Table 5.11.2–2. Waste generated by site preparation of the facility would differ between Sites 1, 2, and 3 because 46,867 m^3 (61,300 yd^3) at Site 2 and 22,707 m^3 (29,700 yd^3)at Site 3 of mixed LLW would be generated that would not be generated at Site 1 (Table 5.11.2–1). This waste would be generated by the excavation and removal of soil contaminated by past practices at the Site and has been in other characterized CERCLA documentation. Use of Site 1, Site 2, or Site 3 would also generate an additional 917.4 m^3 (1,200 yd^3), 3,420 m^3 (4,470 yd^3), and 3445 m^3 (4,500 yd^3) of solid non-hazardous waste respectively.

Waste would also be generated by routine operations under this alternative. A conservative estimate of anticipated waste was developed by estimating waste generation through operation of a new Special Materials Complex and then adding it to Alternative 1B (No Action - Planning Basis Operations Alternative) (Table 5.11.2–1).

5.11.2.3 *Alternative 4 (No Action - Planning Basis Operations Plus HEU Materials Facility Plus Special Materials Complex)*

Under this alternative, waste would be generated as a result of both facility construction and potentially as a result of D&D of the old facilities. Waste generated by the construction of both a new HEU storage facility (Alternative 2A) and a new Special Materials Complex (Alternative 3A) as well as D&D waste volumes for complete demolition of the current HEU storage facility (Alternative 2A) and Special Materials Complex were combined as a conservative estimate of waste that could result from implementing Alternative 4.

Waste would also be generated by routine operations under this alternative. A conservation estimate of anticipated operations waste for this alternative was developed by estimating waste generation from operation of an expanded HEU facility (Alternative 2B) together with waste from operations waste generated under Alternative 3, the new Special Materials Complex, and then adding it to Alternative 1B (No Action - Planning Basis Operations Alternative) (Table 5.11.2–1).

5.11.3 Pollution Prevention

5.11.3.1 *Alternatives 1A and 1B (No Action - Status Quo and No Action - Planning Basis Operations Alternatives)*

Under the No Action - Status Quo and No Action - Planning Basis Operations Alternatives, Y-12 would continue to manage LLW, mixed LLW, hazardous waste, and nonhazardous waste. The type of waste streams generated under both of the No Action alternatives would be nearly identical, thus, the same waste minimization and pollution prevention techniques would be appropriate for both alternatives. As observed in Section 5.11.1, little difference is anticipated in annual waste generation rates between Alternatives 1A and B. This lack of difference in anticipated waste generation rates is due, in part, to the expectation that current, successful waste minimization and pollution prevention practices would continue to off-set potential increases in waste generation.

Additional waste minimization and pollution prevention measures would depend upon the development and implementation of new pollution prevention and waste minimization techniques, because readily-implementable, existing techniques are already in practice. While DOE is committed to maximizing pollution prevention savings, it would not be appropriate to differentiate pollution prevention expectations between the two alternatives.

Cost savings/avoidance would be over $2 million over each of the next several years. Approximately 30 to 40 pollution prevention projects in each of the next several years would account for as much as 10,000 m^3 (353,150 ft^3) per year in waste reduction. The amount of cost savings/avoidance is expected to decline as the number of possible opportunities decline due to previous successes.

5.11.3.2 *Alternatives 2, 3, and 4 (HEU Storage Mission and Special Materials Mission Action Alternatives)*

Implementation of the HEU Storage Mission action alternatives and Special Materials Mission action alternatives would result in pollution prevention activities and beneficial impacts. Generally the prevention activities and beneficial impacts would be similar to the previously discussed. While the HEU Materials Facility does not represent a new activity, existing cost savings/avoidance knowledge would transfer to the new facility. Many of the older buildings at Y-12 are inefficient for use as HEU storage facilities. These structures have shortcomings with HVAC, fire protection (fire retardant), and natural phenomena protection requirements (seismic and tornadic). With the addition of the proposed Special Materials Complex, existing cost savings/avoidance knowledge would transfer to the new facilities and new cost savings/avoidance would likely occur as operating knowledge improves (an estimate is provided below).

The HEU Materials Facility Conceptual Design Report (Y-12 1999a) includes the general provisions for using current construction and equipment standards which should result in pollution prevention through design improvements. For example, lighting systems would use extended-life lamps and high-efficiency electronic ballasts to minimize O&M costs. In the event an accident sets off, or spills from the wet-pipe sprinkler system, the water collection system would permit monitoring and testing prior to discharge.

While no specific pollution prevention initiatives are currently identified for the Special Materials Complex, it is generally accepted that worker protection would be improved through engineering controls, which replace existing administrative controls and reduce the need for personal protective equipment, providing better comfort and reducing LLW generation. Utility upgrades would be implemented, resulting in improved efficiencies through reduced O&M costs.

While not specified, a reduction of 10 to 30 percent of the waste associated with Special Materials Complex as presented in Table 5.11.1–1 is a reasonable expectation. The waste reductions would amount to approximately 77 to 230 kg (170 to 507 lbs) of LLW, 2,160 to 6,450 kg (4,762 to 14,219 lbs) of hazardous waste, and 17,534 to 52,602 kg (38,655 to 115,966 lbs) of sanitary/industrial waste. Assuming a 30 percent reduction, this would represent an estimated cost savings/avoidance reduction by over $0.6 million (in today's dollars) over the next 10 years. Approximately two to four new pollution prevention projects in each of the next 10 years would account for as much as 3,100 m^3 (109,480 ft^3) total in waste reduction in the next 10 years.

5.12 OCCUPATIONAL AND PUBLIC HEALTH AND SAFETY IMPACTS

This section describes potential human health impacts associated with radiation exposures, chemical exposures, and worker safety issues due to Y-12 current operations under Alternative 1A (No Action - Status Quo Alternative) and those proposed under Alternative 1B (No Action - Planning Basis Operations Alternative), Alternative 2 (No Action - Planning Basis Operations Plus HEU Storage Mission Alternative), Alternative 3 (No Action - Planning Basis Operations Plus Special Materials Mission Alternative). A comprehensive evaluation of the potential risks associated with human exposure to environmental media (air, surface water, soil, sediment, and groundwater) was conducted under the No Action - Status Quo Alternative. While contaminants of concern were detected in the evaluation of surface water, soil, sediment, and groundwater, their on-site concentrations were based on historical releases. The inhalation pathway is the primary pathway considered for evaluation the potential effects of current and proposed operations on the public and the involved and non-involved worker. The results of this evaluation are discussed in detail in Appendix D.

Under Alternative 1B (No Action - Planning Basis Operations Alternative), Y-12 National Security Complex facility operations would continue in support of assigned missions, but at an increased activity level. As such, a review was conducted to determine what historical data were available that would most accurately represent the operations effluents for the projected workload in the 2001–2010 time period (LMES 2000a). The 1987 emissions data were determined to be the most appropriate and were modeled based on the assumption that 65 percent of the 1987 emissions are representative of the proposed 2001–2010 workload estimates (see Section 3.2.2).

5.12.1 Radiological Impacts

Public Health Impacts. The release of radioactive materials and the potential level of radiation doses to workers and the public are regulated by DOE for its contractor facilities. Environmental radiation protection is currently regulated contractually with DOE Order 5400.5. This Order sets annual dose standards to members of the public, as a consequence of routine DOE operations, of 100 mrem through all exposure pathways. The Order requires that no member of the public receives an EDE in a year greater than 10 mrem from inhalation of airborne emissions of radionuclides and 4 mrem from ingestion of drinking water. In addition, the dose requirements in the *Radionuclide National Emission Standards for Hazardous Air Pollutants* (Rad-NESHAP) limit exposure to the MEI of the public from all air emissions to 10 mrem/yr.

The EDE received by the hypothetical MEI for Y-12 under the No Action - Status Quo Alternative was calculated to be 0.53 mrem based on both monitored and estimated effluent data. This individual is postulated to be located about 1,120 m (0.7 mi) north-northeast of the Y-12 release point. The major radionuclide emissions from Y-12 are ^{234}U, ^{235}U, ^{236}U, and ^{238}U. The contribution of Y-12 emissions under the No Action - Status Quo Alternative to the committed collective EDE to the population residing within 80 km (50 mi) of the ORR was calculated to be about 4.5 person-rem. The potential radiological impacts to the MEI of the public and the population within 80 km (50 mi) are presented in Table 5.12.1–1 for the No Action - Status Quo Alternative, No Action-Planning Basis Operations Alternative, and the Preferred Alternative (Alternative 4).

The implementation of the HEU Storage Mission and the Special Materials Mission Alternatives would not effect the airborne emissions concentrations as determined for Alternative 1B (No Action - Planning Basis Operations Alternative). All activities projected to take place under each of these alternatives in the new facilities would have no higher, and possibly lower, emissions than the existing facilities they replace.

Under the No Action - Planning Basis Operations, HEU Storage Mission, and Special Materials Mission Alternatives, radiological emissions from existing sources would be expected to initially increase from No Action - Status Quo levels due to increased workload. However, all values remain below the annual dose limit of 10 mrem for all atmospheric releases (DOE Order 5400.5). The conservatively estimated dose to the MEI from radiological atmospheric releases would be 4.5 mrem pre year. The estimated collective dose to the off-site population residing within an 80-km (50-mi) radius would be 33.7 person-rem per year. For all the routine operation emissions, uranium would be the major dose contributor to both the MEI and the off-site population. The potential health risks associated with these alternatives are also summarized in Table 5.12.1–1.

TABLE 5.12.1–1.—*Radiation Doses and Health Impact to the Public for the Proposed Alternatives*

	Dose (mrem/yr)			Latent Cancer Fatality		
	Alternative 1A No Action - Status Quo	**Alternative 1B No Action - Planning Basis Operations**	**Alternative 4 No Action - Planning Basis Operations, HEU Materials Facility, and Special Materials Complex**	**Alternative 1A No Action - Status Quo**	**Alternative 1B No Action - Planning Basis Operations**	**Alterative 4 No Action - Planning Basis Operations, HEU Materials Facility, and Special Materials Complex**
MEI of the Public Dose (mrem/yr)	0.53	4.5	4.5	2.65×10^{-7}[a]	2.65×10^{-7}[a]	2.25×10^{-6}[a]
Population[b] (person-rem/yr)	4.5	33.7	33.7	2.15×10^{-6}[c]	2.15×10^{-6}[c]	1.69×10^{-5}[c]

[a]Represents risk of LCF for an individual of the public.
[b]Population residing within 80 km (50 mi) of ORR.
[c]This represents the number of LCFs for each year of exposure.
Note: The HEU Storage Mission and the Special Materials Mission Alternatives would not effect the airborne emissions concentrations as determined for Alternative 1B (No Action - Planning Basis Operations). All activities projected to take place under each of these alternatives in the new facilities would have no higher, and possibly lower, emissions than the existing facilities they replace. Impacts of Alternative 1B are cumulative with those of Alternative 1A.
Source: EPA 1999a, LMES 2000a, LMES 2000b, LMES 2000c.

Y-12 Worker Health Impacts. Occupational radiation protection is regulated by the Occupational Radiation Protection Rule (10 CFR 835). DOE has set occupational dose limits for an individual worker at 5,000 mrem per year. Accordingly, Y-12 has set administrative exposure guidelines at a fraction of this exposure limit to help enforce the goal to manage and control worker exposure to radiation and radioactive material ALARA. The Y-12 ALARA administrative control level for the whole body is 1,000 mrem per year for all other Y-12 workers. The worker radiation dose projected in this SWEIS is the total effective dose equivalent incurred by workers as a result of routine operations. This dose is the sum of the external whole body dose as monitored by personnel dosimeters, including dose from both photons and neutrons, and internal dose, as required by 10 CFR 835. The internal dose is the 50-year CEDE. These values are determined through the Y-12 National Security Complex External and Internal Dosimetry Programs.

For Alternative 1B (No Action - Planning Basis Operations Alternative), it was determined that annual enriched uranium emissions and other effluents for the 2001–2010 time period can be assumed to be 65 percent of the 1987 levels (LMES 2000a). However, internal dose reporting requirements were not in effect until 1989. Prior to that time, only external (deep) dose was reported. The average deep dose for all monitored Y-12 employees was 16 mrem in 1987, 12 mrem in 1989, and less than 5 mrem for subsequent years. Consequently, 1989 radiation doses provide the best available data for estimating radiation impacts to the worker for the No Action - Planning Basis Operations Alternative. The projected health impacts to workers for major production operations under the No Action - Planning Basis Operations Alternative are presented in Table 5.12.1–2.

TABLE 5.12.1–2.—*Radiological Health Effects for Workers for Major Production Operations Under Alternative 1B (No Action - Planning Basis Operations Alternative)*

All Workers (Radiological and Nonradiological)				
Organization	**No. of Workers**	**Individual Worker Average Dose (mrem)**	**Collective Average Dose (person-rem)**	**Latent Cancer Annual Fatalities**
Enriched Uranium	492	11.6	5.71	2.28×10^{-3}
Depleted Uranium	223	11.6	2.59	1.04×10^{-3}
Assembly/Disassembly/ Quality Evaluation	160	11.6	1.86	7.44×10^{-4}
Product Certifications	158	11.6	1.83	7.32×10^{-4}
Analytical Chemistry	180	11.6	2.09	8.36×10^{-4}
Y-12	5,128	11.6	59.48	2.38×10^{-2}

Source: LMES 2000a.

TABLE 5.12.1–3.—*Radiation Doses and Health Impacts to Workers Under the HEU Storage Mission Alternatives*

Alternative 1B (No Action - Planning Basis Operations)	
Dose (mrem)	33
No. of involved workers	35
Collective dose (person-rem)	1.16
No. of fatal cancers	4.62×10^{-4}
Alternative 2 (No Action - Planning Basis Operations Plus HEU Storage Mission Alternatives)	
Initial Relocation Operations	
Dose (mrem)	150
No. of involved workers	35
Collective dose (person-rem)	5.25
No. of fatal cancers	2.1×10^{-3}
Normal Operations	
Dose (mrem)	33
No. of involved workers	14
Collective dose (person-rem)	0.46
No. of fatal cancers	1.85×10^{-4}

Source: LMES 2000b.

The process operations projected for the HEU Materials Facility include loading, unloading, and storage of canned materials and general fissile containers; nondestructive evaluation activities; sampling, canning, and recontainerization of special nuclear materials; and materials inventory and tracking. Because these activities closely mirror current operations at the Building 9720-5 facility, monitored radiation doses from 9720-5 warehouse operations were used to estimate the projected health impacts to HEU workers. Table 5.12.1–3 presents the radiation dose and projected health impact to workers for Alternative 1B (No Action - Planning Basis Operations Alternative) and for the two HEU Storage Mission options (New HEU Materials Facility and Upgrade Expansion of Building 9215) under Alternative 2.

5.12.2 Hazardous Chemical Impacts

Airborne emissions of chemicals used at Y-12 occur as a result of plant production, maintenance, waste management operations, and steam generation. Most process operations are served by ventilation systems that remove air contaminants from the workplace. Nonradionuclide emissions at Y-12 include chemical processing aids (hydrochloric and nitric acids), cleaning and cooling aids (methanol), refrigerants (Freon 11, 12, 22, 13, and 502), and emissions from the Y-12 Steam Plant (particulates, SO_2, carbon monoxide, VOCs and NO_2). More than 90 percent of the pollutants emitted from Y-12 are the result of Y-12 Steam Plant operations.

Airborne emissions, with the exception of mercury, are represented by modeled concentrations based on the purchases recorded and maintained in the Y-12 Hazardous Materials Inventory System (MMES 1998) and engineering calculations for emissions from the Y-12 Steam Plant. Modeled concentrations of noncarcinogenic and carcinogenic materials both on-site and at the Y-12 Site boundary were calculated for an MEI and an 8-hr worker exposure. On-site emissions concentrations are not available for the Y-12 Steam Plant because the stack height used in the modeling effort negates the possibility for the modeled plume to disperse prior to the facility boundary. With the exception of mercury, these data are considered representative of emissions of nonradionuclides under No Action - Status Quo operations at Y-12. Mercury is the only nonradionuclide for which actual air measurements were available**.**

The results of the air modeling of purchase data and engineering calculations for the Y-12 Steam Plant are presented in Tables 5.12.2–1 through 5.12.2–5. The contaminants and associated concentrations to which an on-site worker and an MEI located at the Y-12 Site boundary might be exposed, based on the modeled chemical inventory purchase data, are listed in Tables 5.12.2–1 through 5.12.2–4. Modeled concentrations of Y-12 Steam Plant emissions data are listed in Table 5.12.2–5 for the MEI at the Site boundary. On-site emissions concentrations are not available for the Y-12 Steam Plant because the stack height used in the modeling effort negates the possibility for the modeled plume to disperse prior to the facility boundary.

TABLE 5.12.2–1.—*Y-12 Facility Operations Maximum Boundary Hazardous Air Pollutants Noncarcinogenic Chemical Hazard Quotients*

Chemical	Maximum Boundary Concentration Fg/m^3	Inhalation RfC - Chronic (mg/m^3)[a]	Hazard Quotient
Cobalt & Compounds	3.31×10^{-2}	[b]	[c]
Lead Compounds	3.43×10^{-2}	[b]	[c]
Methylene Biphenyl Isocyanate	9.82×10^{-2}	6.00×10^{-4}	1.64×10^{-1}

[a]Toxicity values were obtained from the EPA's Integrated Risk Information System (EPA 1999a).
[b]Toxicity values are not currently available.
[c]Not calculated due to lack of toxicity values.
Note: RfC - reference concentration.

TABLE 5.12.2–2.—*Y-12 Facility Operations Maximum Boundary Hazardous Air Pollutants Carcinogenic Chemical Excess Cancer Risk*

Chemical	Maximum Boundary Concentration (Fg/m^3)	Inhalation Unit Risk (mg/m^3)$^{-1}$[a]	Excess Cancer Risk
Cadmium & Compounds	1.42×10^{-5}	1.8	2.56×10^{-8}

[a]Toxicity values were obtained from the EPA's Integrated Risk Information System (EPA 1999a).

TABLE 5.12.2–3.—*Y-12 Facility Operations Maximum On-Site Hazardous Air Pollutants Noncarcinogenic Chemical Hazard Quotients*

Chemical	Maximum On-site Concentration (Fg/m^3)	Inhalation RfD - Chronic (mg/m^3)[a]	Hazard Quotient
Cobalt & Compounds	5.88×10^{1}	[b]	[c]
Lead Compounds	6.10×10^{1}	[b]	[c]
Methylene Biphenyl Isocyanate	1.75×10^{2}	1.71×10^{-4}	6.68×10^{1}

[a]Toxicity values were obtained from the EPA's Integrated Risk Information System (EPA 1999a).
[b]Toxicity values are not currently available.
[c]Not calculated due to lack of toxicity values.
Note: RfD - reference dose.

TABLE 5.12.2–4.—*Y-12 Facility Operations Maximum On-Site Hazardous Air Pollutants Carcinogenic Chemical Excess Cancer Risks*

Chemical	Maximum On-site Concentration (Fg/m^3)	Inhalation Slope Factor (mg/kg-day)$^{-1}$[a]	Excess Cancer Risk
Cadmium & Compounds	2.52×10^{-2}	6.10	5.72×10^{-6}

[a]Toxicity values were obtained from the EPA's Integrated Risk Information System (EPA 1999a).

TABLE 5.12.2–5.—*Y-12 Steam Plant Maximum Boundary Hazardous Air Pollutant Carcinogenic Chemical Concentrations*

Chemical	Maximum Boundary Concentration (Fg/m^3)	Inhalation Unit Risk (mg/m^3)$^{-1}$[a]	Excess Cancer Risk
Arsenic	3.40×10^{-5}	4.3	1.46×10^{-7}
Beryllium	5.1×10^{-6}	2.4	1.22×10^{-8}
Nickel	8.14×10^{-5}	[b]	[c]

[a]Toxicity values were obtained from the EPA's Integrated Risk Information System (EPA 1999a).
[b]Toxicity values are not currently available.
[c]Not calculated due to lack of toxicity values.

The hazard quotients and excess cancer risks for the chemicals and compounds that were determined to be of concern as a result of the air quality screening of purchase data (see Section 5.7.1) are listed in Tables 5.12.2–1 through 5.12.2–4. Two exposure scenarios were evaluated: MEI (residential), and on-site worker (industrial). The hazard quotients and excess cancer risks for contaminant concentrations modeled to the MEI of the public were all below levels of concern. Thus, no adverse health impacts to the public are anticipated from exposure to airborne nonradiological contaminants emitted from Y-12 normal operations. The hazard quotient for the on-site worker exposed to the maximum on-site concentration of methylene biphenyl isocyanate was determined to be greater than 1.0. Therefore, methylene biphenyl isocyanate is considered to be a baseline contaminant of concern for on-site workers. Cadmium and cadmium compounds under the on-site exposure scenario were also determined to pose an excess cancer risk within the EPA's range of concern and are also considered a baseline contaminant of concern for the on-site worker.

No noncarcinogenic contaminants exceeded the preliminary air quality screening of Y-12 Steam Plant emissions data (see Section 5.7.1). As such, no noncarcinogenic chemicals were included in the evaluation of public exposures. The carcinogenic contaminants and their associated excess cancer risks resulting from Y-12 Steam Plant emissions are presented in Table 5.12.2–5. No excess cancer risks were determined to fall within the EPA's range of concern. Thus, no noncarcinogenic or carcinogenic contaminants of concern were determined to be associated with Y-12 Steam Plant emissions.

Average mercury vapor concentrations in 1999 for the four sites currently monitored are comparable to those reported for the last 2 years. In 1999, ambient mercury concentrations at the two monitoring sites near Building 9201-4 were still elevated above natural background, but are lower than the concentrations measured during the first 3 years of the monitoring program and are well below the ACGIH threshold limit value of 25 Fg/m^3 and the EPA reference concentration of 0.3 Fg/m^3 for chronic inhalation exposure. Hazard quotients were calculated for each location in an effort to demonstrate that the measured concentrations are below (i.e., Hazard Quotient<1.0) both the threshold for continuous public and occupational exposure.

Nonradiological airborne discharges from Y-12 mission facilities under Alternative 1B (No Action - Planning Basis Operations Alternative) consist of those criteria and chemical pollutant emissions from the Y-12 Steam Plant and chemical emissions from Y-12 operations. Because no air quality standards would be exceeded, no adverse direct or indirect air quality impacts are expected from normal operations associated with the continuation of Y-12 missions under the No Action - Planning Basis Operations Alternative (see Section 5.7).

The emission data for Alternative 1B (No Action - Planning Basis Operations Alternative) is assumed to include all the emissions from the storage of HEU in existing facilities. The impacts associated with the criteria and toxic pollutants presented would be the same as described for the No Action - Planning Basis Operations Alternative environmental consequences. Chemical emissions are considered to be the same as those under Alternative 1A (No Action - Status Quo Alternative). Criteria, toxic pollutant, and chemical emissions contributions from the current HEU Storage Mission facilities are reflected in the emissions from the Y-12 Steam Plant which supplies steam to the facilities (see Section 5.7.1). In addition, the environmental emissions for Alternative 2 (No Action - Planning Basis Operations Plus HEU Storage Mission Alternatives) are expected to be equal to or less than the No Action - Status Quo Alternative levels due to administrative and engineered controls. Risks to the public from environmental emissions would remain the same as were presented for the Alternative 1B (No Action - Planning Basis Operations Alternative).

No criteria pollutant emissions would be generated from the new Special Materials Complex facilities. Chemical emissions are considered to be the same as those under No Action - Status Quo and No Action - Planning Basis Operations Alternatives (current special materials operations). The relocation of beryllium operations to the new facility would result in a positive impact on beryllium emissions at Y-12. The new Beryllium Facility would be equipped with process gloveboxes and a 99.5 percent pre-filtration system through which process exhausts would be filtered prior to passing through a HEPA filtration system and subsequent exhausting through the building stacks. The new filtration system is estimated to reduce No Action - Planning Basis Operations emissions of beryllium by 90 percent (LMES 2000c).

5.12.3 Detailed Evaluation: Beryllium

Because of the heightened sensitivity and awareness associated with worker exposure to beryllium, a detailed evaluation of the impact of exposure to beryllium is presented below.

Since the 1950s, the processing of beryllium metals and alloys has been an important part of the Y-12 mission. Beryllium-containing compounds have been used for R&D, testing, and manufacturing operations at multiple locations throughout the plant. Included in the beryllium operations have been melting and molding, grinding, and machine tooling of parts. Recent studies and experience with the manufacture of beryllium-containing compounds have indicated a potential significant hazard to employees. As such, much emphasis has been placed on evaluating, communicating, and mitigating the health effects of occupational exposure to ensure worker protection and public safety.

Beryllium and beryllium compounds enter the environment as a result of the release and or disposal of beryllium contaminated wastewater, dust, or as a component of solid wastes. Once beryllium has been released to the environment, exposure to beryllium can occur by breathing air, eating food, or drinking water that contains beryllium. Dermal contact with metal containing beryllium or water containing dissolved beryllium salts will result in only a small fraction of the beryllium actually entering the body. A portion of beryllium dust breathed into the lungs will dissolve and eventually result in the transfer of the beryllium into the bloodstream; some may be transferred to the mouth then swallowed, and the rest will remain in the lungs for a long time. Of the beryllium ingested via contaminated foodstuffs or water, or swallowed subsequent to inhalation, about 1 percent will pass from the stomach and intestines into the bloodstream. Therefore, most of the beryllium that is swallowed leaves the body through the feces without entering the bloodstream. Of the beryllium that enters the bloodstream, some is routed to the kidneys and is eliminated from the body in urine. Some beryllium can also be carried by the blood to the liver and bones where it may remain for a long period of time. If beryllium is swallowed, it leaves the body in a few days. However, if beryllium is inhaled, it may take months to years before the body rids itself of beryllium.

As with any contaminant, the health effects resulting from exposure to beryllium are dependent on the exposure concentration, frequency and duration. Inhalation of large amounts of soluble beryllium compounds can result in acute beryllium disease. Acute beryllium disease results in lung damage that resembles pneumonia with reddening and swelling of the lungs. Lung damage may heal provided exposure does not continue or the exposed individual may become sensitive to beryllium. The increased sensitivity of some individuals to beryllium results in an immune or inflammatory reaction when subsequent low level exposures occur. This condition is called chronic beryllium disease. This disease can occur long after exposure to either the soluble or the insoluble forms of beryllium. Studies linking exposure to beryllium or beryllium compounds with an increased incidence of cancer (in particular, lung cancer) have been performed on laboratory animals. However, these studies are not considered reliable predictors of human health effects and ongoing efforts are currently underway to evaluate workers who have been known to be exposed.

In 1997, DOE initiated an Interim Chronic Beryllium Disease Prevention Program. The purpose of the program was to enhance, supplement, and integrate a worker protection program to reduce the number of current workers exposed, minimize the levels of beryllium exposure and the potential for exposure to beryllium, and to establish medical surveillance protocols to ensure early detection of disease. In December of 1999, DOE published a final rule to establish the chronic beryllium disease prevention program that became effective on January 7, 2000 (10 CFR 850). The final rule establishes:

- An airborne beryllium concentration action level as 0.2 Fg/m^3

- A requirement for employers to ensure that workers use respirators in areas where the concentration of beryllium is at or above the action level and to provide a respirator to any employee who requests one regardless of the concentration of airborne beryllium

- Criteria and requirements governing the release of beryllium-contaminated equipment and other items at DOE sites for use by other DOE facilities or the public

- Requirements for offering medical surveillance to any "beryllium-associated worker"

- Medical removal protection and multiple physician review provisions

An estimate of beryllium emissions was presented in the *Environmental Surveillance of the U. S. Department of Energy Oak Ridge Reservation and Surrounding Environs During 1987* and was obtained from actual stack sampling data on six exhaust stacks. This stack data indicated that <0.005 kg/year of beryllium are released to the atmosphere from the Y-12. Modeling of this volume of material results in an emission rate of 6.94×10^{-7} g/s for beryllium. This emission rate was multiplied by the maximum modeled concentrations from a centrally located stack at Y-12 assuming a 1 gram per second emission rate (see Table E.3.1–3) to determine the maximum boundary and on-site concentration. The concentrations as well as the associated hazard quotients and excess cancer risks are included in Tables 5.12.3–1 through 5.12.3–4.

TABLE 5.12.3–1.—*Y-12 Beryllium Operations Maximum Boundary Hazard Quotient*

Chemical	Maximum Boundary Concentration ug/m^3	Inhalation RfC - Chronic (mg/m^3)[a]	Hazard Quotient
Beryllium	2.7×10^{-7}	2.0×10^{-5}	1.35×10^{-2}

[a]Toxicity values were obtained from the EPA's Integrated Risk Information System (EPA 1999a).

TABLE 5.12.3–2.—*Y-12 Beryllium Operations Maximum Boundary Excess Cancer Risk*

Chemical	Maximum Boundary Concentration (ug/m^3)	Inhalation Unit Risk (mg/m^3)$^{-1}$[a]	Excess Cancer Risk
Beryllium	2.7×10^{-7}	2.4	6.48×10^{-7}

[a]Toxicity values were obtained from the EPA's Integrated Risk Information System (EPA 1999a).

TABLE 5.12.3–3.—*Y-12 Beryllium Operations Maximum On-Site Hazard Quotient*

Chemical	Maximum On-site Concentration (ug/m^3)	Inhalation RfD - Chronic (mg/m^3)[a]	Hazard Quotient
Beryllium	4.81×10^{-7}	5.71×10^{-6}	8.4×10^{-2}

[a]Toxicity values were obtained from the EPA's Integrated Risk Information System (EPA 1999a).

TABLE 5.12.3–4.—*Y-12 Beryllium Operations Maximum On-Site Excess Cancer Risks*

Chemical	Maximum On-site Concentration (ug/m^3)	Inhalation Slope Factor (mg/kg-day)$^{-1}$[a]	Excess Cancer Risk
Beryllium	4.81×10^{-7}	8.4	4.04×10^{-6}

[a]Toxicity values were obtained from the EPA's Integrated Risk Information System (EPA 2000).

The hazard quotient and excess cancer risk for exposure of the public to beryllium emissions from current operations at Y-12 are below 1.0 and less than the EPA range of concern (10^{-4} to 10^{-6}), respectively. Thus, no adverse public health impacts are associated with normal beryllium operations. The hazard quotient for worker exposure assuming that exposure occurs continually for 8 hours per day, 5 days per week, 50 weeks per year is less than 1.0. The excess cancer risk for such an exposure is within the EPA range of concern.

Extensive efforts have been made to reduce risk to the involved worker through the use of personal protective equipment, engineered controls, and other administrative controls such as:

- Initial and periodic exposure monitoring (currently includes monitoring of all beryllium workers)
- Hazard assessment
- Posting of beryllium work areas
- Medical surveillance, respiratory protection
- Training
- Counseling for the sensitized workers
- Warning signs
- Waste disposal

To evaluate the beryllium-contaminated areas and to protect worker health, the Y-12 Industrial Hygiene Department has developed a sampling and analysis plan to identify the areas within Y-12 where beryllium was once used. Approximately 300 legacy areas were identified in 39 buildings. These beryllium legacy areas were defined to protect the workers at risk, including beryllium-sensitized individuals, to provide data for modernization projects and to reduce the number of beryllium-contaminated areas.

One such project is the proposed Special Materials Complex, which is designed to house all production operations that must currently be performed in a beryllium control area. This will allow the enclosure of all operations within gloveboxes, hoods, or other inert environments so as to isolate workers from beryllium. In addition, HEPA-filtered exhaust systems from these enclosures will be provided. An estimated 90 percent of current beryllium emissions would be reduced as a result of the increased health and safety protocols for production activities associated with the Special Materials Complex.

Design Mitigation Measures

The facilities being constructed would be equipped with appropriate alarm and emergency notification systems to alert and inform workers of accidents and emergency response requirements. Layered engineered and administrative controls would be designed to protect the worker by providing primary, secondary, and tertiary confinement of the effects of an accident, thus providing the protection for the worker and the environment. Process changes, engineered confinement controls, and the use of gloveboxes would reduce worker exposures to beryllium from Alternative 1A (No Action - Status Quo Alternative) or Alternative 1B (No Action - Planning Basis Operations Alternative) by an estimated 75 to 90 percent in the new Special Materials Complex.

5.12.4 Worker Safety

The Y-12 worker non-fatal injury/illness rates presented in Table 5.12.4–1 were used to calculate the 5-year average (1995-1999) injury/illness rate for 100 workers (or 200,000 hours). The 5-year average injury/illness rate and the 5-year average Y-12 worker population size were then used to calculate the total number of Y-12 worker non-fatal injury/illness per year for the entire Y-12 workforce under Alternative 1B (No Action - Planning Basis Operations Alternative). It was assumed that the 5-year average rate would remain constant.

TABLE 5.12.4–1.—*Y-12 5-Year Average (1995-1999) Illness/Injury Rate per 100 Workers*

Parameter	1995	1996	1997	1998	1999	5-Year Average
Annual Y-12 Worker Population	5,777	5,034	5,034	5,105	5,128	5,216
Annual Y-12 Nonfatal Occupational Injury/Illness Rate	8.03	9.14	9.53	7.58	7.02	8.26

Source: LMES 1999; Y-12 2001b.

The estimated Y-12 worker population under each alternative was multiplied by the 5-year averaged non-fatal injury/illness rate (per 100 workers) to obtain the total number of non-fatal injuries/illnesses per year for the entire Y-12 workforce for each alternative (Table 5.12.4–2).

The additional number of injuries/illnesses posed by the construction of new facilities is projected in Tables 5.12.4–3 and 5.12.4–4. The No Action - Planning Basis Operations plus the construction and operation of a new HEU Materials Facility would result in a calculated non-fatal injury/illness of 427 per year. The No Action - Planning Basis Operations plus the Special Materials Complex would result in a calculated non-fatal injury/illness of 427 per year.

Under Alternative 4 (No Action - Planning Basis Operations Plus HEU Materials Facility Plus Special Materials Complex) the number of non-fatal injuries/illness would be 430 per year.

TABLE 5.12.4–2.—*Calculated Nonfatal Injuries/Illnesses per Year for Y-12 Workforce by No Action - Status Quo and No Action - Planning Basis Operations*

Parameter	5-Year Average	Alternative 1A No Action - Status Quo	Alternative 1B No Action - Planning Basis Operations
Y-12 Worker Population	5,216	5,128	5,128[a]
Y-12 Nonfatal Occupational Injury/Illness (per 100 workers) 4-year average (1995-98)	8.26	8.26	8.26
Total Number of Nonfatal Occupational Injuries/Illnesses for the Y-12 Workforce	431	424	424

[a]Worker population is assumed to remain the same as current level of 5,128.

TABLE 5.12.4–3.—*Calculated Non-Fatal Injuries/Illnesses for Construction of the HEU Materials Facility*

Total employment (worker years)	145
Peak employment (workers)	200
Construction period (years)	4
Calculated injury rate (4-year average)	8.26
Projected No. of injuries (annually)	3
Projected Total injuries (4-year construction period)	12

TABLE 5.12.4–4.—*Calculated Non-Fatal Injuries/Illnesses for Construction of the Special Materials Complex*

Total employment (worker years)	125
Peak employment (workers)	210
Construction period (years)	3.5
Calculated injury rate (4-year average)	8.26
Projected No. of injuries (annually)	3
Projected Total injuries (3.5 year construction period)	11

5.13 ENVIRONMENTAL JUSTICE

Pursuant to Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low Income Populations*, environmental justice analyses identify and address any disproportionately high and adverse human health or environmental effects on minority or low-income populations from the alternatives included in this SWEIS. Adverse health effects may include bodily impairment, infirmity, illness, or death. Adverse environmental effects include socioeconomic effects, when those impacts are interrelated to impacts on the natural or physical environment.

Environmental justice guidance provided by the CEQ defines "minority" as individual(s) who are members of the following population groups: American Indian or Alaskan Native, Asian or Pacific Islander, Black, or Hispanic (CEQ 1997b). Minority populations are identified when either the minority population of the affected area exceeds 50 percent or the percentage of minority population in the affected area is substantially greater than the minority population percentage in the general population in the surrounding area or other appropriate unit of geographical analysis. Low-income populations are identified using statistical poverty thresholds from the Bureau of Census (defined in 1990 as 1989 income less than $12,674 for a family of four). Minority population and income data at the census tract level are only available from the decennial census. The most recent data available is from 1990.

Environmental justice impacts occur if the proposed activities result in disproportionately high and adverse human and environmental effects to minority or low-income populations. Disproportionately high and adverse human health effects are identified by assessing these three factors:

- Whether the adverse health effects, which may be measured in risks or rates, are significant or above generally accepted norms. Adverse health effects may include bodily impairment, infirmity, illness, or death.
- Whether health effects occur in a minority population or low-income population affected by cumulative or multiple adverse exposures from environmental hazards.
- Whether the risk or rate of exposure to a minority population or low-income population to an environmental hazard is significant and appreciably exceeds or is likely to appreciably exceed the risk or rate to the general population or other appropriate comparison group.

The Department has conducted aerial surveys to measure radiation levels in the Scarboro Community since 1959. These surveys, which measure for gamma radiation, have identified no radiation levels over those found in the natural background environment. DOE began working with the Scarboro Community beginning in 1997 with a public meeting to discuss the aerial surveys. Since then DOE staff has worked closely with the residents in developing plans for conducting radiological and chemical surveys. In 1997, the residents of the Scarboro Community asked the DOE to examine if there is contamination in the soil and water from ORR operations. In response DOE initiated environmental sampling activities in 1998 on soil, surface sediment, and water from over 40 locations in the Scarboro Community to examine for the presence of mercury and uranium. DOE awarded a grant to the Joint Center for Political and Economic Studies that focuses on issues of concern to African Americans and has special expertise in health policy issues affecting black and minority populations, to assist Scarboro residents in interpreting data resulting from the DOE sampling and other Scarboro Community related studies. The Joint Center completed the work in October 2000 with the issuance of five summary publications. While these summaries generated no new epidemiological analyses, they served to help the community understand the purpose and results of the various environmental and health studies involving the community which indicated disproportionately high and adverse health impacts for the Y-12 operation.

5.13.1 Alternative 1A (No Action - Status Quo Alternative)

The EDE received by the MEI under this alternative would be 0.53 mrem which is below the 10 mrem NESHAP standard. As discussed in Section 4.13 (Environmental Justice) minority and low-income populations comprise a relatively small proportion of the total population in both an 80-km (50-mi) radius of the Y-12 Site and in the socioeconomic ROI. For environmental justice impacts to occur, there must be disproportionately high and adverse human health or environmental impacts on minority populations or low-income populations.

As discussed in the Occupational and Public Health and Safety Impacts analyses (Section 5.12) routine operations would pose no significant health risks to the public. The EDE received by the MEI would be 0.53 mrem, significantly lower than the 10 mrem limit set by DOE Order 5400.5. In addition, results from the ORR ambient air monitoring program show that the potential EDE received within the Scarboro Community (Monitoring Station 46) was 0.16 mrem/yr, lower than the level of the reference sample from an area not affected by releases from the ORR (DOE 2000d). Because the Scarboro Community includes the largest concentration of minority or low-income populations in the area, there would therefore be no disproportionately high and adverse effects on minority populations or low-income populations. In addition, no special circumstances exist that would result in disproportionately high and adverse impact on monitory or low-income populations from any exposure pathway, such as subsistence dependence on fish or hunting.

5.13.2 Alternative 1B (No Action - Planning Basis Operations Alternative)

The conservatively estimated EDE received by the MEI from radiological atmospheric releases from Y-12 under this alternative would be 4.5 mrem which is below the 10 mrem NESHAP standard. As discussed in the preceding analyses, the resumption of the remaining Y-12 operations from the 1994 stand down would not cause disproportionately high and adverse human health or environmental impacts on minority or low-income populations. Therefore, there would be no environmental justice impacts.

The EDE received by the MEI under this alternative would be 4.5 mrem which is below the 10 mrem DOE Order 5400.5 standard. There would be no environmental justice impacts from either the Environmental Management Waste Management Facility or the ORNL NABIR Program Field Research Center being implemented under the No Action - Planning Basis Operations Alternative.

5.13.3 Alternative 2 (No Action - Planning Basis Operations Plus HEU Storage Mission Alternatives)

Alternative 2A (No Action - Planning Basis Operations Plus Construct and Operate a New HEU Materials Facility)

The EDE received by the MEI under this alternative would be 4.5 mrem which is below the 10 mrem NESHAP and DOE Order 5400.5 standard. As discussed in the Occupational and Public Health and Safety Impacts analyses (Section 5.12), this alternative would pose no significant health risks to the public and radiological emissions would remain below the 10 mrem/year NESHAP standard. Results from the ORR ambient air monitoring program show that the hypothetical EDE received within the Scarboro Community (Monitoring Station 46) is typically lower (0.16 mrem/yr) than at other monitoring stations to the south (Monitoring Station 48) and west (Monitoring Station 35) of Y-12 where the hypothetical EDE would be 0.18 mrem/yr (Monitoring Station 48) or 0.19 mrem/yr (Monitoring Station 35) (DOE 2000d). There are no special circumstances that would result in any greater impact on minority or low-income populations than the population as a whole. As discussed in Section 5.3, the short-term socioeconomic impacts during construction of the facilities would be positive and not result in any disproportionately high and adverse effects on minority populations or low-income populations. Therefore no disproportionately high and adverse effects on minority populations or low-income populations would be expected.

Alternative 2B (No Action - Planning Basis Operations Plus Upgrade Expansion of Building 9215)

The EDE received by the MEI under this alternative would be 4.5 mrem which is below the 10 mrem NESHAP and DOE Order 5400.5 standard. As discussed in the Occupational and Public Health and Safety Impacts analyses (Section 5.12), this alternative would pose no significant health risks to the public and radiological emissions would remain below the 10 mrem/year NESHAP standard. Results from the ORR ambient air monitoring program show that the hypothetical EDE received with in the Scarboro Community (Monitoring Station 46) is typically lower (0.16 mrem/yr) than at other monitoring stations to the south (Monitoring Station 48) and west (Monitoring Station 35) of Y-12 where the hypothetical EDE would be 0.18 mrem/yr (Monitoring Station 48) or 0.19 mrem/yr (Monitoring Station 35) (DOE 2000d). There are no special circumstances that would result in any greater impact on minority or low-income populations than the population as a whole. As discussed in Section 5.3, the short-term socioeconomic impacts during construction of the facilities would be positive and not result in any disproportionately high and adverse effects on minority populations or low-income populations. Therefore no disproportionately high and adverse effects on minority populations or low-income populations would be expected.

5.13.4 Alternative 3 (No Action - Planning Basis Operations Plus Special Materials Mission Alternative)

The EDE received by the MEI under this alternative would be 4.5 mrem which is below the 10 mrem NESHAP and DOE Order 5400.5 standard. As discussed in the Occupational and Public Health and Safety Impacts analyses (Section 5.12), this alternative would pose no significant health risks to the public and radiological emissions would remain below the10 mrem/year NESHAP standard. Results from the ORR ambient air monitoring program show that the hypothetical EDE received with in the Scarboro Community (Monitoring Station 46) is typically lower (0.16 mrem/yr) than at other monitoring stations to the south (Monitoring Station 48) and west (Monitoring Station 35) of Y-12 where the hypothetical EDE would be 0.18 mrem/yr (Monitoring Station 48) or 0.19 mrem/yr (Monitoring Station 35) (DOE 2000d). There are no special circumstances that would result in any greater impact on minority or low-income populations than the population as a whole. As discussed in Section 5.3, the short-term socioeconomic impacts during construction of the facilities would be positive and not result in any disproportionately high and adverse effects on minority populations or low-income populations. Therefore no disproportionately high and adverse effects on minority populations or low-income populations would be expected.

5.13.5 Alternative 4 (No Action - Planning Basis Operations Plus HEU Materials Facility Plus Special Materials Complex)

The EDE received by the MEI under this alternative would be 4.5 mrem which is below the 10 mrem NESHAP and DOE Order 5400.5 standard. As discussed in the Occupational and Public Health and Safety Impacts analyses (Section 5.12), this alternative would pose no significant health risks to the public and radiological emissions would remain below the 10 mrem/year NESHAP standard. Results from the ORR ambient air monitoring program show that the hypothetical EDE received with in the Scarboro Community (Monitoring Station 46) is typically lower (0.16 mrem/yr) than at other monitoring stations to the south (Monitoring Station 48) and west (Monitoring Station 35) of Y-12 where the hypothetical EDE would be 0.18 mrem/yr (Monitoring Station 48) or 0.19 mrem/yr (Monitoring Station 35) (DOE 2000d). There are no special circumstances that would result in any greater impact on minority or low-income populations than the population as a whole. As discussed in Section 5.3, the short-term socioeconomic impacts during construction of the facilities would be positive and not result in any disproportionately high and adverse effects on minority populations or low-income populations. Therefore, no disproportionately high and adverse effects on minority populations or low-income populations would be expected.

5.14 ACCIDENTS

This section summarizes the potential impacts to workers and the public from accidents involving the release of radioactive and/or chemical materials, explosions, and other hazards associated with Y-12 operations. The methods used to estimate the accident impacts and additional details on the accident analyses and impacts are described in Appendix D.7.

Most of the accidents analyzed in this SWEIS do not vary by alternative because the same facilities are potentially involved in the accidents and subsequent consequences; therefore, this SWEIS presents first, the accident analysis that pertains to all the alternatives. A section is also included which discusses the consideration of accidents unique to the HEU Storage Mission and the Special Materials Mission Alternatives compared to the No Action - Status Quo Alternative.

5.14.1 Accident Screening

The potential for facility accidents and the magnitudes of their consequences are important factors in evaluating the alternatives addressed in this SWEIS. The health risk issues are twofold:

- The potential accidents that could occur at Y-12 facilities and the risks that these postulated accidents could pose to workers or the general public

- The reduction in existing public or worker health risks when HEU Storage Mission and Special Materials Mission Alternatives in this SWEIS are compared to the existing facilities. (These reduced risks may arise either from modernized, improved facility systems that better protect the workers or public, or from design and construction of facilities built to higher seismic resistance standards.) NEPA Guidance for preparing an EIS (40 CFR 1522.22) requires the evaluation of impacts which have low probability of occurrence but high consequences if they do occur; thus facility accidents must be addressed to the extent feasible in this SWEIS. Further, public comments received during the scoping process clearly indicated the public's concern with facility safety and consequent health risks and the need to address these concerns in the comparison-making process.

For both the No Action - Status Quo and No Action - Planning Basis Operations Alternatives, potential accidents are defined in existing facility documentation, such as safety analysis reports, bases for interim operation, hazards assessment documents, and NEPA documents. From an accident analysis standpoint, there is no difference in the analyzed accidents in the two No Action alternatives. The accidents include radiological and chemical accidents that result in high consequences but have a low likelihood of occurrence, and a spectrum of other accidents that have a higher likelihood of occurrence, and lower consequences. Additional data on accident selection, the source document, and methodologies can be found in Section D.7.2. Events with major consequences such as a fire-induced release due to the crash of a large aircraft are not separately analyzed due to the very small frequency (less than 10^{-7} per year) and the consequences of these events would be bound by the consequences of the site-wide earthquake (DOE 1996e). For proposed new or expanded facilities, the identification of accident scenarios and associated data would normally be based on analysis reports performed on completed facility designs. However, facility designs have not been completed for the HEU Storage Mission and Special Materials Mission Alternatives analyzed in this SWEIS. Accordingly, the accident information developed for this SWEIS has been developed based upon the best available existing information for similar facilities.

This analysis also includes semiquantitative or qualitative estimates of the differences in likelihood for accident initiation at new facilities. For example, the proposed new HEU Materials Facility, built at a higher elevation, would have a reduced potential for flooding. Also qualitatively discussed, are the opportunities for risk reduction afforded by the potential incorporation of new technologies, processes, or protective features in the newly constructed facilities. These would improve public health and safety compared to the existing facilities.

5.14.2 Methodology

The MELCOR Accident Consequence Code System (MACCS) was used to estimate the radiological consequences for the population of workers and the public for all accidents. Doses to a maximally exposed collocated worker or to a member of the public at the Y-12 Emergency Response Boundary were derived from facility safety documentation. A discussion of how the collocated workers and the public population doses were calculated using the MACCS code is provided in Section D.7.2.5. A detailed description of the MACCS model is available in a three volume report: *MELCOR Accident Consequence Code System (MACCS)* (NUREG/CR-6613).

MACCS models the off-site consequences of an accident that releases a plume of radioactive materials to the atmosphere. Should such an accidental release occur, the radioactive gases and aerosols in the plume would be transported by the prevailing wind while dispersing in the atmosphere. The environment would be contaminated by radioactive materials deposited from the plume, and the population would be exposed to radiation. The objectives of a MACCS calculation are to estimate the range and probability of the health effects induced by the radiation exposures not avoided by protective actions.

In previous NEPA documentation (DOE 1994a) for Y-12, detailed MACCS modeling was performed for several hypothetical accidents. The results and assumptions for these MACCS models are documented in the report, *An Assessment of the Radiological Doses Resulting from Accidental Uranium Aerosol Releases and Fission Product Releases from a Postulated Criticality Accident at the Oak Ridge Y-12 Plant* (Fisher 1995). This assessment provides results for releases of fission product gases resulting from a criticality accident and releases of HEU aerosols. This report contains detailed information for the Site as well as a wind rose. This assessment provides dose consequences for theoretical accidents and was used for estimating the radiological population doses presented in the accidents in this analysis. Conservative assumptions were made in estimating the source terms for the releases. The Site boundary selected for estimating doses to the MEI was the Y-12 Emergency Response Boundary. Public dose estimates are based upon census data and site meteorological data. Additional information on methodology for radiological accidents can be found in Section D.7.2.5.

Accidental chemical releases were estimated using the HGSYSTEM. The HGSYSTEM code is a suite of codes, including a modification of the HEGADAS dense gas dispersion code. HEGADAS was modified to better model the dispersion of anhydrous hydrogen fluoride after test results in Nevada showed that existing models did not properly match the results of the outdoor testing. The modification incorporated several attributes: (1) the ability to account for HF/$H_2$0/air thermodynamics and plume aerosol effects on plume density (both positive and negative effects); (2) the ability to model both pressurized (jet) and unpressurized (pool) releases; (3) the ability to predict concentrations over a wide range of surface roughness conditions; (4) the ability to predict concentrations at specific locations for user-specified averaging periods (sampling times) that are consistent with release duration; (5) the ability to consider steady-state, time-varying, and finite-duration releases; and (6) the ability to compute crosswind and vertical concentration profiles. After the HGSYSTEM development was completed, the computer model was validated against the data from the Nevada testing series.

Especially near the source of a release, actual short-term gas concentrations will depart markedly from average model values in response to random turbulent eddies and are therefore unpredictable. As the actual released material moves downwind, concentrations within the plume become more similar to HGSYSTEM model calculations. HGSYSTEM shows concentrations that represent averages for time periods of 15 minutes and predicts that average concentrations will be highest near the release point and along the center line of the release (this is typical plume modeling). The concentration is modeled as dropping off smoothly and gradually in the downwind and crosswind directions. HGSYSTEM is the only dispersion code that can model releases of anhydrous hydrogen fluoride and account for the unique thermochemistry of depolymerization and hydrolysis.

Moreover, HGSYSTEM models the dispersion of heavy gases assuming the terrain is flat. Thus, if a ridge is located between the release point and a potential receptor, HGSYSTEM models the scenario as though the ridge were absent. This is a conservative approach because potential receptors are offered some protection from heavy gases by intervening ridges. Under the most stable atmospheric conditions (most commonly found late at night or very early in the morning), there is little wind, reduced turbulence, and less mixing of the released material with the surrounding air. High gas concentrations can build up in small valleys or depressions and remain for long periods of time. HGSYSTEM does not account for gas accumulations in low-lying areas. Additional information regarding HGSYSTEM is provided in Section D.7.2.5.

5.14.3 Accident Scenarios

5.14.3.1 *Wildfires*

A wildfire could be initiated by lightning, an aircraft crash, a burning cigarette, the sun shining on a piece of glass, or even a “controlled burn” during windy conditions. Fires on the ORR are not common but they do occur. Records indicate that nine wildfires have occurred on the ORR since 1966. The largest area burned by a wildfire was 162 to 202 ha (400-500 acres). This wildfire occurred April 7, 1966 and originated in the Y-12 burning pits. Another significant wildfire occurred February 21, 1977. This wildfire burned uncontrolled on the Reservation on Pine Ridge, immediately west of a 500-kv transmission line. This wildfire resulted from brush piles being burned by a TVA contractor clearing the Watts Bar-Roane transmission line right-of-way on the northwest slopes of Pine Ridge. The total area burned by this fire was approximately 20 ha (49 acres).

Although wildfires are not expected to reach Y-12 facilities, hot embers from such a fire could blow onto roof tops, potentially initiating a building fire. Depending on the proximity of the fire and wind conditions, ash and other byproducts from a wildfire could plug fresh intakes and exhaust filters for the Y-12 facilities. Heavy smoke could cause the filters to become clogged or “loaded”, which could lead to failure in the filtering system.

5.14.3.2 *Site-Wide Earthquake*

For many DOE facilities, due largely to their age and the absence of safety documentation, the original design bases, including those for safety-related features, are severely lacking or non-existent. In recognition earthquakes are part, are referred to in Y-12 Site safety documentation as evaluation basis earthquakes. Evaluation basis accidents are developed based upon existing documentation, engineering assessments, and evaluations of facility capabilities . These derivative design basis accidents are then documented in a facility safety evaluation.

To assure conservative consequence estimates, the beyond-evaluation basis earthquake estimated for the Y-12 Site is a seismic event with a frequency of less than 5 x 10^{-4}/yr but greater than 1x10^{-6}/yr. This beyond-evaluation basis earthquake is based on guidance in DOE-STD-1020, *Natural Phenomena Hazards Design and Evaluation Criteria for Department of Energy Facilities*, for high hazard facilities. DOE-STD-1020 provides guidance on appropriate frequency and intensity for the evaluation of natural phenomena hazards at DOE facilities. In DOE-STD-1020, event frequencies provide a baseline for natural phenomena strength. Seismic events of greater magnitudes than those suggested in DOE-STD-1020 were selected for evaluation to ensure that beyond evaluation basis effects were being examined. Further conservatism was included by a three-distinct-event criterion, where the natural phenomena initiator itself is considered the first distinct event. Two additional distinct events, defined as events which pre-suppose an abnormal facility/equipment condition or response, were assumed to maximize the consequences of the earthquake. The probability of a fire following a beyond-evaluation basis seismic event is high and was assumed to be one for this analysis.

For the beyond-evaluation basis earthquake, structural collapse was postulated to be accompanied by the most significant internal events, including fire and explosions. This practice, coupled with the short site boundary distances at Y-12, results in overly conservative values for maximum doses to the public and site workers. Based on a review of facility Basis of Interim Operations (BIOs) and Safety Analysis Reports, the Y-12 facilities that have the potential for such significant internal events are Buildings 9204-4, 9206, 9212, and 9215. In general, a beyond-evaluation basis earthquake is bounding as it destroys building confinement and includes all significant individual fire and explosion scenarios.

If a beyond-evaluation basis earthquake accident were to occur, there would be an estimated 0.21 cancer fatalities in the population within 80 km (50 mi) of Y-12. For a non-involved worker located 200m (660 ft) from the accident, there would be an increased incidence of cancer fatality of 0.012. For the MEI located at the Site boundary, there would be an increased incidence of cancer fatality of 0.008. The risks for the beyond-evaluation basis earthquake accident, reflecting both the probability of the accident occurring and the consequences, are shown in Table 5.14–1 (at the end of Section 5.14). For the same worker, the MEI, and the population, the risks, taking into account the probability of accidents, would be 1.2 x 10^{-6}, 8 x 10^{-7}, and 2.1 x 10^{-5} cancer fatalities per year, respectively. A summary of the beyond-evaluation basis earthquake consequences for Y-12 is provided in Table 5.14–1. A detailed summary by facility of the potential consequences for the public and collocated workers is presented in Appendix Table D.7.4–4.

5.14.3.3 *Facility Hazards*

Some of the facilities at Y- 12 contain occupational hazards with the potential to endanger the health and safety of workers in the vicinity of an accident. Some of the facilities also contain hazardous materials that, in the event of an accident, could endanger the health and safety of people outside the immediate vicinity of an accident and beyond. These people include collocated workers as well as the public.

Potential accidents associated with facility hazards such as radiological, fissile, chemically toxic, and explosive materials have been analyzed and discussed in the following sections. Potential accidents associated with other facility hazards such as lasers, electricity, x rays, noise, and compressed gases could affect the health and safety of the involved workers. However, the impacts to collocated workers and the public from these other accidents would be lower than the impacts from the radiological, fissile, chemically toxic, and explosive materials accidents described in Appendix D.7.

DOE recognizes the potential adverse effects for workers, the public, and the environment that could result from the deterioration of Y-l2 equipment, structures, and facilities. However, the analysis of potential accidents discussed in this section assumes that equipment, structures, and facilities would be properly maintained and repaired to meet their analyzed purpose. The basis for this assumption is the DOE safety analysis process, as specified in the ES & H requirements identified in Chapter 18 "Facility (Nuclear) Safety," of the *Standards/Requirements Identifications Document* and the *Engineering Design and Construction Work Smart Standards*. The Unreviewed Safety Question Determination process also applies to ensure changes remain within the DOE-approved authorization basis.

Explosion Accidents

Materials that could lead to an explosion are stored, handled, transported, and used in some Y-12 facilities. Explosion hazards are analyzed to identify the need for controls to prevent or mitigate the hazards.

Authorization basis documents for Buildings 9212, 9206, 9204-2E, 9215, 9204-4, 9720-5, 9201-5 and 9720-38 identified postulated explosion events. All of the dominant explosion scenarios resulted in significant consequences to the worker but did not produce any significant radiological consequences to the collocated worker or off-site public. The conclusions were based upon the determination that HEU materials subject to the event are present in small amounts of respirable forms in the susceptible areas and, in most cases, shielded from the force of the blast by equipment. The dominant explosion scenarios identified are associated with organic chemical and nitrate reactions resulting in nitrated organic compounds (red oil) explosions and fume-off reactions; flammable gas leaks from hydrogen, natural gas, and oxygen; thermal or chemical reactions and steam and dust explosions. A summary of the postulated explosion accident consequences to the public and collocated workers is presented in Appendix D (Table D.7.4–3).

Criticality Accidents

Postulated criticality events have been evaluated for Y-12 facilities that store or process enriched uranium. The four main categories of criticality initiating events are those resulting from administrative error (procedural non-compliance), solutions being introduced into unfavorable geometries, holdup in fissile materials equipment, and natural phenomena events.

The consequences associated with a solution criticality event have been evaluated using the prompt dose equations and those associated with the committed effective dose equivalence (CEDE). The predicted prompt dose for a solution criticality with an initial pulse of 10^{18} fissions (taking no credit for attenuation due to concrete, steel, or other intervening shielding material that might provide a significant dose reduction) drops below 100 rem within 19 m (62 ft), below 25 rem at 35 m (115 ft) from the accident, and below 1 rem at 142m (466 ft). Acute lethal exposures can be received by unshielded persons who are within 5 to 10 m (16 to 33 ft) of an accident. Due to subsequent pulses over the next 24 hours following the initial accident, the total fissions would approach 10^{19} (solution criticality accidents often involve an initial critical pulse followed periodically by other pulses of energy). Fatalities could occur absent prompt evacuation by workers. Because of the potential for operator fatality, the consequence rating is "High". No credit was taken for shielding that would be available for any criticality that occurs inside the building, and the analysis assumes a ground-level release of fission products. The dose rates, based on an unmitigated release, were calculated to be those received by a hypothetical MEI at the Site boundary.

If a criticality accident were to occur, there would be an estimated 0.0043 cancer fatalities in the population within 80 km (50 mi) of Y-12. For a non-involved worker located 200 m (660 ft) from the accident, there would be an increased incidence of cancer fatality of 0.0032. For the MEI located at the Site boundary, there would be an increased incidence of cancer fatality of 0.0015. The risks for the criticality accident, reflecting both the mitigated frequency of the accident occurring and the consequences, are shown in Table 5.14–2 (at end of Section 5.14) (note: mitigated frequency assumes that administrative and engineering controls are implemented to prevent accidents). For the same worker, the MEI, and the population, the risks, taking into account the probability of accidents, would be 3.2×10^{-7}, 1.5×10^{-7}, and 4.3×10^{-7} cancer fatalities per year, respectively.

Fire Accidents Involving Radioactive Materials

For the fire accident involving radioactive materials of concern at Y-12 are enriched uranium, uranium compounds, and thorium that present a radiological hazard based on large, airborne respirable releases. The typical enriched uranium (93.5 percent ^{235}U) that is present has a specific activity of 7.0×10^{-5} Ci/g and an inhalation dose conversion factor of 1.23×10^{8} rem/Ci CEDE. Higher enrichments do exist in limited activities; however, they will not significantly impact the consequences of the postulated accidents. Small quantities of radioisotopes of elements such as plutonium, niobium, technetium, cesium, cerium, and neptunium may also be present at Y-12. Depleted uranium is present in large quantities at Y-12. However, the toxicological effects outweigh the radiological effects for depleted uranium. The consequences of a radiological fire in the facilities at Y-12 include potential exposure to airborne releases of various forms of enriched elemental uranium, uranium compounds, and thorium.

If a fire event involving radioactive materials were to occur, there would be an estimated 9×10^{-5} to 0.28 cancer fatalities in the population within 80 km (50 mi) of Y-12. For a non-involved worker located 200 m (660 ft) (site boundary) from the accident, there would be an increased incidence of cancer fatality of 4×10^{-6} to 0.023. For the MEI located at the site boundary, there would be an increased incidence of cancer fatality of 5×10^{-6} to 0.008. The risks for the fire accidents involving radioactive materials, reflecting both the mitigated frequency of the accident occurring and the consequences, are shown in Table 5.14–3 (at end of Section 5.14). For the same worker, the MEI, and the population, the risks, taking into account the probability of accidents, would be 4×10^{-10} to 2.3×10^{-6}, 5×10^{-10} to 8×10^{-7}, and 9×10^{-9} to 2.8×10^{-5} cancer fatalities per year, respectively. A detailed listing of the potential consequences to the public and collocated workers of the dominant postulated accident scenarios are presented in Appendix Table D.7.4–2.

Chemical Accidents

Many Y-12 facilities store and use a variety of hazardous chemicals. The quantities of chemicals vary, ranging from small amounts in individual laboratories to bulk amounts in processes and specially designed storage areas. In addition, the effects of chemical exposure on personnel would depend upon its characteristics and could range from minor to fatal. Minor accidents within a laboratory room, such as a spill, could result in injury to workers in the immediate vicinity. A catastrophic accident such as a large uncontrolled fire, explosion, earthquake, or aircraft crash could have the potential for more serious impacts to workers and the public (See Appendix D.7.5.1 for a discussion of the December 8, 1999 accident involving sodium-potassium in Building 9201-5). A catastrophic accident could also release various chemicals from multiple release points and increase the potential for human exposure and serious injury.

To assess the impacts of chemical accidents in a bounding manner, a multiple step review of the facilities was performed. The nuclear facility accidents were reviewed for potential chemical accidents related to the nuclear facilities. In addition, the annual *Emergency Planning and Community Right-to-Know Act* (hereafter known as *Superfund Amendments and Reauthorization Act* [SARA]) Section 311 and Section 312 reports were reviewed (Evans 1999a, Evans 1999b). The list of chemicals ascertained from this multiple step review was further screened to identify chemicals that were also listed as highly hazardous chemicals by OSHA in 29 CFR 1910.119 or as a regulated substance by EPA under 40 CFR 68.130. Additionally, chemicals determined to require further evaluation met all of the following criteria as defined in DOE/EIS-0238 (DOE 1999l).

- Has a time-weighted average (TWA) less than 2 ppm (for chemicals without TWAs, the temporary emergency exposure limit [TEEL]-0 was used)
- Is found in a readily dispersible form (i.e., a gas or liquid)
- Has a boiling point of less than 100EC (212EF) and a vapor pressure greater than 0.5 mm mercury

Mercury, a chemical of local interest, was added to the list of chemicals identified for further analysis.

A fire involving mercury could result in the exposure of some members of the public to Emergency Response Planning Guidelines (ERPG)-2 concentrations. The consequences of exposures to fires involving other chemicals were exposures of ERPG-2 concentrations to on-site personnel. The fires could expose between 80 and 190 workers to ERPG-2 or higher concentrations of toxic chemicals. A summary of the results of a release of toxic material in the event of fire is presented in Appendix D (Table D.7.5–1).

The exposures to toxic chemicals due to a loss of containment (leak of a container or spill from a tank) were evaluated. Nitric acid, hydrochloric acid, or sulfuric acid or sodium hydroxide spills are not expected to expose the pubic to ERPG-2 concentrations. Toxic gas releases could expose between 80 and 310 workers to ERPG-2 concentrations or greater. Exposures from a release of hydrogen flouride from Building 9212 could exceed ERPG-2 levels 60 m beyond the Y-12 Emergency Response Boundary, but would not reach the closest residential area. A summary of the evaluation is presented in Appendix D (Table D.7.5–2).

5.14.4 Accidents for the HEU Storage Mission and Special Materials Mission Alternatives Compared to the No Action - Status Quo Alternative

A new HEU Materials Facility or Building 9215 addition is proposed in this SWEIS as an alternative to the existing facilities currently performing the HEU Storage Mission at Y-12. The conceptual design analysis of the HEU Materials Facility indicates that the frequency of fire would be reduced by limiting combustible materials in the facility. The new facility would be constructed of noncombustive materials and the contents would provide extremely low combustible material loading. Considering the segmentation of the inventory, the use of fire barriers as proposed in the new HEU Materials Facility or Building 9215 addition, and the noncombustible building construction, the consequences of any release and the likelihood of a large fire would be expected to be below the results presented in Table 5.14–3 for the existing facilities.

New facilities such as the proposed HEU Materials Facility or Building 9215 addition would be constructed to current building design standards. New buildings for the Y-12 Site would be designed and built to withstand higher seismic accelerations and thus would be more resistant to earthquake damage. These new facilities would experience earthquake damage less frequently. The new HEU Materials Facility or the Building 9215 addition would be designed to PC-3 and constructed to PC-2 standards (see DOE-STD-1021-93). The frequency of a beyond-design basis earthquake would be less than 5×10^{-4}/yr. The new HEU Materials Facility or the Building 9215 addition would also be built at a higher elevation, precluding flooding of HEU storage with the potential for increasing the likelihood of a postulated criticality accident.

A new Special Materials Complex is proposed for construction to consolidate the existing special materials operations described under the No Action - Status Quo and No Action - Planning Basis Operations Alternatives. This proposed complex would be built to current codes and standards. Additionally, the proposed Special Materials Complex would make use of engineered controls in lieu of some administrative controls used in existing operations; thus, the controls that prevent or mitigate accidents would be more reliable. The proposed complex would be composed of several buildings that would provide segmentation of inventories and would generally be constructed from noncombustible materials (see Section 3.2.4). Therefore, the likelihood of accidents involving the chemicals stored in the new complex would decrease with the new facilities over the present special material processing facilities. The likelihood of these accidents is expected to be significantly lower. The candidate locations that are being considered for the Special Materials Complex show that Site 1 is located north of Bear Creek Road and much closer to the closest Y-12 Emergency Response Boundary and closest to the location of an MEI member of the public. This location would increase the likelihood of exceeding ERPG-2 (or TEEL-2) concentrations at the Y-12 Emergency Response Boundary if the same inventories of chemicals are stored at all of the candidate sites, and no compensating design improvements were made to decrease the risk. New facilities are designed specifically to process hazardous materials; however, the facilities can be expected to incorporate modern features to prevent the occurrence of accidents with the materials, as well as mitigate the accident consequences. Specific examples must await the final facility design, but would include material containment systems, ventilation filter systems, fire protection systems, and improved material handling and storage.

TABLE 5.14–1.—*Summary of Beyond Evaluation Basis Earthquake Composite Consequences for Y-12*

Frequency (yr^{-1})	Source Term (kg)	Maximum Individual (rem)		Maximum Individual Latent Cancer Fatalities		Population (person-rem)		Population Latent Cancer Fatalities	
		Public	Collocated Workers	Public	Collocated Workers	Public	Collocated Workers	Public	Collocated Workers
<1 x 10^{-4}	15.85 of HEU	17	30	0.008	0.012	404	26,500	0.21	11
Risk (LCF/yr)				8 x 10^{-7}	1.2 x 10^{-6}			8.1 x 10^{-5}	1.1 x 10^{-3}

Source: Appendix Section D.7.4.

TABLE 5.14–2.—*Summary of Criticality Consequences for Y-12*

Mitigated Frequency (yr^{-1})	Source Term (kg)	Maximum Individual (rem)		Maximum Individual Latent Cancer Fatalities		Population (person-rem)		Population Latent Cancer Fatalities	
		Public	Collocated Workers	Public	Collocated Workers	Public	Collocated Workers	Public	Collocated Workers
10^{-4} to 10^{-6}	1 x 10^{19} fissions	3	8	1.5 x 10^{-3}	3.2 x 10^{-3}	8.6	870	4.3 x 10^{-5}	0.35
Risk (LCF/yr)				1.5 x 10^{-7}	3.2 x 10^{-7}			4.3 x 10^{-7}	3.5 x 10^{-5}

Source: Appendix Section D.7.4.

TABLE 5.14–3.—*Summary of Fire Consequences Involving Radioactive Materials for Y-12*

Mitigated Frequency (yr^{-1})	Source Term (kg)	Maximum Individual (rem)		Maximum Individual Latent Cancer Fatalities		Population (person-rem)		Population Latent Cancer Fatalities	
		Public	Collocated Workers	Public	Collocated Workers	Public	Collocated Workers	Public	Collocated Workers
10^{-4} to 10^{-6}	0.007 to 22 of HEU	0.01 to 16	0.01 to 57	5 x 10^{-6} to 0.008	4 x 10^{-6} to 0.023	0.18 to 570	12 to 3,300	9 x 10^{-5} to 0.28	0.005 to 1.3
Risk (LCF/yr)				5 x 10^{-10} to 8 x 10^{-7}	4 x 10^{-10} to 2.3 x 10^{-6}			9 x 10^{-9} to 2.8 x 10^{-5}	5 x 10^{-7} to 1.3 x 10^{-4}

Source: Appendix Section D.7.4

5.15 RESOURCE COMMITMENTS

This section describes the potential impacts of the Y-12 HEU Storage Mission and Special Materials Mission Alternatives on the commitment of resources in terms of unavoidable adverse impacts, short-term uses verses long-term productivity, and the irreversible or irretrievable commitments of resources.

The section presents information drawn from the previous sections of Chapter 5 (Environmental Consequences) and the Comparison of Alternatives and Environmental Impacts (Section 3.5 and Table 3.5–1). The resource commitment assessment focuses on those potential impacts, which cannot be mitigated, and would result in a loss or long-term commitment of the resource.

Unavoidable Adverse Impacts. Current operations at Y-12 use approximately 5.7 billion L/yr (1.5 billion gal/yr) of treated water. The water usage required for each of the HEU Storage Mission and Special Materials Mission Alternatives would be relatively small compared to current usage or water usage under the No Action - Planning Basis Operations Alternative; about 7.4 billion L/yr (2 billion gal/yr). The operation of a new HEU Materials Facility would require about 550,000 L/yr (145,000 gal/yr); the addition to Building 9215 operations would require about 720,000 L/yr (190,000 gal/yr) of water. The Special Materials Complex would need about 84 million L/yr (22 million gal/yr). Over the life of the construction period, the new HEU Materials Facility would have total water requirements of about 7.6 million L (2 million gal); the Building 9215 Upgrade Expansion requires less water, about 5.7 million L (1.5 million gal) in the construction period. The Special Materials Complex construction would require about 5.7 million L (1.5 million gal).

New construction activities would require the potential redesign or relocation of discharge channels. The adverse impacts would be short-term in nature as natural plants are re-established and wildlife returns to the area.

The candidate sites for the proposed HEU Materials Facility are within the existing industrialized Y-12 Site boundary and are all previously disturbed to some degree. Consequently, the use of either site would not result in an adverse change to existing Y-12 land use patterns and plans.

The candidate sites and Y-12 Site areas that may be affected are inhabited primarily by urban-type wildlife species. There are no areas providing substantial habitat support. Adverse impacts to biological resources therefore would not constitute major habitat modifications or long-term loss of species.

Unavoidable radiation and chemical exposures, which include continued occupational exposures and exposures to the general public from normal Y-12 operations, while an adverse impact, would be well below regulatory limits.

As DOE continues operations under the No Action - Status Quo and No Action - Planning Basis Operations Alternatives, the potential for injuries and fatalities of workers exists. Engineered controls and training and safety programs would reduce but not eliminate the potential for worker injuries or fatalities.

Short-term Uses Versus Long-term Productivity. The proposed actions could require short-term use of the environment that would affect long-term environmental productivity. This section describes possible consequences to long-term environmental productivity for short-term environmental uses. The terms “short-term” and “long-term” commonly used in NEPA analyses do not have specific definitions. For purposes of this SWEIS, the short-term refers to the time from the present out to 10 years. Long-term refers to the time frame out to 30 years, or the estimated operating life of a facility.

In general, Alternative 1B (No Action - Planning Basis Operations Alternative) and proposed actions for the Y-12 HEU Storage Mission and Special Materials Mission would benefit long-term national security by fulfilling an integral role in maintaining a safe, secure, and reliable nuclear weapons stockpile over the next 10 years and beyond. Y-12, through the implementation of the HEU Materials Facility and Special Materials Complex projects, would contribute to the safe, secure, and consolidated storage of HEU and the dismantling of weapon components and special materials operations. Additionally, proposed new construction would increase operational efficiency while reducing maintenance costs.

Up to 5 to 8 ha (12.4 acres) of land would be committed to host the construction of the new HEU Materials Facility and Special Materials Complex. In the short-term, this would remove the land from existing or other future uses. In the long-term, however, the land would be the site of a state-of-the-art HEU Materials Facility and a Special Materials Complex.

Short-term uses that could cause impacts to biological resources and soils would be associated with the construction and operation of Y-12 facilities; those activities could lead to long-term productivity loss in disturbed areas. The loss would be limited to approximately 4 ha (10 acres) per facility in addition to minimal areas disturbed by infrastructure modifications. The areas likely to be disturbed are in existing industrialized areas of the Y-12 Site. Biological resources would be affected by land disturbances. The overall impact, however, would be limited because the areas disturbed and the individuals affected would be small in relation to the regional populations.

Small occupational and public radiation exposures would continue in the short-term from existing Y-12 operations. With proposed new construction, expected exposures should be less due to the installation of the state-of-the-art equipment and engineered barriers. In the long-term, the modernization efforts would represent a positive impact through reduced risk and decreased occupational and public exposure to radiation. Short-term employment, expenditures, and tax revenues during the new construction period would benefit the local economy. The longer-term operational workforce impacts would be negligible. Employment associated with new construction would help retain workers that would otherwise be lost through downsizing.

Irreversible or Irretrievable Resource Commitments. Resources that could be irreversibly or irretrievably be committed during the construction of Y-12 facilities include:

- Resources that cannot be recovered or recycled
- Resources consumed or reduced to unrecoverable forms

The commitment of a resource is irreversible if its primary or secondary impacts limit future options for the resource. An irretrievable commitment refers to the use or consumption of resources that are neither renewable nor recoverable for later use by future generations.

The land requirements for support of Y-12's new construction would be small and would represent an irreversible commitment. Because of the aboveground construction, the land would not be restored to its original condition. Consequently, the land would not be available for other uses.

The commitment of capital, labor, material, and energy during the construction and operation of the facilities would be irretrievable. Energy would be consumed in the form of diesel fuel, gasoline, and oil for construction equipment and vehicles, and as electricity and raw materials for construction and operations.

Materials used for construction would include wood, aggregate, plastics, metals (steel, copper, aluminum, and stainless steel), concrete, and small amounts of other materials. Waste generation estimates can be found in Sections 3.2.3 and 3.2.4. Some of these materials (e.g., copper and stainless steel) could be salvaged when facilities are decontaminated and decommissioned.

In general, the Special Materials Complex would consume the most resources. Table 5.15–1 provides resource requirements by alternatives.

TABLE 5.15–1.—*Commitment of Construction Resources for the Highly Enriched Uranium Storage Mission and Special Materials Mission Alternatives*

Requirements	HEU Materials Facility Sites A or B	Building 9215 Addition	Special Materials Complex		
			Site 1	Site 2	Site 3
Materials/Resource					
Electrical Energy (MWh)	5,000	5,000	8,000	8,000	8,000
Concrete (m^3)	25,100	7,650	13,800	14,500	14,500
Steel (t)	2,100	1,100	3,000	3,200	3,200
Liquid Fuel and lube oil (L)	568,000	265,000	984,200	1,582,300	1,582,300
Water (L)	7,571,000	5,678,000	5,700,000	5,700,000	5,700,000
Land (ha)	5	1	8	5	5

Source: Tables 5.8.3–1 and 5.8.4–1.

CHAPTER 6: CUMULATIVE IMPACTS

Consistent with NEPA, this chapter considers past, present, and reasonably foreseeable actions that could, along with the Y-12 proposed actions for the HEU Storage Mission and Special Materials Mission, result in cumulative impacts to the environment. It considers other ongoing operations at the ORR, actions that might occur in the future at ORR, and actions that are ongoing or planned within the ROI.

6.1 METHODOLOGY AND ANALYTICAL BASELINE

The CEQ regulations that implement the procedural provisions of NEPA define cumulative effects as impacts on the environment that result from the addition of the incremental impact of the action to other past, present, and reasonably foreseeable future actions. These impacts are considered regardless of what agency (Federal or non-Federal) or person undertakes the actions (40 CFR 1508.7). DOE based the cumulative impact analysis in this chapter on proposed Y-12 HEU Storage and Special Materials operations, other actions associated with the ORR, and off-site activities with the potential to contribute to the cumulative environmental impact.

Based on the analysis presented in Chapter 5, DOE has determined that the following resource areas have the greatest potential for cumulative impacts: (1) land use, (2) traffic and transportation, (3) socioeconomics, (4) water resources, (5) air resources, (6) utilities and energy consumption, (7) waste generation, and (8) public and worker health. For purposes of analysis, DOE has used the Y-12 Alternative 1B (No Action - Planning Basis Operations Alternative) as its basis for calculating cumulative impacts. The analysis has been conducted in accordance with CEQ NEPA regulations and the CEQ handbook, *Considering Cumulative Effects Under the National Environmental Policy Act* (CEQ 1997a), on the preparation of cumulative impact assessments.

Cumulative impact assessment is based on both geographic (spatial) and time (temporal) considerations. As mentioned above, past impacts are captured in the existing No Action - Status Quo Alternative. Future impacts will be analyzed for the same timeframe (2001 to 2010) as the No Action - Planning Basis Operations Alternative, as described in Section 1.5. Geographic boundaries vary by discipline depending upon the time an effect remains in the environment, the extent to which the effect can migrate, and the magnitude of the potential impact. Based on these factors, DOE has determined that for impacts to air, water, utilities, waste generation, and public and worker health, an 80-km (50-mi) radius surrounding the ORR is the potential impact zone. The impact zone for transportation and socioeconomic resources is a four-county region where over 90 percent of the ORR workforce lives: Anderson, Knox, Roane, and Blount counties. The impact zone for land use is the ORR and adjoining properties.

The site-wide analysis presented for the Y-12 No Action - Planning Basis Operations Alternative in Chapter 5 may be considered by its scope, an analysis of cumulative impacts. To analyze the effects of continuing the Y-12 missions, ROIs were selected to identify the maximum extent of impacts while still providing a discussion of effects that can be evaluated meaningfully. The discussion that follows is not greatly influenced by the variation in impacts from the HEU Storage Mission or Special Materials Mission alternatives because the differences are not significant and/or there is little or no contribution to impacts from other sources that are in the same ROI as the Y-12 National Security Complex.

Information was gathered from city, county, state, and other Federal organizations concerning future plans for development and to obtain information regarding regional planning efforts. CERCLA and NEPA documents including PEISs, EISs, EAs, FONSIs, and RODs were reviewed to determine if current or proposed projects could affect the cumulative impact analysis for the Y-12 SWEIS. The reasonably foreseeable future action descriptions, included in Section 6.2, were determined from planning documents through communications with ORO personnel and others to identify potential actions that may contribute to cumulative impacts on or in the vicinity of the Y-12 National Security Complex.

6.2 POTENTIALLY CUMULATIVE ACTIONS

In addition to this SWEIS, DOE has prepared other recent NEPA documentation related to the ORR actions that could potentially contribute to the cumulative impact of Y-12 operations and modernization actions. DOE has also identified other reasonably foreseeable actions. The information was based on a review of city, county, state, and Federal information as well as any known plans in the private sector. The potential cumulative environmental impacts are quantified for each action that has available information (see Tables 6.4.4–1, 6.4.5–1, 6.4.7–1, and 6.4.8–1). For those actions which are not yet specifically defined, or are expected to have a negligible contribution to cumulative impacts, the actions are described but not included in the cumulative effects. A discussion of each potentially cumulative action is provided below.

6.2.1 TVA Plants

TVA operates three electric generating facilities within an 80-km (50-mi) radius of ORR: the Bull Run (Anderson County) and Kingston (Roane County) coal-fired steam plants, and the Watts Bar Nuclear Plant (Loudon County). Radiological impacts from the operation of the Watts Bar Plant, a two-unit commercial nuclear power plant, are minimal, but DOE has factored them into the analysis. The Watts Bar Plant is also the planned site for the generation of tritium in support of the Nation's nuclear stockpile. The potential environmental impacts of this action can be found in the *Production of Tritium in a Commercial Light Water Reactor EIS* (DOE 1999b).

6.2.2 Y-12 Modernization Program

As discussed in Section 3.3 of this SWEIS, DOE is considering a number of potential actions that may be implemented in the future as part of the effort to modernize the Y-12 facilities. Table 3.3–1 lists the major potential actions including an Enriched Uranium Manufacturing Facility, an Assembly/Disassembly/Quality Evaluation Facility, a Depleted Uranium Operations Facility, a Lithium Operations Complex, and other facilities as needed to meet Y-12 Site mission requirements. Planning and design of these modernized facilities are in the very early stages and, thus, no detailed quantitative impacts have been assessed. However, modernized facilities would reduce radiation exposure to workers, incorporate pollution prevention/waste minimization measures in their operation, and reduce emissions to the environment compared to the facilities that are currently operating.

Environmental Restoration (ER) and D&D activities are currently proceeding at Y-12. To the extent that some of these activities have already occurred, some impacts from these activities are reflected within data provided for the No Action - Status Quo Alternative. Cleanup and D&D activities conducted under CERCLA are reviewed through the CERCLA process. While ER and D&D activities would continue to proceed regardless of modernization activities, the timing of some cleanup and D&D activities may, in some instances, be interrelated with the modernization program.

If modernization program actions are implemented in the future, there would be short-term cumulative impacts due to construction activities, which may affect material resources, land use, traffic and transportation, and employment. However, once the potential modernized facilities are operating, DOE expects that through more efficient and safer processes, impacts on workers, the public, and the environment would be reduced. Therefore, implementation of the modernization program will not contribute to long-term cumulative impacts.

6.2.3 Lease of Parcel ED-1, ED-3, and Land and Facilities within the ETTP

DOE completed an EA (DOE 1996a) for the proposed lease of 387 ha (957 acres) of land (Parcel ED-1) within ORR to the East Tennessee Economic Council. The land is located on the ETTP Site about 21 km (13 mi) west of downtown Oak Ridge and Y-12. The East Tennessee Economic Council plans to develop an industrial park on the leased site to provide employment opportunities for DOE and contractor employees affected by decreased Federal funding. Plans are to create approximately 1,500 jobs over the next 10 years and to develop a total of about 202 ha (500 acres).

DOE determined that this action is not a major Federal action that would significantly affect the quality of the human environment. Since no specific industries have been announced, a quantitative assessment of impacts are not available to include in the SWEIS, with the exception of the job opportunities and total acreage described above.

DOE is also considering leasing the 182-ha (450-acre) parcel of land designated as ED-3 for development purposes. The land is located to the south and east of the ETTP. Under this action, the land would be leased through the Community Reuse Organization of East Tennessee to private companies. DOE is preparing an EA on the possible lease of this land. As with ED-1, no specific industries have been announced, and quantitative assessments are not available. Figure 6.2–1 shows the location of parcel ED-1 and ED-3 with respect to the ETTP.

DOE also has prepared an EA concerning the expansion of its leasing program at ETTP (DOE 1997d). DOE's leasing program was established to reindustrialize vacant, underutilized, and/or inactive facilities at the ETTP. The Community Reuse Organization of East Tennessee has subleased, or plans to sublease, these facilities to private-sector firms or other organizations for industrial, commercial, office, R&D, manufacturing, and industrial applications.

6.2.4 Construction and Operation of the Spallation Neutron Source

DOE issued a ROD on June 30, 1999 (64 FR 35140) to proceed with the construction and operation of a SNS facility at ORNL. The SNS is an accelerator-based research facility that will provide the U.S. scientific and industrial research communities a source of pulsed neutrons. The facility will be used to conduct research in such areas as materials science, condensed matter physics, the molecular structure of biological materials, properties of polymers and complex fluids, and magnetism. Values for effluent emissions used in the cumulative impact analysis were obtained from the EIS for this action with the assumption that the source would be operating at the 4-MW power level (DOE 1999c). The SNS is currently in the early stages of construction.

6.2.5 Surplus HEU Disposition Activities

DOE issued the *Disposition of Surplus Highly Enriched Uranium Final EIS* (DOE 1996b) on June 28, 1996. In the Final EIS, DOE considered the potential environmental impacts of alternatives for a program to reduce global nuclear proliferation risks by blending up to 200 metric tons (440,920 lbs) of U.S.-origin surplus HEU down to low enriched uranium to make it nonweapons-usable. The resulting low enriched uranium could either be sold for commercial use as fuel feed for non-defense nuclear power plants, or disposed of as LLW.

Source: Tetra Tech, Inc.

FIGURE 6.2.3–1.—*Locations of Parcels ED-1 and ED-3.*

DOE issued a ROD to that EIS on August 5, 1996 (61 FR 40619) in which DOE decided to implement the proposed program, which involves gradually blending up to 85 percent of the surplus HEU to a ^{235}U enrichment of approximately 4 percent for eventual sale and commercial use over time as reactor fuel feed, and blending the remaining surplus HEU down to an enrichment level of about 0.9 percent for disposal as LLW. These actions would take place over a 15 to 20-year period. Because one of the sites that could be used for blending purposes was Y-12, DOE has considered the potential effects of disposition of surplus HEU on cumulative impacts.

6.2.6 Treating Transuranic/Alpha Low-Level Waste

DOE issued the *Transuranic Waste Treatment Facility EIS* in June 2000 and its ROD on August 9, 2000 (65 FR 48683). DOE has selected the Low-Temperature Drying Alternative (the preferred alternative in the Final EIS) and will proceed with the construction, operation, and D&D of the TRU Waste Treatment Facility at ORNL. The waste to be treated is legacy waste, i.e., waste generated from past isotope production and research/development that supported national defense and energy initiatives. TRU Waste generated from ongoing ORNL operations will also be treated at the facility. The facility is adjacent to the Melton Valley Storage Tanks, where the waste sludge and supernatant are currently stored. All treated TRU waste will be transported and disposed of at the WIPP while treated LLW transported and disposed of at NTS.

6.2.7 ORNL Facilities Revitalization Project

DOE is implementing a Facilities Revitalization Project (FRP) at the ORNL in order to modernize some ORNL facilities, maintain ORNL's competitive R&D capabilities, to enhance worker health and safety, and to reduce operating costs. The FRP includes constructing new facilities on brownfield land and remodeling numerous existing facilities in order to relocate ORNL staff currently housed at the Y-12 National Security Complex, other ORR facilities, and in commercial office space from aging, inefficient facilities to new or remodeled facilities. Up to six buildings will potentially be demolished. Approximately 167,225 m^2 (1.8 million ft^2) of space in aging buildings, mostly at the Y-12 National Security Complex, will be vacated.

Conceptual plans for the FRP include construction of up to 24 new facilities totaling approximately 111,484 m^2 (1.2 million ft^2) in Bethel Valley near the main ORNL entrance, near the West Portal in Melton Valley, near the West Portal, and within the recently established footprint for the Spallation Neutron Source (SNS) facility. Some of the new construction will be funded by the State of Tennessee and the private sector. Up to 20 ha (50 acres) of brownfield property in Bethel Valley could be transferred from DOE to the private sector in support of this proposed action. The environmental consequences of this project were reviewed in an EA and a FONSI was signed June 1, 2001 (DOE 2001a).

6.2.8 Oak Ridge Area Infrastructure Upgrades and Expansions

DOE Y-12 Water Plant. On May 1, 2000, DOE transferred the Y-12 Water Plant to the city of Oak Ridge. A 1997 feasibility report indicated that the transfer would assure DOE favorable water rates for its Y-12 and ORNL facilities while providing excess capacity to the city (DOE 1997e). The transfer requires approximately 11 new city employees to replace DOE employees at the plant. This transfer has no impact since there is no change in the total number of employees.

West End Utility Expansion. Partners for Progress, a group of public and private organizations, is working to extend the utility infrastructure to make industrial sites in western Oak Ridge more attractive to prospective industries. DOE-ORO has offered to transfer a 61-cm (24-in) water line to the city and to fund water and sewer lines through the Community Reuse Organization of East Tennessee. The plans for the utility expansions are not yet solidified and are not included. However, the transfer of the waterline has no additional impact.

Kerr Hollow Road. The Tennessee DOT is currently converting a section of State Highway 62 between Union Valley and Bethel Valley roads into a four-lane highway. The work includes a fly-over to connect to Pellissippi Parkway. The section of road involved in the construction is a primary route for Y-12 traffic. Traffic congestion will occur during the 2-year construction period, but the completed project should ease congestion caused by additional traffic from SNS and TRU Waste Treatment Projects.

I-40 Connector. Within the next decade, a four-lane highway is planned from I-40 in Roane County to downtown Oak Ridge; however, the alternative routes have not yet been identified. The conversion of TSR 58 from a two-lane to a four-lane from I-40 to its intersection with SR 95 is estimated to be completed in the late spring of 2001. The project would improve access to the ETTP. Traffic congestion will occur during the construction period, but the completed project should ease congestion caused by additional traffic from SNS and TRU Waste Treatment Projects.

6.3 ACTIONS CONSIDERED BUT NOT INCLUDED

The following actions were considered for inclusion in the cumulative effects analysis but were not pursued further for various reasons. Some were dropped due to the uncertainty of the action, while others due to the lack of relevant data such as resource consumption rates and effluent emission streams to evaluate. These actions are described in detail below.

6.3.1 Remediation of Contaminated Areas in the Melton Valley Watershed

Contamination in the Melton Valley watershed originated from operations of ORNL and other ORR facilities, including Y-12, over a 50-year period. Numerous active and inactive waste management facilities used by operations at ORNL are located in Melton Valley. ORNL's historic missions of plutonium production and chemical separation during World War II and development of nuclear technology during the post-war era produced a diverse legacy of contaminated inactive facilities, research areas, and waste disposal sites throughout the Melton Valley watershed that are potential candidates for remedial actions. Any remedial actions would be handled on a case-by-case basis with proper environmental documentation completed prior to the project initiation.

6.3.2 Receipt and Storage of Uranium Materials from the Fernald Site

DOE completed an EA and issued a FONSI for the receipt and storage of uranium materials at various DOE sites (DOE 1999e). The material has commercial market value and is currently stored at Fernald but needs to be transferred because of regulatory commitments. Y-12 and the ETTP are candidate sites for its maintenance until it can be marketed. The uranium inventory consists of approximately 6,800 t (15 million lbs) of which 800 t (1.8 million lbs) is currently in the process of being sold. Although the EA and FONSI have been issued, no decision as to the specific locations for storage have been made. Under the worst case scenario, the entire inventory is moved to Y-12, impacts would be minimal since adequate storage facilities already exist for this option. In any event, due to the uncertainty of the action, no further analysis is warranted.

6.3.3 Alternative Strategies for the Long-term Management and Use of Depleted Uranium Hexafluoride UF_6

The long-term management and use of depleted uranium hexafluoride was assessed in a PEIS with the ROD issued on August 10, 1999 (64 FR 43358). The PEIS assessed alternatives for the management of UF_6 currently stored at three sites including ETTP (the old K-25 Site). The total inventory of depleted uranium at ETTP is stored in approximately 4,700 cylinders. DOE has decided to convert the depleted uranium to uranium oxide, depleted uranium metal, or a combination of both. The material at ETTP would be shipped to a conversion facility, possibly at Paducah, KY or Portsmouth, OH. Any proposal to proceed with the siting, construction, and operation of a facility or facilities will involve additional NEPA review. The impact of continued storage of the material at ETTP is included in the analysis of the No Action - Status Quo Alternative. Until completion of an EIS on the conversion facility, no information is available for further assessments.

6.3.4 Management of Potentially Reusable Uranium Materials at the DOE Management Center

DOE intends to prepare an EIS that addresses the packaging, transportation, receipt, and storage of large quantities of potentially reusable uranium materials that must be moved from various DOE sites due to remediation activities. The potential Oak Ridge storage sites include Y-12, ETTP, and ORNL. However, until DOE issues an NOI defining the scope of the proposed EIS, it is not reasonable to make any assumptions regarding this action and therefore, it is not included in this cumulative analysis.

6.3.5 Disposition of Stockpiled Mercury

The Defense Logistics Agency is preparing an EIS on the impacts associated with the disposition of excess mercury that was stockpiled for national defense purposes. Stockpiled mercury is now warehoused at five locations in the United States, including the Y-12 National Security Complex. Approximately 675,000 kg (1.5 million lbs) of Defense Logistics Agency-managed mercury is collocated with approximately 675,000 kg (1.5 million lbs) of DOE-managed mercury at Y-12. DOE is a cooperating agency for the EIS. The impact of continued storage of the mercury at Y-12 is included in the analysis of the No Action - Status Quo Alternative. The Y-12 National Security Complex does not have suitable storage space to be considered an alternative site for consolidation of Defense Logistics Agency-managed mercury.

6.3.6 Environmental Impact Statement - Proposed Route 475

The Federal Highway Administration, in cooperation with the Tennessee DOT, published an NOI on October 28, 1999 (64 FR 58123) to prepare an EIS on a proposal to connect I-40 with I-75. The proposed connection would be from near the current I-40/I-75 interchange in Loudon County, near Lenoir City, Tennessee, to an area north and east in Anderson County, near the interchange of I-75 and SR 61. The proposed project is considered necessary to improve the operation and safety of these affected interstate highways. Alternatives to be considered include taking no action and three build alternatives consisting of different alignments. Information as to this proposed action's direct impact on the ORR will not be available until completion of the EIS.

6.3.7 Commercial Ventures

A number of independent commercial development ventures are planned in and around ORR in the foreseeable future. The majority of these involve using land at or near ETTP to take advantage of the excess utilities and the highly trained technical personnel available in the area. Most all involve using land rezoned for its intended use and targeting the experienced labor pool available from the ORR community due to the reductions in work done at the DOE facilities. The major impacts of these ventures would be beneficial, with increased employment for the region. As with any commercial undertaking, there is an element of risk involved, and not all may come to fruition. Since none of them directly affect the options for Y-12, it was felt to be too speculative to include them in the current analysis. The following ventures are being considered near ORR and may have a beneficial cumulative impact, but are not specifically included in the analysis for the reasons stated above.

Horizon Center. The Horizon Center has one tenant that has leased an 8.5 ha (21 acre) parcel at ETTP with options on a contiguous 8.5-ha (21-acre) parcel. The tenant, Thermagenics, produces medical isotopes and expects to have substantial R&D efforts in Oak Ridge. Thermagenics could add approximately 140 jobs in the first 3 years of operation.

Boeing Property. Oak Ridge Properties, a limited partnership, is pursuing purchasing from Boeing, Inc. a 492-ha (1,217-acre) undeveloped site located in Roane County north of SR 58 on the west side of the Clinch River across from ETTP at the K-25 Site. Oak Ridge Properties has proposed a $200 million mixed-use development plan. The development would include approximately 1,500 residential units including houses, apartments, and condominiums, approximately187 ha (450 acres) of industrially zoned property, and a shopping area. A full build-out of this area would pull infrastructure down TSR 58 to the Horizon Center.

The Boeing Property was rezoned from industrial to mixed-use in February 2000. The Oak Ridge Land Company has acquired a 74-ha (182-acre) floodplain strip abutting the Boeing Property for use as a buffer zone and green space from DOE. DOE prepared an EA on the transfer of the property to the abutting landowner (86 FR 25711).

Roane Regional Business and Technology Park (Macedonia Site). The Roane Regional Business and Technology Park, also know as the Macedonia Site, consists of 265 ha (655 acres). The site is located in east Roane County, adjacent to I-40 and less than 3 miles from the I-40/I-75 interchange in Loudon County. It is directly across the Clinch River from the ORNL and the Center for Manufacturing Technology. The site's current predominant land use includes pasture and farmland, with approximately three homes scattered throughout the site. The technology park is an area proposed for medium industrial development (i.e., information technology, instrumentation, computers, and metal work). The total site area is 265 ha (655 acres), total lot area of 231 ha (570 acres), developable lot areas of 172 ha (426 acres), 41 lots, and 25 ha (61 acres) of greenbelt. Roane County officials have signed a contract with Highway Inc. of Cookeville, commencing the first of three construction phases of the technology park: Phase I includes clearing the site; widening, straightening and adding shoulders to Buttermilk Road; and installing sewer, water and gas services. Employment is speculative, but projected around 2,500-5,000 jobs with 500 - 600 as a result of the first phase.

ClientLogic. ClientLogic, a Canadian information technology company, has hired 412 people at its 1,393 m^2 (15,000 ft^2) facility in Commerce Park. ClientLogic is in the process of constructing a new building in Commerce Park to house an additional 500 employees.

Home Depot. Home Depot has purchased property off Laboratory Road for a store that opened in the first quarter of 2001 and employs between 120 to 200 full- and part-time employees.

Bechtel Jacobs Company. As part of Bechtel Jacobs Company's investment in the local economy, a total of 1,500 jobs now exist in Anderson, Roane, Knox, and Blount counties as the result of $50 million generated in payroll. All jobs are in the private sector outside of ETTP.

6.4 CUMULATIVE IMPACTS BY RESOURCE AREA

The following sections indicate that future potentially adverse cumulative impacts contributed by the Y-12 National Security Complex HEU Storage Mission and Special Materials Mission alternatives are minimal. Many components of the proposed actions would ultimately result in more efficient operations, resulting in potentially less air emissions, water pollution, and soil contamination due to the cleanup of contaminated sites. The population projections for the years 1990 through 2010 indicate that the surrounding counties will experience population growth from 7 percent to 31 percent (growth projection: Roane County 31 percent; Loudon County 17 percent, and Knox County 7 percent) with the exception of Anderson County, which is projected to decrease by approximately 3 percent (TEDC 1999c). Therefore, pressure will continue to be exerted on all resources and impact areas but continuing the Y-12 National Security Complex Mission and alternatives associated with the HEU Storage Mission and Special Materials Mission would add very little to regional impacts.

6.4.1 Land Use

The ROI for cumulative effects to land use is the ORR and adjoining properties. No cumulative effects have been identified under the No Action - Planning Basis Operations Alternative since the continued operation of Y-12 do not represent a change in land use. The Y-12 National Security Complex missions would continue to be compatible with the historical mission of industrial use and research. However, with the addition of the new Special Materials Complex, one of the sub-alternatives (Site 1) would result in a change in land use. Approximately 4 ha (10 acres) of this site is wooded and would require clearing. The change in land use would be adverse but would not affect land use activities outside the ORR boundary.

Construction of the SNS on ORR required clearing a 45-ha (110-acre) greenfield site between Y-12 and ORNL and changing its use from Mixed Research/Future Initiatives to Institutional/Research. Minimal net change in land use would result from implementation of the ORNL FRP. Construction of a TRU Waste Treatment facility adjacent to the Melton Valley Storage tanks at ORNL required developing 5 acres of a brownfield site with no change in land use classification. These potential developments and projects would result in small area land use changes on ORR that would be adverse but would not affect land use or residential development outside the ORR boundary.

6.4.2 Transportation

Transportation is not expected to be affected from the continuation of the Y-12 National Security Complex missions. The Y-12 work force is not forecasted to appreciably increase over current employment levels. Therefore, Y-12 employees related traffic would increase, if any, minimally. The required construction work force tends to arrive earlier at the job site and is not expected to add notably to the number of vehicles during the workday rush-hours.

Construction of the SNS with a peak workforce of 578 will increase traffic on ORNL access roads by approximately 7 percent. Operation of the SNS at the 4-MW level with a workforce of 375 would increase traffic on the same roads by approximately 5 percent. The construction and operation of the TRU Waste Treatment facility will have less of an impact with only a peak construction workforce of 97 and operations workforce of 88. Minor increases in routine traffic flow could result from the ORNL FRP, but this would be off-set by recent declines in daily traffic by long-term employees. Traffic problems will arise due to the increase in construction traffic, which is unavoidable and short term, but to an extent, controllable. Increases in workers for the new facilities will cause more traffic congestion but the road improvements previously described will greatly help to alleviate this congestion.

Special shipments to and from ORR of materials such as TRU Waste, Surplus HEU, and cylinders containing depleted uranium hexafluoride can be controlled so as to avoid or minimize traffic congestion caused by the cumulative impact with other activities at ORR. Transportation problems of these shipments outside of ORR have been covered in their individual EIS's.

6.4.3 Socioeconomics

The ROI for the cumulative impact analysis is the four-county area in Tennessee consisting of Anderson, Knox, Loudon, and Roane Counties. More than 90 percent of the ORR work force resides in this area.

No adverse socioeconomic impacts, direct or indirect, have been identified from the continuation of the Y-12 National Security Complex missions. Y-12 operation and use of production, storage, and support buildings at Y-12 would not result in the hiring of substantial numbers of additional operational personnel. Therefore, there would be no cumulative impacts from continuation of the Y-12 National Security Complex missions and operations under the No Action - Planning Basis Operations Alternative.

Under the HEU Storage Mission and Special Materials Mission Alternatives, DOE does not expect adverse cumulative impacts because the construction and operation work force associated with the missions could be supplied from within the ROI, as discussed in Section 5.3.

The separate analyses for the large projects, SNS and TRU waste treatment and for the ORNL FRP, have shown no adverse socioeconomic impacts from their construction and operation. Competition between these and other independent commercial developments for construction resources within the ROI could cause some project delays and perhaps a temporary influx of workers from outside of the region. Many of these developments are designed to create jobs to take advantage of the existing job pool resulting from the overall downsizing of the ORR workforce.

6.4.4 Water Resources

Table 6.4.4–1 summarizes the estimated cumulative radiological doses to human receptors from exposure to waterborne sources near ORR. The ORNL FRP would not add to the radiation dose from waterborne sources because there would be no change in affected ORNL operations. Liquid effluents from Y-12 could contain small quantities of radionuclides that would be released to the UEFPC. The exposure pathways considered in this analysis included drinking water, fish ingestion, shoreline exposure, swimming, and boating. As discussed in Chapter 5, the action alternatives would not cause increased releases of radiological contaminants.

TABLE 6.4.4–1.—*Estimated Average Annual Radiological Doses and Resulting Health Effects to Off-site Population Due to Liquid Releases from Facilities in the Oak Ridge Area*

Activity	MEI Dose (mrem per year)	Population Dose (person-rem per year)	Population Latent Cancer Fatalities
Oak Ridge Reservation[a]	4	3	0.0015
Surplus HEU Disposition	0	0	0
Watts Bar Nuclear Plant[b]	0.26	1.2	0.0006
Spallation Neutron Source[c]	NR[d]	NR	NR
Cumulative Effect	4	4.2	0.004

[a] Values include contributions from Y-12, ETTP, and ORNL.
[b] Includes contribution from tritium production at Watts Bar.
[c] Values are conservatively based on the 4-MW power level.
[d] NR=None reported. The Spallation Neutron Source is designed to have no releases of radioactive liquid effluents.
Source: DOE 2000d; DOE 1996b, DOE 1999c; DOE 1999b.

The estimated cumulative dose from all ORR activities to the maximally exposed member of the public from liquid releases would be 4 mrem per year from drinking water, fish ingestion, shoreline exposure, swimming and boating. By comparison, the DOE Order 5400.5 standard for all exposure pathways is 100 mrem per year. Adding the population doses associated with current and projected ORR activities would yield a cumulative annual dose of 3 person-rem from liquid sources. This translates into 0.0015 LCF for each year of exposure to the population living within an 80-km (50-mi) radius of the ORR. The addition of the dose from the Watts Bar Nuclear Plant cannot be directly added to the ORR MEI dose due to the spatial definition of the MEI dose. Operation of the TRU Waste Treatment Facility would eliminate the primary source of groundwater contamination in the Solid Waste Storage Area 5 North. This would reduce the overall values listed for ORR.

As discussed in Section 4.5, a number of Y-12 facilities discharge treated wastewater into EFPC via NPDES-permitted outfalls. NPDES Compliance Monitoring studies of water quality and biota downstream of these outfalls suggest that discharges from these facilities have not degraded the water quality (DOE 2000d).

6.4.5 Air Resources

DOE also evaluated the cumulative impacts of airborne radioactive releases in terms of dose to an MEI at the Y-12 Site boundary. Table 6.4.5–1 lists the results of this analysis. There would be no change in the radiation dose to the public from the ORNL FRP because there would be no overall change in the operations. The cumulative dose to the maximally exposed member of the public would be 7.04 mrem per year, using the very conservative assumption that the same individual could receive the maximum dose from all activities.

The population doses from current and projected Y-12 activities, and other actions listed in Table 6.4.5–1 could yield a total annual cumulative dose of about 62 person-rem from airborne sources. The total annual cumulative dose translates into 0.03 LCF for each year of exposure to the population living within an 80-km (50-mi) radius of the ORR.

TABLE 6.4.5–1.—*Estimated Average Annual Radiological Doses and Resulting Health Effects to Off-Site Population from Airborne Releases*

Activity	MEI Dose (mrem/yr)	Population Dose (person-rem/yr)	Population Latent Cancer Fatalities
ORNL	0.5	7	0.0035
ETTP	0.4	7	0.0035
Y-12	4.5	34	0.017
Surplus HEU Disposition	0.039	0.16	$8x10^{-5}$
Watts Bar Nuclear Plant[a]	0.078	0.57	0.0003
Spallation Neutron Source[b]	1.5	13	0.0065
TRU Waste Treatment Facility	0.023	0.12	$6x10^{-5}$
Cumulative Effect	7.04	62	0.03

[a] Includes contribution from tritium production at Watts Bar.
[b] Values are conservatively based on the 4-MW power level.
Source: DOE 2000d; DOE 1996b; DOE 1999c; DOE 1999b. DOE/EIS/0305.

DOE also evaluated the potential for cumulative impacts from nonradiological air emissions. As shown in Section 5.7, the operation of the Y-12 Steam Plant is the dominant source of nonradiological air emissions for Y-12. When the emissions from this facility are examined, the off-site concentrations are well below regulatory standards. Other facilities in the area that have the potential for nonradiological emissions have little or no spatial overlap with any emissions plume that originates from Y-12. Therefore, DOE does not expect adverse cumulative impacts due to nonradiological air emissions.

6.4.6 Utilities and Energy

As discussed in Chapter 5, the actions under any of the alternatives in this SWEIS would not cause appreciable increases in utility usage. The ORNL FRP would not affect utilities and energy cumulatively because new facilities would for the most part be serviced by the Spallation Neutron Source. TVA has excess electrical capacity to accommodate future uses at Y-12 and the ORR, and DOE would ensure that other site infrastructure needs were met. The installed capacity of site utilities is much greater than the current or projected usage, to include those actions considered in Section 6.2. Therefore, DOE does not expect adverse cumulative impacts to utility usage and infrastructure capacities.

6.4.7 Waste Generation

Table 6.4.7–1 lists cumulative volumes of LLW, mixed LLW, hazardous waste, and sanitary/industrial wastes that the Oak Ridge ROI would generate. The values are based on the *1999 Annual Report of Waste Generation and Pollution Prevention Progress* (DOE 2000c), the SNS EIS, and the *Production of Tritium in a Light Water Reactor EIS*. The Y-12 waste volumes are based on the No Action - Planning Basis Operations Alternative values presented in Section 5.11.

As stated in Chapter 5, LLW would be generated from maintenance, radiological surveys, and production activities, and mixed and hazardous waste would be generated from maintenance and production activities. The waste volumes generated by other actions shown in Table 6.4.7-1 when combined with the waste generated from proposed actions in the Y-12 SWEIS would not exceed existing ORR and offsite waste management facilities capacities and capabilities for treatment, disposal and/or storage. No increases in waste generation from routine operations would be anticipated as a result of the ORNL FRP. Therefore, DOE does not expect any adverse cumulative impacts on waste management facilities. The potential impact of the large increases in LLW and hazardous waste from the SNS are also covered in the EIS prepared for the SNS project (DOE 1999c).

TABLE 6.4.7–1.—*Estimated Annual Volumes of Waste Generated by Actions in the Oak Ridge Area*

Activity	Low-level waste (m^3/yr)	Mixed low-level waste (m^3/yr)	Hazardous waste (m^3/yr)	Sanitary/Industrial waste (m^3/yr)
ORNL[a]	294	21	7	1,960
ETTP[a]	22	122	3	219
Y-12[b]	1,404	69	18.5	7,295
ORR Total (ORNL, ETTP, and Y-12)	1720	212	28.5	9474
Surplus HEU Disposition	825	50	90	19,800
Watts Bar Nuclear Plant[c]	41	<1	1.0	860[d]
Spallation Neutron Source[e]	34,000	18	40	1,350
TRU Waste Treatment Facility[f]	556	4.6	<1	375
Cumulative Effect	37,819	1,946	203	29,412

[a] Source: DOE 1999i.
[b] Based on estimates for the Y-12 Site No Action - Planning Basis Operations in Chapter 5 and assuming a density of 1000 kg/m^3.
[c] Includes contribution from tritium production at Watts Bar. Source: DOE 1999b.
[d] This value is expressed as kilograms instead of cubic meters in the source document. The conversion to cubic meters was done assuming a density of 1,000 kg/m^3 .
[e] Values are conservatively based on the 4-MW power level. Source: DOE 1999c
[f] Approximately 607 m^3 of treated TRU waste would result from the 5 years of operation of this facility. In addition, 5,550 m^3 of industrial waste would result from D&D of the facility after its operational life. Source: DOE/EIS/0305.

6.4.8 Public and Worker Health

Table 6.4.8–1 summarizes the cumulative radiological health effects of routine ORR operations and proposed DOE actions. The values listed in this table describe the impacts resulting from proposed DOE actions. In addition to estimated radiological doses to the hypothetical MEI and the off-site population, Table 6.4.8–1 lists potential LCFs for the public and workers due to exposure to radiation. The cumulative effect for the general population is shown as a small (less than 5 percent) increase over that from ORR alone. The worker effects are not additive, but site-specific.

TABLE 6.4.8–1.—*Estimated Annual Radiological Impacts to Off-site Population and Facility Workers*

Activity	MEI Dose (mrem/yr)	Population Dose (person-rem/year)	Population Latent Cancer Fatalities	Collective Worker Dose (person-rem/year)	Worker Latent Cancer Fatalities
ORR Total[a]	8.0	90	0.045	125[b]	0.06
Surplus HEU Disposition[c]	0.039	0.16	$8x10^{-5}$	11.3	0.005
Watts Bar Nuclear Plant[d]	0.34	1.8	0.009	110	0.045
Spallation Neutron Source[e]	1.5	1.3	0.0065	370	0.2
TRU Waste Treatment Facility [f]	0.023	0.12	$6x10^{-5}$	6.2	0.003
Cumulative Effect	NA	94	0.047	NA	NA

[a] Includes Y-12, ETTP, and ORNL. Source: DOE 2000d.
[b] Includes 106.5 person-rem for 1999 ORR Operations (40.61 person-rem attributable to Y-12) and accounts for the Y-12 Site No Action - Planning Basis Operations contribution of 59.5 person-rem (see Table D.2.3–5).
[c] Source: DOE 1996b.
[d] Includes contribution from tritium production at Watts Bar. Source: DOE 1999b.
[e] Values are conservatively based on the 4-MW power level. Source: DOE 1999c.
[f] Values based on the preferred alternative (Low Temperature Drying). Source: DOE/EIS/0305.

CHAPTER 7: STATUTES, REGULATIONS, CONSULTATIONS, AND OTHER REQUIREMENTS

This chapter provides information concerning the environmental standards that regulate or guide proposed plans for Y-12. This section presents primary environmental compliance requirements that would result from implementation of the proposed action or alternatives. These requirements are found in Federal and state statutes, regulations, permits, approvals, and consultations and in Executive and DOE Orders, consent orders, FFCAs, and a Federal Facility Agreement. These citations identify the standards to be used for evaluating the ability of the alternative actions to meet the environmental, safety, and health requirements and for obtaining required Federal and state permits and licenses.

Y-12 was constructed during the 1940s and 1950s, when national security requirements were the dominant considerations for facilities design and operation. In the interim, emphasis on operational safety, worker heath and safety, and public and environmental health and safety has resulted in DOE shifting resources to achieve compliance with all applicable requirements. Today, both Federal and state agencies have several types of regulatory authority over Y-12 operations because of compliance agreements between DOE and regulators. These agreements detail schedules for achieving compliance with applicable environmental, health, and safety requirements.

At Y-12, the application of evolving requirements to facilities that are more than 40 years old makes achieving or maintaining compliance an expensive challenge. However, all facilities at Y-12, whether they are newly constructed or existing, must comply with the increasing number and complexity of regulations. Any action to continue operations or to change operations at Y-12 must comply with the applicable environmental, safety, and health regulations.

An overview of the roles and regulations of DOE, Federal, and state agencies is provided in the following sections. Section 7.1 presents Federal and state environmental, safety, and health regulating agencies in which DOE must cooperate in operation of Y-12 facilities. Section 7.2 presents the regulatory requirements employed by DOE and the cooperating regulators to help guide decisions and determine regulatory compliance for continued operation as well as for the SWEIS proposed action and alternatives. Section 7.3 identifies and discusses regulations requiring DOE consultations with other agencies that may also be required to be completed as part of this SWEIS.

7.1 REGULATORY FRAMEWORK

Federal and state governments mandate environmental, safety, and health requirements for operations at Y-12 through the U.S. Congress, Federal agencies, Executive Orders, the Tennessee State Legislature, and state agencies. Federal statutes establish national programs and policies, create broad legal requirements, and authorize Federal agencies to promulgate regulations that conform to the statutes. Detailed implementation of these statutes is delegated to various Federal agencies including DOE, EPA, Department of Transportation (DOT), and the U.S. Department of Labor. Executive Orders are issued by the President and establish policies and requirements for Federal Executive Branch agencies, but do not have the force of law or regulation. Many programs under the jurisdiction of the EPA, such as permitting and enforcement, go to state agencies with EPA retaining oversight of the delegated program.

State legislatures issue their own statutes to authorize and mandate promulgation of state regulations. State statutes, like Federal statutes, establish broad legal requirements. State regulations, developed by state agencies, then promulgate specific requirements to enforce state statutes. In Tennessee, statutes passed by the Tennessee State Legislature are found in the Tennessee Codes Annotated. Most state regulations for environmental requirements are in chapter 1200 of the TDEC Rules (TDEC 1999a).

7.2 STATUTES AND REGULATIONS

NEPA requires that before action is taken at Y-12, the proposed action and alternatives be evaluated for their environmental impact. Regulatory environmental protection requirements are designed to protect human health and the environment, including the air, water, and land. Identification of environmental protection statutes, regulations, and orders with requirements that would be triggered by the alternatives is one means for examining actions that may harm the environment before making a decision to carry out an action. Principal requirements are identified by the applicable environmental statutes, regulations, and approval requirements. Compliance with these requirements would allow DOE to accomplish the actions being considered to at least a threshold level of safety. It does not evaluate the significance of the potential effects, but does provide a basis for relative comparison between the alternatives.

The Atomic Energy Act of 1954 (42 U.S.C. §2011 *et seq*.) makes the Federal government responsible for regulatory control of production, possession, use, and disposal of source, special nuclear, and radioactive material. Included in this responsibility is authorization for DOE to establish standards that protect health and minimize danger to life or property from activities under DOE's jurisdiction. The *Federal Compliance with Pollution Control Standards,* Executive Order 12088, requires Federal agencies, including DOE, to comply with applicable administrative and procedural pollution control standards established by, but not limited to, the CAA, *Noise Control Act, Clean Water Act* , *Safe Drinking Water Act*, TSCA, and RCRA. The *General Environmental Protection Program*, DOE Order 5400.1, establishes the environmental protection program requirements, authorities, and responsibilities for DOE operations for ensuring compliance with applicable protection laws and regulations, executive orders, and internal DOE policies. It establishes formal recognition that DOE's environmental management activities are extensively, but not entirely, regulated by EPA and state and local environmental agencies, and it provides requirements for satisfying these externally imposed regulations. DOE must comply with applicable Federal and state requirements to the same extent as any other entity. Noncompliance with these requirements can lead to enforcement actions. As a result, all environmental protection and compliance activities at Y-12, with the exception of radioactive materials, are externally regulated by other Federal and state agencies.

7.2.1 Federal and State Environmental Statutes and Regulations

Applicable regulatory environmental laws and regulations can be categorized by environmental pathways: air, water, land (which includes waste management and pollution prevention), and the subsequent impact to worker safety and health, the public, and the natural environment. Table 7.2.1-1 lists Federal statutes, Executive Orders, and state statutes that pertain to control, remediation, and/or regulation of the environment and worker safety, grouped by the resources to which each requirement pertains. For most requirements identified, the statute and corresponding regulatory citations are listed. The description providing the basic environmental actions resulting from each of the Federal and state statutes and Executive Orders is also provided.

DOE is committed to fully comply with all applicable environmental statutes, regulatory requirements, and Executive and internal orders. Table 7.2.1–2 lists the most pertinent DOE Directives (orders, manuals, and notices) for implementation of ES&H regulations.

TABLE 7.2.1–1.—*Major Federal and State Requirements Regulating Environmental Control Remediation and Worker Safety Arranged by Topic* [Page 1 of 9]

Statute/Regulation/ Order	Statute Citation	Regulatory Citation	Responsible Agency	SWEIS-Level Potential Applicability; Permits, Approvals, and Notifications
Air Resources				
Clean Air Act, as amended	42 U.S.C. § 7401 *et seq.*	40 CFR Subchapter C	EPA	Requires sources to meet standards and obtain permits to satisfy NAAQS, Tennessee State Implementation Plans, Standards of Performance for New Stationary Sources, NESHAP, and Prevention of Significant Deterioration.
Tennessee Air Quality Act	TCA, Sect. 53-3408 *et seq*.	TDEC Rules 1200-3	TDEC, Division of Air Pollution Control	Permits required to construct, modify, or operate an air contaminant source; sets fugitive dust requirements.
National Ambient Air Quality Standards/State Implementation Plans	42 U.S.C. § 7409 *et seq.* 42 U.S.C. § 7410	40 CFR 50-52	EPA	Includes requirements for compliance with primary SOx, NOx, CO, O_3, Pb and particulate matter and secondary ambient air quality standards and emission limits/reduction measures as designated in each state's implementation plan. Additional emission standards under 40 CFR 63 are also applicable.
Air Pollution Control	TCA, 68-201-105, 4-5-202	TDEC Rules 1200-3-3	TDEC, Division of Air Pollution Control	Adopts the primary NAAQS of Federal regulations for state enforcement.
Procurement Requirements and Policies for Federal Agencies for Ozone-Depleting Substances	Executive Order 12843		DOE/EPA	Requires Federal agencies to minimize procurement of ozone depleting substances and comply with Title VI of CAA Amendments with respect to stratospheric ozone protection and to recognize the limited availability of Class I substances until final phaseout.
Greening the Government through Efficient Energy Management	Executive Order 13123		EPA	Calls for Federal agencies to reduce greenhouse gas emissions by 30 percent and establish energy improvement goals.
Standards of Performance for New Stationary Sources	42 U.S.C. § 7411	40 CFR 60	EPA	Establishes control/emission standards and record keeping requirements for new or modified sources specifically addressed by a standard.

TABLE 7.2.1–1.—*Major Federal and State Requirements Regulating Environmental Control Remediation and Worker Safety Arranged by Topic* [Page 2 of 9]

Statute/Regulation/ Order	Statute Citation	Regulatory Citation	Responsible Agency	SWEIS-Level Potential Applicability; Permits, Approvals, and Notifications
National Emission Standards for Hazardous Air Pollutants	42 U.S.C. § 7412	40 CFR 61	EPA	Requires sources to comply with emission levels of radiological, carcinogenic, or mutagenic pollutants; may require a preconstruction approval, depending on the process being considered and the level of emissions that will result from the new or modified source.
Hazardous Air Contaminants	TCA, 68-201-105, 4-5-202 *et seq.*	TDEC Rules 1200-3-11	TDEC, Division of Air Pollution Control	Adopts the primary NESHAP of Federal regulations for state enforcement.
Prevention of Significant Deterioration	42 U.S.C. § 7470 *et seq.*		EPA	Applies to areas that are in compliance with NAAQS. Requires comprehensive preconstruction review and the application of Best Available Control Technology to major stationary sources (emissions $100 t/yr) and major modifications; requires a preconstruction review of air quality impacts and the issuance of a construction permit from the responsible state agency setting forth emission limitations to protect the Prevention of Significant Deterioration increments.
Noise Control Act of 1972	42 U.S.C. § 4901 *et seq.*	40 CFR Subchapter G	EPA	Requires facilities to maintain noise levels that do not jeopardize the health and safety of the public.

TABLE 7.2.1–1.—*Major Federal and State Requirements Regulating Environmental Control Remediation and Worker Safety Arranged by Topic* [Page 3 of 9]

Statute/Regulation/ Order	Statute Citation	Regulatory Citation	Responsible Agency	SWEIS-Level Potential Applicability; Permits, Approvals, and Notifications
				Water Resources
Clean Water Act, as amended	33 U.S.C. § 1251 *et seq.*	40 CFR Subchapter D	EPA	Requires EPA or state-issued permits and compliance with provisions of permits regarding point source and nonpoint source discharge of effluents to surface water or other activities affecting water quality.
Tennessee Water Quality Control Act	TCA, 69-3-101 *et seq.*, 70-324-70	TDEC Rules 1200-4	TDEC, Divisions of Groundwater Protection, Water Pollution Control, Water Supply	Establishes state authority to issue new or modify existing NPDES permits required for a water discharge source and mandates protection of water quality.
National Pollutant Discharge Elimination System (Section 402 of *Clean Water Act*)	33 U.S.C. § 1342	40 CFR 122	EPA	Requires permit to discharge effluents (pollutants) and storm waters to surface waters; permit modifications are required if discharge effluents changed.
Tennessee National Pollutant Discharge Elimination System	TCA, 69-3-108	TDEC Rules, 1200-4-10	TDEC, Division of Water Quality	In accordance with 33 U.S.C. 1342, Tennessee enforces an EPA-authorized state program that administers both Federal and state requirements for point and nonpoint source discharges to surface water.
Dredged or Fill Material (Section 404 of CWA)	33 U.S.C. § 1344	33 CFR 320, 325, 326, 329, 330, 335-338	COE	Requires permits to authorize the discharge of dredged or fill material in wetlands and to authorize certain work in or structures affecting wetlands.
Aquatic Resource Alteration		TDEC Rules, 1200-4-7 *et seq.*	TDEC, Division of Water Quality	Any activity which involves the alteration of waters of the state typically requires a state aquatic resource alteration permit, including activities in, but not limited to, wetlands, culverts, and road crossings over surface water.

TABLE 7.2.1–1.—*Major Federal and State Requirements Regulating Environmental Control Remediation and Worker Safety Arranged by Topic* [Page 4 of 9]

Statute/Regulation/ Order	Statute Citation	Regulatory Citation	Responsible Agency	SWEIS-Level Potential Applicability; Permits, Approvals, and Notifications
Safe Drinking Water Act	42 U.S.C. § 300h-3	40 CFR 31, 34, 35, 124, 125, 143-146, 233, 270, 271	EPA	Requires permits for construction/operation of underground injection wells and subsequent discharging of effluents to ground aquifers and establishes minimum standards for drinking water at the tap.
Safe Drinking Water Act	TCA, 68-221-701	TCEC Rules, 1200-5-1	TDEC, Division of Water Supply	Adopts the Federal standards for drinking water.
Cultural Resources				
National Historic Preservation Act, as amended	16 USC 470 *et.seq.*	C7 CFR 656, 36 CFR 61, 63, 65, 68, 78, 79, 800-811	DOE, Tennessee Historical Commission (SHPO), Advisory Council on Historic Preservation (ACHP)	Requires the DOE to take into account the effect of it's actions on the historic properties present. Requires consultation with SHPO and interested parties regarding determinations of effect and in mitigations developed to avoid or minimize adverse effects to cultural resources. The ACHP may choose to participate in the consultation and any subsequent agreements.
Archaeological Resource Protection Act, as amended	16 USC 470aa *et seq.*	43 CFR 7	DOE, SHPO	Requires a permit for the removal of archaeological resources from public land. If archaeological resources are discovered during construction, provides penalties for unauthorized removal or destruction.
Native American Graves Protection and Repatriation Act	25 USC 3001	43 CFR 10	DOE, Native American tribe(s), SHPO	Describes the procedures to be followed if Native American cultural items and human remains are discovered during construction and the conditions under which these items can be removed or excavated.
American Indian Religious Freedom Act (AIRFA)	42 USC 1996		DOE, Native American tribe(s)	AIRFA affirms the right of Native Americans to have access to their sacred places. AIRFA promotes consultation with Indian religious practitioners to identify, maintain access, and avoid impacts to places of religious importance to Native Americans.
Indian Sacred Sites	Executive Order 13007	NA	DOE, Native American tribe(s)	Requires the DOE to accommodate access to and ceremonial use of Indian sacred sites by Indian religious practitioners and avoid adversely affecting the physical integrity of such sacred sites.

TABLE 7.2.1–1.—*Major Federal and State Requirements Regulating Environmental Control Remediation and Worker Safety Arranged by Topic* [Page 5 of 9]

Statute/Regulation/ Order	Statute Citation	Regulatory Citation	Responsible Agency	SWEIS-Level Potential Applicability; Permits, Approvals, and Notifications
Curation of Federally Owned and Administered Archaeological Collections	16 U.S.C. 470 et seq.	36 CFR 79	DOE	Requires the DOE to take responsibility for the curation of archaeological collections that are recovered from lands under it's control or from DOE projects. The DOE must assure through funding agreements and inspections that archaeological collections are properly curated in an facility that meets the standards outlined in the regulations.
Tennessee Burial Law	TCA 39-17-311, TCA 39-17-312		DOE, local law enforcement and coroner	Provides for the respectful treatment of human remains that may be encountered during construction excavation.
Tennessee Native American Cemetery Removal and Reburial	TCA 11-6-116	0400-9-1	DOE, Tennessee Commission on Indian Affairs, SHPO	Provides additional guidance for the removal and reinternment of Native American human remains that may be encountered during construction excavation.
Soil/Waste Management				
Resource Conservation and Recovery Act/Hazardous and Solid Waste Amendments of 1984	42 U.S.C. § 6901 *et seq.* 42 U.S.C. § 6991	40 CFR Subchapter I	EPA	Requires notification and permits for operations involving hazardous waste treatment, storage, or disposal facilities; changes to site hazardous waste operations could require amendments to RCRA hazardous waste permits involving public hearings.
Tennessee Hazardous Waste Management Act	TCA 68-46-101 *et seq.*, 68-211-101& 1001 *et seq.*, 68-212-101 *et seq.*, 68-215-107, 4-5-202	TDEC Rules, 1200-1-11, 14, 15	TDEC, Divisions of Solid Waste Management, Hazardous Waste Management, Underground Storage Tanks	Tennessee is authorized by EPA to administer and enforce hazardous waste standards; the Tennessee RCRA requirements mirror the Federal RCRA requirements.

TABLE 7.2.1–1.—*Major Federal and State Requirements Regulating Environmental Control Remediation and Worker Safety Arranged by Topic* [Page 6 of 9]

Statute/Regulation/ Order	Statute Citation	Regulatory Citation	Responsible Agency	SWEIS-Level Potential Applicability; Permits, Approvals, and Notifications
Toxic Substances Control Act	15 U.S.C. § 2601 *et seq.*	40 CFR Subchapter R	EPA	Provisions of TSCA require inventory reporting and chemical control provisions to protect the public from the risks of exposures to chemicals; strict limitations on use and disposal imposed on polychlorinated biphenyl, lead-based paint, and asbestos-contaminated equipment and material.
Comprehensive Environmental Response, Compensation, and Liability Act/Superfund Amendments and Reauthorization Act of 1986	42 U.S.C. § 9601 *et seq.*	40 CFR Subchapter J	EPA	Requires cleanup and notification if there is a release or threatened release of a hazardous substance; requires DOE to enter into Interagency Agreements with EPA and state to control the cleanup of each DOE site on the National Priorities List.
Superfund Implementation	Executive Order 12580	3 CFR 33 CFR 1, 138, 153 40 CFR 35, 300, 303-305, 307 44 CFR 220-222	DOE/EPA	DOE shall comply with the National Contingency Plan in addition to the other requirements of the Order, as amended.
Worker Safety and Health				
Occupational Safety and Health Act	29 U.S.C. 651 *et seq.*, 655	29 CFR Chap. XVII	OSHA	Employers shall comply with all applicable worker safety and health standards including, but limited to, requirements for protection from physical and chemical hazards, training, medical monitoring as needed, and information available such as Material Safety Data Sheets.

TABLE 7.2.1–1.—*Major Federal and State Requirements Regulating Environmental Control Remediation and Worker Safety Arranged by Topic* [Page 7 of 9]

Statute/Regulation/ Order	Statute Citation	Regulatory Citation	Responsible Agency	SWEIS-Level Potential Applicability; Permits, Approvals, and Notifications
Chronic Beryllium Disease Prevention Program Final Rule December 8, 1999	42 U.S.C. § 2011 (i)(3), 29 U.S.C. 688	10 CFR Part 850	DOE	Establishes a chronic beryllium disease prevention program that supplements and is integrated into existing worker protection programs that are established for DOE employees and contractor employees.
		Radiological		
Atomic Energy Act of 1954	42 U.S.C. § 2011 *et seq.*	10 CFR 835, 830, 120, 820	DOE	DOE shall develop and follow its own standards and procedures, particularly with respect to radioactive substances, to ensure the safe operation of its facilities.
Nuclear Waste Policy Act of 1982	42 U.S.C. § 10101 *et seq.*	40 CFR 191, 194	DOE	DOE shall complete all required permits and dispose of spent nuclear fuel, high level, and TRU radioactive waste; certification and compliance of Waste Isolation Pilot Plant.
Low Level Radioactive Waste Policy Act	42 U.S.C. § 2021b - 2021d	NA	DOE/TDEC	DOE shall dispose of low-level radiological waste off-site in accordance with State of Tennessee rules.
Occupational Radiation Protection	42 U.S.C. § 2201; 7191	10 CFR 835	DOE	Establishes limits for worker exposure to radioactivity.
		Other		
National Environmental Policy Act of 1969, as Amended/Council on Environmental Quality Regulations Implementing the Procedural Provisions of NEPA	42 U.S.C. § 4321 *et seq.*	10 CFR 1021 40 CFR 6 40 CFR Subchapter V	CEQ	DOE shall implement NEPA and comply with the Council on Environmental Quality procedures.

TABLE 7.2.1–1.—*Major Federal and State Requirements Regulating Environmental Control Remediation and Worker Safety Arranged by Topic* [Page 8 of 9]

Statute/Regulation/ Order	Statute Citation	Regulatory Citation	Responsible Agency	SWEIS-Level Potential Applicability; Permits, Approvals, and Notifications
Hazardous Material Transportation Act	49 U.S.C. § 5101 *et seq.*	49 CFR Chapter 1 Subchapters A & C 40 CFR 263	DOT	DOE shall comply with the requirements governing hazardous materials and waste transportation.
Hazardous Materials Transportation Uniform Safety Act of 1990	49 U.S.C. § 5105	10 CFR 71 49 CFR 173, 174, 397	DOT	Restricts shippers of overland route-controlled quantities of radioactive materials to use-only permitted carriers.
Emergency Planning and Community Right-to-Know Act of 1986 (SARA Title III)	42 U.S.C. § 11001 *et seq.*	40 CFR 350-374	EPA	Requires the development of emergency response plans and reporting requirements for chemical spills and other emergency requirements covering storage and use of chemicals which are reported in toxic chemical release forms.
Federal Compliance with Right-to-Know Laws and Pollution Prevention Requirements	Executive Order 12856	NA	DOE/EPA	Requires Federal agencies to achieve 50 percent reduction of agency's total releases of toxic chemicals to the environment and offsite transfers, to publicly report toxic chemicals entering any waste stream from Federal facilities, including any releases to the environment, and to improve local emergency planning, response, and accident notification.
Pollution Prevention Act of 1990	42 U.S.C. 13101 & 13102	NA	EPA	Establishes a national policy that pollution should be reduced at the source; requires DOE to submit a toxic chemical source reduction and recycling report for Y-12, a facility required to file an annual toxic chemical release form under section 313 of SARA.
Federal Facility Compliance Act of 1992	42 U.S.C. § 6961	40 CFR 255	TDEC	Waives sovereign immunity for Federal facilities under RCRA and requires DOE to develop plans and enter into agreements with states as to specific management actions.

TABLE 7.2.1–1.—*Major Federal and State Requirements Regulating Environmental Control Remediation and Worker Safety Arranged by Topic* [Page 9 of 9]

Statute/Regulation/ Order	Statute Citation	Regulatory Citation	Responsible Agency	SWEIS-Level Potential Applicability; Permits, Approvals, and Notifications
Greening the Government Through Waste Prevention, Recycling, and Federal Acquisition	Executive Order 13101	NA	DOE	States a national policy preference for pollution prevention (reducing the generation of waste at its source) over waste recycling, treatment, and disposal. If pollution prevention is not feasible, waste should be recycled or treated in an environmentally safe manner. Disposal should be used only as a last resort. The Secretary of Energy is required to incorporate waste prevention and recycling into daily operations. In addition, DOE must implement cost-effective procurement programs that favor the purchase of environmentally preferable products and services. There are products or services with a lesser or reduced effect on human health and the environment compared to competing products and services used for the same purposes. This EO would require the incorporation of waste prevention and recycling into construction and operation of the proposed HEU Materials Facility or Upgrade Expansion of Building 9215, and the Special Materials Complex, consistent with the demands of efficiency and cost-effectiveness.
Federal Compliance with Pollution Control Standards	Executive Order 12088		Office of Management and Budget/DOE/ EPA	Requires Federal agency landlords to submit to the Office of Management and Budget an annual plan for the control of environmental pollution and to consult with EPA and state agencies regarding the best techniques and methods.

TABLE 7.2.1–2.—*Selected Department of Energy Directives*

DOE Directive	Directive Title
5400.1	General Environmental Protection Program
5400.5	Radiation Protection of the Public and the Environment
5480.4	Environmental Protection, Safety, and Health Protection Standards
5480.19	Conduct of Operations
5480.21	Unreviewed Safety Questions
5480.22	Technical Safety Requirements
5480.23	Nuclear Safety Analysis Reports
5484.1	Environmental Protection, Safety, and Health Protection Information Reporting Requirements
5530.1A	Accident Response Group
5530.4	Aerial Measuring System
470.2A	Security and Emergency Management Independent Oversight and Performance Assurance Program
5632.1C	Protection and Control of Safeguards and Security Interests
M 231.1 Chg 2	Environment, Safety, and Health Reporting Manual
N 441.1	Radiological Protection for DOE Activities
O 151.1A	Comprehensive Energy Management System
O 225.1A	Accident Investigations
O 231.1 Chg 2	Environment, Safety and Health Reporting
O 232.1A	Occurrence Reporting and Processing of Operations Information
O 414.1A	Quality Assurance
O 420.1 Chg 2	Facility Safety
O 430.1A	Life Cycle Asset Management
O 435.1	Radioactive Waste Management
O 440.1A	Worker Protection Management for DOE Federal and Contractor Employees
O 450.5	Line Environment, Safety and Health Oversight
O 451.1A	*National Environmental Policy Act Compliance Program*
O 460.1A	Packaging and Transportation Safety
O 460.2 Chg 1	Departmental Materials Transportation and Packaging Management
O 470.1 Chg 1	Safeguards and Security Program

7.2.2 Other Pertinent Laws and Requirements

DOE has entered into agreements with Federal and state regulatory agencies that have substantive provisions in effect for Y-12. These agreements establish a schedule, the means, interim conditions or actions for achieving full compliance at the DOE facility. Table 7.2.2-1 lists environmental agreements with Federal and state regulatory agencies that have substantial provisions in effect for Y-12.

7.3 CONSULTATION

Some environmental laws and Executive Orders are integrated into the NEPA process and establish guidelines for review. Pursuant to NEPA and DOE Regulations (10 CFR 1021), consultations are conducted with outside Federal and state agencies having jurisdiction or special expertise. Agencies involved include those responsible for protecting significant resources, such as, endangered species, critical habitats, or historic resources. Federal and state agencies with jurisdiction or expertise in these areas have been, and will be, consulted during the development of the Y-12 SWEIS. Representatives of Federal and state agencies were involved in scoping activities for this SWEIS and will be consulted in the preparation of the Final Y-12 SWEIS. Copies of letters from DOE inviting the participation of consulting agencies and response letters received by DOE are included in Appendix C.

Table 7.3-1 provides laws and Executive Orders that involve consultation for this SWEIS and that are applicable to the Y-12 proposed actions and alternatives. Accompanying each law or Executive Order is a brief description of the purpose of the cited statutes and the consultation occurring for the current Y-12 proposed actions and alternatives.

TABLE 7.2.2–1.—*Agreements Between DOE-ORO and Other Regulatory Agencies*

Areas of Agreement	Regulation for Which Agreement Reached	Regulatory Agency	Explanation and Summary of Agreement
TSCA Storage Requirements for PCBs	40 CFR 761.65	EPA and TDEC	PCBs and PCB-contaminated items with concentration above 50 ppm must be disposed of within 1 year. Agreement set milestones for disposal of various PCB-contaminated materials, providing wastes could be stored for more than 1 year provided milestones met and complete disposal of all PCB wastes be achieved before the year 2016.
Programmatic Agreement on Historic Preservation	16 U.S.C. 470	TSHPO	A Programmatic Agreement for the Management of Historical and Cultural Properties at the ORR, Memorandum of Agreement, was executed on May 6, 1994. The three-party agreement was among DOE/ORO, the Tennessee State Historic Preservation Officer (TSHPO) and the National Advisory Council on Historic Preservation to fulfill DOE's responsibilities under Section 106 and 110 of the *National Historic Preservation Act*.
Mixed Waste	40 CFR 268.50	EPA and TDEC	Storage of RCRA LDR waste for other than accumulation of sufficient quantities to facilitate proper recovery, treatment, or disposal is prohibited. Storage of mixed LDR wastes pending development of treatment capacity is not an approved reason for accumulation. EPA granted a national capacity variance for mixed LDR wastes; however, the variance expired on May 8, 1992. In June 1992, an agreement to make past, present, and future LDR waste generation and storage facilities on the ORR in compliance with environmental laws. Mixed waste covered in this agreement includes flammable and corrosive liquids, solvents, paint waste, waste oils and organics, and solid mixed wastes.
DOE-ORO Placed on the National Priorities List on November 21, 1989, and effective December 21, 1989	NA	EPA and TDEC	As a result of the listing, DOE entered into an agreement (effective date January 1, 1992). Agreement coordinates RCRA corrective actions underway with response action under CERCLA to ensure comprehensive remediation at ORR. Environmental media and inactive facilities known or suspected to contain hazardous material would be addressed under this agreement pursuant to CERCLA or RCRA.
National Historic Preservation Act, as amended	36 CFR 800	DOE, Tennessee Historical Commission (SHPO), Advisory Council on Historic Preservation (ACHP)	Programmatic Agreement (1994). Allows an alternative compliance procedure for NHPA requirements for certain routine and/or repetitive activities defined in the agreement. Commits DOE-ORO to the preparation of a Cultural Resource Management Plan to address compliance with the full range of cultural resource requirements.

TABLE 7.3–1.—*Applicable Laws and Executive Orders Y-12 Proposed Action and Alternatives* [Page 1 of 5]

Statute/Executive Order	Statute Citation	Regulatory Citation	Consulting Agency	SWEIS- Applicability; Consultations, and DOE involvement
Endangered Species Act	16 U.S.C. 1531 *et seq.*	19 CFR 10, 12 30 CFR 773 32 CFR 190 43 CFR 8340 50 CFR 17, 23, 81, 225, 230, 402, 424, 450-453	USFWS	Ensures that actions authorized, funded, or carried out by DOE are not likely to jeopardize the continued existence of any federally listed threatened or endangered species or destroy or adversely modify their critical habitat. A biological assessment and a Section 7 Endangered Species Consultation for proposed activities included in the SWEIS shall be conducted by DOE in consultation with the U.S. Fish and Wildlife Service.
Endangered and Threatened Wildlife and Plant/Interagency Cooperation		50 CFR 17 50 CFR 402	USFWS	Describes interagency implementation regulations for the *Endangered Species Act*.
Migratory Bird Treaty Act, as amended	16 U.S.C. 703 *et seq.*	30 CFR 773 50 CFR 14, 20	Department of the Interior, USFWS	Federal statute mandates protection of sensitive or otherwise regulated wildlife species making it unlawful to pursue, hunt, take, capture, or kill (or attempt any of the preceding) any migratory bird, nest, or eggs of such birds.
Taking Possession, Transportation, Sale, Purchase, Barter, Exportation, and Importation of Wildlife and Plants/Migratory Bird Hunting		50 CFR 10 50 CFR 20	USFWS	Implementation regulations for the *Migratory Bird Treaty Act*.

TABLE 7.3–1.—*Applicable Laws and Executive Orders Y-12 Proposed Action and Alternatives* [Page 2 of 5]

Statute/Executive Order	Statute Citation	Regulatory Citation	Consulting Agency	SWEIS- Applicability; Consultations, and DOE involvement
National Historic Preservation Act, as amended	16 U.S.C. 470	7 CFR 656 36 CFR 61,63, 65, 68, 78, 79, 800-811	SHPO	Protects sites with significant national historic value, placing them on the National Register of Historic Places (NRHP). DOE, as a governmental agency, must locate and inventory historic properties and cultural resources under their jurisdiction prior to undertaking an activity that might remove or alter their appearance. As required by Section 106 of the *National Historic Preservation Act* and per DOE's Memorandum of Agreement with the TSHPO, proposed Y-12 activities shall be evaluated in consultation with the SHPO.
National Historic Preservation	Executive Order 11593	NA	DOE	DOE, in consultation with the Advisory Council on Historic Preservation (16 U.S.C. 470i), is to institute procedures to assure Federal plans and programs that contribute to historic preservation and to proactively interact with the SHPO to identify structures, buildings, and properties to nominate for listing in the NRHP.
Native American Graves Protection and Repatriation Act of 1990	25 U.S.C. 3001	43 CFR 10	CIN	Tribal descendants shall own American Indian human remains and cultural items discovered on Federal lands after November 16, 1990. Notification of tribal governments by DOE is required if and when items are discovered during an activity at Y-12 or elsewhere on the DOE ORR.
Protection of Wetlands	Executive Order 11990	NA	USACE	Federal activities are required to avoid short- and long-term adverse impacts to wetlands whenever a practicable alternative exists.
Floodplains Management	Executive Order 11988	NA	USACE	DOE is directed to establish procedures to ensure that the potential effects of flood hazards and floodplain management are considered for any action undertaken. Impacts to floodplains are to be avoided to the extent practicable.
Wetland Protection and Floodplain Management		10 CFR 1022	DOE	Regulations establish requirements for compliance with Executive Orders 11990 and 11988. No floodplain impacts are identified for the SWEIS; wetland impacts are under consultation.

TABLE 7.3–1.—*Applicable Laws and Executive Orders Y-12 Proposed Action and Alternatives* [Page 3 of 5]

Statute/Executive Order	Statute Citation	Regulatory Citation	Consulting Agency	SWEIS- Applicability; Consultations, and DOE involvement
Right-to-Know Laws and Pollution Prevention Requirements	Executive Order 12856	NA	DOE	Expands the 33/50 Pollution Prevention Program (*Superfund Amendments and Deauthorization Act*, Section 313). Under the expanded program, DOE is requiring each of its sites to establish site-specific goals to reduce the generation of all waste types. This order also requires DOE to (1) report toxic chemicals entering waste streams; (2) improve emergency planning, response, and accident notification; and (3) encourage clean technologies and the testing of innovative pollution prevention technologies.
Environmental Justice	Executive Order 12898	NA	DOE	Federal entities are directed to identify and address disproportionately high adverse human health or environmental impacts on minority and low-income populations resulting from an agency's program, policies, or activities. Data must be collected, analyzed, and made publicly available on race, national origin, and income level of populations in areas surrounding the Federal facility expected to have a substantial environmental, human health, or economic effect. Environmental justice issues for Y-12 have been identified and addressed prior to preparation of this SWEIS, are further addressed through this SWEIS; the policies requirements of this Executive Order remain applicable to future actions at Y-12.
Greening the Government Through Waste Prevention, Recycling, and Federal Acquisition	Executive Order 13101	NA	DOE	States a national policy preference for pollution prevention (reducing the generation of waste at its source) over waste recycling, treatment, and disposal. If pollution prevention is not feasible, waste should be recycled or treated in an environmentally safe manner. Disposal should be used only as a last resort. The Secretary of Energy is required to incorporate waste prevention and recycling into daily operations. In addition, DOE must implement cost-effective procurement programs that favor the purchase of environmentally preferable products and services. There are products or services with a lesser or reduced effect on human health and the environment compared to competing products and services used for the same purposes. This EO would require the incorporation of waste prevention and recycling into construction and operation of the proposed HEU Materials Facility or Upgrade Expansion of Building 9215, and the Special Materials Complex, consistent with the demands of efficiency and cost-effectiveness.

TABLE 7.3–1.—*Applicable Laws and Executive Orders Y-12 Proposed Action and Alternatives* [Page 4 of 5]

Statute/Executive Order	Statute Citation	Regulatory Citation	Consulting Agency	SWEIS- Applicability; Consultations, and DOE involvement
Greening the Government Through Leadership in Environmental Management	Executive Order 13148	NA	EPA	Gives responsibility to each Federal agency for ensuring that all necessary actions are taken to integrate environmental accountability into agency day-to-day decisionmaking and longterm planning processes, across all agency missions, activities, and functions. Environmental management must be considered in all Federal Government policy making, operations, planning, and management. The goals set forth by this EO focus on pollution prevention through the development of effective environmental management systems; establishment of environmental compliance audit programs and policies; implementation of Community Right-To-Know; reductions in both the use of release of toxic chemicals, hazardous substances, and other pollutants; reductions in the use of ozone-depleating substances; and promotion of environmentally and economically beneficial landscaping. Under this EO, DOE is required to implement these goals through effective pollution prevention practices and the introduction of new technologies that will reduce waste and toxic chemicals for both current and future operations at the Y-12 National Security Complex to the extent practical.
Greening the Government through Federal Fleet and Transportation Efficiency	Executive Order 13149	NA	EPA/DOE/OMB/GSA	The purpose of this EO is to ensure that the Federal Government exercises leadership in the reduction of petroleum consumption through improvements in fleet fuel efficiency and the use of alternative fuel vehicles (AFVs) and alternative fuels. Each agency operating 20 or more motor vehicles within the U.S. shall reduce it's entire fleets annual petroleum consumption by at least 20 percent by the end of FY 2005 (compared to FY 1999 levels). This EO lists a number of strategies to achieve this reduction and requires Federal agencies to use alternative fuels to meet fuel requirements of AFVs (established by section 303 of *Energy Act of 1992*) by the end of FY 2005. This EO also calls for an increase in the average EPA fuel economy rating of passenger cars and light trucks acquired by at least 1 mile per gallon (mpg) by the end of FY 2002 and at least 3 mpg by the end of FY 2005 (compared to FY 1999 acquisitions).

TABLE 7.3–1.—*Applicable Laws and Executive Orders Y-12 Proposed Action and Alternatives* [Page 5 of 5]

Statute/Executive Order	Statute Citation	Regulatory Citation	Consulting Agency	SWEIS- Applicability; Consultations, and DOE involvement
Federal Workforce Transportation	Executive Order 13150	NA	EPA/DOT/Treasury Dept/OMB/GSA	Directs DOT, EPA, and DOE to implement a "transit pass" transportation fringe benefit program as part of a three-year Nationwide Pilot Program no later than October 1, 2000. Before extending the program to other Federal agencies and their employees nationwide, results from the pilot program will be analyzed by an entity to be determined by the consulting agencies to determine if it is effective in reducing single occupancy vehicle travel and local area traffic congestion. Federal agencies are encouraged to use any nonmonetary incentive that the agencies may otherwise offer under any other provision of law or other authority to encourage mass transportation and vanpool use. Under this EO, DOE is required to implement a carpool program for all Federal employees working at ORR facilities, including Y-12.

Notes: EO - Executive Ord

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CHAPTER 9: INDEX

A

Advanced Design and Production Technologies Program 2-5
Advisory Council on Historic Preservation 5-62
Air Quality Control Region (AQCR) 4-56
American Conference of Governmental Industrial Hygienists (ACGIH) 2-2, D-34, E-2
Ancestors of the Eastern Band of the Cherokee Indians 4-83
Anderson County 4-1, 4-18, 4-21, 5-11, 6-7, 6-8, D-47
Atomic Energy Act of 1954 4-69, 7-2, A-32, D-7
Atomic Energy Community Act of 1955 4-4

B

Bear Creek 4-13, 4-29, 4-30, 4-34
Bear Creek Valley 1-10, 1-17, 3-25, 4-4, 4-12, 4-23, 4-26, 4-29, 4-30, 4-34, 4-69, 4-80, 5-14, 5-18
Bear Creek Burial Ground 4-13, 4-74, 4-76, 5-22
Beryllium disease 1-20, 5-78, D-42
Blue Ridge Mountains 4-53
Bureau of Land Management (BLM) 4-79

C

Central Scrap Management Office (CSMO) 2-5
Cherokee Nation of Oklahoma 4-83
Chestnut Ridge 4-9, 4-12, 4-23, 4-34, 4-75, 4-36, 5-22
Clean Air Act 5-20, 7-2, 7-3, D-34, E-7
Clean Water Act 4-6, 7-5, D-34, 4-40
Clinch River 4-4, 4-23, 4-29, 4-40, 4-49, 4-53, 5-22, 5-54, 6-8, D-20
Comprehensive Environmental Response, Compensation, and Liability Act 3-17, 5-19, 7-8, A-52
Conasauga Group 4-33
Core Stockpile Management Program 2-3
Criticality Accident 5-89, D-74
Cumberland Mountains 4-53, 4-80

D

Decontamination and decommissioning (D&D) 1-1, A-1
Defense Nuclear Facilities Safety Board 1-1
Defense Programs 2-2, 3-5, A-1
Disposition of Surplus Highly Enriched Uranium Environmental Impact Statement 1-4, 1-14, 6-3
Division of Solid Waste Management (DSWM) 4-68

E

East Fork Poplar Creek (EFPC)   4-29, 5-18, D-22
East Tennessee Economic Council   6-3
East Tennessee Technology Park (ETTP)   1-1, 6-3
Environmental Justice   4-93, 5-82
Enriched Uranium Operations   2-4
Environmental Management (EM)   1-1, 2-6, 3-16, 3-73, A-2
Environmental Management Waste Management Facility   3-16, 3-73, 5-19, 5-22, 5-25, 5-28, 5-36

F

Facility Program   2-5
Federal Aviation Administration   4-63
Federal Compliance with Pollution of Control Standards 7-2
Federal Highway Administration   6-7
Federal Interagency Committee on Urban Noise   4-63
Federal Facility Compliance Act (FFCA)   7-1, 7-10
Final Environmental Impact Statement for the Continued Operation of the Pantex Plant and Associated Storage of Nuclear Weapons Components   1-14

G

Great Smoky Mountains National Park   4-53, 4-56

H

Hazardous and Solid Waste Amendments of 1984   4-85
High-efficiency particulate air (filter)   5-79
Highly Enriched Uranium   1-4, D-1, E-20
Highly Enriched Uranium Materials Facility   5-36, 5-40, 5-53, 5-61, D-15, E-20

I

Integrated Risk Information System (IRIS)   E-15
Interim Storage of Enriched Uranium Environmental Assessment   1-14
International Atomic Energy Agency (IAEA)   2-7, A-18
International Commission for Radiation Protection (ICRP)   D-10, E-17

J

No Entries

K

Karst Features   4-23
Knox County   4-4, 4-18, 4-21
Knox Group   4-23

L

Lawrence Livermore National Laboratory (LLNL)   A-52
Loudon County   4-4, 4-18, 6-7, 6-8

M

Manufacturing Processes Program   2-5
Materials Recycle and Recovery Program   2-4
Materials Surveillance Program   2-5
Melton Hill Dam   4-30, 4-50
Melton Hill Lake   4-6, 4-79, 5-54, D-21
Melton Valley Storage Tanks   6-5
Mission Support   2-6
Modernization and Facility Transition Program   2-4

N

National Ambient Air Quality Standards (NAAQS)   4-55, 5-29, E-2
National Emission Standards for Hazardous Air Pollutants (NESHAP)   4-60, D-6, E-17
National Environmental Policy Act (NEPA)   1-7, 1-11, 5-1, 5-64
National Institute of Occupational Safety and Health (NIOSH) D-34, E-2
National Pollutant Discharge Elimination System (NPDES)   4-29, 5-18, A-48
National Register of Historic Places (NRHP)   4-81, 5-56, 7-16
Natural and Accelerated Bioremediation Research (NABIR) 1-10, 1-15
New Hope Pond   4-59
Nuclear Materials Management and Storage Program   2-3
Nuclear Nonproliferation and National Security   3-2
Nuclear Packaging Systems Program   2-4
Nuclear Regulatory Commission (NRC)   D-72, E-17
Nuclear Weapons Stockpile Plan   3-70

O

Oak Ridge National Laboratory (ORNL)   1-1, 2-7, A-8, D-6, D-19, D-56
Oak Ridge Operations (ORO)   2-7
Oak Ridge Reservation (ORR)   1-1, 4-1, 4-4, 4-6, 4-9, 4-11, 4-12, 4-63, 4-86, 6-1, A-10, D-5
Oak Ridge Reservation End Use Working Group   4-13, A-32
Occupational Safety and Health Act (OSHA)   5-91, 7-8, D-33, E-2, E-15
Oak Ridge Reservation Annual Site Report 1-17, 1-23

P

Pantex   1-3, 1-14, 2-4
Perimeter Intrusion Detection and Assessment System (PIDAS)   3-32, 3-34, 3-35, 3-39, 3-52, 3-60, 3-64
Pine Ridge 4-23, 4-29, 4-34, 4-50, 4-78, 5-46, 5-54, 5-87
Pollution Prevention Act of 1990   4-83, 7-9, 7-15
Pollution Prevention and Waste Avoidance Program   4-85
Pollution Prevention and Waste Minimization Program   4-83
Polychlorinated Biphenyl (PCB)   2-6, 3-16, 4-89, 4-92, A-4, A-25, A-34, D-23, D-57

Poplar Creek 4-29, 4-30, 4-33, 4-89, D-8, D-21, D-57
Prevention of Significant Deterioration (PSD) 4-55
Production of Tritium in a Commercial Light Water Reactor Environmental Impact Statement 6-2
Protective Service Organization 2-2

Q

Quality Evaluation and Surveillance Program 2-2, 2-3

R

Radionuclide-National Emission Standards for Hazardous Air Pollutants (Rad-NESHAP) 5-36, 5-37, 5-39, 5-70, 5-83
Receipt and Storage of Uranium Materials for the Fernald Environmental Management Project Site Environmental Assessment 1-15, 6-6
Region of Influence (ROI) 3-85, 4-21, 4-22, 4-94, 4-95, 5-14, 5-54, 5-83, 6-8
Replacement and Operation of the Anhydrous Hydrogen Fluoride Supply and Fluidized-Bed Chemical Processing Systems Environmental Assessment 1-15
Report on the Remedial Investigation of the Upper East Fork Poplar Creek Characterization Area at the Oak Ridge Y-12 Plant, Oak Ridge, Tennessee 1-16
Report on the Remedial Investigation of Bear Creek Valley at the Oak Ridge Y-12 Plant, Oak Ridge Tennessee 1-16
Resource Conservation and Recovery Act (RCRA) 2-5, 2-6, 4-6, 4-66, 4-67, 4-68, 4-69, 4-70, 4-71, 4-72, 4-73, 4-82, 4-83, 4-84, 4-86, 7-7, A-4, A-24, A-31, D-27
Roane County 4-4, 4-18, 4-19, 4-21, 4-22, 4-54, 4-56, 5-30, 6-1, 6-8, D-1, D-46
Rome Formation 4-23, 4-33

S

Safe Drinking Water Act 7-2, 7-5, D-33
Safeguards and Security Program 2-2
Scarboro Community 4-60, 4-76, 4-78, 4-91, 4-92
Scoping Summary Report for the Site-Wide Environmental Impact Statement, Oak Ridge Y-12 Plant 1-17
Spallation Neutron Source (SNS) 6-3, 6-5, 6-8
Spallation Neutron Source Environmental Impact Statement 1-15, 6-3
Special Materials Complex 3-1, 3-2, 3-4, 3-8, 3-47, 5-1, 5-2
Special Materials Operations 3-8, 3-48, 3-82
State of Tennessee Water Quality Standards 4-30
Stockpile Evaluation and Maintenance Program 2-2, 2-4
Stockpile Management Restructuring Initiative 1-5, 3-8, 3-13
Stockpile Stewardship and Management Programmatic Environmental Impact Statement (SSM EIS) 1-12, 3-1
Storage and Disposition of Weapons-Usable Fissile Material Programmatic Environmental Impact Statement 1-14, 3-1
Superfund Amendment and Reauthorization Act (SARA) 5-90, D-33

T

Technology Transfer Program 2-7, 3-28, 4-87, 5-3
Tennessee Department of Environment and Conservation (TDEC) 2-6, 4-56, 5-28

Tennessee Valley Authority (TVA)   4-1, A-7
transuranic waste   1-14, 6-5
Transuranic Waste Treatment Facility Environmental Impact Statement   1-16
Toxic Substances Control Act   7-7, A-47, D-33

U

Upper East Fork Poplar Creek (UEFPC)   1-16, 2-6, 3-24, 4-25, 4-34, 5-17, D-8, D-35
U.S. Army Corps of Engineers (USACE)   4-33, 4-49
U.S. Department of Defense (DoD)   2-7
U.S. Department of Energy (DOE)   1-1, 2-4, 3-16, 3-28, 4-40, 4-59, 4-68, 6-1, 7-1
U.S. Department of Transportation (DOT)   7-1
U.S. Environmental Protection Agency (EPA)   2-6, 4-6, 4-40, 4-54, 4-62, 4-87, 7-1
U.S. Fish and Wildlife Service (USFWS)   4-49, 4-50, 5-24, 5-25, 5-28

V

Volitile Organic Compounds (VOCs)   4-37, 4-59, 4-71, 4-72, 4-89, A-35, A-48, D-32, D-40

W

Walker Branch Watershed   4-4, 4-11, 4-48, 4-50
Waste Isolation Pilot Plant (WIPP)   1-13, 4-81, 6-5
Waste Management Program   2-6
Waste Management Programmatic Environmental Impact Statement   1-14
Water Quality Control Act   4-33
Watts Bar Nuclear Plant   6-2, 6-10
Weapons Dismantlement and Disposal Program   2-2, 2-3
White Oak Mountain Thrust Fault   4-23
White Oak Creek   4-29, 4-30
Work-for-Others Program   2-3, 3-2, 4-66, 5-1, 5-2, 5-14

X

No Entries

Y

Y-12 Modernization Program   1-5, 3-65
Y-12 Weapons Programs Organization   A-1

Z

No Entries

CHAPTER 10: REFERENCES

10 CFR 835 — U.S. Department of Energy (DOE), "Energy: Occupational Radiation Protection," *Code of Federal Regulations*, Office of the Federal Register, National Archives and Records Administration, U.S. Government Printing Office, Washington, DC, Revised January 1, 2000.

10 CFR 850 — DOE, "Energy: Chronic Beryllium Disease Prevention Program," *Code of Federal Regulations*, Office of the Federal Register, National Archives and Records Administration, U.S. Government Printing Office, Washington, DC, Revised January 1, 2000.

10 CFR 1021 — DOE, "Energy: *National Environmental Policy Act* Implementing Procedures," *Code of Federal Regulations*, Office of the Federal Register, National Archives and Records Administration, U.S. Government Printing Office, Washington, DC, Revised January 1, 2000.

14 CFR 150 — Department of Transportation (DOT), "Aeronautics and Space: Airport Noise Compatibility Planning," *Code of Federal Regulations*, Office of the Federal Register, National Archives and Records Administration, U.S. Government Printing Office, Washington, DC, Revised January 1, 1999.

29 CFR 1910 — Occupational Safety and Health Administration (OSHA), "Department of Labor: Occupational Safety and Health Standards," *Code of Federal Regulations*, Office of the Federal Register, National Archives and Records Administration, U.S. Government Printing Office, Washington, DC, Revised July1, 1999.

29 CFR 1910.95 — OSHA, "Department of Labor: Occupational Noise Exposure," *Code of Federal Regulations*, Office of the Federal Register, National Archives and Records Administration, U.S. Government Printing Office, Washington, DC, Revised July 1,1999.

36 CFR 79 — Advisory Council on Historic and Cultural Preservation, "Parks, Forests, and Public Property: Curation of Federally Owned and Administrated Archeological Collections," *Code of Federal Regulations*, Office of the Federal Register, National Archives and Records Administration, U.S. Government Printing Office, Washington, DC, Revised July 1, 2000.

36 CFR 800 — Advisory Council on Historic and Cultural Preservation, "Parks, Forests, and Public Property: Protection of Historic and Cultural Properties," *Code of Federal Regulations*, Office of the Federal Register, National Archives and Records Administration, U.S. Government Printing Office, Washington, DC, Revised May 17, 1999.

36 CFR 800.5[a] — Advisory Council on Historic and Cultural Preservation, "Parks, Forests, and Public Property: Protection of Historic and Cultural Properties – Criteria of Adverse Effect," *Code of Federal Regulations*, Office of the Federal Register, National Archives and Records Administration, U.S. Government Printing Office, Washington, DC, Revised May 17, 1999.

36 CFR 800.5[b] Advisory Council on Historic and Cultural Preservation, "Parks, Forests, and Public Property: Protection of Historic and Cultural Properties – Resolving Adverse Effects," *Code of Federal Regulations*, Office of the Federal Register, National Archives and Records Administration, U.S. Government Printing Office, Washington, DC, Revised May 17, 1999.

36 CFR 800.13 Advisory Council on Historic and Cultural Preservation, "Parks, Forests, and Public Property: Protection of Historic and Cultural Properties – Post-Review Discoveries," *Code of Federal Regulations*, Office of the Federal Register, National Archives and Records Administration, U.S. Government Printing Office, Washington, DC, Revised May 17, 1999.

36 CFR 800.16[d] Advisory Council on Historic and Cultural Preservation, "Parks, Forests, and Public Property: Protection of Historic and Cultural Properties – Definition of the APE," *Code of Federal Regulations*, Office of the Federal Register, National Archives and Records Administration, U.S. Government Printing Office, Washington, DC, Revised May 17, 1999.

40 CFR 50 Environmental Protection Agency (EPA), "Protection of the Environment: National Ambient Air Quality Standards (NAAQS), National Primary and Secondary Ambient Air Quality Standards," *Code of Federal Regulations*, Office of the Federal Register, National Archives and Records Administration, U.S. Government Printing Office, Washington, DC, Revised July 1, 1999.

40 CFR 51 EPA, "Protection of the Environment: Guideline on Air Quality Models Requirements for Preparation, Adoption, and Submittal of Implementation Plans," *Code of Federal Regulations*, Office of the Federal Register, National Archives and Records Administration, U.S. Government Printing Office, Washington, DC, Revised July 1, 1999.

40 CFR 51.166 EPA, "Protection of the Environment: Requirements for Preparation, Adoption, and Submittal of Implementation Plans - Prevention of Significant Deterioration of Air Quality," *Code of Federal Regulations*, Office of the Federal Register, National Archives and Records Administration, U.S. Government Printing Office, Washington, DC, Revised July 1, 1999.

40 CFR 61 EPA, "Protection of the Environment: National Emission Standards for Hazardous Air Pollutants," *Code of Federal Regulations*, Office of the Federal Register, National Archives and Records Administration, U.S. Government Printing Office, Washington, DC, Revised July 1, 1999.

40 CFR 81.343 EPA, "Protection of the Environment: Designation of Areas for Air Quality Planning Purposes - Tennessee," *Code of Federal Regulations*, Office of the Federal Register, National Archives and Records Administration, U.S. Government Printing Office, Washington, DC, Revised July 1, 1999.

40 CFR 141 EPA, "Protection of the Environment: National Primary Drinking Water Regulations," *Code of Federal Regulations*, Office of the Federal Register, National Archives and Records Administration, U.S. Government Printing Office, Washington, DC, Revised July 1, 1999.

40 CFR 761 — EPA, "Protection of the Environment: Polychlorinated Biphenlys (PCBs) Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions," *Code of Federal Regulations*, Office of the Federal Register, National Archives and Records Administration, U.S. Government Printing Office, Washington, DC, Revised July 1, 1999.

40 CFR 1500 — EPA, "Council on Environmental Quality: Purpose, Policy, and Mandate," *Code of Federal Regulations*, Office of the Federal Register, National Archives and Records Administration, U.S. Government Printing Office, Washington, DC, Revised July 1, 1999.

40 CFR 1508.7 — EPA, "Council on Environmental Quality: Terminology and Index, Cumulative Impact," *Code of Federal Regulations*, Office of the Federal Register, National Archives and Records Administration, U.S. Government Printing Office, Washington, DC, Revised July 1, 1999.

43 CFR 10.4 — U.S. Department of the Interior (DOI) "Public Lands: Interior – Native American Graves Protection and Repatriation Regulations," *Code of Federal Regulations*, Office of the Federal Register, National Archives and Records Administration, U.S. Government Printing Office, Washington, DC, Revised July 1, 1999.

50 CFR 17.11 — U.S. Fish and Wildlife Service (USFWS), "Wildlife and Fisheries, Endangered and Threatened Wildlife and Plants-Endangered and Threatened Wildlife," *Code of Federal Regulations*, Office of the Federal Register, National Archives and Records Administration, U.S. Government Printing Office, Washington, DC, Revised October 1, 1999.

50 CFR 17.12 — USFWS, "Wildlife and Fisheries, Endangered and Threatened Wildlife and Plants-Endangered and Threatened Plants," *Code of Federal Regulations*, Office of the Federal Register, National Archives and Records Administration, U.S. Government Printing Office, Washington, DC, Revised October 1, 1999.

60 FR 54068 — DOE, "Environmental Assessment and Finding of No Significant Impact for the Proposed Interim Storage of Enriched Uranium at the Y-12 Plant, Oak Ridge, TN," *Federal Register*, Volume 60, Pg 54068, Office of the Federal Register, National Archives and Records Administration, U.S. Government Printing Office, Washington, DC, October 19, 1995.

61 FR 40619 — DOE, "Record of Decision for the Disposition of Surplus Highly Enriched Uranium Final Environmental Impact Statement," *Federal Register*, Volume 61, Pg 40619, Office of the Federal Register, National Archives and Records Administration, U.S. Government Printing Office, Washington, DC, August 5, 1996.

61 FR 68014 — DOE, "Record of Decision Programmatic Environmental Impact Statement for Stockpile Stewardship and Management," *Federal Register*, Volume 61, Pg 68014, Office of the Federal Register, National Archives and Records Administration, U.S. Government Printing Office, Washington, DC, December 26, 1996.

62 FR 3014 — DOE, "Record of Decision for the Storage and Disposition of Weapons-Usable Fissile Materials Final Programmatic Environmental Impact Statement," *Federal Register*, Volume 62, Pg 3014, Office of the Federal Register, National Archives

and Records Administration, U.S. Government Printing Office, Washington, DC, January 21, 1997.

62 FR 3880 DOE, "Record of Decision: Environmental Impact Statement for the Continued Operation of the Pantex Plant and Associated Storage of Nuclear Weapon Components," *Federal Register*, Volume 62, Pg 3880, Office of the Federal Register, National Archives and Records Administration, U.S. Government Printing Office, Washington, DC, January 27, 1997.

62 FR 38855 DOE, "National Ambient Air Quality Standards for Ozone; Final Rule," *Federal Register*, Volume 62, Pg 38855, Office of the Federal Register, National Archives and Records Administration, U.S. Government Printing Office, Washington, DC, July 18, 1997.

63 FR 3629 DOE, "Record of Decision for the Department of Energy's Waste Management Program: Treatment and Storage of Transuranic Waste," *Federal Register*, Volume 63, Pg 3629, Office of the Federal Register, National Archives and Records Administration, U.S. Government Printing Office, Washington, DC, January 23, 1998.

63 FR 41810 DOE, "Record of Decision for the Department of Energy's Waste Management Program: Treatment of Non-Wastewater Hazardous Waste," *Federal Register*, Volume 63, Pg 41810, Office of the Federal Register, National Archives and Records Administration, U.S. Government Printing Office, Washington, DC, August 5, 1998.

64 FR 4079 DOE, "Notice of Intent to Prepare an Environmental Impact Statement for a Transuranic Waste Treatment Facility at Oak Ridge, TN," *Federal Register*, Volume 64, Page 4079, Office of the Federal Register, National Archives and Records Administration, U.S. Government Printing Office, Washington, DC, January 27, 1999.

64 FR 13179 DOE, "Site-Wide Environmental Impact Statement (SWEIS); Oak Ridge Y-12 Plant, Notice of Intent," *Federal Register*, Volume 64, Pg 13179, Office of the Federal Register, National Archives and Records Administration, U.S. Government Printing Office, Washington, DC, March 17, 1999.

64 FR 26369 DOE, "Consolidate Record of Decision for Tritium Supply and Recycling," *Federal Register*, Volume 64, Pg 26369, Office of the Federal Register, National Archives and Records Administration, U.S. Government Printing Office, Washington, DC, May 14, 1999.

64 FR 35140 DOE, "Record of Decision for the Construction and Operation of the Spallation Neutron Source," *Federal Register*, Volume 64, Pg 35140, Office of the Federal Register, National Archives and Records Administration, U.S. Government Printing Office, Washington, DC, June 30, 1999.

64 FR 36454 DOI,"Endangered and Threatened Wildlife and Plants; Proposed Rule to Remove the Bald Eagle in the Lower 48 States from the List of Threatened Wildlife; Proposed Rule," *Federal Register*, Volume 64, Pg 36454, Office of the Federal

Register, National Archives and Records Administration, U.S. Government Printing Office, Washington, DC, 1999.

64 FR 43358 — DOE, "Record of Decision for Long-Term Management and Use of Depleted Uranium Hexafluoride," *Federal Register*, Volume 64, Pg 43358, Office of the Federal Register, National Archives and Records Administration, U.S. Government Printing Office, Washington, DC, August 10, 1999.

64 FR 46542 — DOI, "Endangered and Threatened Wildlife and Plants; Final Rule to Remove the American Peregrine Falcon from the Federal List of Endangered and Threatened Wildlife, and to Remove the Similarity of Appearance Provision for Free-flying Peregrines in the Contiguous United States," *Federal Register*, Volume 64, Pg 46543, Office of the Federal Register, National Archives and Records Administration, U.S. Government Printing Office, Washington, DC, 1999.

64 FR 58123 — Federal Highway Administration (FHA), "Environmental Impact Statement; Loudon, Roane, Anderson, and Knox Counties, TN," *Federal Register*, Volume 64, Pg 58123, Office of the Federal Register, National Archives and Records Administration, U.S. Government Printing Office, Washington, DC, October 28, 1999.

64 FR 69241 — DOE, "Identification of Preferred Alternatives for the Department of Energy's Waste Management Program: Low-Level Waste and Mixed Low-Level Waste Disposal Sites," *Federal Register*, Volume 64, Pg 69241, Office of the Federal Register, National Archives and Records Administration, U.S. Government Printing Office, Washington, DC, December 10, 1999.

65 FR 10061 — DOE, "Record of Decision for the Department of Energy's Waste Management Program: Treatment and Disposal of Low-Level Waste and Mixed Low-Level Waste; Amendment of the Record of Decision for the Nevada Test Site," *Federal Register*, Volume 65, Pg 10061, Office of the Federal Register, National Archives and Records Administration, U.S. Government Printing Office, Washington, DC, February 25, 2000.

65 FR 25711 — DOE, "Notice of Floodplain and Wetlands Involvement for the Floodplain Strip Adjoining the Boeing Property in Roane County, TN," *Federal Register*, National Archives and Records Administration, U.S. Government Printing Office, Washington, DC, May 3, 2000.

65 FR 48683 — DOE, "Record of Decision on Treating Transuranic (TRU)/Alpha Low-Level Waste at the Oak Ridge National Laboratory," *Federal Register*, National Archives and Records Administration, U.S. Government Printing Office, Washington, DC, August 9, 2000.

42 USC §4321 — "Congressional Declaration of Purpose," Title 42, Public Health and Welfare; Chapter 55, National Environmental Policy, *United States Code*, Washington, DC, as amended, January 1, 1970.

42 U.S.C.§4901 — "Congressional Findings and Statement of Policy," Title 42, Public Health and Welfare; Chapter 65, Noise Control Administration, *United States Code*, Washington DC, as amended, October 27, 1972.

DOE Order 420.1 — DOE, *Facility Safety*, U.S. Department of Energy, Environmental Health, Washington, DC, issued October 13, 1995, changed November 16, 1995, and October, 24, 1996.

DOE Order 440.1A — DOE, *Worker Protection Management for DOE Federal and Contractor Employees*, U.S. Department of Energy, Washington, DC, May 27, 1998.

DOE Order 5400.1 — DOE, *General Environmental Protection Program*, U.S. Department of Energy, Washington, DC, June 29, 1990.

DOE Order 5400.5 — DOE, *Radiation Protection of the Public and Environment*, U.S. Department of Energy, Washington, DC, January 7, 1993.

DOE-STD-1021-93 — DOE, *Natural Phenomena Hazards Performance Categorization Guidelines for Structures, Systems, and Components*, Change 1 (January 1996), U.S. Department of Energy, Washington, DC, July 1993.

Executive Order 12088 — Executive Office of the President, "Federal Compliance with Pollution Prevention Standards," October 13, 1978.

General

ACGIH 1997 — American Conference of Governmental Industrial Hygienists (ACGIH), *Guide to Occupational Exposure Values-1997*, ISBN: 1-882417-20-8, American Conference of Governmental Industrial Hygienists, Cincinnati, OH, 1997.

AHA 1995 — American Hospital Association (AHA), *The AHA Guide to the Health Care Field*, American Hospital Association, Chicago, IL, 1995.

AMA 1996 — American Medical Association (AMA), *Physician Characteristics and Distribution in the US*, American Medical Association, Chicago, IL, 1996.

BEA 1999 — Bureau of Economic Analysis (BEA), *REIS: Regional Economic Information System 1969-1997 (CD-ROM)*, U.S. Department of Commerce, Economics and Statistics Division, Bureau of Economic Analysis, Washington, DC, 1999.

Beres 1990 — Beres, D.A., *The Clean Air Act Assessment Package -1998 (CAP-88): A Dose and Risk Assessment Methodology for Radionuclide Emissions to Air*, SC&A, Inc., McLean, Virginia, 1990.

Bechtel Jacobs 1999 — Bechtel Jacobs Company LLC, *Application of Sanitary Biosolids on the Oak Ridge Reservation, Program Plan*, Revision 6, June 1999.

Bechtel Jacobs 2000 — Bechtel Jacons Company, *DOE-ORO Environmental Permits, Commitments, and Compliance Agreements List*, working database status as of March 31, 2000 provided by D. Buxbaum of BJC to A. Dickie of Tetra Tech, Inc., Oak Ridge, TN, May 9, 2000.

BLS 1999 — Bureau of Labor Statistics (BLS), "Local Area Unemployment Statistics," Internet file, accessed May 14 and 19, 1999, Bureau of Labor Statistics, Washington, DC, 1999. http://146.142.4.24/cgi-bin/dsrv?la

Burns 1993 — Burns and McDonnell Engineers, Architcts, Consultants, *Design and Operating Procedure for the Y-12 Construction/Demolition Landfill VII*, Y/WM-090 Rev 1, prepared by J.R. Thornbury of Burns and McDonnell Engineers, Architects, Consultants for MMES and the U.S. Department of Energy, Oak Ridge Operations Office, February, 1993.

BWXT 2001 — BWXT-y12, Response to Data Update Requests for the No Action - Status Quo Alternative for the Y-12 Site-Wide Environmental Impact Statement, transmitted from I. Shelton of BWXT-Y12, Y-12 National Security Complex, Oak Ridge, TN, to F. Jackson of Tetra Tech, Inc., March 2001.

Census 1992 — Bureau of the Census, *Census of Population and Housing, 1990*: *Summary Tape File 3* (CD-ROM), U.S. Department of Commerce, Economics and Statistical Administration, Washington, DC, 1992.

Census 1995 — Bureau of the Census, "Tennessee Population of Counties by Decennial Census: 1900-1990," Internet file, accessed May 24, 1999, U.S. Department of Commerce, Economics and Statistical Administration, Washington, DC.

Census 1999 — Bureau of the Census, "CO-98-2: County Population Estimates for July 1, 1998 and Population Change for April 1, 1990 to July 1, 1998," U.S. Department of Commerce, Economics and Statistical Administration, Washington, DC, 1999.

CEQ 1997a — Council on Environmental Quality (CEQ), *Considering Cumulative Effects Under the National Environmental Policy Act,* Washington, DC, January, 1997.

CEQ 1997b — CEQ, *Environmental Justice Guidance Under the National Environmental Policy Act*, Washington, DC, December 10, 1997.

DNFSB 1994 — Recommendation 94-4 to the Secretary of Energy pursuant to 42 USC & 2286a(5), *Atomic Energy Act of 1954*, as amended, prepared by Defense Nuclear Facilities Safety Board, Washington, DC, 1994.

DOE 1985 — DOE, *Contractor Industrial Hygiene Program*, U.S. Department of Energy, Washington, DC, June 26, 1985.

DOE 1988 — DOE, *Internal Dose Conversion Factors for Calculation of Dose to Public*, DOE/EH-0071, U.S. Department of Energy, Washington, DC, 1988.

DOE 1989 — DOE, *Oak Ridge Reservation Site Development and Facilities Utilization Plan*, DOE/OR-885, prepared by Martin Marietta Energy Systems, Inc. for the U.S. Department of Energy, Oak Ridge Operations Office, Oak Ridge, TN, June 1989.

DOE 1990 — DOE, *Oak Ridge Reservation Environmental Report for 1989,* ES/ESH-18/V1, prepared by Environmental, Safety, and Health Compliance and Environmental Management Staff for the U. S. Department of Energy, Oak Ridge Operations Office, Oak Ridge, TN, October 1990.

DOE 1991a — DOE, *Oak Ridge Reservation Site Development and Facilities Utilization Plan 1990 Update*, DOE/OR-885/R1, prepared by Site and Facilities Planning, Martin Marietta

Energy Systems, Inc., for the U.S. Department of Energy, Washington, DC, June 1991.

DOE 1991b DOE, *Oak Ridge Reservation Environmental Report for 1990 - Volume 1: Narrative, Summary, and Conclusions*, ES/ESH-18/V1, prepared by Oak Ridge National Laboratory managed by Martin Mariettia Energy Systems, Inc., for the U.S. Department of Energy, Oak Ridge Operations Office, Oak Ridge, TN, September 1991.

DOE 1993a DOE, *Oak Ridge Reservation Environmental Report for 1992*, ES/ESH-31/V1, prepared by Oak Ridge National Laboratory, managed by Lockheed Martin Energy Systems, Inc., for the U.S. Department of Energy, Washington, DC, June, 1993.

DOE 1993b DOE, *Nonnuclear Consolidation Environmental Assessment,* DOE/EA-0792, Volume I, Nuclear Weapons Complex Reconfiguration Program, U.S. Department of Energy, Office of Defense Programs, Washington, DC, June 1993.

DOE 1994a DOE, *Environmental Assessment for the Proposed Interim Storage of Enriched Uranium Above the Maximum Historical Storage Level at the Y-12 Plant*, DOE/EA-0929, U.S. Department of Energy, Oak Ridge Operations Office, Oak Ridge, TN, 1994.

DOE 1994b DOE, *Environmental Restoration Soil Borrow Area Site Selection Study for the Remediation of Lower East Fork Poplar Creek Floodplain Soils.* U.S. Department of Energy, Oak Ridge Operations Office, Oak Ridge, TN, 1994

DOE 1994c DOE, *Programmatic Agreement Among the Department of Energy - Oak Ridge Operations Office, the Tennessee Historic Preservation Officer, and the Advisory Council on Historic Preservation Concerning Management of Historical and Cultural Properties at the Oak Ridge Reservation.* Agreement Document on file with the U.S. Department of Energy, Environmental Protection Division, Oak Ridge Operations Office, Oak Ridge, TN, May 1994.

DOE 1995a DOE, *Department of Energy Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs Final Environmental Impact Statement*, DOE/EIS-0203-F, Volume 1, U.S. Department of Energy, Office of Environmental Management, Idaho Operations Office, Idaho Falls, ID, April 1995.

DOE 1995b DOE, *Environmental Assessment and FONSI Proposed Replacement and Operation of the Anhydrous Hydrogen Fluoride Supply and Fluidized-bed Chemical Processing Systems at Building 9212*, EA/1049, U.S. Department of Energy, Oak Ridge Operations Office, Oak Ridge, TN, September 1995.

DOE 1995c DOE, *Final Programmatic Environmental Impact Statement for Tritium Supply and Recycling*. DOE/EIS-0161, Volume 1, U.S. Department of Energy, Office of Reconfiguration, Washington, DC, October 1995.

DOE 1995d DOE, *Memorandum on Application of DOE 5400 5 Requirement for Release and Control of Property Containing Residual Radioactive Material*, U.S. Department of Energy, Office of Environmental Policy and Assistance, November 17, 1995.

DOE 1996a DOE, *Environmental Assessment and FONSI of Parcel ED-1 of the Oak Ridge Reservation by the East Tennessee Economic Council*, EA-1113, U.S. Department of Energy, Oak Ridge Operations Office, Oak Ridge, TN, April 1996.

DOE 1996b DOE, *Disposition of Surplus Highly Enriched Uranium Final Environmental Impact Statement*, DOE/EIS-0240, Volume 1, U.S. Department of Energy, Office of Fissile Materials Disposition, Washington, DC, June 1996.

DOE 1996c DOE, *Oak Ridge Operations Office Environmental Management Ten Year Plan, Oak Ridge, Tennessee,* U.S. Department of Energy, Oak Ridge Operations Office, Oak Ridge, TN, July 31, 1996.

DOE 1996d DOE, *Y-12 Plant Receives Renew America Award,* press release, U.S. Department of Energy, Oak Ridge Operations Office, Oak Ridge, TN, August 18, 1996.

DOE 1996e DOE, *Final Programmatic Environmental Impact Statement for Stockpile Stewardship and Management*, DOE/EIS-0236, Volume 1, U.S. Department of Energy, Office of Technical and Environmental Support, DP-45, Washington, DC, September 1996.

DOE 1996f DOE, *Final Environmental Impact Statement for the Continued Operation of the Pantex Plant and Associated Storage of Nuclear Weapons Components*, DOE/EIS-0225, Volumes I-III, U.S. Department of Energy, Washington, DC, November 1996.

DOE 1996g DOE, *Highly Enriched Uranium Working Group Report on Environmental, Safety and Health Vulnerabilities Associated with the Department's Storage of Highly Enriched Uranium*, DOE/EH-0525, Volume II: Number 1, Oak Ridge Y-12 Plant Working Group and Site Assessment Team Reports, U.S. Department of Energy, December 1996.

DOE 1996h DOE, *Storage and Disposition of Weapons-Usable Fissile Materials, Final Programmatic Environmental Impact Statement*, DOE/EIS-0229, Volume 1, U.S. Department of Energy, Office of Fissile Materials Disposition, Washington, DC, December 1996.

DOE 1997a DOE, *Report on the Remedial Investigation of Bear Creek Valley at the Oak Ridge Y-12 Plant, Oak Ridge, Tennessee*, DOE/OR/01-1455/V1&D2, U.S. Department of Energy, Oak Ridge Operations Office, Oak Ridge, TN, March 1997.

DOE 1997b DOE, *Highly Enriched Uranium Management Plan* DOE/DP-0139, U.S. Department of Energy, Office of Defense Programs, April 1997.

DOE 1997c DOE, *Final Waste Management Programmatic Environmental Impact Statement for Managing Treatment, Storage, and Disposal of Radioactive and Hazardous Waste,* Volumes I - V, DOE/EIS-0200-F, U.S. Department of Energy, Office of Environmental Management, Washington DC, May 1997.

DOE 1997d DOE, *Memorandum on Radiological Control Technical Position (RCTP 97-E01) Ref: DOE 5400 5. Radiation Protection of the Public and Environment*, U.S.

Department of Energy, Office of Environmental Policy and Assistance, October 3, 1997.

DOE 1997e DOE, *Final Environmental Assessment, Lease of Land and Facilities within the East Tennessee Technology Park, Oak Ridge, Tennessee*, DOE/EA-1175. U.S. Department of Energy, Oak Ridge Operations Office, Oak Ridge, TN, November 1997.

DOE 1997f DOE, *Feasibility Study for Bear Creek Valley at the Oak Ridge Y-12 Plant, Oak Ridge, Tennessee*, DOE/OR/02-1525/V1&D2, U.S. Department of Energy, Oak Ridge Operations Office, Oak Ridge, TN, November 1997.

DOE 1998a DOE, *Remedial Investigation/Feasibility Study for the Disposal of Oak Ridge Reservation Comprehensive Environmental Response, Compensation, and Liability Act of 1980 Waste*, DOE/OR/02-1637&D2, U.S. Department of Energy, Oak Ridge Operations Office, Oak Ridge, TN, January 1998.

DOE 1998b DOE, *Report on the Remedial Investigation of the Upper East Fork Poplar Creek Characterization Area at the Oak Ridge Y-12 Plant, Oak Ridge, Tennessee*, DOE/OR/01-1641/V1&D2, U.S. Department of Energy, Oak Ridge Operations Office, Oak Ridge, TN, August 1998.

DOE 1998c DOE, *National Environmental Policy Act Compliance Guide*, Volume 1, U.S. Department of Energy, Environment, Safety, and Health, Office of NEPA Policy and Assistance, August 1998.

DOE 1998d DOE, *Addendum to Remedial Investigation/Feasability Study for the Disposal of Oak Ridge Reservation Comprehensive Environmental Response, Compensation and Liability Act of 1980 Waste*, DOE/OR/02-1637&D2/A1, U.S. Department of Energy, Oak Ridge, TN, September 1998.

DOE 1998e DOE, *DOE Occupational Radiation Exposure 1997 Report*, DOE/EH-0575, U.S. Department of Energy, Office of Worker Health and Safety, Washington, DC, 1998.

DOE 1999a DOE, *Proposed Plan for the Disposal of Oak Ridge Reservation Comprehensive Environmental Response, Compensation, and Liability Act of 1980 Waste*, DOE/OR/01-1761&D3, U.S. Department of Energy, Oak Ridge Operations Office, Oak Ridge, TN, January 1999.

DOE 1999b DOE, *Final Environmental Impact Statement for the Production of Tritium in a Commercial Light Water Reactor*, DOE/EIS-0288, U.S. Department of Energy, Office of Defense Programs, Washington, DC, March 1999.

DOE 1999c DOE, *Final Environmental Impact Statement for the Construction and Operation of the Spallation Neutron Source*, DOE/EIS-0247, Volume I, U.S. Department of Energy, Office of Science, Washington, DC, April 1999.

DOE 1999d DOE, *Final Programmatic Environmental Impact Statement for Alternative Strategies for the Long-Term Management and Use of Depleted Uranium Hexafluoride*, DOE/EIS-0269, Volumes 1 - 3, U.S. Department of Energy, Office of Nuclear Energy, Science and Technology, April 1999.

DOE 1999e — DOE, *Environmental Assessment and FONSI for the U.S. Department of Energy, Oak Ridge Operations Receipt and Storage of Uranium Materials from the Fernald Environmental Management Project Site*, DOE/EA-1299, U.S. Department of Energy, Oak Ridge Operations Office, Oak Ridge, TN, April 1999.

DOE 1999f — DOE, "DOE Related Employment and Payroll by County (Calendar Year 97)," Internet file, accessed May 14, 1999. http://www.oakridge.doe.gov/factsheets/97payroll.html

DOE 1999g — DOE, *Feasibility Study for the Upper East Fork Poplar Creek Characterization Area at the Oak Ridge Y-12 Plant, Oak Ridge, Tennessee,* DOE/OR/01-1747&D2, U.S. Department of Energy, Oak Ridge Operations Office, Oak Ridge, TN, June 1999.

DOE 1999h — DOE, *Scoping Summary Report for the Site-Wide Environmental Impact Statement Oak Ridge Y-12 Plant*, U.S. Department of Energy, Oak Ridge Operations Office, Oak Ridge, TN, July 1999.

DOE 1999i — DOE, *Record of Decision for the Disposal of Oak Ridge Reservation Comprehensive Environmental Response, Compensation, and Liability Act of 1980 Waste,* DOE/OR/01-1791&D2, U.S. Department of Energy, Oak Ridge Operations Office, Oak Ridge, TN, November 1999.

DOE 1999j — DOE, *Final Site-Wide Environmental Impact Statement for Continued Operation of the Los Alamos National Laboratory*, DOE/EIS-0238, Appendix D, U.S. Department of Energy, Washington, DC, January 1999.

DOE 2000a — DOE, *Final Environmental Impact Statement (DEIS) for Treating Transuranic (TRU)/Alpha Low-Level Waste at the Oak Ridge National Laboratory, Oak Ridge, Tennessee*, Department of Energy, Oak Ridge Operations, Oak Ridge, Tennessee, June 2000.

DOE 2000b — DOE, *Environmental Assessment for the Selection and Operation of the Proposed Field Research Centers for the Natural and Accelerated Bioremediation Research (NABIR) Program,* DOE/EA-1196, U.S. Department of Energy, Office of Biological and Environmental Research, March 2000.

DOE 2000c — DOE, *Clean Air Act General Conformity Requirements and the National Environmental Policy Act Process*, U.S. Department of Energy, Office of NEPA Policy and Assistance, Washington, DC, April 2000.

DOE 2000d — DOE, *Oak Ridge Reservation Annual Site Environmental Report for 1999*, DOE/ORO/2100, prepared by UT Battelle, LLC, Lockheed Martin Energy Systems, Inc. and Bechtel Jacobs Company for the U.S. Department of Energy, Oak Ridge Operations, Oak Ridge, TN, September 2000.

DOE 2000e — DOE, *Annual Report of Waste Generation and Pollution Prevention Progress 1999*, DOE/EM-0545, U.S. Department of Energy, Office of Environmental Management, EM-77, Pollution Prevention Program, Washington DC, September 2000.

DOE 2001a DOE, *Finding of No Significant Impact (FONSI) and Environmental Assessment for the Oak Ridge National Laboratory Facilities Revitalization Project*, DOE/EA-1362, U.S. Department of Energy, Oak Ridge Operations Office, Oak Ridge, TN, June 2001.

DOI 1990a DOI, *The Secretary of the Interior's Standards for Rehabilitation and Guidelines for Rehabilitating Historic Buildings*, National Park Service, U.S. Department of the Interior, Washington, DC.

DOI 1990b DOI, *The Secretary of the Interior's Standards and Guidelines for Architectural and Engineering National Park Services, Historic American Buildings Survey/Historic American Engineering Record (HABS/HAER)*, U.S. Department of the Interior, Washington, DC.

DuVall 1999 DuVall and Associates, *An Evaluation of Previously Recorded and Inventoried Archaeological Sites Within Portions of the Y-12 Plant, Anderson and Roane Counties, Tennessee (Draft)*, prepared for U.S. Department of Energy, Oak Ridge, TN, June 1999.

EPA 1974 U.S. Environmental Protection Agency (EPA), *Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety*, EPA/550/9-74-004, Office of Noise Abatement and Control, Washington, DC, March 1974.

EPA 1995a EPA, *Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources*, AP-42, Fifth Edition, Office of Air Quality Planning and Standards, Research Triangle Park, NC, January 1995.

EPA 1995b EPA, *User's Guide for the Industrial Source Complex (ISC3) Dispersion Models, Volume I -- Users Instructions*, EPA-454/B-95-003a, Office of Air Quality Planning and Standards Research, Triangle Park, NC, September 1995.

EPA 1997 EPA, *Federal Facilities Agreement for Management of Polychlorinated Biphenyl Waste on the Oak Ridge Reservation, Oak Ridge, TN, Rev 2*, an agreement between EPA Region IV and the U.S. Department of Energy, Oak Ridge Operations Office, Oak Ridge, TN, August 19, 1997.

EPA 1999a EPA, *Integrated Risk Information System* (IRIS), Inhalation Reference Concentrations, U.S. Environmental Protection Agency, Washington, DC, 1999.

EPA 1999b EPA, "EPA Summary of the Court's Decision," Internet file, accessed June 28, 1999. http//ttnwww.rtpnc.epa.gov/naaqsfin/

Evans 1999a Evans, R.A., *Emergency Planning and Community Right-to-Know Act Section 312 Tier Two Report Forms*, Y/TS-1737, prepared by Lockheed Martin Energy Systems, Inc., Oak Ridge, TN, February 1999.

Evans 1999b Evans, R.A., *Emergency Planning and Community Right-to-Know Act Section 311*, Y/TS-1745, prepared by Lockheed Martin Energy Systems, Inc., Oak Ridge, TN, March 1999.

Fisher 1995 — S.E. Fisher and K.E. Lenox, *An Assessment of the Radiological Doses Resulting from Accidental Uranium Aerosol Releases and Fission Product Releases from a Postulated Criticality Accident at Oak Ridge Y-12 Plant,* Lockheed Martin Energy Systems, Y/TS-1272, ORNL/TM-12782, Oak Ridge, TN, March 1995.

FWC 1995 — Foster Wheeler Corporation (FWC), *Design and Operating Procedure for the Oak Ridge Y-12 Plant Industrial Landfill V*, Y/WM-089/R3, prepared for the U.S. Department of Energy, Oak Ridge Operations Office, November, 1995.

Garber 2000 — Garber, J., B. McElroy, and M. Reichert, *Recommended Baseline for Use in the Y-12 Site-Wide Environmental Impact Statement*, transmittal to I. Shelton and T. Smith at Lockheed Martin Energy Systems, Inc., Oak Ridge, TN, February 18, 2000.

Golder 1987 — Golder Associates, Inc., *Aquifer Pump Test with Tracers,* ORNL/SUB/86-32136/2, prepared for the Oak Ridge National Laboratory, Energy Division, managed by Martin Marietta Energy Systems, Inc., Oak Ridge, TN, October 1987.

Golden et. al. 1980 — Golden J., R.P. Onellete, S. Saari, and P.N. Cheremisinoff, *!980 Environmental Impact Book,* Ann Arbor Science Publishers, Ann Arbor, Michigan.

Hartman 1999 — Personal Communications from Gary Hartman to Fred Jackson via e-mail, "Comments on Y-12 SWEIS Section 4.1.1- Land Use," July 16, 1999.

Hartman 2000 — Personal Communications from Gary Hartman to Becky Miller via e-mail, "Geologic Figure from Steve Haas," March 30, 2000.

HPI 1999a — Harden Political InfoSystems, "Tennessee School Districts by County," Internet File, accessed May 14, 1999. http://hpi.www.com/tnsch

HPI 1999b — Harden Political InfoSystems, "Tennessee Law Enforcement Agencies by County," Internet file, accessed May 14, 1999. http://hpi.www.com/tnlaw

HSW 1994 — HSW Environmental Consultants, *Calendar Year 1993 Groundwater Quality Report for the Upper East Fork Poplar Creek Hydrogeologic Regime, Y-12 Plant, Oak Ridge, Tennessee,* February 1994.

ICRP 1991 — ICRP, *1990 Recommendations of the International Commission on Radiological Protection.* Publication 60, Volume 21, No. 1-3, Annals of the ICRP, Pergamon Press, New York, NY, 1991.

LMER 1999a — Lockheed Martin Energy Research Corporation (LMER), *Oak Ridge National Land and Facilities Plan*, ORNL/M-6714, prepared for the U.S. Department of Energy, Oak Ridge Operations Office, Oak Ridge, TN, August 1999.

LMER 1999b — Bechtel Jacobs Company LLC, Lockheed Martin Energy Research Corporation, and Lockheed Martin Energy System, Inc. *Comprehensive Integrated Planning Process for the Oak Ridge Operations Sites*, ORNL/M-6727, prepared for the U.S. Department of Energy, Oak Ridge Operations Office, Oak Ridge, TN, September 1999.

LMES 1997a — Lockheed Martin Energy Systems (LMES), *Major Source Operating Permit Applications for the U.S. Department of Energy, Oak Ridge, Y-12 Plant, Volume 2, Applications for Emission Sources in Buildings 9201-1, 9201-1W, 9401-2, 9401-3, 9404-9, 9720-32, 9738, 9767-4, 9767-13, 9811-5, 9815*, Air Compliance Program, Environmental Compliance Organization Y-12 Plant, July 1997.

LMES 1997b — LMES, *Evaluation of Calendar Year 1996 Groundwater and Surface Water Quality Data for the Bear Creek Hydrogeologic Regime at the U.S. Department of Energy Y-12 Plant, Oak Ridge, Tennessee*, Y/SUB/97-KDS15V/4, prepared for U.S. Department of Energy, Oak Ridge Operations Office, Oak Ridge, TN, 1997.

LMES 1999 — LMES, *Industrial Safety Information System, Occupational Injury/Illness Report, 1995-1998*, Lockheed Martin Energy Systems, Inc., Oak Ridge, TN, 1999.

LMES 1999a — Poligone, S.E., *Forecasted Waste Generation for Defense Programs*, Y-12 Plant managed by Lockheed Martin Energy Systems, Inc., for the U.S. Department of Energy, Oak Ridge Operations Office, Oak Ridge, TN, June 24, 1999. **UCNI**

LMES 1999b — DOE, *DOE's Mansel Wins Pollution Prevention Awards*, press release, U.S. Department of Energy, Oak Ridge Operations Office, Oak Ridge, TN, August 18, 1999.

LMES 1999c — LMES, *Y-12 Site Modernization Preliminary Operations Assessment Report*, Y/EN-5865, prepared by Lockheed Martin Energy Systems, Inc., for the U.S. Department of Energy, Oak Ridge Operations Office, Oak Ridge, TN, May 1999.

LMES 1999d — LMES, *Y-12 Site Integration Modernization Development Study*, Y/EN-5943, prepared by Lockheed Martin Energy Systems, Inc., for the U.S. Department of Energy, Oak Ridge Operations Office, Oak Ridge, TN, October 1999.

LMES nda — LMES, *Environmental Technologies From The DOE Facilities in Oak Ridge Tennessee*, Lockheed Martin Energy Systems, Inc., Office of Environmental Technology Development, Oak Ridge, TN.

LMES 2000a — LMES, *Responses to Data Requests for the No Action Alternative for the Y-12 Site-Wide Environmental Impact Statement*, transmittal from I. Shelton of Lockheed Martin Energy Systems, Inc., Y-12 Plant, Oak Ridge, TN to F. Jackson of Tetra Tech, Inc., March 2000.

LMES 2000b — LMES, *Responses to Data Requests for the Highly Enriched Uranium Storage Mission Alternatives for the Y-12 Site-Wide Environmental Impact Statement*, transmittal from I. Shelton of Lockheed Martin Energy Systems, Inc., Y-12 Plant, Oak Ridge, TN to F. Jackson of Tetra Tech, Inc., March 2000.

LMES 2000c — LMES, *Responses to Data Requests for the Special Materials Mission Alternatives for the Y-12 Site-Wide Environmental Impact Statement*," transmittal from I. Shelton of Lockheed Martin Energy Systems, Inc., Y-12 Plant, Oak Ridge, TN, to F. Jackson of Tetra Tech, Inc., March 2000.

LMES 2000d — LMES, *Excerpts from RCRA Permits and Working Databases and Comments on the Status of Facility Use at the Y-12 Plant*, provided by S. Rathke of LMES to A. Dickie of Tetra Tech, Inc., Oak Ridge, TN, May 18, 2000.

Mitchell 1996 — Mitchell, J.M., E.R. Vail, J.W. Webb, A.L. King, and P.A. Hamlett 1996, *Survey of Protected Terrestrial Vertebrates on the Oak Ridge Reservation*, ES/ER/TM-188/R1, prepared by Lockheed Martin Energy Systems, Inc., Environmental Restoration Division, May 1996.

MMES 1992 — Martin Marietta Energy Systems, Inc. (MMES), *Design and Operating Procedure for Y-12 Construction/Demolition Landfill VI, Y/WM-070 Rev 1*, prepared by C. W. Hutzler of MMES for the Department of Energy, Oak Ridge Operations Office, April 1992.

MMES 1995 — MMES, *Design and Operating Procedure for the Y-12 Industrial Landfill IV, Y/TS-399/R3*, prepared by MMES for the U.S. Department of Energy, Oak Ridge Operations Office, April 28, 1995.

MMES 1998 — MMES, *Hazardous Material Information System* (HMIS), 1998.

NCRP 1993 — National Council on Radiation Protection and Measurement (NCRP), *Limitation of Exposure to Ionizing Radiation*, NCRP Report No. 116, Washington, DC, 1993.

NEIC 1999 — U.S. Geological Survey National Earthquake Information Center, Internet file, accessed May 11, 1999. http://wwneic.cr.usgs.gov

NRC 1977 — U.S. Nuclear Regulatory Commission (NRC), *Final Environmental Impact Statement on the Transportation of Radioactive Material by Air and Other Modes*, Nureg-0170, Volume I, U.S. Nuclear Regulatory Commission, Office of Nuclear Reactor Regulations, Washington, DC, December 1977.

NRC 1998 — Code Manual for MACCS2, NUREG/CR-6613, U.S. Nuclear Regulatory Commission, Washington, DC, May 1998.

Oak Ridge 2000 — City of Oak Ridge, Community Development Department, Code Enforcement, Chapter 5, Performance Standards, Section(s) 6-504, Noise, 8/26/99.

ORNL 1981a — NUS, *Environmental and Safety Report for Oak Ridge National Laboratory*, ORNL-SUB-41B38403C, NUS 3892, prepared by NUS Corporation, Rockville, MD for the Oak Ridge National Laboratory managed by Martin Marietta Energy Systems, Inc. for the U.S. Department of Energy, Oak Ridge Operations Office, Oak Ridge, TN, September 30, 1981.

ORNL 1981b — Loar, J.M., J.A. Solomon, and G.F. Cada, *Technical Background Information for the ORNL Environmental and Safety Report:A Description of the Aquatic Ecology of White Oak Creek Watershed and the Clinch River Below Melton Hill Dam*, ORNL/TM-7509/V2, Publication No. 1852, prepared by Oak Ridge National Laboratory, Environmental Sciences Division managed by Martin Marietta Energy Systems, Inc. for the U.S. Department of Energy, Oak Ridge Operations Office, Oak Ridge, TN, October 1981.

ORNL 1984 Kitchings, J.T. and J.D. Story, *Resource Management Plan for U.S. Department of Energy, Oak Ridge Reservation*, ORNL-6026/V16, prepared by the Oak Ridge National Laboratory managed by Martin Marietta Energy Systems, Inc. for the U.S. Department of Energy, Oak Ridge Operations Office, Oak Ridge, TN, July 1984.

ORNL 1988 Cada G.F., R.L. Kroodsma, and P.D. Parr, *Ecology of the Oak Ridge Reservation*, ORNL/TM-10939/V1 and V2, prepared by the Oak Ridge National Laboratory, Environmental Sciences Division managed by Martin Marietta Energy Systems, Inc. for the U.S. Department of Energy, Oak Ridge Operations Office, Oak Ridge, TN, 1988.

ORNL 1991 Cunningham, M. and L. Pounds, *Resource Management Plan for the Oak Ridge Reservation Volume 28:Wetlands on the Oak Ridge Reservation*, ORNL/NERP-5, prepared by Oak Ridge National Laboratory, Environmental Sciences Division (Publication No. 3765) managed by Martin Marietta Energy Systems, Inc., for the Oak Ridge National Environmental Research Park and the U.S. Department of Energy, Oak Ridge Operations Office, Oak Ridge, TN, December 1991.

ORNL 1992a Hardy, C., L. Pounds, and R. Cook, *Results of the Y-12 Area Rare Plant and Wetland Survey*, prepared by Oak Ridge National Laboratory, Environmental Sciences Division, managed by Martin Marietta Energy Systems, Inc. for the Oak Ridge National Environmental Research Park and the U.S. Department of Energy, Oak Ridge Operations Office, Oak Ridge, TN, January 1992.

ORNL 1992b Parr, P.D., and J.W. Evans, *Resource Management Plan for the Oak Ridge Reservation, Volume 27: Wildlife Management Plan*, ORNL/NERP-6, prepared by Oak Ridge National Laboratory, Environmental Sciences Division (Publication No. 3903), managed by Martin Marietta Energy Systems, Inc. for the Oak Ridge National Environmental Research Park and the U.S. Department of Energy, Oak Ridge Operations Office, Oak Ridge, TN, June 1992.

ORNL 1993a Johnson, P.E., D.S. Joy, D.B. Clarke, and J.M. Jacobi, *HIGHWAY 3.1, An Enhanced Highway Routing Model: Program Description, Methodology, and Revised User's Manual*, ORNL/TM-12124, Oak Ridge National Laboratory, Computational Physics and Engineering Division, Oak Ridge, TN, March 1993.

ORNL 1993b Pounds, L.R., P.D. Parr, and M.G. Ryon, *Resource Management Plan for the Oak Ridge Reservations Volume 30:Oak Ridge National Environmental Research Park Natural Areas and Reference Areas - Oak Ridge Preservation Environmentally Sensitive Sites Containing Special Plants, Animals, and Communities*, ORNL/NERP-8, prepared by Oak Ridge National Laboratory, Environmental Science Division (Publication No. 3995), managed by Martin Marietta Energy Systems, Inc. for the Oak Ridge National Environmental Research Park and the U.S. Department of Energy, Oak Ridge Operations Office, Oak Ridge, TN, August 1993.

ORNL 1993c Cunningham, M., L. Pounds, S. Oberholster, P. Parr, L. Edwards, B. Rosentsteel, and L. Mann, *Resource Plan for the Oak Ridge Reservation Volume 29:Rare Plants on the Oak Ridge Reservation*, ORNL/NERP-7, prepared by Oak Ridge National Laboratory, Environmental Sciences Division (Publication No. 4054), managed by Martin Marietta Energy Systems, Inc. for the Oak Ridge National Environmental

Research Park and the U.S. Department of Energy, Oak Ridge Operations Office, Oak Ridge, TN, August 1993.

ORNL 1994 — Rosensteel, B.A., *Wetland Survey of Selected Areas in the Y-12 Area of Responsibility, Upper East Fork Poplar Creek Operable Unit, Chestnut Ridge Operable Unit 2, South of Bethel Valley Road, East End of Bar Creek Groundwater Operable Unit, and Y-12 West End Environmental Management Area*, prepared by the Oak Ridge National Laboratory, Environmental Sciences Division and the U.S. Department of Energy, Oak Ridge Operations Office, Oak Ridge, TN, October 1994.

ORNL 1997a — Rosensteel, B.A., *Wetland Survey of Selected Areas in the Oak Ridge Y-12 Area of Responsibility*, Y/ER-279, prepared by Jaycor Environmental for Oak Ridge National Laboratory, Environmental Sciences Division managed by Lockheed Martin Energy Research Corporation for the U.S. Department of Energy, Oak Ridge Operations Office, Oak Ridge, TN, Janurary1997.

ORNL 1997b — ORNL, *Annual Report, Implementation of Mitigation Action Plan for DOE/EA-113: Lease of Parcel ED-1 of the Oak Ridge Reservation*, Oak Ridge National Laboratory managed by Lockheed Martin Energy Research Corporation for the U.S. Department of Energy, Oak Ridge Operations Office, Oak Ridge, TN, October 1997.

ORNL 1999 — ORNL, *Environmental Analysis of a Proposed NABIR Field Research Center on the Oak Ridge Reservation, Tennessee*, prepared by the Oak Ridge National Laboratory managed by Lockheed Martin Energy Research Corporation for the U.S. Department of Energy, Oak Ridge Operations Office, Oak Ridge, TN, April 1999.

PA 1994 — DOE, *Programmatic Agreement Among the Department of Energy - Oak Ridge Operations Office, the Tennessee Historic Preservation Officer, and the Advisory Council on Historic Preservation Comcerning Management of Historical and Cultural Properties at the Oak Ridge Reservation*, Environmental Protection Division, Oak Ridge Reservation, May 1994.

PAI 1996 — PAI Corporation, *Description of Y-12 Plant Waste Management System 1996*, prepared for the U.S. Department of Energy, Oak Ridge Operations Office, Oak Ridge, TN, 1996.

PEC 1998 — End Use Working Group & Phoenix Environmental Corporation, *Final Report of the Oak Ridge Reservation End Use Working Group, End Use Recommendations for the Y-12 Plant, Chestnut Ridge, and Upper East Fork Poplar Creek*, prepared for U.S. Department of Energy, Oak Ridge Operations Office, July 1998.

Sauer 1997 — Sauer, J.R., J.E. Hines, G. Gough, I. Thomas, and B.G. Peterjohn. *The North American Breeding Bird Survey Results and Analysis*. Version 96.4. U.S. Fish and Wildlife Service, Patuxent Wildlife Research Center, MD, 1997

Schaefer 2000 — Schaefer, Sarah, *Personal Communications Re: Landfill Volumes for Y-12 SWEIS*, e-mails between S. Schaefer of GTS Duratek, Oak Ridge, TN and M. Willoughby of Tetra Tech NUS, Oak Ridge, TN, June 19, 2000.

Shelton 1999	Shelton, Iris, *Personal Communications Regarding Meteorological Towers*, from Lockheed Martin Energy Systems to F. Jackson, Tetra Tech, Inc., Oak Ridge, TN, July 1999.
Smith 1999	Smith, T.E., *Additional Modernization Alternative Information*, memoranda from Lockheed Martin Energy Systems, Inc. to F. Jackson, Tetra Tech, Inc., August 16, 1999.
SNL 1982	Sandia National Laboratories (SNL), *Non-Radiological Impacts of Transporting Radioactive Material*, SAND81-1703 TTC-0236, Sandia National Laboratories, Albuquerque, NM, February 1982.
SNL 1986	SNL, *Transportation Impacts of the Commercial Radioactive Waste Management Program*, SAND85-2715, Sandia National Laboratories, Albuquerque, NM, and Livermore, CA, April 1986.
SNL 1992	Neuhauser, K.S. and F.L. Kanipe, *RADTRAN 4: Volume 3, User's Guide*, SAND89-2370 TTC-0943 VC-722, Sandia National Laboratories, Albuquerque, NM, and Livermore, CA, January 1992.
Souza 1997	Souza, P.A., G.D. Duvall, and N. Tinker, *DOE Oak Ridge Operations Office, Cultural Resource Management Plan, Anderson and Roane Counties, Tennessee*, ORNL/M-5080, Oak Ridge National Laboratory, Environmental Sciences Division for the U.S. Department of Energy, Oak Ridge Operations Office, Oak Ridge, TN, September 1997.
SPAS 1998	Site Planning and Assessment Services (SPAS), *Y-12 Area Management Plan*, Site Management Services Division, Energy Systems Architecture and Planning, and Barge, Waggoner, Sumner and Cannon, Inc., April 1998.
TCA 11-6-116	State of Tennessee, "Excavation of Areas Containing Native American Human Remains", Tennessee Criminal Code – Annotated, Acts 1990, Chapter 852, State of Tennessee, Nashville, TN, 1990.
TCA 39-17-311	State of Tennessee, "Declaration of a Venerated Object", Tennessee Criminal Code – Annotated, Acts 1989, Chapter 591, State of Tennessee, Nashville, TN, 1989.
TCA 39-17-312	State of Tennessee, "Abuse of a Corpse", Tennessee Criminal Code – Annotated, Acts 1989, Chapter 591, State of Tennessee, Nashville, TN, 1989.
TDEC 1995a	Tennessee Department of Environment and Conservation (TDEC), *Tennessee County Distribution Records for Endangered, Threatened, and Status Review Species*, Division of Ecological Services, Nashville, TN, prepared in cooperation with the U.S. Fish and Wildlife Service, January 20, 1995.
TDEC 1995b	TDEC, *Rare Vertebrates of the State of Tennessee*, Division of Natural Heritage, Nashville, TN, August 2, 1995.
TDEC 1995c	TDEC, *Rare Invertebrates of the State of Tennessee*, Division of Natural Heritage, Nashville, TN, August 2, 1995.

TDEC 1995d — TDEC, *Rare Plants of the State of Tennessee*, Tennessee Rare Plant Protection Program, Division of Natural Heritage, Nashville, TN, August 2, 1995.

TDEC 1997 — TDEC, *Rules of the Tennessee Department of Environment and Conservation, Ambient Air Quality Standards, Chapter 1200-3-3*, Bureau of Environment, Division of Air Pollution Control, May 6, 1997.

TDEC 1998 — TDEC, *AIRS Quick Look Report*, Bureau of Environment, Division of Air Pollution Control, Nashville, TN, 1998.

TDEC 1999a — TDEC, *Rules of Tennessee Department of Environment and Conservation, Chapter 1200-3-1 through Chapter 1200-3-34*, Bureau of Environment, Division of Air Pollution Control, revised April 1999.

TDEC 1999b — TDEC, *Rules of the Tennessee Department of Environment* and Conservation, *Chapter 1200-4-3, General Water Quality Criteria*, Bureau of Environment, Division of Water Pollution Control, October 1999.

TDEC 2000 — TDEC, *AIRS Quick Look Report, Bureau of Environment*, Division of Air Pollution Control, Nashville, TN 2000.

TDOT 1998 — Tennessee Department of Transportation (TDOT), *Average Daily Traffic*, Tennessee Department of Transportation in cooperation with the U.S. Department of Transportation, Washington, DC, 1998

TEDC 1999 — Tennessee Economic Development Center, "Tennessee Regional Statistics, Category: Population Growth: 1999-2010", Tennessee Economic Development Center, TEDC County Profiles: Display of Regional Statistics, September 8, 1999. http://www.tnedc.org/cgi-bin/php.cgi/profiles/regstats.html.

Thomason 1999 — Thomason and Associates, *Architectural/Historic Evaluation of the Y-12 Plant, Oak Ridge Reservation, Anderson County, Tennessee*, prepared for the U.S. Department of Energy, Oak Ridge Operations Office, Oak Ridge, TN, April 1999.

TVA 1991 — Tenessee Valley Authority (TVA), *Flood Analyses for Department of Energy Y-12, ORNL, and K-25 Plants*, Flood Protection Section, Water Resources Operations Department, Natural Resources Division, Tennessee Valley Authority, Knoxville, TN, December 1991.

TWRA 1995 — Todd, R. M., *Tennessee Commercial Fishing*, PEIS Request for Information provided by Fisheries Biologist, Tennessee Wildlife Resources Agency (TWRA), Nashville, TN, May 17, 1995.

TWRC 1991a — Tennessee Wildlife Resources Commission (TWRC), *Proclamation-Wildlife in Need of Management*, Proc. 86-29, March 2, 1991.

TWRC 1991b — TWRC, *Proclamation-Endangered or Threatened Species*, Proc. 86-30, March 2, 1991.

USACOE 1987 — U.S. Army Corps of Engineers, *Wetlands Delineation Manual*, Technical Report Y-87-1, Waterways Experiment Station, Vicksburg, MS, 1987.

USFWS 1979 — Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe, *Classification of Wetlands and Deepwater Habitats of the United States*, FWS/OBS-79/31, U.S. Fish and Wildlife Service, Washington, DC, 1979.

USFWS 1992 — Widlak, J., A. Status, *Update on Possible Occurrence of Threatened and Endangered Species on the Oak Ridge Reservation*, PEIS Request for Information provided by U.S. Fish and Wildlife Service, 1992.

USFWS 1999a — Letter from Lee A. Barclay, Field Supervisor, U.S. Fish and Wildlife Service, Cookeville, TN to Gary S. Hartman, U.S. Department of Energy, Oak Ridge Operations Office, Oak Ridge, TN, May 12, 1999.

USFWS 1999b — Letter from Lee A. Barclay, Field Supervisor, U.S. Fish and Wildlife Service, Cookeville, TN to Paul E. Bayer, U.S. Department of Energy, Environmental Sciences Division, Germantown, MD, September 14, 1999.

USFWS 1999c — Letter from Lee A. Barclay, Field Supervisor, U.S. Fish and Wildlife Service, Cookeville, TN to James L. Elmore, U.S. Department of Energy, Oak Ridge Operations Office, Oak Ridge, TN, November 24, 1999.

Van der Leeden 1990 — Van der Leeden, F., F.L. Troise, and D.K Todd, *The Water Encyclopedia*, Geraghty & Miller Ground-Water Series, Second Edition, Lewis Publishers, Chelsea, MI, 1990.

Webb 1991 — Webb, J.W., *Preliminary Bat Survey of ORAU Structures*, internal correspondence to Linda Mann, Martin Marietta Energy Systems, Inc., October 24, 1991.

Y-12 1999a — *Highly Enriched Uranium Materials Facility Conceptual Design Report*, Y/EN-586OR1, July 1999. **UCNI**

Y-12 1999b — LMES, *Radiation Dose Trends for Y-12 Workers*, Y-12 DRS Database, transmittal from Rhonda Bogard to Lori Moore, Y-12 Plant, Department of Energy, Oak Ridge, TN, August 1999.

Y-12 2001a — BWXT y-12, *RW and all Monitored Data for SWEIS Tables*, electronic message from L.S. Oxley to L.W. Moore et al, BWXT Y-12, Oak Ridge, TN, April 2001.

Y-12 2001b — BWXT y-12, *Total Illness/Injury Rate for 1999*, Telecon from D. Johnson to L.W. Moore, Oak Ridge, TN, April 2001.

CHAPTER 11: GLOSSARY

Absorbed dose: The energy imparted to matter by ionizing radiation per unit mass of irradiated material at the place of interest in that material. Expressed in units of radiation absorbed dose or grays, where one radiation absorbed dose equals 0.01 gray. Also, see "radiation absorbed dose."

Acute exposure: The exposure incurred during and shortly after a radiological release. Generally, the period of acute exposure ends when long-term interdiction is established, as necessary. For convenience, the period of acute exposure is normally assumed to end 1 week after the inception of a radiological accident.

Air pollutant: Any substance in air which could, if in high enough concentration, harm man, other animals, vegetation, or material. Pollutants may include almost any natural or artificial composition of matter capable of being airborne.

Air Quality Control Region (AQCR): Geographic subdivisions of the United States, designed to deal with pollution on a regional or local level. Some regions span more than one state.

Air quality standards: The level of pollutants in the air prescribed by regulations that may not be exceeded during a specified time in a defined area.

Alpha activity: The emission of alpha particles by fissionable materials (uranium or plutonium).

Alpha particle: A positively charged particle, consisting of two protons and two neutrons, that is emitted during radioactive decay from the nucleus of certain nuclides. It is the least penetrating of the three common types of radiation (alpha, beta, and gamma).

Ambient air: The surrounding atmosphere as it exists around people, plants, and structures. Air quality standards are used to provide a measure of the health-related and visual characteristics of the air.

Aquifer: A saturated geologic unit through which significant quantities of water can migrate under natural hydraulic gradients.

Archaeological sites (resources): Any location where humans have altered the terrain or discarded artifacts during either prehistoric or historic times.

Artifact: An object produced or shaped by human workmanship of archaeological or historical interest.

As low as reasonably achievable (ALARA): A concept applied to the quantity of radioactivity released in routine operation of a nuclear system or facility, including "anticipated operational occurrences." It takes into account the state of technology, economics of improvements in relation to benefits to public health and safety, and other societal and economic considerations in relation to the use of nuclear energy in the public interest.

Atmospheric dispersion: The process of air pollutants being dispersed in the atmosphere. This occurs by the wind that carries the pollutants away from their source and by turbulent air motion that results from solar heating of the Earth's surface and air movement over rough terrain and surfaces.

***Atomic Energy Act* of 1954:** This act was originally enacted in 1946 and amended in 1954. For the purpose of this Programmatic Environmental Impact Statement "...a program for Government control of the possession, use, and production of atomic energy and special nuclear material whether owned by the

Government or others, so directed as to make the maximum contribution to the common defense and security and the national welfare, and to provide continued assurance of the Government's ability to enter into and enforce agreements with nations or groups of nations for the control of special nuclear materials and atomic weapons..." (Section 3(c)).

Atomic Energy Commission: A five-member commission, established by the *Atomic Energy Act* of 1946, to supervise nuclear weapons design, development, manufacturing, maintenance, modification, and dismantlement. In 1974, the Atomic Energy Commission was abolished and all functions were transferred to the Nuclear Regulatory Commission and the Administrator of the Energy Research and Development Administration. The Energy Research and Development Administration was later terminated and its functions vested by law in the Administrator were transferred to the Secretary of Energy.

Background radiation: Ionizing radiation present in the environment from cosmic rays and natural sources in the Earth; background radiation varies considerably with location. Also, see "natural radiation."

Badged worker: A worker equipped with an individual dosimeter who has the potential to be exposed to radiation.

Baseline: A quantitative expression of conditions, costs, schedule, or technical progress to serve as a base or standard for measurement during the performance of an effort; the established plan against which the status of resources and the progress of a project can be measured.

BEIR V: Biological Effects of Ionizing Radiation; referring to the fifth in a series of committee reports from the National Research Council.

Beryllium: An extremely lightweight, strong metal used in weapons systems.

Benthic: Plants and animals dwelling at the bottom of oceans, lakes, rivers, and other surface waters.

Best Available Control Technology: A term used in the Federal *Clean Air Act* that means the most stringent level of air pollutant control considering economics for a specific type of source based on demonstrated technology.

Beta particle: A charged particle emitted from the nucleus of an atom during radioactive decay. A negatively charged beta particle is identical to an electron. A positively charged beta particle is called a positron.

Beyond Evaluation Basis Accident: An accident, generally with more severe impacts to on-site personnel and the public than a Evaluation Basis Accident or Design Basis Accident (DBA), initiated by operational or external causes with an estimated probability of occurrence less than 10^{-6} per year and used for estimating the impacts of a planned new or modified facility and/or process. For those cases where a DBA is defined, these accidents are often referred to as Beyond Design Basis Accidents or Severe Accidents.

Cask (radioactive materials): A container that meets all applicable regulatory requirements for shipping spent nuclear fuel or high-level waste.

Category I, II, III, IV: Designated categories of nuclear material used in the implementation of Department of Energy's graded safeguards program. The material category of a Special Nuclear Materials location (e.g., material balance area, material access area, protested area, facility) is used to determine and establish the required protection level. Determination of category involves grouping materials by Special Nuclear Material type, attractiveness level, and quantity. Material quantities are element weights for plutonium and ^{233}U and isotope weights for ^{235}U. The table shows category levels for ^{235}U and attractiveness level.

	Attractiveness Level	Contained U-235 Category (quantities in kgs)			
		I	II	III	IV[a]
WEAPONS Assembled weapons and test devices	**A**	**All**	**N/A**	**N/A**	**N/A**
PURE PRODUCTS Pits, major components, button ingots, recastable metal, directly convertible materials	**B**	**$5**	**$1<5**	**$0.4<1**	**<0.4**
HIGH-GRADE MATERIALS	**C**	**$20**	**$6<20**	**$2<6**	**<2**
LOW-GRADE MATERIALS	**D**	**N/A**	**$50**	**$8<50**	**<8**

[a] The lower limit for Category IV is equal to reportable quantities.

Chemical oxygen demand: A measure of the quantity of chemically oxidizable components present in water.

Chronic exposure: Low-level radiation exposure incurred over a long period of time.

***Clean Air Act*:** This Act mandates and enforces air pollutant emissions standards for stationary sources and motor vehicles.

***Clean Air Act* Amendments of 1990:** Expands the Environmental Protection Agency's enforcement powers and adds restrictions on air toxics, ozone depleting chemicals, stationary and mobile emissions sources, and emissions implicated in rain and global warming.

***Clean Water Act* of 1972, 1987:** This Act regulates the discharge of pollutants from a point source into navigable waters of the United States in compliance with an National Pollution Discharge Elimination System permit as well as regulates discharges to or dredging of wetlands.

Climatology: The science that deals with climates and investigates their phenomena and causes.

***Code of Federal Regulations* (CFR):** All Federal regulations in force are published in codified form in the *Code of Federal Regulations*.

Collective committed effective dose equivalent (CEDE): The CEDE of radiation for a population.

Committed dose equivalent: The predicted total dose equivalent to a tissue or organ over a 50-year period after an intake of radionuclide into the body. It does not include external dose contributions. Committed dose equivalent is expressed in units of rem or Sievert. The committed effective dose equivalent is the sum of the committed dose equivalents to various tissues of the body, each multiplied by the appropriate weighting factor.

***Comprehensive Environmental Response, Compensation, and Liability Act* of 1980 (CERCLA or Superfund):** This act provides regulatory framework for remediation of past contamination from hazardous waste. If a site meets the act's requirements for designation, it is ranked along with other "Superfund" sites and is listed on the National Priorities List. This ranking is the Environmental Protection Agency's way of determining which sites have the highest priority for cleanup.

Comprehensive Test Ban Treaty (CTBT): A proposed treaty prohibiting nuclear tests of all magnitudes.

Conceptual design: Efforts to develop a project scope that will satisfy program needs; ensure project feasibility and attainable performance levels of the project for congressional consideration; develop project criteria and design parameters for all engineering disciplines; and identify applicable codes and standards, quality assurance requirements, environmental studies, construction materials, space allowances, energy conservation features, health, safety, safeguards, and security requirements and any other features or requirements necessary to describe the project.

Credible accident: An accident that has a probability of occurrence greater than or equal to one in a million years.

Criteria pollutants: Six air pollutants for which national ambient air quality standards are established by the Environmental Protection Agency under Title I of the Federal *Clean Air Act*: sulfur dioxide, nitrogen oxides, carbon monoxide, ozone, particulate matter (smaller than 10 microns in diameter), and lead.

Critical habitat: Defined in the *Endangered Species Act* of 1973 as "specific areas within the geographical area occupied by [an endangered or threatened] species..., essential to the conservation of the species and which may require special management considerations or protection; and specific areas outside the geographical area occupied by the species... that are essential for the conservation of the species."

Criticality: The condition in which nuclear fuel sustains a chain reaction. It occurs when the number of neutrons present in one generation cycle equals the number generated in the previous cycle.

Cultural resources: Archaeological sites, architectural features, traditional use areas, and Native American sacred sites or special use areas.

Cumulative impacts: In an EIS, the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal), private industry, or individuals undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time (40 CFR 1508.7).

Decommissioning: The process of withdrawing a building, equipment, or a facility from active service.

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

Depleted uranium: Uranium whose content of the isotope uranium-235 is less than 0.7 percent, which is the uranium-235 content of naturally occurring uranium.

Direct economic effects: The initial increases in output from different sectors of the economy resulting from some new activity within a predefined geographic region.

Direct Effect Multiplier: The total change in regional earnings and employment in all related industries as a result of a one-dollar change in earnings and a one-job change in a given industry.

Direct jobs: The number of workers required at a site to implement an alternative.

Disposition: The ultimate "fate" or end use of a surplus Department of Energy facility following the transfer of the facility to the Office of the Assistant Secretary for Environmental Waste Management.

Dose: The energy imparted to matter by ionizing radiation. The unit of absorbed dose is the rad.

Dose commitment: The dose an organ or tissue would receive during a specified period of time (e.g., 50 to 100 years) as a result of intake (as by ingestion or inhalation) of one or more radionuclides from a defined release, frequently over a year's time.

Dose equivalent: The product of absorbed dose in rad (or gray) and the effect of this type of radiation in tissue, and a quality factor. Dose equivalent is expressed in units of rem or Sievert, where 1 rem equals 0.01 Sievert. The dose equivalent to an organ, tissue, or the whole body will be that received from the direct exposure plus the 50-year committed dose equivalent received from the radionuclides taken into the body during the year.

Dosimeter: A small device (instrument) carried by a radiation worker that measures cumulative radiation dose (e.g., TLD - thermoluminescent badge or ionization chamber).

Drinking-water standards: The prescribed level of constituents or characteristics in a drinking water supply that cannot be exceeded legally.

Dual use/dual benefit: Projects that have uses in or benefits for the defense sector and the private industry or civilian sector.

Effective dose equivalent (EDE): The summation of the products of the dose equivalent received by specified tissues of the body and a tissue-specific weighting factor. This sum is a risk-equivalent value and can be used to estimate the health effects risk of the exposed individual. The tissue-specific weighting factor represents the fraction of the total health risk resulting from uniform whole-body irradiation that would be contributed by that particular tissue. The EDE includes the CEDE from internal deposition of radionuclides, and the effective dose equivalent due to penetrating radiation from sources external to the body. EDE is expressed in units of rem (or Sievert).

Effluent: A gas or fluid discharged into the environment.

Emission standards: Legally enforceable limits on the quantities and/or kinds of air contaminants that can be emitted into the atmosphere.

Endangered species: Defined in the *Endangered Species Act* of 1973 as "any species which is in danger of extinction throughout all or a significant portion of its range."

***Endangered Species Act* of 1973:** This act requires Federal agencies, with the consultation and assistance of the Secretaries of the Interior and Commerce, to ensure that their actions will not likely jeopardize the continued existence of any endangered or threatened species or adversely affect the habitat of such species.

Enduring stockpile: Weapons types expected to be retained in the smaller stockpile for the foreseeable future.

Environment, safety and health (ES&H) program: In the context of the Department of Energy, encompasses those Department of Energy requirements, activities, and functions in the conduct of all Department of Energy and Department of Energy-controlled operations that are concerned with: impacts to the biosphere; compliance with environmental laws, regulations, and standards controlling air, water, and soil pollution; limiting the risks to the well-being of both operating personnel and the general public to acceptably low levels; and protecting property adequately against accidental loss and damage. Typical activities and functions related to this program include, but are not limited to, environmental protection, occupational safety, fire protection, industrial hygiene, health physics, occupational medicine, and process and facilities safety, nuclear safety, emergency preparedness, quality assurance, and radioactive and hazardous waste management.

Environmental assessment (EA): A written environmental analysis that is prepared pursuant to the *National Environmental Policy Act* to determine whether a Federal action would significantly affect the environment and thus require preparation of a more detailed environmental impact statement. If the action would not significantly affect the environment, then a finding of no significant impact is prepared.

Environmental impact statement (EIS): A document required of Federal agencies by the *National Environmental Policy Act* for major proposals significantly affecting the environment. A tool for decision-making, it describes the positive and negative effects of the undertaking and alternative actions.

Environmental justice: The fair treatment of people of all races, cultures, incomes, and educational levels with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. Fair treatment implies that no population of people should be forced to shoulder a disproportionate share of the negative environmental impacts of pollution or environmental hazards due to a lack of political or economic strength.

Environmental survey: A documented, multidisciplined assessment (with sampling and analysis) of a facility to determine environmental conditions and to identify environmental problems requiring corrective action.

Epicenter: The point on the Earth's surface directly above the focus of an earthquake.

Epidemiology: The science concerned with the study of events that determine and influence the frequency and distribution of disease, injury, and other health-related events and their causes in a defined human population.

ES&H vulnerabilities: Conditions or weaknesses at facilities that could lead to unnecessary or increased exposure of workers or the public to radiation or to HEU associated chemical hazards, or to the release of radioactive materials to the environment.

Evaluation Basis Accident: An accident, generally with small impacts to the public, initiated by operational or external causes with an estimated probability of occurrence greater than 10^{-6} per year and used for estimating the impacts of a planned new or modified facility and/or process when a Safety Analysis Report, that would define a DBA, has not been prepared. A DBA is used to establish the performance requirements of structures, systems, and components that are necessary to maintain them in a safe shutdown condition indefinitely or to prevent or mitigate the consequences of the DBA so that the public and onsite personnel are not exposed to radiation in excess of appropriate guideline values.

Exposure limit: The level of exposure to a hazardous chemical (set by law or a standard) at which or below which adverse human health effects are not expected to occur:

- Reference dose is the chronic exposure dose (mg or kg per day) for a given hazardous chemical at which or below which adverse human non-cancer health effects are not expected to occur.

- Reference concentration is the chronic exposure concentration (mg/M^3) for a given hazardous chemical at which or below which adverse human non-cancer health effects are not expected to occur.

Fault: A fracture or a zone of fractures within a rock formation along which vertical, horizontal, or transverse slippage has occurred. A normal fault occurs when the hanging wall has been depressed in relation to the footwall. A reverse fault occurs when the hanging wall has been raised in relation to the footwall.

Finding of No Significant Impact (FONSI): A document by a Federal agency briefly presenting the reasons why an action, not otherwise excluded, will not have a significant effect on the human environment and will not require an environmental impact statement.

Fissile material: Any material capable of supporting a self-sustaining neutron chain reaction to include uranium-233, enriched uranium, plutonium-239, plutonium-241, americium-242, curium-243, curium-245,-247, californium-249,-251.

Floodplain: The lowlands adjoining inland and coastal waters and relatively flat areas including at a minimum that area inundated by a 1-percent or greater chance flood in any given year. The base floodplain is defined as the 100-year (1.0 percent) floodplain. The critical action floodplain is defined as the 500-year (0.2 percent) floodplain.

Formation: In geology, the primary unit of formal stratigraphic mapping or description. Most formations possess certain distinctive features.

Fugitive emissions: Emissions to the atmosphere from pumps, valves, flanges, seals, and other process points not vented through a stack. Also includes emissions from area sources such as ponds, lagoons, landfills, and piles of stored material.

Gamma rays: High-energy, short-wavelength, electromagnetic radiation accompanying fission and emitted from the nucleus of an atom. Gamma rays are very penetrating and can be stopped only by dense materials (such as lead) or a thick layer of shielding materials.

Gaussian plume: The distribution of material (a plume) in the atmosphere resulting from the release of pollutants from a stack or other source. The distribution of concentrations about the centerline of the plume, which is assumed to decrease as a function of its distance from the source and centerline (Gaussian distribution), depends on the mean wind speed and atmospheric stability.

Genetic effects: The outcome resulting from exposure to mutagenic chemicals or radiation which results in genetic changes in germ line or somatic cells.

- Effects on genetic material in germ line (sex cells) cause trait modifications that can be passed from parents to offspring.

- Effects on genetic material in somatic cells result in tissue or organ modifications (e.g. liver tumors) that do not pass from parents to offspring.

Glove box: An airtight box used to work with hazardous material, vented to a closed filtering system, having gloves attached inside of the box to protect the worker.

Hazard chemical: Under 29 CFR 1910, Subpart Z, "hazardous chemicals" are defined as "any chemical which is a physical hazard or a health hazard." Physical hazards include combustible liquids, compressed gases, explosives, flammables, organic peroxides, oxidizers, pyrophorics, and reactives. A health hazard is any chemical for which there is good evidence that acute or chronic health effects occur in exposed employees. Hazardous chemicals include carcinogens, toxic or highly toxic agents, reproductive toxins, irritants, corrosives, sensitizers, hepatotoxins, nephrotoxins, agents that act on the hematopoietic system, and agents that damage the lungs, skin, eyes or mucous membranes.

Hazard Index (HI): A summation of the hazard quotient for all chemicals now being used at a site and those proposed to be added to yield cumulative levels for a site. A HI value of 1.0 or less means that no adverse human health effects (non-cancer) are expected to occur.

Hazard quotient (HQ): The ratio of the estimated exposure (e.g., daily intake rate) to be expected to have no adverse effects. It is independent of a cancer risk, which is calculated only for those chemicals identified as carcinogens.

Hazardous material: A material, including a hazardous substance, as defined by 49 CFR 171.8 which poses a risk to health, safety, and property when transported or handled.

Hazardous/toxic waste: Any solid waste (can also be semisolid or liquid, or contain gaseous material) having the characteristics of ignitability, corrosivity, toxicity, or reactivity, defined by the *Resource Conservation and Recovery Act* and identified or listed in 40 CFR 261 or by the *Toxic Substances Control Act*.

Heavy metals: Metallic or semimetallic elements of high molecular weight, such as mercury, chromium, cadmium, lead, and arsenic, that are toxic to plants and animals at known concentrations.

High-efficiency particulate air (HEPA) filter: A filter used to remove particulates from dry gaseous effluent streams.

High-level waste: The highly radioactive waste 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. High-level waste contains a combination of transuranic waste and fission products in concentrations requiring permanent isolation.

Highly enriched uranium (HEU): Uranium in which the abundance of the isotope ^{235}U is increased well above normal (naturally occurring) levels.

Historic resources: Archaeological sites, architectural structures, and objects produced after the advent of written history dating to the time of the first Euro-American contact in an area.

Hydrology: The science dealing with the properties, distribution, and circulation of natural water systems.

Incident-free risk: The radiological or chemical impacts resulting from packages aboard vehicles in normal transport. This includes the radiation or hazardous chemical exposure of specific population groups such as crew, passengers, and bystanders.

Indirect economic effects: Indirect effects result from the need to supply industries experiencing direct economic effects with additional outputs to allow them to increase their production. The additional output from each directly affected industry requires inputs from other industries within a region (i.e., purchases of goods and services). This results in a multiplier effect to show the change in total economic activity resulting from a new activity in a region.

Induced economic effects: The spending of households resulting from direct and indirect economic effects. Increases in output from a new economic activity lead to an increase in household spending throughout the economy as firms increase their labor inputs.

Indirect jobs: Within a regional economic area, jobs generated or lost in related industries as a result of a change in direct employment.

Interim (permit) status: Period during which treatment, storage, and disposal facilities coming under the *Resource Conservation and Recovery Act* of 1980 are temporarily permitted to operate while awaiting denial or issuance of a permanent permit.

Ionizing radiation: Alpha particles, beta particles, gamma rays, x rays, neutrons, high speed electrons, high speed protons, and other particles or electromagnetic radiation that can displace electrons from atoms or molecules, thereby producing ions.

Isotope: An atom of a chemical element with a specific atomic number and atomic mass. Isotopes of the same element have the same number of protons but different numbers of neutrons and different atomic masses.

Lacustrine wetland: Lakes, ponds, and other enclosed open waters at least 8 ha (20 acres) in extent and not dominated by trees, shrubs, and emergent vegetation.

Large release: A release of radioactive material that would result in doses greater than 25 rem to the whole body or 300 rem to the thyroid at 1.6 km from the control perimeter (security fence) of a reactor facility.

Laser: A device that produces a beam of monochromatic (single-color) "light" in which the waves of light are all in phase. This condition creates a beam that has relatively little scattering and has a high concentration of energy per unit area.

Latent fatalities: Fatalities associated with acute and chronic environmental exposures to chemicals or radiation.

Low-level waste: Waste that contains radioactivity but is not classified as high-level waste, transuranic waste, spent nuclear fuel, or "11e(2) by-product material" as defined by DOE Order 5820.2A, *Radioactive Waste Management*. Test specimens of fissionable material irradiated for research and development only, and not for the production of power or plutonium, may be classified as low-level waste, provided the concentration of transuranic waste is less than 100 nanocuries per gram. Some low-level waste is considered classified because (1) the nature of the generating process and/or constituents, and (2) the waste would reveal too much about the generating process.

Manufacturing: see "production."

Maximum contaminant level: The maximum permissible level of a contaminant in water delivered to any user of a public water system. Maximum contaminant levels are enforceable standards.

Maximally exposed individual (MEI): A hypothetical person who could potentially receive the maximum dose of radiation or hazardous chemicals.

Meteorology: The science dealing with the atmosphere and its phenomena, especially as relating to weather.

Migration: The natural movement of a material through the air, soil, or groundwater; also, seasonal movement of animals from one area to another.

Mixed waste: Waste that contains both “hazardous waste” and “radioactive waste” as defined in this glossary.

Modified Mercalli intensity: A level on the modified Mercalli scale. A measure of the perceived intensity of earthquake ground shaking with 12 divisions, from I (not felt by people) to XII (damage nearly total).

National Ambient Air Quality Standards (NAAQS): Air quality standards established by the *Clean Air Act,* as amended. The primary NAAQS are intended to protect the public health with an adequate margin of safety, and the secondary NAAQS are intended to protect the public welfare from any known or anticipated adverse effects of a pollutant.

National Emission Standards for Hazardous Air Pollutants (NESHAP): A set of NESHAP emitted from specific classes or categories of new and existing sources. These were implemented in the *Clean Air Act* Amendments of 1977.

***National Environmental Policy Act* of 1969 (NEPA):** This Act is the basic national charter for the protection of the environment. It requires the preparation of an environmental impact statement for every major Federal action that may significantly affect the quality of the human or natural environment. Its main purpose is to provide environmental information to decision makers and the public so that actions are based on an understanding of the potential environmental consequences of a proposed action and its reasonable alternatives.

National Environmental Research Park (NERP): An outdoor laboratory set aside for ecological research to study the environmental impacts of energy developments. NERPs were established by the Department of Energy to provide protected land areas for research and education in the environmental sciences and to demonstrate the environmental compatibility of energy technology development and use.

***National Historic Preservation Act* of 1966, as amended (NHPA):** This Act provides that property resources with significant national historic value be placed on the National Register of Historic Places. It does not require any permits but, pursuant to Federal code, if a proposed action might impact an historic property resource, it mandates consultation with the proper agencies.

National Pollutant Discharge Elimination System (NPDES): Federal permitting system required for hazardous effluents regulated through the *Clean Water Act,* as amended.

National Register of Historic Places (NRHP): A list maintained by the Secretary of the Interior of districts, sites, buildings, structures, and objects of prehistoric or historic local, state, or national significance. The list is expanded as authorized by Section 2(b) of the *Historic Sites Act* of 1935 (16 U.S.C. 462) and Section 101(a)(1)(A) of the NHPA of 1966, as amended.

Nitrogen oxides (NOX): Refers to the oxides of nitrogen, primarily NO (nitrogen oxide) and NO_2 (nitrogen dioxide). These are produced in the combustion of fossil fuels and can constitute an air pollution problem. When nitrogen dioxide combines with volatile organic compounds, such as ammonia or carbon monoxide, ozone is produced.

Nonattainment area: An air quality control region (or portion thereof) in which the Environmental Protection Agency has determined that ambient air concentrations exceed NAAQS for one or more criteria pollutants.

Nonproliferation Treaty: A treaty with the aim of controlling the spread of nuclear weapons technologies, limiting the number of nuclear weapons states and pursuing, in good faith, effective measures relating to the cessation of the nuclear arms race. The treaty does not invoke stockpile reductions by nuclear states, and it does not address actions of nuclear states in maintaining their stockpiles.

Nuclear facility: A facility whose operations involve radioactive materials in such form and quantity that a nuclear hazard potentially exists to the employees or the general public. Included are facilities that produce, process, or store radioactive liquid or solid waste, fissionable materials, or tritium; conduct separations operations; conduct irradiated materials inspection, fuel fabrication, decontamination, or recovery operations. Incidental use of radioactive materials in a facility operation (e.g.,check sources, radioactive sources, and X-ray machines) does not necessarily require a facility to be included in this definition.

Nuclear grade: Material of a quality adequate for use in a nuclear application.

Nuclear production: Production operations for components of nuclear weapons that are fabricated from nuclear materials, including plutonium and uranium.

Nuclear weapon: The general name given to any weapon in which the explosion results from the energy released by reactions involving atomic nuclei, either fission, fusion, or both.

Nuclear Weapons Complex: The sites supporting the research, development, design, manufacture, testing, assessment, certification and maintenance of the Nation's nuclear weapons and the subsequent dismantlement of retired weapons.

Occupational Safety and Health Administration (OSHA): Oversees and regulates workplace health and safety, created by the *Occupational Safety and Health Act* of 1970.

Off-site: As used in this EIS, the term denotes a location, facility, or activity occurring outside the boundary of the entire Oak Ridge Reservation site.

On-site: As used in this EIS, the term denotes a location or activity occurring somewhere within the boundary of the Oak Ridge Reservation.

On-site population: Department of Energy and contractor employees who are on duty, and badged on-site visitors.

Operable unit: A discrete action that comprises an incremental step toward comprehensively addressing site problems. This discrete portion of a remedial response manages migration or eliminates or mitigates a release, threat of release, or pathway of exposure. The cleanup of a site can be divided into a number of operable units.

Outfall: The discharge point of a drain, sewer, or pipe as it empties into a body of water.

Ozone: The triatomic form of oxygen; in the stratosphere, ozone protects the Earth from the sun's ultraviolet rays, but in lower levels of the atmosphere ozone is considered an air pollutant.

Packaging: The assembly of components necessary to ensure compliance with Federal regulations. It may consist of one or more receptacles, absorbent materials, spacing structures, thermal insulation, radiation shielding, and devices for cooling or absorbing mechanical shocks. The vehicle tie-down system and auxiliary equipment may be designated as part of the packaging.

Palustrine wetland: Nontidal wetlands dominated by trees, shrubs, and emergent vegetation.

Perched groundwater: A body of groundwater of small lateral dimensions lying above a more extensive aquifer.

Performance Categories (PC): Defined in DOE O 420.1, performance categories classify the performance goals of a facility in terms of facility's structural ability to withstand natural phenomena hazards (i.e., earthquakes, winds, and floods). Ranging from 0 to 4, each PC has a qualitative and quantitative description of the performance goal for its category. Both the qualitative description of acceptable performance and the quantitative probability for each PC are equally significant in establishing the design and evaluation criteria. In general, facilities that are classified as (1) PC 0 do not consider safety, mission, or cost considerations, (2) PC 1 must maintain occupant safety, (3) PC 2 must maintain occupant safety and continued operations with minimum interruption, (4) PC 3 must maintain occupant safety, continued operations, and hazard materials confinement, and (5) PC 4 must meet occupant safety, continued operations, and confidence of hazard confinement**.**

Person-rem: The unit of collective radiation dose commitment to a given population; the sum of the individual doses received by a population segment.

Physical setting: The land and water form, vegetation, and structures that compose the landscape.

Plume: The elongated pattern of contaminated air or water originating at a point source, such as a smokestack or a hazardous waste disposal site.

Plutonium: A heavy, radioactive, metallic element with the atomic number 94. It is produced artificially in a reactor by bombardment of uranium with neutrons and is used in the production of nuclear weapons.

Prehistoric: Predating written history, in North America, also predating contact with Europeans.

Prevention of Significant Deterioration: Regulations established by the 1977 *Clean Air Act* Amendments to limit increases in criteria air pollutant concentrations above baseline.

Prime farmland: Land that has the best combination of physical and chemical characteristics for producing food, feed, fiber, forage, oilseed, and other agricultural crops with minimum inputs of fuel, fertilizer, pesticides, and labor without intolerable soil erosion, as determined by the Secretary of Agriculture (*Farmland Protection Policy Act* of 1981, 7 CFR 7, paragraph 658).

Probable maximum flood: Flood levels predicted for a scenario having hydrological conditions that maximize the flow of surface waters.

Production: Encompasses the fabrication, processing, assembly, and acceptance testing of nuclear weapons and nuclear weapon components, and is interchangeable with the term manufacturing.

Programmatic Environmental Impact Statement (PEIS): A legal document prepared in accordance with the requirements of 102(2)(C) of NEPA which evaluates the environmental impacts of proposed Federal actions that involve multiple decisions potentially affecting the environment at one or more sites.

Project-specific EIS: A legal document prepared in accordance with the requirements of 102(2)(C) of NEPA which evaluates the environmental impacts of a single action at a single site.

Proliferation: The spread of nuclear weapons and the materials and technologies used to produce them.

Protected area: An area encompassed by physical barriers, subject to access controls, surrounding material access areas, and meeting the standards of DOE Order 5632.1C, *Protection and Control of Safeguards and Security Interests.*

Quality factor: The principal modifying factor that is employed to derive dose equivalent from absorbed dose.

Rad: See "radiation absorbed dose."

Radiation: The particles or electromagnetic energy emitted from the nuclei of radioactive atoms. Some elements are naturally radioactive; others are induced to become radioactive by bombardment in a reactor. Naturally occurring radiation is indistinguishable from induced radiation.

Radiation absorbed dose: The basic unit of absorbed dose equal to the absorption of 0.01 joule per kilogram of absorbing material.

Radioactive waste: Materials from nuclear operations that are radioactive or are contaminated with radioactive materials, and for which use, reuse, or recovery are impractical.

Radioactivity: The spontaneous decay or disintegration of unstable atomic nuclei, accompanied by the emission of radiation.

Radioisotopes: Radioactive nuclides of the same element (same number of protons in their nuclei) that differ in the number of neutrons.

Radionuclide: A radioactive element characterized according to its atomic mass and atomic number which can be man-made or naturally occurring. Radionuclides can have a long life as soil or water pollutants, and are believed to have potentially mutagenic or carcinogenic effects on the human body.

RADTRAN: A computer code combining user-determined meteorological, demographic, transportation, packaging, and material factors with health physics data to calculate the expected radiological consequences and accident risk of transporting radioactive material.

Reasonably Available Control Technology : The lowest emissions limit that a particular source is capable of meeting by the application of control technology that is reasonably available as well as technologically and economically feasible.

Receiving waters: Rivers, lakes, oceans, or other bodies of water into which wastewaters are discharged.

Recharge: Replenishment of water to an aquifer.

Record of Decision (ROD): A document prepared in accordance with the requirements of 40 CFR 1505.2 that provides a concise public record of Department of Energy's decision on a proposed action for which an EIS was prepared. A ROD identifies the alternatives considered in reaching the decision, the environmentally preferable alternative(s), factors balanced by Department of Energy in making the decision, whether all practicable means to avoid or minimize environmental harm have been adopted, and if not, why they were not.

Regional economic area: A geographic area consisting of an economic node and the surrounding counties that are economically related and include the places of work and residences of the labor force. Each regional economic area is defined by the U.S. Bureau of Economic Analysis.

Region of influence (ROI): A site-specific geographic area that includes the counties where approximately 90 percent of the current Department of Energy and/or contractor employees reside.

Rem: See "roentgen equivalent man."

Remediation: The process, or a phase in the process, of rendering radioactive, hazardous, or mixed waste environmentally safe, whether through processing, entombment, or other methods.

Replacement Secondary Fabrication: This function includes the fabrication, surveillance, and storage of the secondary uranium and lithium portion of a nuclear weapon.

***Resource Conservation and Recovery Act* (RCRA), as amended:** This Act provides "cradle to grave" regulatory program for hazardous waste which established, among other things, a system for managing hazardous waste from its generation until its ultimate disposal.

Riparian wetlands: Wetlands on or around rivers and streams.

Risk: A quantitative or qualitative expression of possible loss that considers both the probability that a hazard will cause harm and the consequences of that event.

Risk assessment (chemical or radiological): The qualitative and quantitative evaluation performed in an effort to define the risk posed to human health and/or the environment by the presence or potential presence and/or use of specific chemical or radiological materials.

Roentgen: A unit of exposure to ionizing X- or gamma radiation equal to or producing 1 electrostatic unit of charge per cubic centimeter of air. It is approximately equal to 1 rad.

Roentgen equivalent man (REM): The unit of radiation dose for biological absorption equal to the product of the absorbed dose, in rads, a quality factor which accounts for the variation in biological effectiveness of different types of radiation. Also known as "rem".

Runoff: The portion of rainfall, melted snow, or irrigation water that flows across the ground surface and eventually enters streams.

***Safe Drinking Water Act*, as amended:** This Act protects the quality of public water supplies, water supply and distribution systems, and all sources of drinking water.

Safe secure trailer (SST): A specially designed semitrailer, pulled by an armored tractor, which is used for the safe, secure transportation of cargo containing nuclear weapons or special nuclear material.

Safety Analysis Report: A safety document providing a concise but complete description and safety evaluation of a site, design, normal and emergency operation, potential accidents, predicted consequences of such accidents, and the means proposed to prevent such accidents or mitigate their consequences. A safety analysis report is designated as final when it is based on final design information. Otherwise, it is designated as preliminary.

Sanitary wastes: Wastes generated by normal housekeeping activities, liquid or solid (includes sludge), which are not hazardous or radioactive.

Scope: In a document prepared pursuant to the NEPA of 1969, the range of actions, alternatives, and impacts to be considered.

Scoping: Involves the solicitation of comments from interested persons, groups, and agencies at public meetings, public workshops, in writing, electronically, or via fax to assist Department of Energy in defining the proposed action, identifying alternatives, and developing preliminary issues to be addressed in an EIS.

Secondary: See “weapon secondary.”

Security: Minimizing the likelihood of unauthorized access to or loss of custody of a nuclear weapon or weapon system, and ensuring that the weapon can be recovered should unauthorized access or loss of custody occur.

Seismic: Pertaining to any earth vibration, especially an earthquake.

Seismic zone: An area defined by the Uniform Building Code (1991), designating the amount of damage to be expected as the result of earthquakes. The United States is divided into six zones: (1) Zone 0 - no damage; (2) Zone 1 - minor damage; corresponds to intensities V and VI of the modified Mercalli intensity scale; (3) Zone 2A - moderate damage; corresponds to intensity VII of the modified Mercalli intensity scale (eastern U.S.); (4) Zone 2B - slightly more damage than 2A (western U.S.); (5) Zone 3 - major damage; corresponds to intensity VII and higher of the modified Mercalli intensity scale; and (6) Zone 4 - areas within Zone 3 determined by proximity to certain major fault systems.

Seismicity: The tendency for the occurrence of earthquakes.

Severe accident: An accident with a frequency rate of less than 10^{-6} per year that would have more severe consequences than a design-basis accident, in terms of damage to the facility, offsite consequences, or both.

Shielding: Any material of obstruction (bulkheads, walls, or other constructions) that absorbs radiation in order to protect personnel or equipment.

Short-lived nuclides: Radioactive isotopes with half-lives no greater than about 30 years (e.g., cesium^{137} and strontium^{90}).

Shrink-swell potential: Refers to the potential for soils to contract while drying and expand after wetting.

Silt: A sedimentary material consisting of fine mineral particles intermediate in size between sand and clay.

Siltstone: A sedimentary rock composed of fine textured minerals.

Site-Wide EIS (SWEIS): A legal document prepared in accordance with the requirements of 102(2)(C) of NEPA which evaluates the environmental impacts of many actions at one large, multiple-facility Department of Energy site. Site-wide EISs are used to support programmatic and specific decisions.

Source term: The estimated quantities of radionuclides or chemical pollutants released to the environment.

Special nuclear materials (SNM): As defined in Section 11 of the *Atomic Energy Act* of 1954, special nuclear material means (1) plutonium, uranium enriched in the isotope 233 or in the isotope 235, and any other material which the Nuclear Regulatory Commission determines to be special nuclear material, or (2) any material artificially enriched by any of the foregoing.

Standardization (Epidemiology): Techniques used to control the effects of differences (e.g., age) between populations when comparing disease experience. The two main methods are:

- Direct method, in which specific disease rates in the study population are averaged, using as weights the distribution of the comparison population.

- Indirect method, in which the specific disease rates in the comparison population are averaged, using as weights the distribution of the study population.

Strategic Arms Reduction Talks (START) I and II: Terms which refer to negotiations between the U.S. and Russia (the former Soviet Union during START I negotiations) aimed at limiting and reducing nuclear arms. START I discussions began in 1982 and eventually led to a ratified treaty in 1988. The START II protocol, which in December 2000, will attempt to further reduce the acceptable levels of nuclear weapons ratified in START I.

Strategic reserve: That quantity of plutonium and highly enriched uranium reserved for future weapons use. For the purposes of this SWEIS, strategic reserves of plutonium will be in the form of pits, and strategic reserves of highly enriched uranium will be in the form of canned secondary assemblies. Strategic reserves also include limited quantities of plutonium and highly enriched uranium metal maintained as working inventory at Department of Energy laboratories.

***Superfund Amendments and Reauthorization Act* (SARA) of 1986:** Public Law 99-499 passed in 1986 which amends the CERCLA of 1980. SARA more stringently defines hazardous waste cleanup standards and emphasizes remedies that permanently and significantly reduce the mobility, toxicity, or volume of wastes. Title III of SARA, the Emergency Planning and Community Right-to-Know Act, mandates establishment of community emergency planning programs, emergency notification, reporting of chemicals, and emission inventories.

Surface water: Water on the Earth's surface, as distinguished from water in the ground (groundwater).

Threatened species: Any species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.

Threshold limit values: The recommended concentrations of contaminants workers may be exposed to according to the American Council of Governmental Industrial Hygienists.

***Toxic Substances Control Act* of 1976 (TSCA):** This act authorizes the Environmental Protection Agency to secure information on all new and existing chemical substances and to control any of these substances determined to cause an unreasonable risk to public health or the environment. This law requires that the health and environmental effects of all new chemicals be reviewed by the Environmental Protection Agency before they are manufactured for commercial purposes.

Transuranic waste: Waste contaminated with alpha-emitting radionuclides with half-lives greater than 20 years and concentrations greater than 100 nanocuries/gram at time of assay.

Unclassified Controlled Nuclear Information (UCNI): Certain unclassified but sensitive Government information concerning nuclear material, weapons, and components whose dissemination is controlled under section 148 of the *Atomic Energy Act*.

Unusual occurrence: Any unusual or unplanned event that adversely affects or potentially affects the performance, reliability, or safety of a facility.

Uranium: A naturally occurring heavy, silvery-white metallic element (atomic number 92) with many radioactive isotopes. Uranium-235 is most commonly used as a fuel for nuclear fission. Another isotope, uranium-238, can be transformed into fissionable plutonium-239 following its capture of a neutron in a nuclear reactor.

Volatile organic compound: A broad range of organic compounds, often halogenated, that vaporize at ambient or relatively low temperatures, such as benzene, chloroform, and methyl alcohol.

Visual Resource Management (VRM) Class: Port of BLM's visual resource inventory process that provides a means for determining visual values, consisting of scenic quality evaluation, sensitivity level analysis, and delineation of distance zones. Classes are established through a resource management planning (RMP) process and are ultimately based on management decisions made in the RMPs. Classes range from VRM Class I (highly scenic) to VRM Class IV (industrialized, low scenic quality). Management objectives for these classes are: Class I, preserve existing character of landscape; Class II, retain existing character of landscape with little change that respects basic elements of landscape; Class III, partially retain existing character of landscape with moderate changes that do not dominate view of casual observer; and Class IV, major modifications of existing character of landscape that dominate viewer's attention.

War Reserve: Operational weapons and materials designated as essential for national security needs.

Waste Isolation Pilot Plant (WIPP): A facility in southeastern New Mexico developed as the disposal site for transuranic waste.

Waste minimization and pollution prevention: An action that economically avoids or reduces the generation of waste and pollution by source reduction, reducing the toxicity of hazardous waste and pollution, improving energy use, or recycling. These actions will be consistent with the general goal of minimizing present and future threats to human health, safety, and the environment.

Weapon secondary: Provides additional explosive energy release; composed of lithium deuteride and other materials. As the secondary implodes, the lithium in the isotope form lithium-6 is converted to tritium by neutron interactions, and the tritium product in turn undergoes fusion with the deuterium to create the thermonuclear explosion.

Weapons-grade: Fissionable material in which the abundance of fissionable isotopes is high enough that the material is suitable for use in thermonuclear weapons.

Weighting factor: Represents the fraction of the total health risk resulting from uniform whole-body irradiation that could be contributed to that particular tissue.

Wetland: Land or areas exhibiting hydric soil conditions, saturated or inundated soil during some portion of the year, and plant species tolerant of such conditions.

Whole-body dose: Dose resulting from the uniform exposure of all organs and tissues in a human body. (Also, see "effective dose equivalent.")

Wind rose: A depiction of wind speed and direction frequency for a given period of time.

Worker year: Measurement of labor requirement equal to 1 full-time worker employed for 1 year.

CHAPTER 12: LIST OF AGENCIES, ORGANIZATIONS, AND PERSONS TO WHOM COPIES OF THIS STATEMENT WERE SENT

This chapter lists agencies, organizations, and persons who requested the Summary, Volume I, and Volume II or the Summary of the *Draft Site-Wide Environmental Impact Statement for the Oak Ridge Y-12 Plant*.

Federal Elected Officials
U.S. Representative John J. Duncan, Jr.
U.S. Senator Bill Frist, MD
U.S Representative Bart Gordon
U.S. Representative Van Hilleary
U.S. Senator Fred Thompson
U.S. Representative Zach Wamp

State Elected Officials
The Honorable Don Sundquist
Governor of Tennessee
Ben Atchley
State Senator
William Baird
State Representative - District 36
H.E. Bittle
State Representative - District 14
Tim Burchett
State Senator
Gene Caldwell, MD
State Representative - District 33
Lincoln Davis
State Senator
Dennis Ferguson
State Representative - District 32
Douglas Gunnels
State Representative - District 21
Joe McCord
State Representative - District 8
Jeff Miller
State Senator
Harry Tindell
State Representative - District 13

Local Officials
Mayor, City of Harriman
Mayor, City of Clinton
Mayor, City of Rockwood
Mayor, City of Oak Ridge
Mayor, City of Kingston
Mayor, City of Oliver Springs

City Manager, City of Oak Ridge
City Manager, City of Clinton
Vice Mayor, City of Oak Ridge
Anderson County Executive
Loudon County Executive
Knox County Executive
Roane County Executive
Oak Ridge City Council
Environmental Quality Advisory Board, City of Oak Ridge

Federal Agencies
Tennessee Valley Authority
U.S. Fish and Wildlife Service
U.S. Environmental Protection Agency
Defense Logistics Agency

State Agencies
North Carolina Department of Administration
Tennessee Department of Economic and Community Development
Tennessee Department of Health
Tennessee Division of Radiation Protection
Tennessee Commission on Indian Affairs
Tennessee Department of Environment and Conservation

Native American Tribes
Eastern Band of Cherokee Tribal Council
Cherokee Nation of Oklahoma - Muskogee Area Office
United Keetoowah Band Tribal Council

Organizations
EUCHEE
SCORE
EASI
Earth First!
Anderson Co. Development Corp.
PACE Intl. Union
Nuclear Control Institute
Community Reuse Org. of East Tennessee
League of Women Voters
East Tennessee Economic Council

Southeast Center for Ecological Awareness
East Tennessee Development District
Friends of ORNL
Oak Ridge Reservation Local Oversight Committee
Roane County Industrial Development Board
EUO
Presbytery of East Tennessee
Knox Area Chamber Partnership
The University of Tennessee
Advocates for ORR
SOCM
Oak Ridge Site Specific Advisory Board
Katuah Earth First!
Intl Guards Union of America, Local 3
OREPA/JPIC
LOC/CAP
Roane County Industrial Development Board
Association For Women in Science
United Plant Guard Workers of America, Local 109
Knoxville News-Sentinel
Anderson County Chamber of Commerce
Western NC Physicians for Social
Responsibility
Atomic Trades and Labor Council
Roane County Environmental Review Board
TN Nature Conservancy
Oak Ridge Committees Allied
Roane County Chamber of Commerce

Individuals

Angi Agle
Steven Alexander
Corky Allen
Charlie Anderson
Mike Arms
Dr. Darryl Armstrong
Victor Ashe
James Aslinger
Dale Atkins
Daniel M. Axelrod
Brian Bailey
Dean Ball
Fanny Ball
John Ballard
David Barncord
Sherry Barron
David J. Bean
David Bear
Terry Beder
Brenda Bell
Foelena Bentley
Cathie Berrey
Doug Berry
Dr. Bill Bibb
Yvonne M. Bishop
R. C. Blaum
K.P. Bowling
Norman Bowman
Norm Brandon
Larissa Brass
Jeff Britton
Lorrean Brown
David L. Brown
Joey Brown
Walt Brown
John Brummell
Ed Burns
D. L. Bush
Todd Butz
Jim Campbell
Tony Cappiello
David Castleberry
Bob Cayler
W. L. Chamblee
Steve Chandler
Paul Chapman
Steve Chase
Richard Chinn, Sr.
Mike Church
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Tina Johnson
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Dev Joslin
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Randy Lawson
Ronnie Lawson
Stella Lawson
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