

TABLE OF CONTENTS

<u>Section</u>	<u>Page</u>
COVER SHEET	iii
FOREWORD	v
ACRONYMS, ABBREVIATIONS, AND USE OF SCIENTIFIC NOTATION	xvi
1 INTRODUCTION	1-1
1.1 Background.....	1-1
1.1.1 Historic Missions	1-1
1.1.2 Fuel Cycle	1-1
1.1.3 Changing Missions.....	1-4
1.1.4 Stabilization.....	1-4
1.1.5 Spent Nuclear Fuel Consolidation.....	1-4
1.1.6 Preparation for Disposition.....	1-5
1.2 Purpose and Need for Action	1-5
1.3 Scope.....	1-5
1.4 Decisions to be Based on this EIS	1-7
1.5 Spent Nuclear Fuel Groups.....	1-7
1.5.1 Comparison of Spent Nuclear Fuel Groups.....	1-12
1.6 Relevant Documents.....	1-13
1.6.1 National Environmental Policy Act Documents.....	1-13
1.6.2 Other Relevant Documents	1-18
References	1-19
2 PROPOSED ACTION AND ALTERNATIVES	2-1
2.1 Proposed Action.....	2-1
2.2 Spent Nuclear Fuel Management Technology Options.....	2-2
2.2.1 Repository Considerations.....	2-4
2.2.2 Facilities	2-7
2.2.3 New Packaging Technology Options.....	2-8
2.2.3.1 Prepare for Direct Disposal/Direct Co-Disposal.....	2-8
2.2.3.2 Repackage and Prepare to Ship to Other DOE Sites.....	2-9
2.2.4 New Processing Technology Options	2-9
2.2.4.1 Melt and Dilute.....	2-11
2.2.4.2 Mechanical Dilution.....	2-12
2.2.4.3 Vitrification Technologies	2-15
2.2.4.4 Electrometallurgical Treatment.....	2-16
2.2.5 Conventional Processing Technology	2-17
2.3 Spent Nuclear Fuel Management Facilities.....	2-18
2.3.1 Existing Facilities.....	2-18
2.3.1.1 L-Reactor Facility	2-18
2.3.1.2 Receiving Basin for Offsite Fuel.....	2-20
2.3.1.3 F and H Canyons	2-23
2.3.2 Proposed Facilities	2-24
2.3.2.1 Transfer and Storage Facility	2-24

2.3.2.2 Transfer, Storage, and Treatment Facility.....	2-30
--	------

TABLE OF CONTENTS (Continued)

<u>Section</u>		<u>Page</u>
2.4	Alternatives Evaluated.....	2-35
2.4.1	Minimum Impact Alternative.....	2-35
2.4.2	Maximum Impact Alternative.....	2-37
2.4.3	Preferred Alternative	2-38
2.4.3.1	Melt And Dilute	2-38
2.4.3.2	Conventional Processing.....	2-41
2.4.3.3	Repackaging	2-43
2.4.3.4	Continued Wet Storage	2-43
2.4.4	Direct Disposal Alternative	2-43
2.4.5	No-Action Alternative: Continued Wet Storage.....	2-44
2.4.6	Alternatives Not Analyzed in Detail.....	2-45
2.5	Comparison of Environmental Impacts Among Alternatives	2-45
2.6	Other Decisionmaking Factors	2-51
2.6.1	Technology Availability and Technical Feasibility	2-51
2.6.2	Nonproliferation, Safeguards and Security.....	2-53
2.6.3	Labor Availability and Core Competency	2-55
2.6.4	Minimum Custodial Care	2-56
2.6.5	Cost.....	2-56
	References	2-59
3	AFFECTED ENVIRONMENT	3-1
3.1	Geologic Setting and Seismicity.....	3-1
3.1.1	General Geology	3-1
3.1.2	Subsurface Features.....	3-5
3.1.3	Seismicity	3-5
3.2	Water Resources	3-5
3.2.1	Surface Water Resources	3-5
3.2.1.1	Savannah River.....	3-7
3.2.1.2	SRS Streams.....	3-7
3.2.1.3	Surface-Water Quality	3-9
EC	Groundwater Resources	3-10
3.2.2.1	Groundwater Features	3-10
3.2.2.2	Groundwater Use	3-16
3.2.2.3	SRS Hydrogeology.....	3-17
3.2.2.4	Groundwater Quality.....	3-17
3.3	Air Resources.....	3-18
3.3.1	General Meteorology.....	3-18
3.3.2	Severe Weather	3-18
3.3.3	Radiological Air Quality	3-21
3.3.4	Nonradiological Air Quality	3-23
3.4	Ecological Resources.....	3-28
3.5	Socioeconomics.....	3-30
EC	3.5.1 Employment.....	3-30
	3.5.2 Population	3-30

3.5.3 Community Characteristics	3-31
---------------------------------------	------

TABLE OF CONTENTS (Continued)

<u>Section</u>	<u>Page</u>
3.6 Cultural Resources	3-32
3.7 Public and Worker Health	3-35
3.7.1 Public Radiological Health	3-35
3.7.2 Public Nonradiological Health	3-37
3.7.3 Worker Radiological Health	3-37
3.7.4 Worker Nonradiological Health	3-38
3.8 Waste and Materials.....	3-38
3.8.1 Waste management	3-38
3.8.1.1 Low-Level Radioactive Waste	3-39
3.8.1.2 Low-Level Mixed Waste	3-39
3.8.1.3 High-Level Waste	3-40
3.8.1.4 Sanitary Waste.....	3-40
3.8.1.5 Hazardous Waste.....	3-44
3.8.1.6 Transuranic and Alpha Waste	3-44
3.8.2 Hazardous Materials	3-44
References	3-45
4 ENVIRONMENTAL IMPACTS	4-1
4.1 Impacts from Normal Operations.....	4-1
4.1.1 Impacts of Technology Options	4-2
4.1.1.1 Water Resources	4-3
4.1.1.2 Air Resources	4-6
4.1.1.3 Worker and Public Health	4-7
4.1.1.4 Waste Generation.....	4-16
4.1.1.5 Utility and Energy Resources	4-23
4.1.1.6 Environmental Justice	4-30
4.1.1.7 Transportation	4-33
4.1.2 Impacts of the Alternatives	4-36
4.1.2.1 No-Action Alternative	4-41
4.1.2.2 Minimum Impact Alternative.....	4-41
4.1.2.3 Direct Disposal Alternative	4-41
4.1.2.4 Preferred Alternative	4-41
4.1.2.5 Maximum Impact Alternative.....	4-46
4.2 Accident Analysis.....	4-48
4.3 Construction Impacts.....	4-50
4.3.1 Geology and Groundwater.....	4-50
4.3.2 Traffic and Transportation	4-50
4.3.3 Cultural Resources.....	4-50
4.3.4 Surface Water Resources	4-51
4.3.5 Air Resources	4-51
4.3.6 Ecological Resources	4-51
4.3.7 Impacts from Renovating an Existing Facility.....	4-53
4.3.7.1 Waste Generation.....	4-53
4.3.7.2 Worker Health	4-53

TABLE OF CONTENTS (Continued)

<u>Section</u>		<u>Page</u>
	4.3.8 Socioeconomic Impacts	4-53
	References	4-54
5	CUMULATIVE IMPACTS	5-1
	5.1 Air Resources.....	5-4
	5.2 Water Resources	5-6
	5.3 Public and Worker Health	5-7
	5.4 Waste Generation.....	5-8
	5.5 Utilities and Energy	5-10
EC	5.6 Socioeconomic Impacts	5-11
	References	5-13
6	RESOURCE COMMITMENTS	6-1
	6.1 Introduction.....	6-1
	6.2 Unavoidable Adverse Impacts.....	6-1
	6.3 Relationship between Local Short-Term Uses of the Environment and the Maintenance and Enhancement of Long-Term Productivity	6-2
	6.4 Irreversible and Irretrievable Resource Commitments.....	6-2
	6.5 Waste Minimization, Pollution Prevention, and Energy Conservation	6-3
	6.5.1 Waste Minimization and Pollution Prevention.....	6-3
	6.5.2 Energy Conservation	6-4
7	APPLICABLE LAWS, REGULATIONS, AND OTHER REQUIREMENTS	7-1
	7.1 Statutes and Regulations Requiring Permits or Consultations	7-1
	7.1.1 Environmental Protection Permits.....	7-1
	7.1.2 Protection of Biological, Historic, and Archaeological Resources	7-6
	7.2 Statutes and Regulations Related to Emergency Planning, Worker Safety, and Protection of Public Health and the Environment.....	7-8
	7.2.1 Environmental Protection	7-8
	7.2.2 Emergency Planning and Response	7-9
	7.3 Executive Orders.....	7-11
	7.4 DOE Regulations and Orders.....	7-11
	References	7-15

- APPENDIX A – TECHNOLOGY DESCRIPTIONS
- APPENDIX B – IDENTIFICATION AND RESOLUTION OF SAVANNAH RIVER SITE SPENT NUCLEAR FUEL VULNERABILITIES
- APPENDIX C – SPENT NUCLEAR FUEL BACKGROUND AND INVENTORY
- APPENDIX D – ACCIDENT ANALYSIS
- APPENDIX E – ASSUMED SPENT NUCLEAR FUEL MANAGEMENT ACTIVITY DURATIONS FOR ENVIRONMENTAL IMPACT ANALYSIS

TABLE OF CONTENTS (Continued)

APPENDIX F	- ESTIMATED INCREMENTAL NONRADIOLOGICAL AIR CONCENTRATIONS ATTRIBUTABLE TO SPENT NUCLEAR FUEL MANAGEMENT ACTIVITIES	
APPENDIX G	- PUBLIC COMMENTS ON DRAFT EIS AND DOE RESPONSES	
LIST OF PREPARERS		LP-1
DISTRIBUTION LIST		DL-1
GLOSSARY		GL-1
INDEX		IN-1

List of Tables

<u>Table</u>		<u>Page</u>
1-1	Spent nuclear fuel groups.....	1-8
1-2	Comparison of Spent nuclear fuel groups	1-13
2-1	Applicability commentary of the New Packaging Alternative options	2-10
2-2	Applicability of the New Processing Technology Alternative options	2-14
2-3	Comparison of preferred and backup technologies for aluminum-SNF disposal.....	2-15
2-4	Facilities needed for SNF technologies	2-19
2-5	Transfer and Storage Facility functions.....	2-26
2-6	Road-ready storage capacities.....	2-28
2-7	Fuel groups and technology options that could be applied to meet the purpose and need. For each fuel group, the technologies that would produce the lowest and highest impacts have been identified	2-34
2-8	Alternative analyzed in this EIS	2-36
2-9	The fuel group technology configuration that compose the preferred alternative.	2-39
2-10	Impact summary by alternative.	2-47
2-11	Estimated maximum incremental concentrations of nonradiological air pollutants at SRS boundary for each fuel group and technology (percent of regulatory standard).....	2-48
2-12	Estimated maximum incremental concentrations of nonradiological air pollutants at SRS boundary for each alternative (percent of regulatory standard).	2-49
2-13	Estimated maximum consequence accident for each technology.	2-50
2-14	Life-cycle costs for aluminum-clad fuel technologies (1998 millions of dollars).....	2-57
2-15	Life-cycle costs (1998 billions of dollars) for each alternative.....	2-58
3.1-1	Soil formations of the Floridan aquifer system.....	3-4
3.2-1	Annual liquid releases by source for 1997 (including direct and seepage basin migration releases)	3-10
3.2-2	Liquid radioactive releases by outfall/facility and comparison of annual average radionuclide concentrations to DOE derived concentration guides	3-11

3.2-3 SRS stream water quality (onsite downstream locations)	3-14
--	------

TABLE OF CONTENTS (Continued)

List of Tables (Continued)

<u>Table</u>		<u>Page</u>	
3.2-4	C-Area maximum reported groundwater parameters in excess of regulatory and SRS limits.....	3-18	
3.2-5	F-Area maximum reported groundwater parameters in excess of regulatory and SRS limits.....	3-19	
3.2-6	H-Area maximum reported groundwater parameters in excess of regulatory and SRS limits.....	3-20	
3.2-7	L-Area maximum reported groundwater parameters in excess of regulatory and SRS limits.....	3-20	
3.2-8	P-Area maximum reported groundwater parameters in excess of regulatory and SRS limits.....	3-21	
3.3-1	Radioactivity in air at SRS boundary and at 100-mile (160-kilometer) radius during 1997 (picocuries per cubic meter).....	3-23	
3.3-2	Radiological atmospheric releases by operational group for 1997.	3-24	
3.3-3	SRS baseline air quality for maximum potential emissions and observed ambient concentrations	3-27	
3.3-4	Estimated 24-hour average ambient concentrations at SRS boundary - toxic air pollutants regulated by South Carolina from SRS sources	3-28	
EC	3.5-1	General racial characteristics of population in SRS region of interest.....	3-32
EC	3.5-2	General poverty characteristics of population in SRS region of interest.....	3-32
EC	3.7-1	SRS annual individual and collective radiation doses	3-38
EC	3.7-2	Estimated maximum annual concentrations (milligrams per cubic meter) of workplace pollutants regulated by Occupational Safety and Health Administration.....	3-39
EC	3.8-1	Total waste generation forecast for SRS (cubic meters).	3-40
EC	3.8-2	Planned and existing waste storage facilities.....	3-41
EC	3.8-3	Planned and existing waste treatment processes and facilities.....	3-42
EC	3.8-4	Planned and existing waste disposal facilities.	3-43
4.1-1	Estimated operational staffing for any of the technology options.	4-2	
4.1-2	Estimated maximum incremental annual dose to hypothetical maximally exposed individual and 620,100-person population surrounding SRS due to liquid releases from Conventional Processing	4-5	
4.1-3	Estimated maximum incremental annual dose (millirem) to noninvolved worker from airborne releases.....	4-8	
4.1-4	Estimated maximum incremental annual dose (millirem) to hypothetical maximally exposed individual from airborne releases.	4-9	
4.1-5	Estimated maximum incremental annual dose (person-rem) to the 620,100 person population surrounding SRS from airborne releases.	4-10	
4.1-6	Radiation doses to the public and associated latent cancer fatalities for the entire period of analysis (1998-2035).	4-13	
4.1.7	Number of radiation workers and collective worker radiation dose (per-rem) and associated latent cancer fatalities for the entire period of analysis (1998-2035).	4-14	

4.1-8 Radiation doses to the maximally exposed noninvolved worker (640-meter) and associated latent cancer fatalities for the entire period of analysis (1998-2035).	4-15
---	------

TABLE OF CONTENTS (Continued)

List of Tables (Continued)

<u>Table</u>		<u>Page</u>
4.1-9	Permissible Exposure Limits (milligrams per cubic meter) of nonradiological air pollutants regulated by the Occupational Safety and Health Administration	4-16
4.1-10	High-level waste generation for the entire period of analysis (1998-2035) (cubic meters).....	4-17
4.1-11	Transuranic waste generation for the entire period of analysis (1998-2035) (cubic meters).....	4-18
4.1-12	Hazardous/low-level mixed waste generation for the entire period of analysis (1998-2035) (cubic meters).....	4-18
4.1-13	Low-level waste generation for the entire period of analysis (1998-2035) (cubic meters)....	4-19
4.1-14	Numbers of spent fuel co-disposal and high-level waste canisters.....	4-23
4.1-15	Water Use (millions of liters).....	4-28
4.1-16	Electricity Use (megawatt-hours).....	4-28
4.1-17	Steam Use (millions of kilograms).....	4-29
4.1-18	Diesel Fuel Use (thousands of liters).....	4-29
4.1-19	Estimated per capita annual dose (rem) for identified communities in 80-kilometer (50-mile) region.....	4-32
4.1-20	Collective doses and health effects for onsite incident-free SNF shipments	4-34
4.1-21	Incident-free radiological impacts of 1,400 offsite truck shipments of spent nuclear fuel to the proposed Yucca Mountain Geologic Repository.....	4-35
4.1-22	Impacts on SRS workers, maximally exposed offsite individuals, and offsite population from SNF transportation accidents on Savannah River Site.	4-36
4.1-23	Truck transportation accident analysis impacts.....	4-36
4.1-24	Estimated maximum incremental concentrations of nonradiological air pollutants for the noninvolved worker.	4-38
4.1-25	Estimated maximum incremental concentrations of nonradiological air pollutants at the Site boundary.	4-39
4.1-26	Impacts from alternatives.....	4-40
4.1-27	Fuel group and technology combination that compose the No-Action Alternative.	4-42
4.1-28	Fuel group and technology combination that compose the Minimum Impact Alternative....	4-43
4.1-29	Fuel groups and technology combination that compose the Direct Disposal Alternative.	4-44
4.1-30	Fuel group and technology combination that compose the Preferred Alternative.	4-45
4.1-31	Fuel group and technology combination that compose the Maximum Impact Alternative....	4-47
4.2-1	Estimated maximum consequence accident for each technology.	4-49
4.3-1	Peak and attenuated noise (in dBA) levels expected from operation of construction equipment.....	4-52
5-1	Estimated maximum cumulative ground-level concentrations of nonradiological pollutants (micrograms per cubic meter) at SRS boundary.....	5-5
5-2	Estimated average annual cumulative radiological doses and resulting health effects to the maximally exposed offsite individual and population in the 50-mile radius from airborne releases.....	5-6

5-3	Estimated average annual cumulative radiological doses and resulting health effects to offsite population in the 50-mile radius from aqueous releases.....	5-8
-----	--	-----

TABLE OF CONTENTS (Continued)

List of Tables (Continued)

<u>Table</u>		<u>Page</u>
5-4	Estimated average annual cumulative radiological doses and resulting health effects to offsite population and facility workers.....	5-9
5-5	Estimated cumulative waste generation from SRS concurrent activities (cubic meters)	5-11
5-6	Estimated average annual cumulative utility consumption.....	5-11
6-1	Estimated requirements for concrete and steel for stand-alone facilities.	6-4
6-2	Major chemicals and other materials required for spent nuclear fuel management facilities	6-4
7-1	Environmental permits and consultations required by regulation.	7-2
7-2	DOE Orders and Notices relevant to spent nuclear fuel management.....	7-13

List of Figures

<u>Figure</u>		<u>Page</u>
1-1	Location of the Savannah River Site	1-2
1-2	Historic nuclear materials production cycle at the Savannah River Site.....	1-3
1-3	Typical Materials Test Reactor fuel assembly	1-10
2-1	New Packaging Technology – Direct Disposal/Direct Co-Disposal.	2-11
2-2	New Packaging Technology – Repackage and Prepare to Ship to Another DOE site.....	2-11
2-3	New Processing Technology - Melt and Dilute, Mechanical Dilution, Vitrification Technologies.	2-13
2-4	New Processing Technology – Electrometallurgical Treatment.	2-13
2-5	Conventional Processing.....	2-19
2-6	SRS map indicating locations of facilities needed for Proposed Action.....	2-21
2-7	Plan view of the L-Reactor facility.....	2-22
2-8	Canyon building sections.	2-24
2-9	H Canyon and surrounding area (view toward northeast).....	2-25
2-10	Schematic cut-away of the transfer storage and treatment facility.	2-27
2-11	Typical spent nuclear fuel dry storage facilities.	2-29
2-12	Plan view of C-Reactor facility.	2-31
2-13	Potential Transfer, Storage, and Treatment Facility location in F Area.....	2-32
2-14	Potential Transfer, Storage, and Treatment Facility location in H Area.	2-33
2-15	Preferred Alternative Management Flow-Path.	2-40
2-16	No-Action Alternative – Continued Wet Storage.	2-44
3.1-1	General location of Savannah River Site and its relationship to physiographic provinces of southeastern United States.	3-2
3.1-2	Generalized geologic and aquifer units in SRS region.	3-3
3.1-3	Savannah River Site, showing seismic fault lines and locations of onsite earthquakes and their year of occurrence.	3-6
3.2-1	Savannah River Site, showing 100-year floodplain and major stream systems.	3-8

TABLE OF CONTENTS (Continued)

List of Figures (Continued)

<u>Figure</u>		<u>Page</u>
3.2-2	Radiological surface-water sampling locations.	3-13
3.2-3	SRS streams and Savannah River water quality sampling locations.	3-15
3.2-4	Maximum reported groundwater contamination at Savannah River Site.	3-22
3.5-1	Distribution of minorities by census tract in SRS region of analysis.....	3-33
3.5-2	Low-income census tracts in the SRS region of analysis.....	3-34
3.7-1	Major sources of radiation exposure in the vicinity of the Savannah River Site.	3-36
4.1-1	Type and source of waste streams generated by the Prepare for Direct Co-Disposal technology option.	4-24
4.1-2	Type and source of waste streams generated by the Repackage and Prepare to Ship technology option.	4-24
4.1-3	Type and source of waste streams generated by the Melt and Dilute technology option.....	4-25
4.1-4	Type and source of waste streams generated by the Mechanical Dilution technology option.....	4-25
4.1-5	Type and source of waste streams generated by the Vitrification technology options.....	4-26
4.1-6	Type and source of waste streams generated by the Electrometallurgical Treatment technology option.	4-26
4.1-7	Type and source of waste streams generated by the Conventional Processing technology option.....	4-27
4.1-8	Annular sectors around the Savannah River Site.....	4-31
4.1-9	Distribution of a hypothetical unit population dose among SRS communities.....	4-32

EC |