

TABLE OF CONTENTS

<u>Chapter</u>		<u>Page</u>
Cover Sheet		ii
Preface		iii
Table of Contents		vii
SUMMARY		S-1
1 NEED FOR COOLING WATER SYSTEMS AND PURPOSE OF THIS ENVIRONMENTAL IMPACT STATEMENT		1-1
1.1 Need		1-1
1.2 Purpose		1-3
REFERENCES		1-5
2 COOLING WATER ALTERNATIVES AND PROPOSED ACTION		2-1
2.1 Screening Process		2-1
2.2 Proposed Action		2-4
2.2.1 K-Reactor Cooling Water Alternatives		2-4
2.2.1.1 Once-Through Cooling Tower (Preferred Alternative)		2-4
2.2.1.2 Recirculating Cooling Towers		2-11
2.2.1.3 No Action - Existing System		2-15
2.2.2 C-Reactor Cooling Water Alternatives		2-19
2.2.2.1 Once-Through Cooling Tower (Preferred Alternative)		2-19
2.2.2.2 Recirculating Cooling Towers		2-25
2.2.2.3 No Action - Existing System		2-31
2.2.3 D-Area Powerhouse Alternatives		2-32
2.2.3.1 Increased Flow with Mixing (Preferred Alternative)		2-32
2.2.3.2 Direct Discharge to Savannah River		2-37
2.2.3.3 No Action - Existing System		2-41
2.3 Comparison of Alternatives		2-43
2.3.1 Alternatives for K-Reactor		2-43
2.3.2 Alternatives for C-Reactor		2-45
2.3.3 Alternatives for D-Area		2-45
REFERENCES		2-60
3 AFFECTED ENVIRONMENT		3-1
3.1 Savannah River Plant Site and Region		3-1
3.1.1 Geography		3-1
3.1.2 Socioeconomic and Community Characteristics		3-4
3.1.2.1 Study Area		3-4
3.1.2.2 Demography		3-4
3.1.2.3 Land Use		3-7
3.1.2.4 Public Services and Facilities		3-8

TABLE OF CONTENTS (continued)

<u>Chapter</u>		<u>Page</u>
3 AFFECTED ENVIRONMENT (continued)		
3.1.2.5	Housing	3-8
3.1.2.6	Economy	3-8
3.1.3	Historic and Archaeological Resources	3-9
3.1.4	Geology	3-9
3.1.4.1	Geologic Setting	3-9
3.1.4.2	Stratigraphy	3-12
3.1.4.3	Geologic Structures	3-12
3.1.4.4	Seismicity	3-14
3.1.4.5	Streambed Sediments	3-14
3.1.4.6	Geotechnical Properties of Sediments and Subsurface Materials	3-17
3.1.5	Hydrology	3-18
3.1.5.1	Surface-Water Hydrology	3-18
3.1.5.2	Subsurface Hydrology	3-23
3.1.6	Ecology	3-25
3.1.6.1	Terrestrial Ecology	3-25
3.1.6.2	Aquatic Ecology	3-29
3.1.7	Meteorology and Climatology	3-32
3.1.7.1	Regional Climatology	3-33
3.1.7.2	Local Meteorology	3-33
3.1.7.3	Severe Weather	3-35
3.1.7.4	Atmospheric Dispersion	3-41
3.1.8	Radiation and Radionuclides in the Environment . .	3-42
3.1.8.1	Sources of Environmental Radiation	3-42
3.1.8.2	Environmental Radiation Levels in the Southeastern United States	3-44
3.1.8.3	Environmental Radiation Levels in the Vicinity of the Savannah River Plant	3-45
3.2	Pen Branch and Indian Grave Branch (K-Reactor)	3-48
3.2.1	Geography	3-48
3.2.2	Historic and Archaeological Resources	3-48
3.2.3	Hydrology	3-48
3.2.4	Ecology	3-49
3.2.4.1	Terrestrial Ecology	3-49
3.2.4.2	Aquatic Ecology	3-50
3.2.5	Radioactivity Releases and Radiological Transport	3-51
3.3	Four Mile Creek (C-Reactor)	3-53
3.3.1	Geography	3-53
3.3.2	Historic and Archaeological Resources	3-53
3.3.3	Hydrology	3-53
3.3.4	Ecology	3-54
3.3.4.1	Terrestrial Ecology	3-54
3.3.4.2	Aquatic Ecology	3-55
3.3.5	Radioactivity Releases and Radionuclide Transport	3-57

TABLE OF CONTENTS (continued)

<u>Chapter</u>		<u>Page</u>
3 AFFECTED ENVIRONMENT (continued)		
3.4	Beaver Dam Creek (D-Area Coal-Fired Powerhouse)	3-57
3.4.1	Geography	3-57
3.4.2	Historic and Archaeological Resources	3-57
3.4.3	Hydrology	3-59
3.4.4	Ecology	3-59
3.4.4.1	Terrestrial Ecology	3-59
3.4.4.2	Aquatic Ecology	3-60
3.4.5	Radioactivity Releases and Radionuclide Transport	3-61
REFERENCES	3-62
4 ENVIRONMENTAL CONSEQUENCES		4-1
4.1	Alternatives for K-Reactor	4-1
4.1.1	Once-Through Cooling Tower	4-1
4.1.1.1	Construction Impacts	4-1
4.1.1.2	Operational Impacts	4-4
4.1.2	Recirculating Cooling Towers	4-21
4.1.2.1	Construction Impacts	4-21
4.1.2.2	Operational Impacts	4-23
4.1.3	No Action - Existing System	4-36
4.1.3.1	Water Quality and Hydrology	4-37
4.1.3.2	Ecology and Wetlands	4-38
4.1.3.3	Entrainment and Impingement	4-38
4.1.3.4	Threatened and Endangered Species	4-39
4.2	Alternatives for C-Reactor	4-39
4.2.1	Once-Through Cooling Tower	4-39
4.2.1.1	Construction Impacts	4-39
4.2.1.2	Operational Impacts	4-41
4.2.2	Recirculating Cooling Towers	4-47
4.2.2.1	Construction Impacts	4-47
4.2.2.2	Operational Impacts	4-48
4.2.3	No Action - Existing System	4-54
4.2.3.1	Water Quality and Hydrology	4-55
4.2.3.2	Ecology and Wetlands	4-56
4.2.3.3	Entrainment and Impingement	4-56
4.2.3.4	Threatened and Endangered Species	4-57
4.3	Alternatives for D-Area Coal-Fired Powerhouse	4-57
4.3.1	Increased Flow with Mixing	4-57
4.3.1.1	Construction Impacts	4-57
4.3.1.2	Operational Impacts	4-57
4.3.2	Direct Discharge to Savannah River	4-65
4.3.2.1	Construction Impacts	4-65
4.3.2.2	Operational Impacts	4-66
4.3.3	No Action - Existing System	4-69

TABLE OF CONTENTS (continued)

<u>Chapter</u>		<u>Page</u>
4	ENVIRONMENTAL CONSEQUENCES (continued)	
	4.3.3.1 Water Quality and Hydrology	4-70
	4.3.3.2 Ecology and Wetlands	4-70
	4.3.3.3 Entrainment and Impingement	4-70
	4.3.3.4 Threatened and Endangered Species	4-71
4.4	Cumulative Impacts of Alternative Cooling Water System	
	Construction and Operation	4-71
	4.4.1 Surface-Water Usage	4-71
	4.4.2 Thermal Discharge Effects	4-72
	4.4.2.1 Onsite Streams and Savannah River Swamp .	4-72
	4.4.2.2 Savannah River	4-72
	4.4.3 Ecology	4-73
	4.4.3.1 Terrestrial Areas	4-73
	4.4.3.2 Onsite Streams and Savannah River Swamp .	4-74
	4.4.3.3 Savannah River	4-75
	4.4.3.4 Entrainment and Impingement	4-75
	4.4.3.5 Threatened and Endangered Species	4-76
	4.4.4 Radiological Releases	4-77
	4.4.5 Air Quality	4-79
4.5	Unavoidable/Irreversible Impacts of Alternatives	4-80
	4.5.1 Unavoidable Adverse Impacts	4-83
	4.5.2 Irreversible and Irretrievable Commitments of Resources	4-84
	4.5.3 Short-Term Uses and Long-Term Productivity	4-84
4.6	Comparison of Alternatives for K- and C-Reactors and D-Area	4-84
	4.6.1 Alternatives for K-Reactor	4-85
	4.6.1.1 Once-Through Cooling Tower	4-97
	4.6.1.2 Recirculating Cooling Towers	4-97
	4.6.1.3 No Action	4-98
	4.6.2 Alternatives for C-Reactor	4-99
	4.6.2.1 Once-Through Cooling Tower	4-99
	4.6.2.2 Recirculating Cooling Towers	4-100
	4.6.2.3 No Action	4-101
	4.6.3 Comparisons for D-Area	4-101
	4.6.3.1 Increased Flow with Mixing	4-101
	4.6.3.2 Direct Discharge	4-101
	4.6.3.3 No Action	4-102
	REFERENCES	4-103
5	FEDERAL AND STATE ENVIRONMENTAL REQUIREMENTS	5-1
	5.1 Applicable Statutes and Regulations	5-1
	5.2 Historic Preservation	5-7
	5.3 Solid Waste Disposal	5-8
	5.4 Endangered Species	5-8

TABLE OF CONTENTS (continued)

<u>Chapter</u>		<u>Page</u>
5	FEDERAL AND STATE ENVIRONMENTAL REQUIREMENTS (continued)	
5.5	Wildlife and Fisheries	5-9
5.6	Water Quality	5-9
5.7	Floodplains/Wetlands	5-12
5.8	Air Quality	5-12
5.9	Department of Energy Health and Safety Orders	5-12
	REFERENCES	5-13

LIST OF PREPARERS

DISTRIBUTION LIST FOR FINAL ENVIRONMENTAL IMPACT STATEMENT

GLOSSARY

INDEX

APPENDIX A. IDENTIFICATION OF COOLING WATER ALTERNATIVES FOR
EVALUATION IN THE EIS

APPENDIX B. THERMAL MODELING

APPENDIX C. ECOLOGY

APPENDIX D. RADIOCESIUM INVENTORY AND TRANSPORT AND ATMOSPHERIC
TRITIUM RELEASES

APPENDIX E. ARCHAEOLOGICAL AND HISTORIC RESOURCES

APPENDIX F. FLOODPLAIN/WETLANDS ASSESSMENT

APPENDIX G. RADIATION DOSE CALCULATION METHODS AND
ASSUMPTIONS

APPENDIX H. SCOPING COMMENTS AND RESPONSES

APPENDIX I. POTENTIAL APPLICATIONS FOR UTILIZATION OF WASTE
HEAT FROM K- AND C-REACTOR COOLING WATER DISCHARGES

APPENDIX J. COMMENTS AND DOE RESPONSES ON DRAFT ENVIRONMENTAL
IMPACT STATEMENT ALTERNATIVE COOLING WATER SYSTEMS

LIST OF ILLUSTRATIONS

<u>Figure</u>		<u>Page</u>
2-1	K-Reactor Once-Through Cooling Tower System Flow Diagram	2-6
2-2	K-Reactor Once-Through Cooling Tower System	2-7
2-3	K-Reactor Recirculating Cooling Tower System Flow Diagram	2-12
2-4	K-Reactor Recirculating Cooling Tower System	2-13
2-5	C-Area Once-Through Cooling Tower System Flow Diagram	2-20
2-6	C-Reactor Once-Through Cooling Tower System	2-21
2-7	C-Reactor Recirculating Cooling Tower System Flow Diagram	2-26
2-8	C-Reactor Recirculating Cooling Tower System	2-27
2-9	D-Area Existing System Flow Diagram	2-34
2-10	D-Area Discharge to Savannah River Alternative	2-38
2-11	D-Area Direct Discharge to Savannah River Flow Diagram	2-39
3-1	SRP Location in Relation to Surrounding Population Centers	3-2
3-2	Savannah River Plant Site Map	3-3
3-3	Counties in SRP Area	3-6
3-4	General Map of Archaeological Survey Area	3-10
3-5	Generalized NW to SE Geologic Profile Across the Savannah River Plant	3-11
3-6	Tentative Correlation of Stratigraphic Terminology of Southwestern South Carolina Coastal Plain	3-13
3-7	Characteristics of Streambed Sediments, Four Mile Creek and Pen Branch	3-15
3-8	Savannah River Monthly Average Daily-Minimum Temperatures for 1971-1983	3-22
3-9	Vertical Head Relationship Near the H-Area Seepage Basins	3-24
3-10	K-Area Tower, 1975-1979	3-36
3-11	C-Area Tower, 1975-1979	3-37
3-12	D-Area Tower, 1975-1979	3-38
4-1	K-Reactor Once-Through Tower, Total Solids Deposition	4-7
4-2	K-Reactor Recirculating Tower, Total Solids Deposition	4-25
4-3	K- and C-Reactor Recirculating Towers, Frequency of Occurrence of Elevated Visible Plumes	4-81
4-4	K- and C-Reactor Recirculating Towers, Total Solids Deposition	4-82

LIST OF TABLES

<u>Table</u>		<u>Page</u>
2-1	Temperatures Along Cooling Water Flow Path of K-Reactor Once-Through Cooling Tower	2-10
2-2	Temperatures Along Cooling Water Flow Path--K-Reactor Recirculating Cooling Towers	2-16
2-3	Temperatures Along K-Reactor Cooling Water Flow Path: No Action (Existing System)	2-18
2-4	Temperatures Along Cooling Water Flow Path of C-Reactor Once-Through Mechanical-Draft Cooling Tower	2-24
2-5	Temperatures Along Cooling Water Flow Path--C-Reactor Recirculating Cooling Tower	2-30
2-6	Temperatures Along C-Reactor Cooling Water Flow Path: No Action (Existing System)	2-33
2-7	Temperatures Along Cooling Water Flow Path of D-Area Power- house for Increased Flow with Mixing Alternative	2-36
2-8	Temperatures and Passage Zone Sizes for D-Area Powerhouse Direct Discharge Into Savannah River	2-41
2-9	Temperatures Along Cooling Water Flow Path--D-Area Power- house--No Action (Existing System)	2-42
2-10	Comparison of Cooling Water Alternatives for K-Reactor	2-46
2-11	Comparison of Cooling Water Alternatives for C-Reactor	2-51
2-12	Comparison of Cooling Water Alternatives for D-Area	2-57
3-1	Distribution of June 1980 SRP Employees by Place of Residence	3-5
3-2	1980 Population for Counties and Places of 1000 Persons or Greater	3-7
3-3	Water Quality of the Savannah River, 1973 to 1982, Upriver of the SRP, at Pumphouse 3G and Downriver at the U.S. Highway 301 Bridge	3-21
3-4	Land Utilization, 1983	3-26
3-5	Average and Extreme Temperatures at Savannah River Plant, 1961-1981	3-34
3-6	Average Monthly Wind Speed for Bush Field, Augusta, Georgia, 1951-1981, and WJBF-TV Tower, 1976-1977	3-35
3-7	Precipitation at Savannah River Plant, 1952-1982	3-39
3-8	Extreme Wind Speeds for Area of Savannah River Plant	3-39
3-9	Tornado Occurrence by Month	3-40
3-10	Major Sources of Radiation Exposure in the Vicinity of the Savannah River Plant	3-46
3-11	Pen Branch and Indian Grave Branch Water Quality: November 1983 to May 1984	3-50
3-12	Radionuclide Concentrations in Water and Sediment and Aerial Radiological Survey Results for Pen Branch and Indian Grave Branch (K-Reactor)	3-53
3-13	Temperature and Dissolved Oxygen in Four Mile Creek	3-54
3-14	Four Mile Creek Water Quality	3-55
3-15	Radionuclide Concentrations in Water and Sediment and Aerial Radiological Survey Results for Four Mile Creek (C-Reactor)	3-58

LIST OF TABLES (continued)

<u>Table</u>		<u>Page</u>
3-16	Beaver Dam Creek Water Quality Downstream of All 400-D Area Effluents	3-60
4-1	Projected Total Construction Workforces at Savannah River Plant and Plant Vogtle	4-2
4-2	Increase in Annual Doses to Maximally Exposed Individual Resulting from Atmospheric Releases of Tritium from K-Reactor Once-Through Cooling Tower	4-17
4-3	Decrease in Annual Doses to Maximally Exposed Individual Resulting from a Decrease in Liquid Releases of Tritium from K-Reactor Once-Through Cooling Tower	4-18
4-4	Decrease in Collective Effective Whole-Body Dose Resulting from Liquid Releases of Tritium from K-Reactor Once-Through Cooling Tower	4-18
4-5	Changes in Effective Whole-Body Dose Received by Maximally Exposed Individual Resulting from Operation of K-Reactor Once-Through Cooling Tower	4-19
4-6	Changes in Collective Effective Whole-Body Dose Resulting from Operation of K-Reactor Once-Through Cooling Tower	4-20
4-7	Changes in Annual Health Effects	4-21
4-8	Decrease in Doses to Maximally Exposed Individual Resulting from Cesium Redistribution Associated with K-Reactor Recirculating Cooling Towers	4-32
4-9	Decrease in Collective Effective Whole-Body Dose Resulting from Cesium Redistribution Associated with K-Reactor Recirculating Cooling Towers	4-33
4-10	Increase in Annual Dose to Maximally Exposed Individual Resulting from Atmospheric Releases of Tritium from K-Reactor Recirculating Cooling Towers	4-33
4-11	Decrease in Annual Dose to Maximally Exposed Individual Resulting from a Decrease in Liquid Releases of Tritium from C-Reactor Recirculating Cooling Towers	4-34
4-12	Decrease in Collective Effective Whole-Body Dose Resulting from Liquid Releases of Tritium from K-Reactor Recirculating Cooling Towers	4-35
4-13	Changes in Effective-Whole-Body and Gonadal Doses Received by Maximally Exposed Individual Resulting from Operation of K-Reactor Recirculating Cooling Towers	4-36
4-14	Changes in Collective Effective Whole-Body Dose Resulting from Operation of K-Reactor Recirculating Cooling Towers	4-37
4-15	Changes in Annual Health Effects	4-37
4-16	Increase in Annual Doses to Maximally Exposed Individual Resulting from Atmospheric Releases of Tritium from C-Reactor Once-Through Cooling Tower	4-45
4-17	Changes in Effective Whole-Body Dose Received by Maximally Exposed Individual Resulting from Operation of C-Reactor Once-Through Cooling Tower	4-46

LIST OF TABLES (continued)

<u>Table</u>		<u>Page</u>
4-18	Decrease in Doses to Maximally Exposed Individual Resulting from Cesium Redistribution Associated with C-Reactor Recirculating Cooling Towers	4-51
4-19	Decrease in Collective Effective Whole-Body Dose Resulting from Cesium Redistribution Associated with C-Reactor Recirculating Cooling Towers	4-51
4-20	Increase in Annual Doses to Maximally Exposed Individual Resulting from Atmospheric Releases of Tritium from C-Reactor Recirculating Cooling Towers	4-52
4-21	Changes in Effective Whole-Body and Gonadal Doses Received by Maximally Exposed Individual Resulting from Operation of C-Reactor Recirculating Cooling Towers	4-53
4-22	Changes in Collective Effective Whole-Body Dose Resulting from Operation of C-Reactor Recirculating Cooling Towers . . .	4-54
4-23	Changes in Annual Health Effects	4-55
4-24	Cumulative Effective Whole-Body Doses with Present Cooling Water Systems (Existing Conditions) for K- and C-Reactors . .	4-78
4-25	Cumulative Effective Whole-Body Doses with a Once-Through Cooling Tower for K- and C-Reactors	4-79
4-26	Cumulative Effective Whole-Body Doses with Recirculating Cooling Towers for K- and C-Reactors	4-79
4-27	Cumulative Health Effects	4-80
4-28	Comparison of Potential Environmental Impacts in Reach 1 of Pen Branch System	4-87
4-29	Comparison of Potential Environmental Impacts in Reach 2 of Pen Branch System	4-89
4-30	Comparison of Potential Environmental Impacts in Reach 3 of Pen Branch System	4-91
5-1	Required Regulatory Permits and Notifications	5-2