

Callaway Plant Unit 2

Combined License Application

Part 3: Environmental Report

Revision 0
July 2008

© 2007-2008 UniStar Nuclear Services, LLC in and to the Reference COLA, namely all text not in brackets
© 2007-2008 Union Electric Company d/b/a AmerenUE in and to all Callaway site specific and
AmerenUE specific COLA material, namely all text in brackets.
All rights reserved. COPYRIGHT PROTECTED

Table of Contents

1.0 Introduction	1-4
1.1 Proposed Action	1-4
1.2 Project Description	1-4
1.2.1 Ownership And Applicant.....	1-4
1.2.2 Site Location.....	1-5
1.2.3 Reactor Information.....	1-5
1.2.4 Cooling System Information.....	1-5
1.2.5 Transmission System Information.....	1-6
1.2.6 Proposed Action and Constraints.....	1-7
1.2.7 Major Activity Start and Completion Dates.....	1-8
1.3 Status of Reviews, Approvals and Consultations	1-13
1.3.1 Federal Agencies.....	1-13
1.3.2 State Agencies.....	1-16
1.3.3 Local Agencies.....	1-19
1.4 References	1-24
 2.0 Environmental Description.....	 2-3
2.1 Site Location	2-3
2.2 Land	2-11
2.2.1 The Site and Vicinity	2-11
2.2.2 Transmission Corridors and OffSite Areas	2-12
2.2.3 The Region	2-13
2.2.4 References.....	2-15
2.3 Water	2-38
2.3.1 Hydrology	2-38
2.3.2 Water Use	2-78
2.3.3 Water Quality	2-93
2.4 Ecology	2-239
2.4.1 Terrestrial Ecology	2-239
2.4.2 Aquatic Ecology	2-257
2.4.3 References.....	2-276
2.5 Socioeconomics.....	2-331
2.5.1 Demography	2-331
2.5.2 Community Characteristics.....	2-342
2.5.3 Historical Properties	2-392
2.5.4 Environmental Justice.....	2-397
2.6 Geology	2-480
2.6.1 Geologic Setting.....	2-480
2.6.2 Stratigraphy	2-480
2.6.3 Geologic Impact Evaluation	2-482
2.6.4 References.....	2-483
2.7 Meteorology and Air Quality.....	2-490
2.7.1 General Climate.....	2-490
2.7.2 Regional Air Quality.....	2-491
2.7.3 Severe Weather Phenomena	2-492
2.7.4 Local Meteorology	2-494
2.7.5 Maximum Terrain Heights And Topographic Maps	2-499

Table of Contents

2.7.6 Atmospheric Dispersion Factors	2-499
2.7.7 Noise	2-501
2.7.8 References.....	2-502
2.8 Related Federal Project Activities	2-615
2.8.1 Land Acquisition and Use of Electrical Transmission Corridors	2-615
2.8.2 Cooling Water Source and Supply	2-615
2.8.3 Other Federal Actions Affecting Construction or Operation.....	2-616
2.8.4 Federal Agency Plans Used to Justify the Need for Power.....	2-616
2.8.5 Planned Federal Projects Contingent on Plant Construction or Operation	2-616
2.8.6 Non-Federal Potential Impacts	2-617
2.8.7 References.....	2-617
3.0 Plant Description	3-4
3.1 External Appearance and Plant Layout	3-4
3.2 Reactor Power Conversion System	3-13
3.2.1 General.....	3-13
3.3 Plant Water Use	3-17
3.3.1 Water Consumption.....	3-17
3.3.2 Water Treatment.....	3-19
3.4 Cooling System	3-24
3.4.1 Description and Operational Modes	3-24
3.4.2 Component Descriptions.....	3-27
3.4.3 References.....	3-29
3.5 Radwaste Systems and Source Term	3-40
3.5.1 Source Terms	3-40
3.5.2 Radioactive Liquid Processing Systems	3-43
3.5.3 Radioactive Gaseous Treatment Systems.....	3-48
3.5.4 Solid Radioactive Waste System	3-53
3.5.5 Process and Effluent Monitoring.....	3-57
3.5.6 References.....	3-61
3.6 Non-Radioactive Waste Systems	3-122
3.6.1 Effluents Containing Chemicals or Biocides	3-122
3.6.2 Sanitary System Effluents	3-122
3.6.3 Other Effluents	3-124
3.6.4 References.....	3-127
3.7 Power Transmission System.....	3-133
3.7.1 {Switchyard} and Connecting Circuits.....	3-134
3.7.2 Electrical Design Parameters	3-134
3.7.3 Noise Levels	3-135
3.7.4 Structure Design.....	3-136
3.7.5 Inspection and Maintenance	3-136
3.7.6 References.....	3-136
3.8 Transportation of Radioactive Materials	3-140
3.8.1 Reactor Data.....	3-140
3.8.2 Onsite Storage Facilities for Irradiated Fuel.....	3-140
3.8.3 Treatment and Packaging of Radioactive Materials Other than Irradiated Fuel..	3-141
3.8.4 Transportation System for Fuel and Other Radioactive Wastes.....	3-141
3.8.5 Transportation Distance from the Plant to the Storage Facility.....	3-141

Table of Contents

3.8.6 Conclusions	3-141
3.8.7 References.....	3-141

4.0 Environmental Impacts of Construction 4-4

4.1 Land Use Impacts	4-4
4.1.1 The Site and Vicinity	4-4
4.1.2 Transmission Corridors and Offsite Areas	4-7
4.1.3 Historic Properties	4-7
4.1.4 References.....	4-8
4.2 Water-Related Impacts	4-14
4.2.1 Hydrologic Alterations	4-14
4.2.2 Water Use Impacts	4-23
4.3 Ecological Impact	4-33
4.3.1 Terrestrial Ecosystems.....	4-33
4.3.2 Aquatic Ecosystems.....	4-46
4.3.3 References.....	4-52
4.4 Socioeconomic Impacts	4-64
4.4.1 Physical Impacts	4-64
4.4.2 Social and Economic Impacts.....	4-69
4.4.3 Environmental Justice Impacts	4-77
4.5 Radiation Exposure to Construction Workers	4-88
4.5.1 Site Layout	4-88
4.5.2 Radiation Sources at {Callaway Plant Unit 2}.....	4-88
4.5.3 Historical Dose Rates.....	4-88
4.5.4 {Projected Dose Rates at Callaway Plant Unit 2	4-89
4.5.5 Compliance with Dose Rate Regulations.....	4-90
4.5.6 {Collective Doses to Callaway Plant Unit 2 Workers	4-91
4.5.7 Radiation Protection and Alara Program	4-91
4.5.8 References.....	4-92
4.6 Measures and Controls to Limit Adverse Impacts During Construction	4-102
4.7 Non-Radiological Health Impacts	4-113
4.7.1 Public Health	4-113
4.7.2 Occupational Health	4-113
4.7.3 References.....	4-114

5.0 Environmental Impacts of Station Operation 5-6

5.1 Land Use Impacts	5-6
5.1.1 The Site and Vicinity	5-6
5.1.2 Transmission Corridors and Outside Areas	5-8
5.1.3 Historic Properties and Cultural Resources	5-9
5.1.4 References.....	5-10
5.2 Water Related Impacts.....	5-14
5.2.1 Hydrologic Alterations and Plant Water Supply.....	5-14
5.2.2 Water Use Impacts	5-18
5.2.3 Water Quality Impacts	5-19
5.2.4 References.....	5-22

Table of Contents

5.3 Cooling System Impacts	5-22
5.3.1 Intake System	5-23
5.3.2 Discharge System	5-24
5.3.3 Heat Discharge System	5-29
5.3.4 Impacts to Members of the Public	5-36
5.4 Radiological Impacts of Normal Operations	5-49
5.4.1 Exposure Pathways	5-49
5.4.2 Radiation Doses to Members of the Public	5-52
5.4.3 Impacts to Members of the Public	5-53
5.4.4 Impacts to Biota Other than Members of the Public	5-55
5.5 Environmental Impact of Waste	5-85
5.5.1 Nonradioactive Waste System Impacts	5-85
5.5.2 Mixed Waste Impacts	5-88
5.6 Transmission System Impacts	5-91
5.6.1 Terrestrial Ecosystems	5-91
5.6.2 Aquatic Ecosystems	5-95
5.6.3 Impacts to Members of the Public	5-97
5.7 Uranium Fuel Cycle Impacts	5-100
5.7.1 Land Use	5-103
5.7.2 Water Use	5-104
5.7.3 Fossil Fuel Impacts	5-104
5.7.4 Chemical Effluents	5-105
5.7.5 Radioactive Effluents	5-105
5.7.6 Radioactive Wastes	5-106
5.7.7 Occupational Dose	5-107
5.7.8 Transportation	5-107
5.7.9 Fuel Cycle	5-107
5.7.10 References	5-107
5.8 Socioeconomic Impacts	5-112
5.8.1 Physical Impacts of Station Operation	5-112
5.8.2 Social and Economic	5-116
5.8.3 Environmental Justice Impacts	5-121
5.9 Decommissioning	5-129
5.9.1 NRC Generic Environmental Impact Statement Regarding Decommissioning ..	5-129
5.9.2 Decommissioning Cost Analysis Summary	5-129
5.9.3 References	5-130
5.10 Measures and Controls to Limit Adverse Impacts During Operation	5-130
5.10.1 References	5-131
5.11 Transportation of Radioactive Materials	5-148
5.11.1 Fuel Cladding Environmental Impact	5-148
5.11.2 Heat (Irradiated Fuel Cask in Transit) Environmental Impact	5-149
5.11.3 Incident-Free Dose and Traffic Density Impact Analysis	5-150
5.11.4 Summary and Conclusion	5-153
5.11.5 References	5-153
5.12 Nonradiological Health Impacts	5-163
5.12.1 Public Health	5-163
5.12.2 Occupational Health	5-163
5.12.3 References	5-164

Table of Contents

6.0 Environmental Measurements and Monitoring Programs	6-4
6.1 Thermal Monitoring	6-4
6.1.1 Pre-Application Monitoring	6-4
6.1.2 Pre-Operational Monitoring	6-6
6.1.3 Operational Monitoring	6-6
6.1.4 References	6-7
6.2 Radiological Monitoring	6-10
6.2.1 Pathways Monitored	6-10
6.2.2 Land Use Census	6-11
6.2.3 Environmental Monitoring Program Sample Types	6-11
6.2.4 Sample Sizes	6-13
6.2.5 Radiological Environmental Monitoring Program Reports	6-13
6.2.6 Quality Assurance Program	6-13
6.2.7 REMP Modifications for {Callaway Plant Unit 2}	6-14
6.2.8 References	6-14
6.3 Hydrological Monitoring	6-25
6.3.1 Pre-Application Monitoring	6-25
6.3.2 Construction and Pre-Operational Monitoring	6-27
6.3.3 Operational Monitoring	6-28
6.3.4 References	6-29
6.4 Meteorological Monitoring	6-32
6.4.1 Pre-Application Meteorological Measurement Program	6-32
6.4.2 Pre-Operational, and Operational Meteorological Measurement Programs	6-35
6.4.3 References	6-37
6.5 Ecological Monitoring	6-42
6.5.1 Terrestrial Ecology and Land Use	6-42
6.5.2 Aquatic Ecology	6-44
6.5.3 References	6-46
6.6 Chemical Monitoring	6-46
6.6.1 Pre-Application Monitoring	6-46
6.6.2 Construction and Pre-Operational Monitoring	6-51
6.6.3 Operational Monitoring	6-52
6.6.4 References	6-54
6.7 Summary of Monitoring Programs	6-60
6.7.1 Pre-Application Monitoring	6-60
6.7.2 Construction and Pre-Operational Monitoring	6-60
6.7.3 Operational Monitoring	6-60
6.7.4 References	6-60
 7.0 Environmental Impacts of Postulated Accidents Involving Radioactive Materials	 7-4
7.1 Design Basis Accidents	7-4
7.1.1 References	7-5
7.2 Severe Accidents	7-44
7.2.1 Methodology	7-44
7.2.2 Consequences to Population Groups	7-46
7.2.3 Conclusions	7-48
7.2.4 References	7-49

Table of Contents

7.3 Severe Accident Mitigation Alternatives	7-53
7.3.1 SAMDA Analysis Methodology	7-53
7.3.2 Severe Accident Cost Impact and Maximum Benefit for {Callaway Plant Unit 2}	7-54
7.3.3 Results and Summary	7-55
7.3.4 References	7-56
7.4 Transportation Accidents	7-60
7.4.1 Radiological Impacts	7-61
7.4.2 Non-Radiological Impacts	7-63
7.4.3 Summary and Conclusion	7-65
7.4.4 References	7-65
8.0 Need for Power	8-4
8.1 Description of Power System	8-5
8.1.1 AmerenUE's Service Territory	8-5
8.1.2 Regional Organizations and State Regulation	8-6
8.1.3 The Missouri Integrated Resource Planning Requirements	8-8
8.1.4 References	8-17
8.2 Power Demand	8-22
8.2.1 {Power and Energy Requirements	8-22
8.2.2 Factors Affecting Growth of Demand	8-31
8.2.3 The Need for Power: Overall Evaluation of Findings	8-43
8.2.4 References	8-44
8.3 Power Supply	8-62
8.3.1 {Introduction	8-62
8.3.2 Existing and Planned Generating Capability in the AmerenUE Service Territory	8-62
8.3.3 Purchases and Sales	8-68
8.3.4 Distributed and Self Generation	8-69
8.3.5 Total Capability	8-69
8.3.6 References	8-69
8.4 Assessment of Need for Power	8-77
8.4.1 {Introduction	8-77
8.4.2 Reserve Margin Criteria	8-77
8.4.3 AmerenUE's Planning Process	8-79
8.4.4 Risk Analysis	8-86
8.4.5 The Need for Baseload Capacity	8-87
8.4.6 Summary and Conclusions	8-89
8.4.7 References	8-89
9.0 Alternatives to the Proposed Action	9-4
9.1 No-action Alternative	9-4
9.2 Energy Alternatives	9-5
9.2.1 Alternatives Not Requiring New Generating Capacity	9-5
9.2.2 Alternatives that Require New Generating Capacity	9-7
9.2.3 Assessment of Competitive Alternative Energy Sources and Systems	9-16
9.2.4 Conclusion	9-22
9.2.5 References	9-22
9.3 Alternative Sites	9-27

Table of Contents

9.3.1 Site Selection Process	9-28
9.3.2 Proposed and Alternative Site Evaluation	9-39
9.3.3 Summary and Conclusions	9-63
9.3.4 References.....	9-64
9.4 Alternative Plant and Transmission Systems	9-98
9.4.1 Heat Dissipation Systems.....	9-98
9.4.2 Circulating Water Systems.....	9-104
9.4.3 Transmission Systems.....	9-109
9.4.4 References.....	9-110
10.0 Environmental Consequences of the Proposed Action	10-3
10.1 Unavoidable Adverse Environmental Impacts	10-3
10.1.1 Unavoidable Adverse Environmental Impacts of Construction.....	10-3
10.1.2 Unavoidable Adverse Environmental Impacts of Operations.....	10-3
10.1.3 Summary of Unavoidable Adverse Environmental Impacts from Construction and Operations	10-3
10.1.4 References	10-6
10.2 Irreversible and Irretrievable Commitments of Resources	10-14
10.2.1 Irreversible Environmental Commitments	10-14
10.2.2 Irretrievable Commitments of Resources	10-15
10.2.3 References	10-17
10.3 Relationship Between Short-term Uses and Long-term Productivity of the Human Environment.....	10-20
10.3.1 Construction and Long-Term Productivity	10-20
10.3.2 Operation and Long-Term Productivity	10-21
10.3.3 Summary of Relationship Between Short-Term Uses and Long-Term Productivity ... 10-22	10-22
10.3.4 References	10-22
10.4 Benefit-Cost Balance	10-22
10.4.1 Benefits	10-23
10.4.2 Costs.....	10-27
10.4.3 Summary.....	10-27
10.4.4 References	10-28
10.5 Cumulative Impacts	10-38
10.5.1 Cumulative Impacts from Construction.....	10-39
10.5.2 Cumulative Impacts of Operations	10-42
10.5.3 Cumulative Impacts Summary	10-46
10.5.4 References	10-47