3.0 CHAPTER 3 – THE PROPOSED ACTION

NRC

"The report must contain a description of the proposed action...." 10 CFR 51.53(c)(2)

Ameren proposes that NRC renew the operating licenses for Callaway Plant Unit 1 for an additional 20 years beyond the current licenses' expiration date of October 18, 2024. Renewal of the operating license would give Ameren and the State of Missouri the option of relying on Callaway to provide baseload power beginning in 2024 and throughout the period of extended operation. Section 3.1 discusses the major features of the plant and the operation and maintenance practices directly related to the license renewal period. Sections 3.2 and 3.3 address potential changes that could occur as a result of license renewal. Section 3.4 identifies changes in employment that could result from license renewal.

3.1 GENERAL PLANT INFORMATION

Callaway is a single-unit, nuclear-powered, steam electric generating facility that began commercial operation on December 19, 1984. The nuclear reactor for each unit is a Westinghouse pressurized water reactor (PWR) producing a reactor core power of 3,565 megawatts-thermal [MWt]. The nominal gross electrical capacity is 1,284 megawatts-electric [MWe]. Figures 2.1-1 and 2.1-2 show the location of the Callaway Plant within its 50-mile and 6-mile environs, respectively. Figures 3.1-1 and 3.1-2 depict the site layout.

The following subsections provide information on the reactor and containment systems, the cooling and auxiliary water systems, and the power transmission systems. Additional information about Callaway is available in the final environmental statement for operation of the plant (NRC 1982), the Generic Environmental Impact Statement for License Renewal of Nuclear Plants (GEIS) (NRC 1996), the Final Safety Analysis Report (FSAR) Standard Plant and Site Addendum (AmerenUE 2009).

3.1.1 Reactor and Containment Systems

The powerblock of the Callaway Plant follows the Standardized Nuclear Unit Power Plant System design, known as SNUPPS. The nuclear steam supply system is a four-loop Westinghouse pressurized water reactor. The reactor core heats water to approximately 590 degrees Fahrenheit. Because the pressure exceeds 2,200 pounds per square inch, the water does not boil. The heated water is pumped to four U-tube heat exchangers known as steam generators where the heat boils the water on the shell-side into steam. After drying, the steam is routed to the turbines. The steam yields its energy to turn the turbines, which are connected to the electrical generator. The nuclear fuel is low-enriched uranium dioxide with enrichments less than 5 percent by weight uranium-235 and fuel burnup levels with a maximum fuel assembly burnup of less than 60,000 megawatt-days per metric ton uranium. Callaway operates on an 18-month refueling cycle.

The reactor, steam generators, and related systems are enclosed in a containment building that is designed to prevent leakage of radioactivity to the environment in the improbable event of a rupture of the reactor coolant piping. The containment building is a post-tensioned, pre-stressed, reinforced concrete cylinder with a slab base and a hemispherical dome. A welded steel liner is attached to the inside face of the concrete shell to insure a high degree of leak tightness. In addition, the 4-foot thick concrete walls serve as a radiation shield for both normal and accident conditions.

The containment building is ventilated to maintain pressure and temperatures within acceptable limits. Exhaust from the ventilation system is monitored for radioactivity before being released to the environment through the plant vent. High efficiency particulate air filters are available to filter the air before releasing it. The containment can be isolated if needed.

3.1.2 Cooling and Auxiliary Water Systems

The water systems most pertinent to license renewal are those that directly interface with the environment. The Circulating Water System, River Intake Structure, Water Treatment Plant, Demineralized Water Makeup System, Sanitary Waste Water System, Potable Water System, and stormwater retention ponds, all have environmental interfaces. There are two influent water

sources to Callaway. The largest is river water; the second is the on-site groundwater wells. The plant uses more than 100 gallons per minute of groundwater.

Circulating Water System

The Callaway Plant uses a closed-cycle circulating water system consisting of a main condenser, a cooling tower, circulating water pumps, and makeup and blowdown systems. The Circulating Water System pumps 530,000 gallons per minute to remove the waste heat of normal operations and reject it to the atmosphere using a 555-foot high hyperbolic, natural draft cooling tower.

As a result of evaporation, the salts in the condenser cooling water are concentrated. To maintain the chemical concentrations at no more than four times that of the makeup water, a quantity of the circulating water is discharged as blowdown to the Missouri River. Makeup water to replace water lost to evaporation, drift, and blowdown is provided by the Water Treatment Plant (see below), which obtains its water from the River Intake Structure (see below) on the Missouri River.

Callaway injects anti-scalants and dispersants, biocides, and corrosion inhibitors into the Circulating Water System to maintain the system and prevent fouling by corrosion and biological organisms. Callaway uses sodium hypochlorite to chlorinate the water.

River Intake Structure

The River Intake Structure is on the north bank of the Missouri River as depicted on Figure 2.1-3. Maximum delivery to the Water Treatment Plant is 25,000 gallons per minute of water (limited by capacity of the Water Treatment Plant), but typical usage ranges from 14,000 to 17,000 gallons per minute. Intake Well #1 located near the River Intake Structure provides up to 120 gallons per minute of water to lubricate the pump bearings. River water enters the three-bay, three-pump structure through vertical trash racks designed to stop large objects and debris. Each pump bay contains a vertical traveling screen of ½-inch mesh. The traveling screens have an automatic spray wash. The bays contain fish escape openings in the side walls, but a fish-return system is not provided (nor is required). The screened water is transported approximately 5.5 miles to the Water Treatment Plant on the southeast side of the plant.

Water Treatment Plant

Because the Missouri River water is high in suspended solids, the Water Treatment Plant treats the river water before providing makeup to the Circulation Water System. Water from the River Intake Structure is pumped to the Water Treatment Plant where suspended solids are removed in three clarifiers utilizing flocculants. Sodium hypochlorite and a molluscicide are also added as needed. The finished makeup water is then pumped to the cooling tower basin.

Sludge removed from the clarifiers is pumped to settling ponds. There are currently four settling ponds, but two are sufficiently filled in that they are no longer routinely used to receive sludge. The supernatant from the settling ponds is recycled back to the headend of the Water Treatment Plant. The four settling ponds, as depicted on Figure 3.1-1, total approximately 30 acres (including berms and roads) and support aquatic and terrestrial wildlife.

Up to ten settling ponds could be constructed over the life of the plant, with the next pond potentially being constructed within the next three to four years.

Demineralized Water Makeup System

Demineralized water is needed for various plant systems. The system draws water from the onsite well (Section 2.3.3), treats it, and stores it in a storage tank for plant use. The system has a capacity of approximately 300,000 gallons per day. Treatment consists of filtration and ion exchange. Ion exchange resins are regenerated using acid and caustics, which are neutralized after use in an above ground, open-top neutralization tank. When neutralization is complete, the neutralization tank empties to an equalization basin, where some other waste water is collected. The contents are discharged by gravity to the Water Treatment Plant sludge disposal system (see Water Treatment Plant). Any overflow from the equalization basin is pumped to the regeneration waste lagoon from which, after settlement, the supernatant is recycled to the Water Treatment Plant.

Sanitary Waste Water System

The Sanitary Waste Water System collects, treats, and discharges up to 40,000 gallons of sanitary waste water per day. It consists of a gravity sewer collection system that collects the sewage into a wet well. A lift station at the wet well pumps the sewage to the first of three unaerated sewage treatment lagoons located adjacent to the Water Treatment Plant settling ponds (Figure 3.1-1). The sewage lagoons also receive cafeteria and laboratory waste water. In the first lagoon, the sewage is processed by bacteria under natural conditions. Effluent from the lagoon then gravity flows to the second lagoon, which continues the aerobic bacteria digestion. Effluent from the second lagoon flows by gravity to the third lagoon where any remaining solids settle out. The resulting clear water is then pumped to one of the two settling ponds no longer used to receive Water Treatment Plant sludge.

Two are largely filled with silt deposited as a result of operation of the water treatment plant. Aquatic plants such as cattails, willows, duck weed, bulrush began to thrive after the lagoons were no longer used as a settling pond for silt. These lagoons are now used as a polishing area for sewage treatment. Effluent from the lagoons is combined with the supernatant from the Water Treatment Plant settling ponds (see Water Treatment Plant) and recycled to the Water Treatment Plant.

Potable Water System

The potable water system provides chlorinated water for the domestic water needs of the Callaway Plant. It draws water from an onsite deep well (Section 2.3) and treats it for human consumption.

Storm Water Retention Ponds

The plant has eight stormwater runoff retention ponds (P-1 through P-8). Two of the ponds were pre-existing natural ponds (P-1 and P-2), and the remaining 6 were constructed. The ponds range in acreage from 2 to 15 acres, with depths generally less than 5 feet, with some locations up to 10 feet. These ponds support aquatic and terrestrial wildlife, with four of the ponds open to public fishing under Ameren's land management agreement with the Missouri Department of Conservation for the Reform Conservation Area.

3.1.3 Power Transmission Systems

The following transmission lines running from Callaway to the Montgomery Substation (near Florence, Missouri), Bland Substation (north of Owensville, Missouri), and Loose Creek

Substation (near Loose Creek, Missouri) have been identified as those constructed to connect the plant to the transmission system. They are owned by Ameren and depicted in Figure 3.1-3.

- Montgomery #1 and #2 – These two 345-kilovolt lines extend northeast for approximately 11.9 miles in a 200-foot corridor and then turn more easterly for 11.3 miles to join with a corridor containing a 161-kilovolt line. The Montgomery share of the joint corridor is 150 feet. The overall length is 23.2 miles. The two Montgomery lines are installed on double-circuit, steel lattice towers.

- Bland – This 345-kilovolt line extend south for approximately 6.7 miles in a 200-foot corridor on double circuit towers shared with the Loose Creek line. It then continues for 2.5 miles in an unshared 200-foot corridor before joining a corridor shared by a 161 kilovolt line for 17.4 miles. The Bland share of the joint corridor is 150 feet. The line completes its 31.5-mile course with a 4.9-mile, 200-foot wide corridor into the Bland Substation. This final corridor is unshared with any other line. The Bland line is installed on double-circuit, steel lattice towers.

- Loose Creek – This 345-kilovolt line extends south for approximately 6.7 miles in a 200 foot corridor on double circuit towers shared with the Bland line. It then continues for 16.6 miles in a separate, 200-foot wide corridor into the Bland Substation. After diverging from the Bland line, the Loose Creek line is installed on wooden H-frame towers. The overall length is 23.3 miles.

In total, the transmission lines of interest to Sections 4.10 and 4.13 are contained in approximately 71 miles of corridor using approximately 1,555 acres. The corridors pass through land that is primarily forest and farmland. The areas are mostly remote, with low population densities. The lines cross numerous county, state and U.S. highways as well as the Missouri and Gasconade Rivers. Corridors that pass through farmland generally continue to be used as farmland. Ameren plans to maintain these transmission lines, which are integral to the larger transmission system, indefinitely. The intention is for these transmission lines to remain a permanent part of the transmission system even after Callaway is decommissioned.

The transmission lines were designed and constructed in accordance with the National Electrical Safety Code (for example, IEEE 2007) and other industry guidance that was current when the lines were built. Ongoing surveillance and maintenance of these transmission facilities ensure continued conformance to design standards. These maintenance practices are described in Sections 2.4 and 4.13.

3.2 REFURBISHMENT ACTIVITIES

NRC

> "The report must contain a description of … the applicant's plans to modify the facility or its administrative control procedures...This report must describe in detail the modifications directly affecting the environment or affecting plant effluents that affect the environment…." 10 CFR 51.53(c)(2)
>
> "…The incremental aging management activities carried out to allow operation of a nuclear power plant beyond the original 40-year license term will be from one of two broad categories…(2) major refurbishment or replacement actions, which usually occur fairly infrequently and possibly only once in the life of the plant for any given item...." (NRC 1996)

Ameren has addressed potential refurbishment activities in this environmental report in accordance with NRC regulations and complementary information in the NRC Generic Environmental Impact Statement for License Renewal of Nuclear Plants (GEIS) for license renewal (NRC 1996). NRC requirements for the renewal of operating licenses for nuclear power plants include the preparation of an integrated plant assessment (IPA) (10 CFR 54.21). The IPA must identify and list systems, structures, and components subject to an aging management review. Items that are subject to aging and might require refurbishment include, for example, the reactor vessel, piping, supports, and pump casings (see 10 CFR 54.21 for details), as well as those that are not subject to periodic replacement.

In turn, NRC regulations for implementing the National Environmental Policy Act require license renewal phase environmental reports to describe in detail and assess the environmental impacts of any refurbishment activities such as planned major modifications to systems, structures, and components or plant effluents [10 CFR 51.53(c)(2)]. Resource categories to be evaluated for impacts of refurbishment include terrestrial resources, threatened and endangered species, air quality, housing, public utilities and water supply, education, land use, transportation, and historic and archaeological resources.

The Callaway Unit 1 IPA conducted by Ameren under 10 CFR 54 (included as part of this license renewal application) has not identified (1) the need to undertake any major refurbishment or replacement actions to maintain the functionality of systems, structures, and components during the Callaway Unit 1 license renewal period or (2) other facility modifications associated with license renewal that would affect the environment or plant effluents. Callaway has already replaced its steam generators. The reactor head replacement, which is scheduled to occur 10 years before current license expiration, is being performed to meet the current license life of the plant independent of license renewal, and therefore, it is not part of the license renewal project. Accordingly, Ameren has determined that license renewal regulations in 10 CFR 51.53(c)(3)(ii) do not require Ameren to assess the impact of refurbishment on plant and animal habitats, estimated vehicle exhaust emissions, housing availability, land use, public schools, or highway traffic on local highways. (10 CFR 51.53(c)(3)(ii)(E), (F), (I), (J), respectively.)

3.3 PROGRAMS AND ACTIVITIES FOR MANAGING THE EFFECTS OF AGING

NRC

"The report must contain a description of … the applicant's plans to modify the facility or its administrative control procedures...This report must describe in detail the modifications directly affecting the environment or affecting plant effluents that affect the environment…." 10 CFR 51.53(c)(2)

"…The incremental aging management activities carried out to allow operation of a nuclear power plant beyond the original 40-year license term will be from one of two broad categories: (1) SMITTR actions, most of which are repeated at regular intervals, and (2) major refurbishment or replacement actions, which usually occur fairly infrequently and possibly only once in the life of the plant for any given item." (NRC 1996). ("SMITTR" is defined in NRC (1996) as surveillance, monitoring, inspections, testing, trending, and recordkeeping.)

The IPA required by 10 CFR 54.21 identifies the programs and inspections for managing aging effects at Callaway Unit 1. These programs are described in the License Renewal Application, Ameren-Missouri Callaway Unit 1 to which this Environmental Report is appended. Other than implementation of the programs and inspections identified in the IPA, there are no planned modifications of Callaway Unit 1 administrative control procedures associated with license renewal.

3.4 EMPLOYMENT

Current Workforce

In 2009, Ameren employed approximately 942 permanent employees and 28 long-term contractor personnel at Callaway, a one-unit facility. These values vary over time. Approximately 85 percent of the employees lived in Boone, Callaway, and Cole Counties, Missouri. Table 3.4-1 presents the number of employees that resided in each of these counties. The remaining employees are distributed across 18 additional counties, with numbers ranging from 1 to 35 employees per county. Three of the additional counties are located outside of Missouri.

Ameren is on an 18-month refueling cycle. During normal refueling outages, site employment increases above the permanent work force by as many as 800 workers for approximately 30 to 40 days of temporary duty. This number of outage workers falls within the range (200 to 900 workers per reactor unit) reported in the GEIS for additional maintenance workers (NRC 1996).

Refurbishment Increment

Ameren has determined that there would be no refurbishment activities at Callaway Unit 1 (Section 3.2).

License Renewal Increment

Performing the license renewal activities could necessitate increasing the Callaway Unit 1 staff workload by some increment. The size of this increment would be a function of the schedule within which Ameren must accomplish the work and the amount of work involved. The analysis of the license renewal employment increment focuses on programs and activities for managing the effects of aging.

The GEIS (NRC 1996) assumes that NRC would renew a nuclear power plant license for a 20 year period, plus the duration remaining on the current license, and that NRC would issue the renewal approximately 10 years prior to license expiration. In other words, the renewed license would be in effect for approximately 30 years. The GEIS further assumes that the utility would initiate surveillance, monitoring, inspections, testing, trending, and recordkeeping (SMITTR) activities at the time of issuance of the new license and would conduct license renewal SMITTR activities throughout the remaining 30-year life of the plant, sometimes during full-power operation, but mostly during normal refueling and the 5- and 10-year in-service inspection and refueling outages.

Ameren has determined that the GEIS scheduling assumptions are reasonably representative of Callaway Unit 1 incremental license renewal workload scheduling. Many Callaway Unit 1 license renewal SMITTR activities would have to be performed during outages. Although some Callaway Unit 1 license renewal SMITTR activities would be one-time efforts, others would be recurring periodic activities that would continue for the life of the plant.

The GEIS estimates that the most additional personnel needed to perform license renewal SMITTR activities would typically be 60 persons during the 3-month duration of a 10-year in-service inspection and refueling outage. Having established this upper value for what would be a single event in 20 years, the GEIS uses this number as the expected number of additional

permanent workers needed per unit attributable to license renewal. GEIS Section C.3.1.2 uses this approach in order to "...provide a realistic upper bound to potential population-driven impacts…."

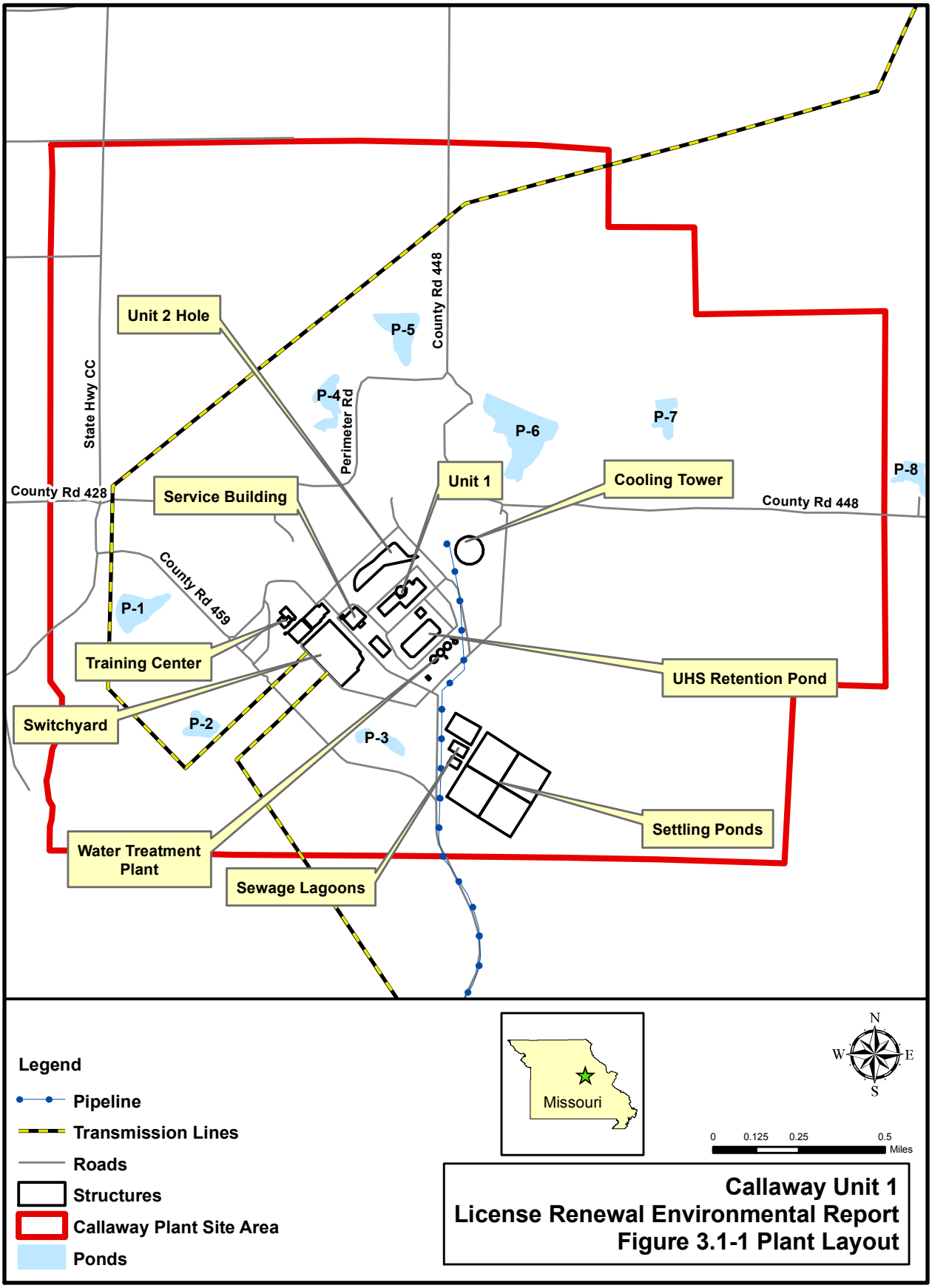
Ameren has identified no need for significant new aging management programs or major modifications to existing programs. Ameren anticipates that existing "surge" capabilities for routine activities, such as outages, will enable Ameren to perform the increased SMITTR workload without increasing Callaway Unit 1 staff. Therefore, Ameren has no plans to add non-outage employees to support Callaway Unit 1 operations during the license renewal term. In recent years, refueling and maintenance outages have typically lasted around 40 days and, as described above, result in a large temporary increase in employment at Callaway Unit 1. Ameren believes that increased SMITTR tasks can be performed within this schedule and employment level. Therefore, Ameren has no plans to add outage workers for license renewal term outages.

Because Ameren is not adding license renewal or refurbishment employees, applying employment multipliers is not needed.

3.5 TABLES AND FIGURES

Table 3.4-1. Residential Distribution of Permanent Employees, by County, 2009

County	Number of Employees	Percent of Total
Audrain, MO	22	2%
Boone, MO	184	20%
Callaway, MO	450	48%
Cole, MO	170	18%
Franklin, MO	14	1%
Gasconade, MO	35	4%
Henry, MO	1	Less than 1%
Howard, MO	1	Less than 1%
Jefferson, MO	2	Less than 1%
Madison, MO	2	Less than 1%
Moniteau, MO	1	Less than 1%
Montgomery, MO	31	3%
Muscogee, GA	1	Less than 1%
Osage, MO	5	1%
Pettis, MO	1	Less than 1%
Pope, AR	1	Less than 1%
Randolph, MO	1	Less than 1%
St. Charles, MO	11	1%
St. Louis, MO	2	Less than 1%
San Diego, CA	1	Less than 1%
Warren, MO	6	1%
TOTAL	**942**	**100%**


Unit 2 Hole
State Hwy CC
County Rd 448
P-5
P-4
Perimeter Rd
P-6
P-7
P-8
Unit 1
Cooling Tower
County Rd 428
Service Building
County Rd 448
County Rd 459
P-1
Training Center
UHS Retention Pond
Switchyard
P-2
P-3
Settling Ponds
Water Treatment Plant
Sewage Lagoons
Legend
Pipeline
Transmission Lines
Roads
Structures
Callaway Plant Site Area
Ponds
Missouri
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0
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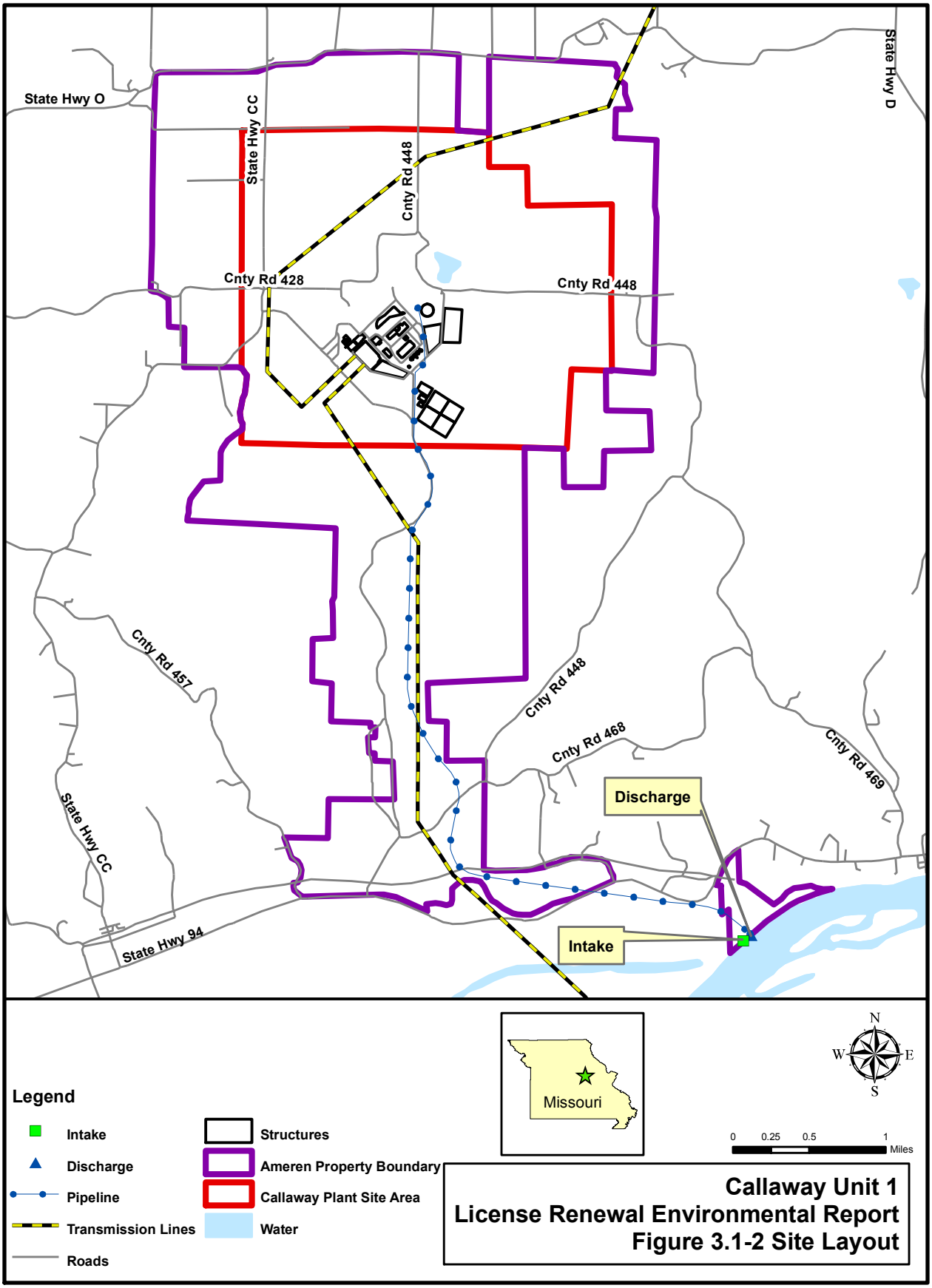
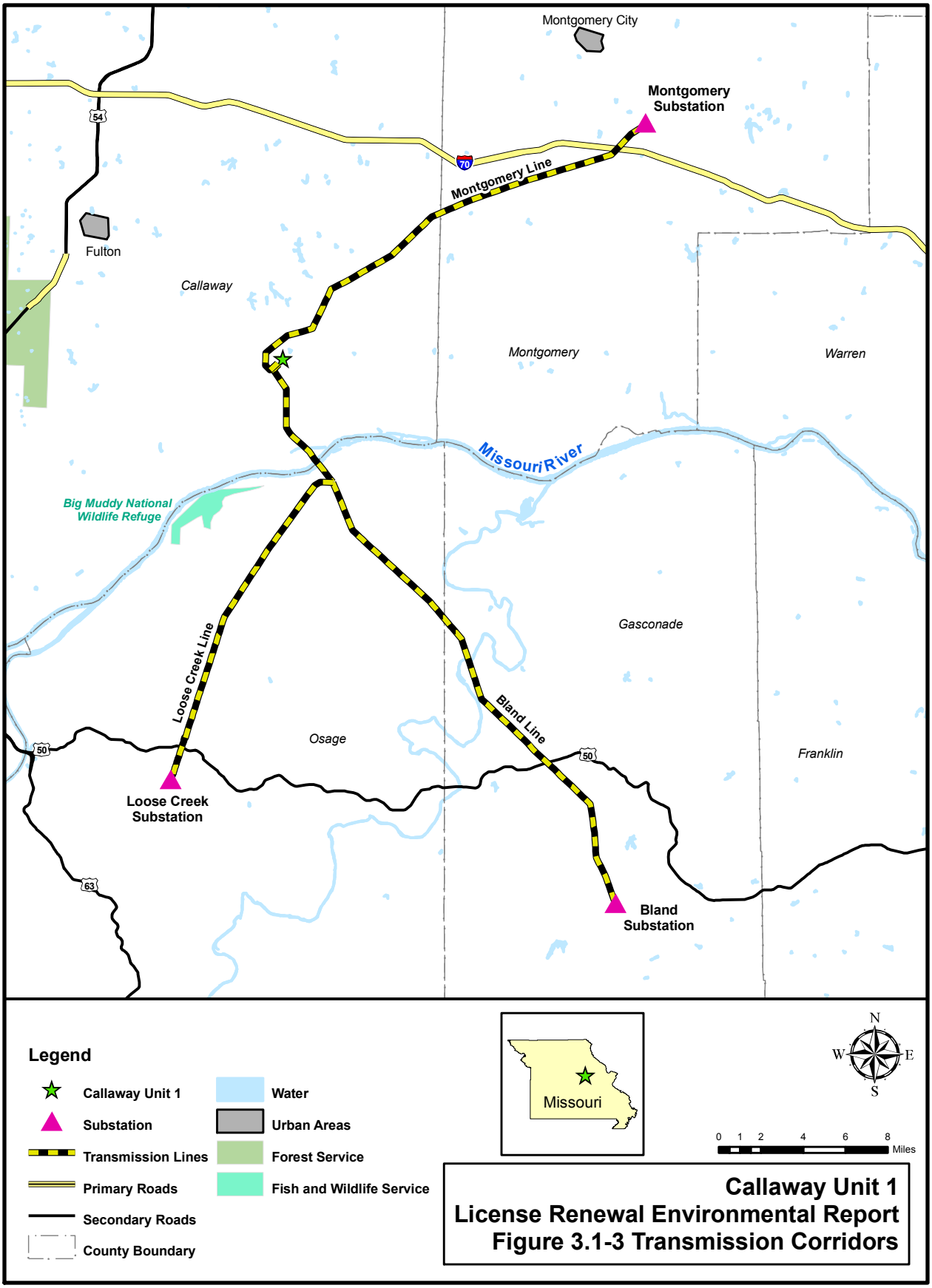
0.25
0.5
Miles
Callaway Unit 1
License Renewal Environmental Report
Figure 3.1-1 Plant Layout


State Hwy O
State Hwy CC
Cnty Rd 448
State Hwy D
Cnty Rd 428
Cnty Rd 448
Cnty Rd 457
Cnty Rd 448
Cnty Rd 468
Cnty Rd 469
Discharge
State Hwy CC
State Hwy 94
Intake
Missouri
N
W
E
S
0 0.25 0.5 1
Miles
Legend
Intake
Discharge
Pipeline
Transmission Lines
Roads
Structures
Ameren Property Boundary
Callaway Plant Site Area
Water
Callaway Unit 1
License Renewal Environmental Report
Figure 3.1-2 Site Layout


Montgomery City
Montgomery Substation
Montgomery Line
54
70
Fulton
Callaway
Montgomery
Warren
Missouri River
Big Muddy National Wildlife Refuge
Gasconade
Loose Creek Line
Bland Line
50
Osage
Franklin
Loose Creek Substation
63
Bland Substation
Legend
Callaway Unit 1
Substation
Transmission Lines
Primary Roads
Secondary Roads
County Boundary
Water
Urban Areas
Forest Service
Fish and Wildlife Service
Missouri
N
W
E
S
0 1 2 4 6 8
Miles
Callaway Unit 1
License Renewal Environmental Report
Figure 3.1-3 Transmission Corridors

3.6 REFERENCES

Section 3.1

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NRC (U.S. Nuclear Regulatory Commission) 1996. Generic Environmental Impact Statement for License Renewal of Nuclear Plants (GEIS), Volumes 1 and 2, NUREG-1437. Office of Nuclear Reactor Regulation, Washington, D.C., May.

Section 3.2

NRC (U.S. Nuclear Regulatory Commission) 1996. Generic Environmental Impact Statement for License Renewal of Nuclear Plants (GEIS), Volumes 1 and 2, NUREG-1437. Office of Nuclear Reactor Regulation, Washington, D.C., May.

Section 3.3

NRC (U.S. Nuclear Regulatory Commission) 1996. Generic Environmental Impact Statement for License Renewal of Nuclear Plants (GEIS), Volumes 1 and 2, NUREG-1437. Office of Nuclear Reactor Regulation, Washington, D.C., May.

Section 3.4

NRC (U.S. Nuclear Regulatory Commission) 1996. Generic Environmental Impact Statement for License Renewal of Nuclear Plants (GEIS), Volumes 1 and 2, NUREG-1437. Office of Nuclear Reactor Regulation, Washington, D.C., May.

4.0 CHAPTER 4 - ENVIRONMENTAL CONSEQUENCES OF THE PROPOSED ACTION AND MITIGATING ACTIONS

NRC

"The report must contain a consideration of alternatives for reducing adverse impacts…for all Category 2 license renewal issues…." 10 CFR 51.53(c)(3)(iii)

"…The environmental report shall include an analysis that considers…the environmental effects of the proposed action…and alternatives available for reducing or avoiding adverse environmental effects.…" 10 CFR 51.45(c) as adopted by 10 CFR 51.53(c)(2) and 10 CFR 51.53(c)(3)(iii)

The environmental report shall discuss "The impact of the proposed action on the environment. Impacts shall be discussed in proportion to their significance" 10 CFR 51.45(b)(1) as adopted by 10 CFR 51.53(c)(2).

"…The information submitted…should not be confined to information supporting the proposed action but should also include adverse information." 10 CFR 51.45(e) as adopted by 10 CFR 51.53(c)(2)

Chapter 4 presents an assessment of the environmental consequences and potential mitigating actions associated with the renewal of the Callaway Plant operating license. The NRC's Generic Environmental Impact Statement for License Renewal of Nuclear Plants (GEIS) (NRC 1996) identifies and analyzes 92 environmental issues that NRC considers to be associated with nuclear power plant license renewal. In its analysis, NRC designated each of the issues as Category 1, Category 2, or NA (not applicable) and required plant-specific analysis of only the Category 2 issues.

NRC designated an issue as Category 1 if, based on the result of its analysis, the following criteria were met:

- the environmental impacts associated with the issue were determined to apply either to all plants or, for some issues, to plants having a specific type of cooling system or other specified plant or site characteristic

- a single significance level (i.e., small, moderate, or large) was assigned to the impacts that would occur at any plant, regardless of which plant was being evaluated (except for collective offsite radiological impacts from the fuel cycle and from high-level waste and spent fuel disposal)

- mitigation of adverse impacts associated with the issue were considered in the analysis, and it was determined that additional plant-specific mitigation measures are likely to be not sufficiently beneficial to warrant implementation.

Absent new and significant information (Chapter 5), NRC rules do not require analyses of Category 1 issues, because NRC resolved them using generic findings presented in 10 CFR 51, Appendix B, Table B-1. An applicant may reference the generic findings or GEIS analyses for Category 1 issues.

If the NRC analysis concluded that one or more of the Category 1 criteria could not be met, the issue was assigned as Category 2. NRC requires plant-specific analyses for Category 2 issues. NRC designated two issues as "NA" (Issues 60 and 92), signifying that the categorization and impact definitions do not apply to these issues. Attachment A of this report lists the 92 issues. Attachment A also identifies the environmental report section that addresses each issue and, where appropriate, references supporting analyses in the GEIS.

Category 1 License Renewal Issues

NRC

"The environmental report for the operating license renewal stage is not required to contain analyses of the environmental impacts of the license renewal issues identified as Category 1 issues in Appendix B to subpart A of this part." 10 CFR 51.53(c)(3)(i)

"…[A]bsent new and significant information, the analysis for certain impacts codified by this rulemaking need only be incorporated by reference in an applicant's environmental report for license renewal…." 61 FR 28483

Ameren has determined that, of the 69 Category 1 issues, 6 do not apply to the Callaway Plant because they apply to design or operational features that do not exist at the facility. In addition, because Ameren does not plan to conduct any refurbishment activities, the NRC findings for the 7 Category 1 issues that pertains only to refurbishment do not apply to this application. As discussed in Section 5.0, Ameren is not aware of any new and significant information that would make the remaining 56 Category 1 findings inapplicable to Callaway. Therefore, Ameren adopts by reference the NRC findings for these Category 1 issues.

Category 2 License Renewal Issues

NRC

"The environmental report must contain analyses of the environmental impacts of the proposed action, including the impacts of refurbishment activities, if any, associated with license renewal and the impacts of operation during the renewal term, for those issues identified as Category 2 issues in Appendix B to subpart A of this part…." 10 CFR 51.53(c)(3)(ii)

"The report must contain a consideration of alternatives for reducing adverse impacts, as required by § 51.45(c), for all Category 2 license renewal issues…." 10 CFR 51.53(c)(3)(iii)

NRC designated 21 issues as Category 2. Sections 4.1 through 4.20 address each of these issues (Section 4.17 addresses two issues). As is the case with Category 1 issues, some Category 2 issues apply to operational features that Callaway does not have. Attachment A provides a summary of the applicability of each of the NRC's 92 issues to the Callaway Plant.

For the 12 Category 2 issues that Ameren has determined to be applicable to Callaway, analyses are provided. These analyses include conclusions regarding the significance of the impacts relative to the renewal of the operating license for Callaway and, when applicable, discuss potential mitigative alternatives. Ameren has identified the significance of the impacts

associated with each issue as either Small, Moderate, or Large, consistent with the criteria that NRC established in 10 CFR 51, Appendix B, Table B-1, Footnote 3 as follows:

> SMALL - Environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource. For the purposes of assessing radiological impacts, the Commission has concluded that those impacts that do not exceed permissible levels in the Commission's regulations are considered small.
>
> MODERATE - Environmental effects are sufficient to alter noticeably, but not to destabilize, any important attribute of the resource.
>
> LARGE - Environmental effects are clearly noticeable and are sufficient to destabilize any important attributes of the resource.

In accordance with National Environmental Policy Act practice, Ameren considered ongoing and potential additional mitigation in proportion to the significance of the impact to be addressed (i.e., impacts that are small receive less mitigative consideration than impacts that are large).

"NA" License Renewal Issues

NRC determined that its categorization and impact-finding definitions did not apply to two issues [Issues 60 (electromagnetic fields) and 92 (environmental justice)]; however, Ameren included these issues in Attachment A. Applicants currently do not need to submit information on chronic effects from electromagnetic fields (10 CFR 51, Appendix B, Table B-1, Footnote 5). For environmental justice, NRC does not require information from applicants, but noted that it will be addressed in individual license renewal reviews (10 CFR 51, Appendix B, Table B-1, Footnote 6). Ameren has included minority and low income demographic information in Section 2.6.2.

4.1 WATER USE CONFLICTS (PLANTS USING COOLING TOWERS OR COOLING PONDS AND WITHDRAWING MAKEUP WATER FROM A SMALL RIVER WITH LOW FLOW)

NRC

"If the applicant's plant utilizes cooling towers or cooling ponds and withdraws make-up water from a river whose annual flow rate is less than 3.15×10^{12} ft^3/year (9×10^{10} m^3/year), an assessment of the impact of the proposed action on the flow of the river and related impacts on in-stream and riparian ecological communities must be provided…" 10 CFR 51.53(c)(3)(ii)(A).

"…The issue has been a concern at nuclear power plants with cooling ponds and at plants with cooling towers. Impacts on instream and riparian communities near these plants could be of moderate significance in some situations…" 10 CFR 51, Subpart A, Appendix B, Table B-1, Issue 13

The water-use issue associated with operation of cooling towers is the availability of adequate stream flows to provide makeup water, particularly during droughts or in the context of increasing in-stream or off-stream uses (NRC 1996). For this reason, NRC made surface water use conflicts a Category 2 issue.

As discussed in Section 3.1, Callaway Unit 1 receives its cooling tower makeup water from the Missouri River. The Missouri River Basin drains an area of 530,000 square miles and significant portions of ten states: Montana, Wyoming, Colorado, North Dakota, South Dakota, Minnesota, Iowa, Nebraska, Kansas and Missouri (USACE 2003). From 1958 to 2008, annual mean flow at the U.S. Geological Survey (USGS) Boonville gaging station, located 82 miles upstream of Callaway, ranged from 36,880 to 140,500 cubic feet per second (cfs) and averaged 67,020 cfs. Daily mean flows over the same period ranged from 5,000 to 721,000 cfs (USGS 2009a). At the USGS Hermann gaging station located approximately 17 miles downstream of Callaway, annual mean flows ranged from 41,690 to 181,800 cfs and averaged 86,190 cfs. Daily mean flows ranged from 6,210 to 739,000 cfs (USGS 2009b). Based on the 50-year average of the mean annual flows for Hermann (86,190 cfs = 2.72×10^{12} cubic feet per year), the Missouri River meets the NRC definition of a small river.

Missouri is a riparian water state, which means that all landowners whose property is adjacent to a body of water have the right to make reasonable use of it. Therefore, water use rights or permits are not required in Missouri (MDNR 2003; MDNR 2007). However, any entity that withdraws water at a rate exceeding 70 gallons per minute (gpm) from either groundwater or surface water is classified as a Major Water User and is required to report water withdrawals to the Missouri Department of Natural Resources (MDNR) (MDNR 2008).

Central Missouri has relatively abundant surface water and groundwater resources, and as a result, water use concerns are primarily focused on water quality and resource protections (MDNR 2002). In central Missouri, surface water withdrawals are used for industrial and residential needs, power generation, and irrigation. However, except for the Central Electric Power Cooperative Chamois Plant, there are no major water users located within five miles of the Callaway plant (MDNR 2010a).

Based on the lowest mean daily flows of the Missouri River at the Boonville and Hermann gaging stations (5,000 and 6,210 cfs, respectively), the lowest daily mean flow at the River Intake Structure could be assumed to be the average of these two values or 5,605 cfs. The maximum Callaway Unit 1 water withdrawal of 56 cfs represents less than one percent of this flow value.

As discussed in Section 3.1, Callaway Unit 1 also discharges cooling tower blowdown and other treated waste streams to the Missouri River. The daily average discharge is 7.5 cfs, while the maximum daily discharge is 25 cfs (MDNR 2010b). Based on the daily average discharge rate of 7.5 cfs, Callaway Unit 1 replaces to the river approximately 13 percent of the plant's daily maximum water withdrawal of 56 cfs. Taking into account the plant's discharge rate of 7.5 cfs indicates that the plant's water withdrawal is approximately 0.86 percent of the estimated lowest daily mean flow of the Missouri River at the River Intake Structure.

Based on the following findings, withdrawals of surface water for the operation of Callaway Unit 1 during low-flow periods would have a SMALL impact on the availability of fresh water downstream of the site and would not warrant further mitigation:

- The Missouri River Basin drains an area of 530,000 square miles.
- Except for the Central Electric Power Cooperative Chamois Plant, there are no major water users located within five miles of the Callaway plant.
- The maximum Callaway Unit 1 water withdrawal of 56 cfs represents less than one percent of this flow value of 5,605 cfs, which is based on the lowest mean daily flows of the Missouri River at the Boonville and Hermann gaging stations.
- Taking into account the plant's discharge rate of 7.5 cfs indicates that the plant's water use is approximately 0.86 percent of the estimated lowest daily mean flow of the Missouri River at the River Intake Structure.

4.2 ENTRAINMENT OF FISH AND SHELLFISH IN EARLY LIFE STAGES

NRC

"If the applicant's plant utilizes once-through cooling or cooling pond heat dissipation systems, the applicant shall provide a copy of current Clean Water Act 316(b) determinations…or equivalent State permits and supporting documentation. If the applicant cannot provide these documents, it shall assess the impact of the proposed action on fish and shellfish resources resulting from…entrainment." 10 CFR 51.53(c)(3)(ii)(B)

"...The impacts of entrainment are small in early life stages at many plants but may be moderate or even large at a few plants with once-through and cooling pond cooling systems. Further, ongoing efforts in the vicinity of these plants to restore fish populations may increase the numbers of fish susceptible to intake effects during the license renewal period, such that entrainment studies conducted in support of the original license may no longer be valid..." 10 CFR 51, Subpart A, Appendix B, Table B-1, Issue 25

NRC made impacts of entrainment of fish and shellfish in early life stages a Category 2 issue for certain plants because it could not assign a single significance level to the issue. The impacts of entrainment are small at many plants, but may be moderate or large at others (NRC 1996). Information needed to ascertain the impacts includes: (1) type of cooling system (whether once-through or cooling pond), and (2) status of Clean Water Act (CWA) Section 316(b) determination or equivalent state documentation. A CWA Section 316(b) determination by the regulatory authority is needed only for once-through cooling systems.

The issue of entrainment of fish and shellfish in early life stages does not apply to Callaway Unit 1 because the plant does not use once-through cooling or cooling pond heat dissipation systems. As described in Section 3.1.2, Callaway Unit 1 uses a closed-cycle cooling system with a large, natural-draft cooling tower. River (raw) water is withdrawn from the Missouri River at the River Intake Structure, pumped to the Water Treatment Plant where suspended solids are removed, then pumped to the cooling tower basin for use as makeup water. Blowdown is discharged to the Missouri River downstream of the River Intake Structure to prevent re-circulation.

4.3 IMPINGEMENT OF FISH AND SHELLFISH

NRC

"If the applicant's plant utilizes once-through cooling or cooling pond heat dissipation systems, the applicant shall provide a copy of current Clean Water Act 316(b) determinations…or equivalent State permits and supporting documentation. If the applicant cannot provide these documents, it shall assess the impact of the proposed action on fish and shellfish resources resulting from…impingement…." 10 CFR 51.53(c)(3)(ii)(B)

"…The impacts of impingement are small at many plants but may be moderate or even large at a few plants with once-through and cooling-pond cooling systems…." 10 CFR 51, Subpart A, Appendix B, Table B 1, Issue 26

NRC made impacts of impingement of fish and shellfish a Category 2 issue for certain plants because it could not assign a single significance level to the issue. The impacts of impingement are small at many plants, but may be moderate or large at others (NRC 1996). Information needed to ascertain the impacts includes: (1) type of cooling system (whether once-through or cooling pond), and (2) status of CWA Section 316(b) determination or equivalent state documentation. A CWA Section 316(b) determination by the regulatory authority is needed only for once-through cooling systems.

The issue of impingement of fish and shellfish does not apply to Callaway Unit 1 because the plant does not use once-through cooling or cooling pond heat dissipation systems. As described in Section 3.1.2, Callaway Unit 1 uses a closed-cycle cooling system with a large, natural-draft cooling tower. River (raw) water is withdrawn from the Missouri River at the River Intake Structure, pumped to the Water Treatment Plant where suspended solids are removed, then pumped to the cooling tower basin for use as makeup water. Blowdown is discharged to the Missouri River downstream of the River Intake Structure to prevent re-circulation.

4.4 HEAT SHOCK

NRC

> "If the applicant's plant utilizes once-through cooling or cooling pond heat dissipation systems, the applicant shall provide a copy of current Clean Water Act… 316(a) variance in accordance with 40 CFR Part 125, or equivalent State permits and supporting documentation. If the applicant cannot provide these documents, it shall assess the impact of the proposed action on fish and shellfish resources resulting from heat shock …." 10 CFR 51.53(c)(3)(ii)(B)
>
> "…Because of continuing concerns about heat shock and the possible need to modify thermal discharges in response to changing environmental conditions, the impacts may be of moderate or large significance at some plants…." 10 CFR 51, Subpart A, Appendix B, Table B-1, Issue 27

NRC made impacts of heat shock on fish and shellfish a Category 2 issue for certain plants because of continuing concerns about thermal discharge effects and the possible need to modify thermal discharges in response to changing environmental conditions (NRC 1996). Information needed to ascertain the impacts includes: (1) type of cooling system (whether once-through or cooling pond), and (2) evidence of CWA Section 316(a) variance or equivalent state documentation.

The issue of heat shock to fish and shellfish does not apply to Callaway Unit 1 because the plant does not use once-through or cooling pond heat dissipation systems. As described in Section 3.1.2, Callaway Unit 1 uses a closed-cycle cooling system with a large, natural-draft cooling tower. River (raw) water is withdrawn from the Missouri River at the River Intake Structure, pumped to the Water Treatment Plant where suspended solids are removed, then pumped to the cooling tower basin for use as makeup water. Blowdown is discharged to the Missouri River downstream of the River Intake Structure to prevent re-circulation.

4.5 GROUNDWATER USE CONFLICTS (PLANTS USING >100 GPM OF GROUNDWATER)

NRC

"If the applicant's plant…pumps more than 100 gallons (total onsite) of groundwater per minute, an assessment of the impact of the proposed action on groundwater use must be provided." 10 CFR 51.53(c)(3)(ii)(C)

"…Plants that use more than 100 gpm may cause ground-water use conflicts with nearby ground-water users…." 10 CFR 51, Subpart A, Table B-1, Issue 33

NRC made groundwater use conflicts a Category 2 issue because, at a withdrawal rate of more than 100 gallons per minute (gpm), a cone of depression could extend offsite. This could deplete the groundwater supply available to offsite users, an impact that could warrant mitigation. Information to ascertain includes: (1) Callaway Unit 1 groundwater withdrawal rate (whether greater than 100 gpm), (2) drawdown at property boundary location, and (3) impact on neighboring wells.

As discussed in Section 3.1, Callaway Unit 1 uses two influent cooling water sources: the Missouri River and groundwater. There are two active groundwater wells at Callaway: potable Well #3 and Intake Well #1 (Section 2.3). Both wells are screened from the lower Cotter-Jefferson City Dolomite aquifer and terminate in the Eminence Dolomite aquifer.

The maximum groundwater use at Well #3 is approximately 400 gpm for two hours a day. The flowrate of the well pump doesn't vary since it is controlled by a level switch in the clearwell. When the water level drops below a certain point in the clearwell, the Well #3 pump is automatically turned on at a rate of approximately 400 gpm until the clearwell is filled (Ameren 2011). The average groundwater use at Intake Well #1 is 120 gpm (AmerenUE 2009). Callaway Well #3 and Intake Well #1 were originally designed to pump at rates of 565 gpm and 665 gpm, respectively.

The nearest public water well to Callaway Well #3, which is 1,480 feet deep, is approximately 1.9 miles northwest of the plant site. The well supplies potable water to the Callaway #2 Water District and is installed in the Cotter-Jefferson City Dolomite aquifer to a depth of 707 feet bgs (USEPA 2009; Tetra Tech 2010). The closest nonpublic supply well to Callaway Well #3 is approximately 0.8 miles north of the site and is classified as an irrigation well. The well is 375 feet deep and likely draws water from the upper Cotter-Jefferson City Dolomite aquifer (MDNR 2007). Since the maximum pumping rate of Well #3 is 70 gpm, and the Cotter-Jefferson City Dolomite and Eminence aquifers have sufficient water to limit the drawdown to the immediate vicinity of Well #3, Ameren concludes that impacts to the Cotter-Jefferson City Dolomite and Eminence aquifers from the Callaway Unit 1 production Well #3 would be SMALL.

The closest private well to the 856-feet deep Callaway Intake Well #1 is approximately 0.25 miles southeast of Intake Well #1. The private well is classified as a domestic well that is 375 feet deep. Since Intake #1 is installed the lower Cotter-Jefferson City Dolomite aquifer and terminates in the Eminence aquifer, the 120 gpm average pumping rate of Intake Well #1 is not expected to adversely affect the upper Cotter-Jefferson City Dolomite aquifer in vicinity of the domestic well (MDNR 2010).

It is not expected that changes in operational water needs would occur during the license renewal period. Therefore, Ameren concludes that impacts to the Cotter-Jefferson City Dolomite and Eminence aquifers from onsite groundwater use over the license renewal period would be SMALL and would not warrant mitigation.

4.6 GROUNDWATER USE CONFLICTS (PLANTS USING COOLING TOWERS OR COOLING PONDS AND WITHDRAWING MAKEUP WATER FROM A SMALL RIVER)

NRC

> "If the applicant's plant utilizes cooling towers or cooling ponds and withdraws make-up water from a river whose annual flow rate is less than 3.15×10^{12} ft^3/year…[t]he applicant shall also provide an assessment of the impacts of the withdrawal of water from the river on alluvial aquifers during low flow." 10 CFR 51.53(3)(ii)(A)
>
> "…Water use conflicts may result from surface water withdrawals from small water bodies during low flow conditions which may affect aquifer recharge, especially if other groundwater or upstream surface water users come on line before the time of license renewal…" 10 CFR 51, Subpart A, Appendix B, Table B-1, Issue 34

NRC made this groundwater use conflicts a Category 2 issue because consumptive use of water withdrawn from small rivers could adversely impact groundwater-aquifer recharge. This is a particular concern during low-flow conditions and could create an adverse cumulative impact if there were additional large consumptive users withdrawing water from the same river. Callaway Unit 1 uses a cooling tower, which loses water through evaporation and drift. This water must be made up by water from the Missouri River.

As discussed in Section 3.1, Callaway Unit 1 uses two influent cooling water sources: the Missouri River and groundwater. From 1958 to 2008, annual mean flow at the U.S. Geological Survey (USGS) Boonville gaging station located 82 miles upstream of Callaway ranged from 36,880 to 140,500 cubic feet per second (cfs) and averaged 67,020 cfs. Daily mean flows over the same period ranged from 5,000 to 721,000 cfs (USGS 2009a). At the USGS Hermann gaging station located approximately 17 miles downstream of Callaway, annual mean flows ranged from 41,690 to 181,800 cfs and averaged 86,190 cfs. Daily mean flows ranged from 6,210 to 739,000 cfs (USGS 2009b). Based on the 50-year average of the mean annual flows for Hermann (86,190 cfs = 2.72×10^{12} cubic feet per year), the Missouri River meets the NRC definition of a small river.

Callaway Unit 1 withdraws its makeup water at the River Intake Structure on the bank of the Missouri River at a maximum rate of 25,000 gallons per minute (gpm) (56 cfs), and at an average rate ranging from 14,000 (31 cfs) to 17,000 gpm (38 cfs).

Based on the lowest mean flows of the Missouri River at the Boonville and Hermann gaging stations (5,000 and 6,210 cfs, respectively), the lowest daily mean flow at the River Intake Structure could be assumed to be the average of these two values or 5,605 cfs. The maximum Callaway Unit 1 water withdrawal of 56 cfs represents less than one percent of this flow value.

As discussed in Section 3.1, Callaway Unit 1 also discharges cooling tower blowdown and other treated waste streams to the Missouri River. The daily average discharge is 7.5 cfs, while the maximum daily discharge is 25 cfs (MDNR 2010). Based on the daily average discharge rate of 7.5 cfs, Callaway Unit 1 replaces to the river approximately 13 percent of the plant's daily

maximum water withdrawal of 56 cfs. Taking into account the plant's discharge rate of 7.5 cfs indicates that the plant's water use is approximately 0.86 percent of the estimated lowest daily mean flow of the Missouri River at the River Intake Structure.

The Missouri River alluvial aquifer receives recharge from three sources: the Missouri River and its tributaries during high flow periods, bedrock adjacent to and underlying the alluvium, and from precipitation. Water from the Missouri River recharges the alluvial aquifer generally under two conditions: when the river is at high flow elevations above the potentiometric surface of the alluvial aquifer and where high-yield wells installed near the river induces direct recharge from the river to the alluvium. Leakage from plateau bedrock aquifers yield significant volumes of water to the alluvial aquifer (MDNR 1997).

In the 147-mile reach of the Missouri River from Jefferson City to St. Charles, the alluvial aquifer underlies approximately 224 square miles and contains about 560 billion gallons, or about 1.7 million acre-feet of water (MDNR 1997). Near the site, the alluvial aquifer is approximately 95 to 99 feet thick and occurs in an approximately 2.5-mile wide band that parallels the river (Burns & McDonnell 2008).

Based on the following findings, withdrawals of surface water for the operation of Callaway Unit 1 during low-flow periods would have a SMALL impact on recharge to the alluvial aquifer and would not warrant mitigation:

- The maximum Callaway Unit 1 water withdrawal of 56 cfs minus the plant's average discharge rate of 7.5 cfs indicates that the plant's water use is approximately 0.86 percent of the estimated lowest daily mean flow of the Missouri River at the River Intake Structure.

- The alluvial aquifer is recharged by the Missouri River only during high flow periods.

- In the 147-mile reach of the Missouri River from Jefferson City to St. Charles, the alluvial aquifer underlies approximately 224 square miles and contains approximately 1.7 million acre-feet of water. Near the site, the alluvial aquifer is approximately 95 to 99 feet thick is approximately 2.5-miles wide.

4.7 GROUNDWATER USE CONFLICTS (PLANTS USING RANNEY WELLS)

NRC

"If the applicant's plant uses Ranney wells…an assessment of the impact of the proposed action on groundwater use must be provided." 10 CFR 51.53(c)(3)(ii)(C)

"…Ranney wells can result in potential ground-water depression beyond the site boundary. Impacts of large ground-water withdrawal for cooling tower makeup at nuclear power plants using Ranney wells must be evaluated at the time of application for license renewal…." 10 CFR 51, Subpart A, Table B-1, Issue 35

NRC made this groundwater use conflict a Category 2 issue because large quantities of groundwater withdrawn from Ranney wells could degrade groundwater quality at river sites by induced infiltration of poor-quality river water into an aquifer.

This issue does not apply to Callaway Unit 1 because Callaway Unit 1 does not use Ranney wells. As Section 3.1.2 describes, there are two influent water sources to Callaway: the Missouri River and groundwater. Groundwater is supplied via two groundwater production wells.

4.8 DEGRADATION OF GROUNDWATER QUALITY

NRC

"If the applicant's plant is located at an inland site and utilizes cooling ponds, an assessment of the impact of the proposed action on groundwater quality must be provided." 10 CFR 51.53(c)(3)(ii)(D)

"…Sites with closed-cycle cooling ponds may degrade ground-water quality. For plants located inland, the quality of the ground water in the vicinity of the ponds must be shown to be adequate to allow continuation of current uses…." 10 CFR 51, Subpart A, Appendix B, Table B 1, Issue 39

NRC made degradation of groundwater quality a Category 2 issue because evaporation from closed-cycle cooling ponds concentrates dissolved solids in the water and settles suspended solids. In turn, seepage into the water table aquifer could degrade groundwater quality.

The issue of groundwater degradation does not apply to Callaway Unit 1 because the plant does not use cooling water ponds.

4.9 IMPACTS OF REFURBISHMENT ON TERRESTRIAL RESOURCES

NRC

The environmental report must contain an assessment of "…the impact of refurbishment and other license-renewal-related construction activities on important plant and animal habitats…." 10 CFR 51.53(c)(3)(ii)(E)

"…Refurbishment impacts are insignificant if no loss of important plant and animal habitat occurs. However, it cannot be known whether important plant and animal communities may be affected until the specific proposal is presented with the license renewal application…." 10 CFR 51, Subpart A, Table B-1, Issue 40

"…If no important resource would be affected, the impacts would be considered minor and of small significance. If important resources could be affected by refurbishment activities, the impacts would be potentially significant…." (NRC 1996)

NRC made impacts to terrestrial resources from refurbishment a Category 2 issue because the significance of ecological impacts cannot be determined without considering site- and project-specific details (NRC 1996). Aspects of the site and project to be ascertained are: (1) the identification of important ecological resources, (2) the nature of refurbishment activities, and (3) the extent of impacts to plant and animal habitats.

As discussed in Section 3.2, Ameren has no plans for refurbishment or other license-renewal-related construction activities at Callaway. Therefore the issue of potential impacts of refurbishment on terrestrial resources is not applicable to Callaway.

4.10 THREATENED OR ENDANGERED SPECIES

NRC

"Additionally, the applicant shall assess the impact of the proposed action on threatened or endangered species in accordance with the Endangered Species Act." 10 CFR 51.53(c)(3)(ii)(E)

"Generally, plant refurbishment and continued operation are not expected to adversely affect threatened or endangered species. However, consultation with appropriate agencies would be needed at the time of license renewal to determine whether threatened or endangered species are present and whether they would be adversely affected." 10 CFR 51, Subpart A, Appendix B, Table B-1, Issue 49

NRC made impacts to threatened and endangered species a Category 2 issue because the status of many species is being reviewed, and site-specific assessment is required to determine whether any identified species could be affected by refurbishment activities or continued plant operations through the renewal period. In addition, compliance with the Endangered Species Act requires consultation with the appropriate federal agency (NRC 1996).

Section 2.2 of this Environmental Report describes the aquatic communities at Callaway. Section 2.4 describes important terrestrial habitats at Callaway and along the associated transmission corridors. Section 2.5 discusses threatened or endangered species that may occur in the counties in which Callaway and its transmission corridors are located. As discussed in Section 3.1.3, the transmission lines that connect Callaway to the regional transmission system are owned and maintained by Ameren.

Ameren has not identified any threatened or endangered species occurring at Callaway or along the associated transmission lines, and no critical habitat has been identified on the site or transmission corridors. The only federally protected species that is known to have been observed at Callaway is the bald eagle (*Haliaeetus leucocephalus*), but it is no longer designated as threatened or endangered. The bald eagle is typically observed along the Missouri River boundary and is not known to nest on or near the Callaway property. A few listed terrestrial species (e.g., Indiana bat, gray bat) may occur in the counties containing Callaway and its associated transmission corridors, but Ameren has not identified any observances of the species at the plant or along its transmission corridors. Similarly, a few threatened or endangered aquatic species (e.g., freshwater mussels, pallid sturgeon) occur within the Missouri River drainage near the plant site and additional listed species (e.g., Topeka shiner, Niangua darter) occur or historically occurred in the Missouri River tributaries that feed the Missouri River. Additional state-listed terrestrial and aquatic species could occur in the vicinity of the transmission corridors described in Section 3.1.3, but current operations of Callaway and vegetation management practices along Callaway transmission corridors are not believed to affect any listed terrestrial or aquatic species or its habitat. Furthermore, plant operations and transmission line maintenance practices are not expected to change significantly during the license renewal term. Therefore, renewal of the Callaway Unit 1 license is not expected to result in the taking of any threatened or endangered species, and is not likely to jeopardize the continued existence of any threatened or endangered species or result in the destruction or adverse modification of any critical habitat.

Ameren contacted the Missouri Department of Conservation and the U.S. Fish and Wildlife Service requesting information on any listed species or critical habitats that might occur at Callaway or along the associated transmission corridors, with particular emphasis on species that might be adversely affected by continued operation over the license renewal period. Agency responses are provided in Attachment C.

4.11 AIR QUALITY DURING REFURBISHMENT (NON-ATTAINMENT AREAS)

NRC

> "If the applicant's plant is located in or near a nonattainment or maintenance area, an assessment of vehicle exhaust emissions anticipated at the time of peak refurbishment workforce must be provided in accordance with the Clean Air Act as amended." 10 CFR 51.53(c)(3)(ii)(F)
>
> "…Air quality impacts from plant refurbishment associated with license renewal are expected to be small. However, vehicle exhaust emissions could be cause for concern at locations in or near nonattainment or maintenance areas. The significance of the potential impact cannot be determined without considering the compliance status of each site and the numbers of workers expected to be employed during the outage…." 10 CFR 51, Subpart A, Table B-1, Issue 50

NRC made impacts to air quality during refurbishment a Category 2 issue because vehicle exhaust emissions could be cause for some concern, and a general conclusion about the significance of the potential impact could not be drawn without considering the compliance status of each site and the number of workers expected to be employed during a refurbishment outage (NRC 1996). Information needed would include: (1) the attainment status of the plant-site area, and (2) the number of additional vehicles as a result of refurbishment activities.

The issue of air quality during refurbishment is not applicable to Callaway Unit 1 because, as discussed in Section 3.2, Ameren has no plans for refurbishment or other license-renewal-related construction activities at Callaway Unit 1. In addition, the plant is not located in or near a nonattainment area.

4.12 IMPACTS ON PUBLIC HEALTH OF MICROBIOLOGICAL ORGANISMS

NRC

> "If the applicant's plant uses a cooling pond, lake, or canal or discharges into a river having an annual average flow rate of less than 3.15×10^{12} ft^3/year (9×10^{10} m^3/year), an assessment of the impact of the proposed action on public health from thermophilic organisms in the affected water must be provided." 10 CFR 51.53(c)(3)(ii)(G)

> "…These organisms are not expected to be a problem at most operating plants except possibly at plants using cooling ponds, lakes, or canals that discharge to small rivers. Without site-specific data, it is not possible to predict the effects generically…." 10 CFR 51, Subpart A, Table B-1, Issue 57

Due to the lack of sufficient data for facilities using cooling ponds, lakes, or canals or discharging to small rivers, NRC designated impacts on public health from thermophilic organisms a Category 2 issue. Information to be determined is: (1) whether the plant uses a cooling pond, lake, or canal or discharges to a small river, and (2) whether discharge characteristics (particularly temperature) are favorable to the survival of thermophilic organisms. This issue is applicable to Callaway because the plant uses a cooling tower that receives its makeup from a small river (Missouri River) and discharges blowdown back to that river.

The microorganisms of concern include the enteric pathogens *Salmonella* and *Shigella*, the *Pseudomonas aeruginosa* bacterium, thermophilic *Actinomycetes* ("fungi"), the many species of *Legionella* bacteria, and pathogenic strains of the free-living *Naegleria* amoeba. Healthy adults are generally resistant to infections of *Naegleria fowleri*, but once infected, death is generally the end result.

These organisms are able to survive and even thrive at temperatures greater than those found in the natural environment. Therefore, most steam-powered plants have the potential to enhance natural concentrations of these organisms, because of the slightly heated water in the circulating water system. As a consequence, condenser cleaning and cooling tower maintenance activities can potentially expose workers to these thermophilic organisms. Heated water discharges into water bodies used by the public can expose members of the public to these organisms.

Of special interest to worker safety is *Legionella* spp. and *Naegleria fowleri*. Optimal temperatures for the various *Legionella* species range from 90 to 105 degrees Fahrenheit. *Naegleria* can be enhanced in heated water bodies at temperatures ranging from 95 to 106 degrees Fahrenheit (NRC 2009). *Naegleria* is also of special interest for public exposure in heated effluents.

Callaway's discharge monitoring reports for 2008 indicate that discharge temperatures rarely exceed 90 degrees. The highest recorded daily temperature in 2008 for Callaway blowdown was 98 degrees Fahrenheit, occurring in August, but most days that month were below 90 degrees. The Callaway discharge permit does not contain a temperature limit (AmerenUE 2008a, b, c; AmerenUE 2009).

Approximately 1.5 river miles upstream from Callaway, on the Missouri River, is the Chamois Power Plant, a two-unit, 59-megawatt, coal-fired power plant. Discharges from this plant are typically below 90 degrees Fahrenheit, but some summer days can exceed 100 degrees, with July 31, 2006 indicating 107 degrees discharge (USEPA 2009). Given that thermal plumes generally dissipate to ambient conditions within hundreds of feet of the discharge (depending on ambient temperature, discharge temperature, discharge flow, river flow, discharge design), the probability of the Chamois plants thermal plume reaching the Callaway discharge is very low.

Ameren has health and safety procedures that protect workers from exposures to thermophilic pathogens. These include use of respirators and chlorination of the circulating water system prior to its removal from service for maintenance. Therefore, infections of plant workers are not expected.

Since there is no public access to the main steam condensers or the cooling tower, public exposures are limited to the small area of the Missouri River near the blowdown discharge. Recreational use of the river in this area is rare. Furthermore, only during the hottest days of the summer do blowdown temperatures approach the level that would enhance concentrations of naturally occurring organisms. Given the frequent chlorination of the circulating water system, thermophilic organisms are not expected in the blowdown water. There have no known occurrences of *Naegleria fowleri* or *Legionella* in the vicinity of Callaway. Ameren believes the risk to public health from thermophilic microorganisms associated with the potential discharge of heated effluent to the Missouri River is SMALL and would not warrant mitigation.

Except for reporting requirements for cases of legionellosis and drinking water treatment regulations that address *Legionella*, the State of Missouri has no regulations regarding thermophilic organisms. Ameren has written the Missouri Department of Health and Senior Services and the Missouri Department of Natural Resources requesting information on any concerns relative to these organisms in the Missouri River at the blowdown discharge point. Both state agencies responded but did not identify any specific concerns. However, neither agency could not rule out that continued operation of Callaway Unit 1 could result in a public health risk from thermophilic microorganisms. Copies of this correspondence are presented in Attachment E.

4.13 ELECTROMAGNETIC FIELDS – ACUTE EFFECTS

NRC

The environmental report must contain an assessment of the impact of the proposed action on the potential shock hazard from transmission lines". [i]f the applicant's transmission lines that were constructed for the specific purpose of connecting the plant to the transmission system do not meet the recommendations of the National Electric Safety Code for preventing electric shock from induced current…" 10 CFR 51.53(c)(3)(ii)(H)

"Electrical shock resulting from direct access to energized conductors or from induced charges in metallic structures have not been found to be a problem at most operating plants and generally are not expected to be a problem during the license renewal term. However, site-specific review is required to determine the significance of the electric shock potential at the site." 10 CFR 51, Subpart A, Appendix B, Table B 1, Issue 59

NRC made impacts of electric shock from transmission lines a Category 2 issue because, without a review of each plant's transmission line conformance with the National Electrical Safety Code (NESC) (IEEE 2007) criteria, NRC could not determine the significance of the electrical shock potential. In the case of Callaway, there have been no previous NRC or NEPA analyses of transmission-line-induced current hazards. Therefore, this section provides an analysis of the plant's transmission lines' conformance with the NESC standard. The analysis is based on computer modeling of induced current under the lines.

Objects located near transmission lines can become electrically charged due to their immersion in the lines' electric field. This charge results in a current that flows through the object to the ground. The current is called "induced" because there is no direct connection between the line and the object. The induced current can also flow to the ground through the body of a person who touches the object. An object that is insulated from the ground can actually store an electrical charge, becoming what is called "capacitively charged." A person standing on the ground and touching a vehicle or a fence receives an electrical shock due to the sudden discharge of the capacitive charge through the person's body to the ground. After the initial discharge, a steady-state current can develop of which the magnitude depends on several factors, including the following:

- the strength of the electric field which, in turn, depends on the voltage of the transmission line as well as its height and geometry
- the size of the object on the ground
- the extent to which the object is grounded.

In 1977, a provision to the NESC was adopted (Part 2, Rules 232C1c and 232D3c) that describes how to establish minimum vertical clearances to the ground for electric lines having voltages exceeding 98-kilovolt alternating current to ground. The clearance must limit the induced current (or steady-state current) due to electrostatic effects to 5 milliamperes (mA) if the largest anticipated truck, vehicle, or equipment were short-circuited to ground. By way of

comparison, the setting of ground fault circuit interrupters used in residential wiring (special breakers for outside circuits or those with outlets around water pipes) is 4 to 6 mA.

As described in Section 3.1.3, there are four 345-kilovolt lines that were specifically constructed to distribute power from Callaway to the electric grid. Ameren's analysis of these transmission lines began by identifying the worst-case ruling span for each line. The limiting case is the configuration along each line where the potential for current-induced shock would be greatest. Once the limiting case was identified, Ameren calculated the electric field strength for each transmission line, then calculated the induced current.

Ameren calculated electric field strength and induced current using a computer code produced by the Southern California Edison. The input parameters included the design features of the limiting-case scenario and the maximum vehicle size under the lines (a tractor-trailer). The results of the analysis are presented in Table 4.13-1. All of the lines conform to the 5-milliampere standard

Title 4 of the Missouri Code of State Regulations, Division 240, Chapter 23 (4 CSR 240-23.020) establishes state requirements for patrols and inspections of electrical infrastructure. Ameren has surveillance and maintenance procedures that comply with these requirements and provide assurance that design ground clearances will not change. These procedures include routine aerial inspections that include checks for encroachments, broken conductors, broken or leaning structures, and signs of trees burning, any of which would be evidence of clearance problems. Ground inspections include examination for clearance at questionable locations, integrity of structures, and surveillance for dead or diseased trees that might fall on the transmission lines. Problems noted during any inspection are brought to the attention within the appropriate organization(s) for corrective action.

Ameren's assessment under 10 CFR 51 concludes that electric shock is of SMALL significance, because the NESC standard is not exceeded. Accordingly, no mitigation measures are required.

4.14 HOUSING IMPACTS

NRC

> The environmental report must contain "...[a]n assessment of the impact of the proposed action on housing availability…" 10 CFR 51.53(c)(3)(ii)(I)
>
> "…Housing impacts are expected to be of small significance at plants located in a medium or high population area and not in an area where growth control measures that limit housing development are in effect. Moderate or large housing impacts of the workforce associated with refurbishment may be associated with plants located in sparsely populated areas or areas with growth control measures that limit housing development…." 10 CFR 51, Subpart A, Table B-1, Issue 63
>
> "...[S]mall impacts result when no discernible change in housing availability occurs, changes in rental rates and housing values are similar to those occurring statewide, and no housing construction or conversion occurs…." (NRC 1996)

NRC made housing impacts a Category 2 issue because impact magnitude depends on local conditions that NRC could not predict for all plants at the time of GEIS publication (NRC 1996). Local conditions that need to be ascertained are: (1) population categorization as small, medium, or high and (2) applicability of growth control measures.

Refurbishment activities and plant aging management activities could result in housing impacts due to increased staffing. As described in Section 3.2, Ameren does not plan to perform refurbishment at Callaway Unit 1 and thus, no additional workers would be necessary. Therefore, Ameren concludes that there would be no refurbishment-related impacts to area housing and that no analysis is required.

Likewise, Ameren estimates that no additional workers would be needed to engage in plant aging management activities during the license renewal term (Sections 3.3 and 3.4). Therefore, Ameren concludes that there would be no aging management employment-related impacts to area housing and that no analysis is required. The appropriate characterization of Callaway Unit 1 license renewal housing impacts is SMALL, and no mitigation would be required.

4.15 PUBLIC WATER SYSTEMS

NRC

> The environmental report must contain "…an assessment of the impact of population increases attributable to the proposed project on the public water supply." 10 CFR 51.53(c)(3)(ii)(I)
>
> "An increased problem with water shortages at some sites may lead to impacts of moderate significance on public water supply availability." 10 CFR 51, Subpart A, Appendix B, Table B-1, Issue 65
>
> "Impacts on public utility services are considered small if little or no change occurs in the ability to respond to the level of demand and thus there is no need to add capital facilities. Impacts are considered moderate if overtaxing of facilities during peak demand periods occurs. Impacts are considered large if existing service levels (such as quality of water and sewage treatment) are substantially degraded and additional capacity is needed to meet ongoing demands for services." (NRC 1996)

NRC made public utility impacts a Category 2 issue because an increased problem with water availability, resulting from pre-existing water shortages, could occur in conjunction with plant demand and plant-related population growth (NRC 1996). Local information needed would include: (1) a description of water shortages experienced in the area and (2) an assessment of the public water supply system's available capacity.

NRC's analysis of impacts to the public water supply system considered both plant demand and plant-related population growth demands on local water resources. Callaway Unit 1 uses approximately 30 to 40 gallons per minute (gpm) of groundwater from onsite production Well #3 for process water makeup, potable water and fire protection, and approximately 120 gpm from Intake Well #1. Callaway Unit 1 does not use water from a municipal water supplier.

As described in Section 3.2, no refurbishment is planned and no refurbishment-related impacts to local public water supplies are therefore anticipated. Likewise, Ameren estimates that no additional workers would be needed to support plant aging management activities during the license renewal term (Sections 3.3 and 3.4). Therefore, there are no projected population increases attributable to the proposed project that would impact public water supply. Also, Ameren has identified no operational changes during the Callaway Unit 1 license renewal term that would increase plant water use. Therefore, Ameren expects license-renewal impacts to public water supplies to be SMALL, and mitigation would not be necessary.

4.16 EDUCATION IMPACTS FROM REFURBISHMENT

NRC

> The environmental report must contain "…[a]n assessment of the impact of the proposed action on…public schools (impacts from refurbishment activities only) within the vicinity of the plant…." 10 CFR 51.53(c)(3)(ii)(I)
>
> "…Most sites would experience impacts of small significance but larger impacts are possible depending on site- and project-specific factors…." 10 CFR 51, Subpart A, Table B-1, Issue 66
>
> "…[S]mall impacts are associated with project-related enrollment increases of 3 percent or less. Impacts are considered small if there is no change in the school systems' abilities to provide educational services and if no additional teaching staff or classroom space is needed. Moderate impacts are generally associated with 4 to 8 percent increases in enrollment. Impacts are considered moderate if a school system must increase its teaching staff or classroom space even slightly to preserve its pre-project level of service….Large impacts are associated with project-related enrollment increases above 8 percent…." (NRC 1996)

NRC made refurbishment-related impacts to education a Category 2 issue because site- and project-specific factors determine the significance of impacts (NRC 1996). Local factors to be ascertained include: (1) project-related enrollment increases and (2) status of the student/teacher ratio.

The issue of education impacts from refurbishment is not applicable to Callaway Unit 1 because, as discussed in Section 3.2, Ameren has no plans for refurbishment or other license-renewal-related construction activities at Callaway Unit 1.

4.17 OFFSITE LAND USE

4.17.1 Offsite Land Use – Refurbishment

NRC

The environmental report must contain "… [a]n assessment of the impact of the proposed action on...land-use" 10 CFR 51.53(c)(3)(ii)(I)

"…Impacts may be of moderate significance at plants in low population areas…." 10 CFR 51, Subpart A, Appendix B, Table B-1, Issue 68

"… [I]f plant-related population growth is less than 5 percent of the study area's total population, off-site land-use changes would be small, especially if the study area has established patterns of residential and commercial development, a population density of at least 60 persons per square mile (2.6 km^2), and at least one urban area with a population of 100,000 or more within 80 km (50 miles)…." (NRC 1996)

NRC made impacts to offsite land use as a result of refurbishment activities a Category 2 issue because land use changes could be considered beneficial by some community members and adverse by others. Local conditions to be ascertained include: (1) plant-related population growth, (2) patterns of residential and commercial development, and (3) proximity to an urban area with a population of at least 100,000 (NRC 1996).

This issue is not applicable to Callaway Unit 1 because, as Section 3.2 "Refurbishment Activities" discusses, Ameren has no plans for refurbishment at Callaway Unit 1.

4.17.2 Offsite Land Use – License Renewal Term

NRC

The environmental report must contain "An assessment of the impact of the proposed action on…land-use…" 10 CFR 51.53(c)(3)(ii)(I)

"…Significant changes in land use may be associated with population and tax revenue changes resulting from license renewal…." 10 CFR 51, Subpart A, Appendix B, Table B-1, Issue 69

"…I]f plant-related population growth is less than 5 percent of the study area's total population, off-site land-use changes would be small…." (NRC 1996).

"If the plant's tax payments are projected to be a dominant source of the community's total revenue, new tax-driven land-use changes would be large. This would be especially true where the community has no preestablished pattern of development or has not provided adequate public services to support and guide development in the past (NRC 1996).

NRC made impacts to offsite land use during the license-renewal term a Category 2 issue, because land-use changes may be perceived as beneficial by some community members and adverse by others. Therefore, NRC could not assess the potential significance of site-specific offsite land-use impacts. Site-specific factors to consider in an assessment of new tax-driven land-use impacts include: (1) the size of plant-related population growth compared to the area's total population, (2) the size of the plant's tax payments relative to the community's total revenue, (3) the nature of the community's existing land-use pattern, and (4) the extent to which the community already has public services in place to support and guide development (NRC 1996).

The GEIS presents an analysis of offsite land use for the renewal term that is characterized by two components: population-driven and tax-driven impacts (NRC 1996).

Population-Related Impacts

Based on the GEIS case-study analysis, NRC concluded that all new population-driven land-use changes during the license renewal term at all nuclear plants would be small. Population growth caused by license renewal would represent a "much smaller percentage" of the local area's total population than the percent change represented by operations-related growth (NRC 1996). Ameren agrees with the NRC conclusion that population-driven land-use impacts would be SMALL. Mitigation would not be warranted.

Tax-Revenue-Related Impacts

Determining tax-revenue-related land-use impacts is a two-step process. First, the significance of the plant's tax payments on taxing jurisdictions' tax revenues is evaluated. Then, the impact of the tax contribution on land use within the taxing jurisdiction's boundaries is assessed.

Tax Payment Significance

NRC has determined that the significance of tax payments as a source of local government revenue would be large if the payments are greater than 20 percent of revenue, moderate if the payments are between 10 and 20 percent of revenue, and small if the payments are less than 10 percent of revenue (NRC 1996).

Land Use Significance

NRC defined the magnitude of offsite land-use changes as follows (NRC 1996):

SMALL - very little new development and minimal changes to an area's land-use pattern.

MODERATE - considerable new development and some changes to land-use pattern.

LARGE - large-scale new development and major changes in land-use pattern.

NRC's case study analyses for projecting the potential new impacts of operations during the license renewal term examined the land-use changes associated with past operations. The conclusion from these analyses was that, if the plant's tax payments are projected to be a dominant source of the community's total revenue, new tax-driven land-use changes would be large. This would be especially true where the community has no preestablished pattern of development or has not provided adequate public services to support and guide development in the past (NRC 1996).

Callaway Unit 1 Tax Significance

Section 2.10 provides a comparison of total property tax payments made by the owners of Callaway Unit 1 to Callaway County and the South Callaway County R-II School District and those taxing entities' total property tax revenues. For the fiscal years 2004 through 2008, the tax payments made by the owners of Callaway Unit 1 to Callaway County have represented more than 20 percent of Callaway County's total property tax revenues and the tax payments to the South Callaway County R-II School District were, likewise, more than 20 percent of their total property tax revenues. Using NRC's criteria, tax payments made by the owners of Callaway Unit 1 are of large significance to Callaway County and the South Callaway County R-II School District.

Callaway Unit 1 Land Use Impacts

Land-use patterns have remained largely unchanged since Callaway Unit 1 commenced operations (Section 2.11). Callaway County is largely rural, as developed land accounts for only 2.9 percent of total land area (Section 2.11). Fulton is the largest city in the County, with a 2008 population estimate of only 12,707 (Section 2.6.1). The land-use patterns remaining largely unchanged since Callaway Unit 1 began operation and the small percentage of land classified as urban or built-up indicate that the tax payments made by the owners of Callaway Unit 1 have had minimal influence on the land-use patterns.

In conclusion, there will be no increase in license-renewal-related population. Drivers for future land-use changes considered in this assessment were population and tax payments. Ameren's tax payments are a large percentage of Callaway County's and South Callaway County R-II School District's total property tax revenues, but the tax contributions to the County and School District have not resulted in significant land-use changes. License renewal would not generate

additional annual tax revenues for Callaway County and the South Callaway County R-II School District, but would lead to a continuation of tax payments by Ameren. Therefore, the land-use impacts of Callaway Unit 1's license renewal term are expected to be SMALL and mitigation would not be warranted.

4.18 TRANSPORTATION

NRC

The environmental report must "...assess the impact of highway traffic generated by the proposed project on the level of service of local highways during periods of license renewal refurbishment activities and during the term of the renewed license." 10 CFR 51.53(c)(3)(ii)(J)

"…Transportation impacts…are generally expected to be of small significance. However, the increase in traffic associated with additional workers and the local road and traffic control conditions may lead to impacts of moderate or large significance at some sites…." 10 CFR 51, Subpart A, Appendix B, Table B-1, Issue 70

Small impacts would be associated with U.S. Transportation Research Board Level of Service A, having the following condition: "…Free flow of the traffic stream; users are unaffected by the presence of others." and Level of Service B, having the following condition: "…Stable flow in which the freedom to select speed is unaffected but the freedom to maneuver is slightly diminished…." (NRC 1996)

NRC made impacts to transportation a Category 2 issue, because impact significance is determined primarily by road conditions existing at the time of license renewal, which NRC could not forecast for all facilities (NRC 1996). Local road conditions to be ascertained are: (1) level of service conditions and (2) incremental increases in traffic associated with refurbishment activities and license renewal staff.

As described in Section 3.2, no refurbishment is planned and no refurbishment impacts to local transportation are therefore anticipated. Likewise, Ameren estimates that no additional workers would be needed to support Callaway Unit 1 aging management activities during the license renewal term (Sections 3.3 and 3.4). Therefore, Ameren expects license-renewal impacts to transportation to be SMALL and mitigation would not be necessary.

4.19 HISTORIC AND ARCHAEOLOGICAL RESOURCES

NRC

The environmental report must contain an assessment of ". . . whether any historic or archaeological properties will be affected by the proposed project." 10 CFR 51.53(c)(3)(ii)(K)

"Generally, plant refurbishment and continued operation are expected to have no more than small adverse impacts on historic and archaeological resources. However, the National Historic Preservation Act requires the Federal agency to consult with the State Historic Preservation Officer to determine whether there are properties present that require protection." 10 CFR 51, Subpart A, Appendix B, Table B-1, Issue 71

"Sites are considered to have small impacts to historic and archaeological resources if (1) the State Historic Preservation Officer (SHPO) identifies no significant resources on or near the site; or (2) the SHPO identifies (or has previously identified) significant historic resources but determines they would not be affected by plant refurbishment, transmission lines, and license renewal term operations and there are no complaints from the affected public about altered historic character; and (3) if the conditions associated with moderate impacts do not occur." (NRC 1996)

NRC made impacts to historic and archaeological resources a Category 2 issue, because determinations of impacts to historic and archaeological resources are site-specific in nature and the National Historic Preservation Act mandates that impacts must be determined through consultation with the State Historic Preservation Officer (SHPO).

There are 129 archaeological sites, historic sites and historic architectural resources on the Callaway Plant property. None of these are located within the fenced area around the plant (Figure 3.1-2). A cultural resource management plan (AmerenUE 2006) describes allowable activities at each of these sites, depending on their National Register-eligibility. The plan also describes environmental review procedures to be undertaken for any proposed project, whether the project is by Ameren or the Missouri Department of Conservation on Ameren property, to determine if the proposed project will have an impact on a cultural resource and the resulting consultation requirements. The plan also describes the procedures to be followed for inadvertent discoveries of artifacts or cultural features. Ameren has formalized these review procedures in their plant procedures, Excavation Construction and Safety Standards (Procedure Number MDP-ZZ-SH001) (AmerenUE 2010). In addition, the Strategic Training and Resource Sharing Programs Review Form (STARS 2010) is completed before any excavation activities are initiated.

The 1982 FES for Unit 1 operation reports that though there are archaeological sites in the vicinity of the Callaway Plant, implementation of the cultural resource management plan would ensure avoidance or mitigation of any impacts from operations and maintenance.

There are three National Register-listed properties within six miles of the Callaway Plant property. These properties, two archaeological sites and one historical site, are not adjacent to or within the plant property. Ameren is not aware of any historic or archaeological resources

that have been affected to date by Callaway Unit 1 operations, including operations and maintenance of transmission lines. Ameren is aware that the plant site, site vicinity, and surrounding environs have potential for containing additional cultural resources. Corporate procedures describe the process for protection of archaeological discoveries.

No refurbishment activities or construction of license renewal-related facilities are planned at the Callaway Unit 1 during the license renewal term. In addition, operations and maintenance activities would primarily be conducted within areas previously disturbed by construction activities. Ameren has developed a cultural resource management plan and corporate procedures to address protection of known historic and archaeological resources and the discovery of artifacts and cultural features during activities. Therefore, Ameren concludes that impacts to historic or archaeological resources would be SMALL from license renewal and associated operations and maintenance activities over the license renewal term, and no mitigation would be warranted. Ameren has consulted with the Missouri SHPO regarding this conclusion. The Missouri SHPO concurs that license renewal and associated operation and maintenance activities would have no effect on historic or archaeological resources. Copies of this correspondence are presented in Attachment D.

4.20 SEVERE ACCIDENT MITIGATION ALTERNATIVES

NRC

The environmental report must contain a consideration of alternatives to mitigate severe accidents "…if the staff has not previously considered severe accident mitigation alternatives for the applicant's plant in an environmental impact statement or related supplement or in an environment assessment..." 10 CFR 51.53(c)(3)(ii)(L)

"…The probability weighted consequences of atmospheric releases, fallout onto open bodies of water, releases to ground water, and societal and economic impacts from severe accidents are small for all plants. However, alternatives to mitigate severe accidents must be considered for all plants that have not considered such alternatives…." 10 CFR 51, Subpart A, Appendix B, Table B-1, Issue 76

Section 4.20 summarizes Ameren's analysis of alternative ways to mitigate the impacts of severe accidents. Attachment F provides a detailed description of the severe accident mitigation alternatives (SAMA) analysis.

The term "accident" refers to any unintentional event (i.e., outside the normal or expected plant operation envelope) that results in the release or a potential for release of radioactive material to the environment. NRC categorizes accidents as "design basis" or "severe." Design basis accidents are those for which the risk is great enough that NRC requires plant design and construction to prevent unacceptable accident consequences. Severe accidents are those that NRC considers too unlikely to warrant design controls.

NRC concluded in its license renewal rulemaking that the unmitigated environmental impacts from severe accidents met its Category 1 criteria. However, NRC made consideration of mitigation alternatives a Category 2 issue because not all plants had completed ongoing regulatory programs related to mitigation (e.g., individual plant examinations and accident management). Site-specific information to be presented in the license renewal environmental report includes: (1) potential SAMAs; (2) benefits, costs, and net value of implementing potential SAMAs; and (3) sensitivity of analysis to changes in key underlying assumptions.

Ameren maintains a probabilistic safety assessment model to use in evaluating the most significant risks of radiological release from Callaway fuel into the reactor and from the reactor into the containment structure. For the SAMA analysis, Ameren used the model output as input to an NRC-approved model that calculates economic costs and dose to the public from hypothesized releases from the containment structure into the environment (Attachment F). Then, using NRC regulatory analysis techniques, Ameren calculated the monetary value of the unmitigated Callaway severe accident risk. The result represents the monetary value of the base risk of dose to the public and worker, offsite and onsite economic impacts, and replacement power. This value became a cost/benefit-screening tool for potential SAMAs; a SAMA whose cost of implementation exceeded the base risk value could be rejected as being not cost-beneficial.

Ameren used industry, NRC, and Callaway-specific information to create a list of 171 SAMAs for consideration. Ameren analyzed this list and screened out SAMAs that would not apply to the

Callaway design, that Ameren had already implemented, or that would achieve results that Ameren had already achieved by other means. Ameren then prepared cost estimates for the 64 remaining SAMAs and used the base risk value to screen out SAMAs that would not be cost-beneficial.

Ameren calculated the risk reduction that would be attributable to each remaining candidate SAMA (assuming SAMA implementation) and re-quantified the risk value. The difference between the base risk value and the SAMA-reduced risk value is the averted risk, or the value of implementing the SAMA. Ameren used this information in conjunction with the cost estimates for implementing each SAMA to perform a detailed cost/benefit comparison.

Ameren performed additional analyses to evaluate how the SAMA results would change if certain key parameters were changed, including re-assessing the cost-benefit calculations using the 95th percentile level of the failure probability distributions. The results of the uncertainty analysis are also discussed in Attachment F.

Based on the results of this SAMA analysis, three SAMAs potentially have a positive net value. Sensitivity studies, such as using the 95th percentile PRA results, did not result in any additional SAMAs becoming cost-beneficial. The potentially cost beneficial SAMAs are the following:

- SAMA 29: Provide capability for alternate injection via diesel-driven fire pump
- SAMA 160: Modify Control Building dumbwaiter to lessen impact of internal flooding
- SAMA 162: Install a large volume emergency diesel generator (EDG) fuel oil tank at an elevation greater than the EDG fuel oil day tanks

While these results are believed to accurately reflect potential areas for improvement at Callaway, Ameren notes that this analysis should not necessarily be considered a formal disposition of these proposed changes, as other engineering reviews are necessary to determine the ultimate resolution. These SAMAs will be entered into the Callaway long-range planning development process for further consideration.

4.21 CUMULATIVE IMPACTS

This section discusses the cumulative impacts to the region's environment that could result from the continued operation of Callaway Unit 1. A cumulative impact is defined in the Council of Environmental Quality regulations (40 CFR 1508.7) as an "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) or person undertakes such other actions."

For the purposes of this analysis, past actions are those related to the resources at the time of the power plant licensing and construction. Present actions are those related to the resources at the time of current operation of the power plant, and future actions are considered to be those that are reasonably foreseeable through the end of plant operation, including the 20-year license renewal term for Callaway Unit 1.

The impacts of operations of Callaway Unit 1, as described in Chapter 4, are combined with other past, present, and reasonably foreseeable future actions in the vicinity of Callaway that would affect the same resources. The geographic area is dependent on the type of action considered and is described below for each impact area. The following sections consider the cumulative impacts of other projects and activities in the region as listed in Section 2.15, with current operations at existing Callaway Unit 1.

4.21.1 Water Use and Quality

This section analyzes the cumulative impacts of existing Callaway Unit 1on water use and water quality.

Surface Water Use

As described in Section 4.1, the impacts from the license renewal of Callaway Unit 1 on surface water use would be SMALL, and would not warrant mitigation.

Section 2.15 identifies existing and reasonably foreseeable projects that potentially have impacts cumulative with Callaway Unit 1. Except for the Central Electric Power Cooperative Chamois Plant, there are no major water users located within five miles of the Callaway plant. Therefore, Ameren concludes that cumulative surface water use impacts of existing and reasonably foreseeable projects with Callaway Unit 1 would be SMALL.

Groundwater Use

As described in Section 4.5, the impacts from the license renewal of Callaway Unit 1 on groundwater use would be SMALL, and would not warrant mitigation. The Section 4.5 analysis addresses interaction with the nearest offsite wells. Therefore cumulative groundwater use impacts would be SMALL.

Groundwater Quality

A discussed in Section 4.8, the issue of groundwater degradation does not apply to Callaway Unit 1 because the plant does not use cooling water ponds. As Section 3.1.2 describes,

Callaway Unit 1 discharges the cooling tower blowdown and water treatment plant effluent to the Missouri River.

4.21.2 Ecological Impacts

4.21.2.1 Terrestrial Resources

As described in Section 4.10, the impacts from the license renewal of Callaway Unit 1 on terrestrial resources would be SMALL, and would not warrant mitigation. None of the actions described in Section 2.15 have the potential to disturb terrestrial resources. Therefore, Ameren concludes that cumulative effects of Callaway area projects have only SMALL to no impacts.

4.21.2.2 Aquatic Resources

As described in Sections 4.2 and 4.4, the impacts from the license renewal of Callaway Unit 1 on heat shock or entrainment and impingement aquatic organisms does not apply to Callaway Unit 1 because the plant does not use once-through or cooling pond heat dissipation systems.

Cumulative impacts are, by definition "incremental" (40 CFR 1508.7). None of the projects described in Section 2.15 would result in additional (incremental) impacts on aquatic resources and would not contribute to cumulative impacts.

4.21.3 Air Quality Impacts

The Callaway site is located in Callaway County, Missouri. Consequently, the region of geographic interest for this cumulative impact analysis is Callaway County. Callaway County is designated as attainment/unclassifiable for all criteria pollutants (40 CFR 81.326). The air quality attainment status for Callaway County reflects the effects of past and present emissions from all pollutant sources in the region.

As discussed in Section 2.13, Callaway Unit 1 has a number of stationary emission sources, such as standby emergency power supply diesel generators, auxiliaries required for safe starting and continuous operation, temporary backup system diesel generators for the Emergency AC system, and several petroleum fuel storage tanks. Emissions from these sources are regulated by the Missouri Department of Natural Resources (MDNR). As reported to MDNR, actual total emissions from all sources at Callaway Unit 1 from 2005 to 2009 were 58.31 tons per year (tpy), 12.96 tpy, 30.32 tpy, 30.24 tpy, and 12.8 tpy, respectively (Ameren Services 2006, 2007, 2008, 2009, 2010). The highest emissions were reported in 2005: 1.47 tpy of particulate matter (PM_{10}), 8.03 tpy of carbon monoxide (CO), 35.41 tpy of oxides of nitrogen (NO_x), 11.91 tpy of sulfur dioxide (SO_2) and 1.49 tpy of volatile organic compounds (VOC). As stated in Section 4.11, Ameren has no plans for refurbishment activities at Callaway Unit 1 during the license renewal period.

Section 2.15 identifies existing and reasonably foreseeable projects that potentially have impacts cumulative with Callaway Unit 1. Given the nature of the projects and their distance from Callaway, the projects would not likely have cumulative impacts.

Stationary emission sources associated with the operation of Callaway Unit 1 would be intermittent and made at low levels with little or no vertical velocity. Because of the intermittent nature of the releases and the small quantities of effluents being released, the cumulative impacts associated with Callaway Unit 1 would be SMALL. Therefore, Ameren concludes that

combined with the emissions from other past, present, and reasonably foreseeable future actions, cumulative air pollutant emissions on air quality from Callaway Unit 1 related actions would be SMALL. When considered with respect to an alternative of building a fossil-fuel powered plant (see Chapter 7), continuing the operation of the Callaway Unit 1 could represent a net cumulative beneficial environmental impact in terms of reducing hazardous and criteria air emissions.

4.21.4 Nonradiological Health Impacts

Section 2.15 identifies existing and reasonably foreseeable projects that potentially have impacts cumulative with Callaway Unit 1. Given the nature of the projects, only the Chamois Power Plant could have cumulative nonradiological health impacts. Potential cumulative impacts could include fugitive dust and vehicle emissions, occupational injuries, noise from operation, exposure to etiological agents, exposure to electromagnetic fields, and the transportation of materials and personnel. However, license renewal of Callaway Unit 1 would not involve construction or refurbishment, so fugitive dust and construction noise would not be cumulative. Vehicle emissions, occupational injuries, and noise from operations were not evaluated in Chapter 4 for license renewal. Although these impacts could be cumulative with the operation of the Chamois Power Plant, Callaway Unit 1 would provide a small contribution, which Ameren concluded were small for both direct and cumulative impacts (AmerenUE 2009). This leaves exposure to etiological agents and exposure to electromagnetic fields for further evaluation.

Callaway Unit 1 blows down heated effluent to the Missouri River. In its evaluation of cumulative impacts for Unit 1, Ameren concluded that cumulative impacts from etiological agents produced by heated effluent would be small because of chlorination of the circulating water and the low incidence of water-borne diseases in the area (AmerenUE 2009). As described in Section 4.12, the thermal plume from the Chamois Power Plant would be dissipated to ambient temperatures before interacting with a plume from Callaway.

NRC (1996) concluded that the nonradiological health impacts from chronic exposure to electromagnetic fields cannot be clearly linked to adverse health effects. However, acute effects of electric shock from induced current under transmission lines could, potentially, be cumulative. Ameren design standards ensure that the resulting induced current from the Callaway Unit 1 transmission lines will not exceed the 5 milliampere standard described in Section 4.13.

Ameren concludes that cumulative nonradiological impacts would be SMALL and no mitigation is required.

4.21.5 Socioeconomic Impacts

Section 2.15 presents a list of other projects and activities in the region that, when combined with license renewal activities, could create impacts to the region's socioeconomic resources. As indicated below, license renewal activities would not contribute to cumulative impacts to socioeconomic resources in the region.

As discussed in Sections 4.14 through 4.18, continued operation of Callaway Unit 1 during the license renewal term would have no impact on socioeconomic conditions in the region beyond those already experienced. Since Ameren has no plans to hire additional workers during the license renewal term, overall expenditures and employment levels at Callaway Unit 1 would

remain relatively constant with no additional demand for permanent housing and public services. In addition, since employment levels and tax payments would not change, there would be no population or tax revenue-related land use impacts. There would also be no disproportionately high and adverse health and environmental impacts on minority and low-income populations in the region. Based on this and other information presented in these sections, there would be no cumulative socioeconomic impacts from the continued operation of Callaway Unit 1 during the license renewal term beyond what is currently being experienced.

4.21.6 Historic and Archeological Resources

As discussed in Section 4.19, no refurbishment activities or construction of license renewal-related facilities are planned at Callaway Unit 1 during the license renewal term. While construction of the Independent Spent Fuel Storage Installation (ISFSI) could potentially have impacts to cultural resources, as described in Section 4.19, controls are in place to prevent or mitigate such impacts. Given that license renewal will not impact cultural resources, the cumulative impacts from the license renewal of Callaway Unit 1 on historic and archeological resources would be SMALL, and would not warrant mitigation.

4.21.7 Fuel Cycle, Transportation, and Decommissioning

4.21.7.1 Uranium Fuel Cycle

The uranium fuel cycle is comprised of uranium mining and milling, the production of uranium hexafluoride, isotopic enrichment, fuel fabrication, transportation of radioactive materials, and management of low level wastes and spent nuclear fuel. In NRC regulation 10 CFR 51.51(a), Table S-3, NRC presents the impacts of the uranium fuel cycle for a single 1,000 MWe reference reactor operating at 80 percent capacity factor. Advances in the uranium fuel cycle since NRC developed Table S-3, which would reduce these impacts uranium fuel cycle impacts are not accrued at any one location, but are spread across multiple locations.

Ameren concludes that cumulative fuel cycle impacts of Callaway Unit 1 would be SMALL, given that the larger impacts are associated with equally larger electricity generation. Mitigation would not be required. This is consistent with NRC's generic analysis in the GEIS for license renewal (NRC 1996).

4.21.7.2 Transportation

Nonradiological Transportation

Section 4.18 states that there will be no additional workers during the license renewal term, and thus, the traffic impacts, including traffic congestion and accidents, would be small. However, the current traffic from Callaway Unit 1 operations would continue into the license renewal term. Ameren concludes that cumulative nonradiological transportation impacts would be SMALL and no mitigation measures would be required.

Radiological Transportation

NRC has standardized the analysis of radiological transportation impacts for nuclear reactors in Table S-4 of 10 CFR 51.52. Table S-4 provides the impacts for normal conditions of transport and accidents for a reference 1100-MWe reactor operating at 80 percent capacity factor. Consequently, NRC's conclusion in the GEIS for license renewal (NRC 1996; NRC 1999) states

that radiological transportation can be considered a small impact for all plants. Ameren adopts this conclusion for Unit 1 radiological transportation impacts and therefore concludes that radiological transportation impacts are SMALL and no further mitigation would be required.

4.21.7.3 Decommissioning

In the GEIS for license renewal (NRC 1996), NRC examined six issues related to decommissioning and concluded that all of them are Category 1 issues. Accordingly, decommissioning was not examined in Chapter 4 of this environmental report. However, environmental impacts from the activities associated with the decommissioning of any reactor are evaluated in the GEIS on Decommissioning (NRC 2002). Ameren concludes that, as long as the regulatory requirements on decommissioning activities that limit the impacts of decommissioning are met, the decommissioning activities would result in a SMALL impact Callaway Unit 1. Mitigation measures would be considered in the development of the Unit 1 decommissioning plan.

4.21.8 Land Use Impacts

As described in Section 4.17, the impacts from the license renewal of Callaway Unit 1 on land use would be SMALL, and would not warrant mitigation.

Ameren concludes that the incremental cumulative impacts of Units 1 with existing and future projects described in Section 2.15 would be SMALL.

4.21.9 Postulated Accidents

NRC classifies potential accidents at nuclear power plants as either design basis accidents or severe accidents. Design basis accidents are those for which the plant has been specifically designed to withstand, to within certain offsite dose limits. Severe accidents are those involving significant core damage but are considered too improbable to warrant specific plant design features. Where design basis accidents are deterministic (consequences reported in dose), severe accidents are probabilistic (consequences reported as dose times probability or dose-risk).

Should Ameren construct the ISFSI described in Section 2.15, there would be some small probability for design basis accidents from that facility. Severe accidents would not be expected. However, the magnitude of such, as yet unanalyzed, accidents would be a small fraction of those from an operating nuclear power plant. In its GEIS for license renewal (NRC 1996), NRC determined that both design basis and severe accident impacts of a nuclear power plant are SMALL. Therefore, any cumulative effect of design basis impacts would also be SMALL.

4.21.10 Radiological Health Impacts

Sources of radioactivity that could potentially be cumulative with Callaway Unit 1 would be within a 50-mile radius of Callaway would include the proposed ISFSI and any hospitals and industrial facilities that use radioactive materials within the 50-mile radius.

The Callaway radiological environmental monitoring program has been measuring radiation and sampling for radioactivity within 50 miles of the plant since before the plant began operation. This program would include all sources of radioactivity including hospitals and industrial

facilities. The Callaway radiological environmental monitoring program augments the plant effluent monitors and provides assurance that the plant continues to operate within the regulations and ALARA parameters established for responsible environmental management.

The principal cumulative impacts would be those from Unit 1 and the ISFSI. Both sources would release small quantities of radioactivity to the environment through permitted liquid and gaseous releases, as well as emit direct radiation. However, the cumulative dose to members of the public would be significantly below the 10 CFR 190 dose limit. Therefore, Ameren concludes that cumulative radiological health impacts are SMALL and no additional mitigation beyond current ALARA programs is required.

4.21.10.1 Occupational Doses

Radiation doses to individual workers in nuclear power plants is limited by NRC regulation 10 CFR 20. Additionally, as required by 10 CFR 20, the plant attempts to operate the plant such that workers receive both individual and collective doses at a level below regulatory limits as is reasonably achievable. Therefore, individual doses, being restricted by regulatory and administrative limits for Unit 1 would not change during the license renewal period. There are no regulatory limits on collective doses, but the plant has programs to keep cumulative does as low as reasonably achievable. Therefore, Ameren concludes that cumulative impacts of occupational doses would be SMALL. Additional mitigation beyond Callaway's ALARA program is not warranted.

4.21.10.2 Public Doses

The calculated dose to a hypothetical maximally exposed member of the public from Callaway Unit 1 is 0.028 millirem in 2004 (AmerenUE 2009). The regulatory limit in 40 CFR Part 190 for exposure to an offsite member of the public is 25 millirem per year. Given that the Unit 1 dose to the maximally exposed individual is a small fraction of the regulatory limit, the cumulative impacts would be SMALL and would not warrant mitigation.

4.22 TABLES

Table 4.13-1 Results of Induced Current Analysis

Transmission Line	Limiting Case Induced Current (milliamperes)
Montgomery	2.2
Bland	2.2
Loose Creek	2.3

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5.0 CHAPTER 5 - ASSESSMENT OF NEW AND SIGNIFICANT INFORMATION

NRC

"The environmental report must contain any new and significant information regarding the environmental impacts of license renewal of which the applicant is aware." 10 CFR 51.53(c)(3)(iv)

5.1 AMEREN PROCESS FOR IDENTIFYING NEW AND SIGNIFICANT INFORMATION

The U.S. Nuclear Regulatory Commission (NRC) licenses the operation of domestic nuclear power plants and provides for license renewal, requiring a license renewal application that includes an environmental report (10 CFR 54.23). NRC regulations at 10 CFR 51 prescribe the environmental report content and identify the specific analyses the applicant must perform. In an effort to streamline the environmental review, NRC has resolved most of the environmental issues generically (Category 1) and only requires an applicant's analysis of the remaining issues (Category 2).

While NRC regulations do not require an applicant's environmental report to contain analyses of the impacts of Category 1 issues, the regulations [10 CFR 51.53(c)(3)(iv)] do require that an applicant identify any new and significant information of which the applicant is aware that would negate any of the generic findings that NRC has codified or evaluated in the Generic Environmental Impact Statement for License Renewal of Nuclear Plants (GEIS) (NRC 1996). The purpose of this requirement is to alert NRC staff to such information, so the staff can determine whether to seek the Commission's approval to waive or suspend application of the rule with respect to the affected generic analysis. NRC has explicitly indicated, however, that an applicant is not required to perform a site-specific validation of GEIS conclusions.

Ameren expects that new and significant information would include:

- Information that identifies a significant environmental issue not covered in the GEIS and codified in the regulation, or
- Information that was not covered in the GEIS analyses of a particular environmental issue and that leads to an impact finding significantly different from that codified in the regulation.

NRC does not define the term "significant," although for the purpose of its review, Ameren used guidance available in Council on Environmental Quality (CEQ) regulations. The National Environmental Policy Act authorizes CEQ to establish implementing regulations for federal agency use. NRC requires license renewal applicants to provide NRC with input, in the form of an environmental report, that NRC will use to meet National Environmental Policy Act requirements as they apply to license renewal (10 CFR 51.10). CEQ guidance provides that federal agencies should prepare environmental impact statements for actions that would significantly affect the environment (40 CFR 1502.3), focus on significant environmental issues (40 CFR 1502.1), and eliminate from detailed study issues that are not significant [40 CFR 1501.7(a)(3)]. The CEQ guidance includes a lengthy definition of "significantly" that

requires consideration of the context of the action and the intensity or severity of the impact(s) (40 CFR 1508.27). Ameren expects that moderate or large impacts, as defined by NRC, would be significant. Chapter 4 presents the NRC definitions of "MODERATE" and "LARGE" impacts.

The new and significant assessment process that Ameren used during preparation of this license renewal application includes:

- Interviews with Ameren and Callaway Unit 1 staff with various responsibilities including environmental, engineering, radiological waste, chemistry, industrial health and safety, communications, operations support, and information related to the conclusions in the GEIS as they relate to Callaway Unit 1

- Review of Callaway Unit 1 environmental management systems for how current programs manage potential impacts and/or provide mechanisms for Callaway Unit 1 staff to become aware of new and significant information

- Correspondence with state and federal regulatory agencies to determine if the agencies had concerns

- Review of documents related to environmental issues at Callaway Unit 1 and regional environs

- Credit for oversight provided by inspections of plant facilities and environmental monitoring operations by state and federal regulatory agencies

- Participation in review of other licensees' Environmental Reports (including NRC Requests for Additional Information), audits, and industry initiatives

- Independent review of plant-related information through Callaway Unit 1 contracts with industry experts on license renewal environmental impacts

- Examination of issues related to the COL application for Unit 2.

Ameren is not aware of any new and significant information regarding the plant's environment or operations that would make any generic conclusion codified by the NRC for Category 1 issues not applicable to Callaway Unit 1, that would alter regulatory or GEIS statements regarding Category 2 issues, or that would suggest any other measure of license renewal environmental impact.

As part of its investigation for new and significant information at Callaway 1, Ameren evaluated information about tritium in the groundwater beneath the site (Sections 2.3 and 4.8). This review did not identify any information that would affect the NRC's Category 1 findings in the GEIS.

5.2 REFERENCES

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6.0 CHAPTER 6 – SUMMARY OF LICENSE RENEWAL IMPACTS AND MITIGATING ACTIONS

6.1 LICENSE RENEWAL IMPACTS

Ameren has reviewed the environmental impacts of renewing the Callaway Plant operating license and has concluded that all impacts would be SMALL and would not require additional mitigation.

This environmental report documents the basis for Ameren's conclusion. Chapter 4 incorporates by reference the NRC findings for the 56 Category 1 issues that apply to Callaway Plant, all of which have impacts that are SMALL (Attachment A, Table A-1). Chapter 4 also analyzes Category 2 issues, all of which are either not applicable or have impacts that would be SMALL. Table 6.1-1 identifies the impacts that Callaway Plant license renewal would have on resources associated with Category 2 issues.

6.2 MITIGATION

NRC

"The report must contain a consideration of alternatives for reducing adverse impacts…for all Category 2 license renewal issues…" 10 CFR 51.53(c)(3)(iii)

"…The environmental report shall include an analysis that considers and balances…alternatives available for reducing or avoiding adverse environmental effects.…" 10 CFR 51.45(c) as incorporated by 10 CFR 51.53(c)(2) and 10 CFR 51.53(c)(3)(iii)

All impacts of license renewal are SMALL and would not require mitigation.

Current operations include monitoring activities that would continue during the term of the license renewal. Ameren performs routine monitoring activities to ensure the safety of workers, the public, and the environment. These activities include:

- the Radiological Environmental Monitoring Program
- water quality monitoring
- emissions monitoring
- groundwater level monitoring
- Environmental Protection Plan monitoring and reporting requirements

These monitoring programs and activities ensure that the plant's permitted emissions and discharges are within regulatory limits, and any unusual or off-normal emissions or discharges would be quickly detected, thus, assuring mitigation of potential impacts.

6.3 UNAVOIDABLE ADVERSE IMPACTS

NRC

The environmental report shall discuss "Any adverse environmental effects which cannot be avoided should the proposal be implemented;" 10 CFR 51.45(b)(2) as adopted by 10 CFR 51.53(c)(2)

6.3.1 Existing Unavoidable Adverse Impacts

This environmental report adopts by reference NRC findings for applicable Category 1 issues, including discussions of any unavoidable adverse impacts (Attachment A, Table A-1). Ameren examined 21 Category 2 issues and identified the following unavoidable adverse impacts of license renewal. However, the impacts are not a result of license renewal specifically, but are continuations of existing impacts.

- Callaway Plant's net withdrawal of water from the Missouri River is approximately 0.86 percent of the estimated lowest daily mean flow. This water will be unavailable for other uses.
- Callaway Plant's average withdrawal rate of groundwater is approximately 520 gpm.
- Some structures, especially the cooling tower, are visible from off site. This visual impact will continue during the license renewal term.
- Disposal of sanitary, chemical, and radioactive wastes have adverse impacts on land commitments. Callaway Plant waste disposal procedures are intended to reduce adverse impacts from these sources to acceptably low levels. A small impact will be present as long as the plant is in operation. Solid radioactive wastes are a product of plant operations, and long-term disposal of these materials must be considered.
- Operation of Callaway Plant results in a very small increase in radioactivity in the air. However, radiation dose increase to the local population due to plant operation is less than that due to natural fluctuation over natural background radiation levels. Operation of Callaway Plant also establishes a very low-probability risk of accidental radiation exposure to inhabitants of the area.

6.3.2 Greenhouse Gas Emissions

The NRC analysis in the GEIS (NRC 1996) presented qualitative discussions regarding the greenhouse gas (GHG) impacts of the nuclear fuel cycle and the operating impacts associated with new coal-fired and oil-fired power plants, but no quantitative assessment of GHG emissions was presented. The GEIS did not address GHG impacts of the nuclear fuel cycle relative to other potential alternatives, such as natural gas and renewable energy sources.

Since the development of the GEIS, several authoritative lifecycle analyses of GHG emissions from nuclear and other electricity-generating technologies have been performed. For the Indian Point Nuclear Generating Plant (NRC 2008), the NRC reviewed a number of these analyses to evaluate carbon dioxide and other GHG emissions associated with license renewal. The NRC

found that the estimates and projections of the carbon footprint of the nuclear power lifecycle vary widely, and considerable debate exists regarding the relative impacts on GHG emissions of nuclear and other electricity-generating technologies. The NRC determined that, a consensus exists that nuclear power produces GHG emissions that are of the same order of magnitude as those for renewable energy sources and are less than GHG emissions from fossil-fuel-based electricity-generating technologies. Lifecycle GHG emissions from the complete nuclear fuel cycle currently range from 2.5 to 55 grams (g) of carbon equivalents per kilowatt-hour (C_{eq}/kWh). The comparable lifecycle GHG emissions from the use of coal range from 264 to 1,250 g C_{eq}/kWh, and GHG emissions from the use of natural gas range from 120 to 780 g C_{eq}/kWh. Based on current technology, estimated GHG lifecycle emissions from renewable energy sources are: solar-photovoltaic (17 to 125 g C_{eq}/kWh), hydroelectric (1 to 64.6 g C_{eq}/kWh), biomass (8.4 to 99 g C_{eq}/kWh), wind (2.5 to 30 g C_{eq}/kWh), and tidal (25 to 50 g C_{eq}/kWh). The NRC also determined that nuclear fuel production is the most significant contributor to possible future increases in GHG emissions from nuclear power, and because most renewable energy sources lack a fuel component, it is likely that GHG emissions from renewable energy sources would be lower than those associated with nuclear power at some point during the period of extended operation.

Ameren has reviewed the NRC analysis and believes it to be sound. Ameren has adopted the NRC analysis and concludes that GHG emissions associated with renewal of the Callaway Unit 1 operating licenses would be similar to the lifecycle GHG emissions from renewable energy sources and lower than those associated with fossil-fuel-based energy sources.

6.4 IRREVERSIBLE OR IRRETRIEVABLE RESOURCE COMMITMENTS

NRC

The environmental report shall discuss "Any irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented." 10 CFR 51.45(b)(5) as adopted by 10 CFR 51.53(c)(2)

The continued operation of Callaway Plant for the license-renewal term will result in irreversible and irretrievable resource commitments, including the following:

- nuclear fuel, which is consumed in the reactor and converted to radioactive waste
- the land required to dispose of spent nuclear fuel and low-level radioactive wastes generated as a result of plant operations, and to dispose of solid and sanitary wastes generated from normal industrial operations
- elemental materials that will become radioactive by neutron activation
- materials used for the nonradiological industrial operations of the plant that cannot be recovered or recycled or that are consumed or reduced to unrecoverable forms.

6.5 SHORT-TERM USE VERSUS LONG-TERM PRODUCTIVITY OF THE ENVIRONMENT

NRC

> The environmental report shall discuss "The relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity..." 10 CFR 51.45(b)(4) as adopted by 10 CFR 51.53(c)(2)

The current balance between short-term use and long-term productivity at the Callaway Plant site was established with the decision to construct the plant. The Final Environmental Statement (NRC 1982) evaluated the impacts of constructing and operating Callaway Plant. Natural resources used in the short term would include land and water. Much of the current 7,354-acre site was cropland and forest land prior to facility construction. Existing transmission corridors were used when feasible, reducing the need for new right-of-way acquisition. Transmission corridors were returned to agricultural use after construction, to the extent feasible. Consumptive use and the discharge of effluents have no effect on the commercial use of the Missouri River.

After decommissioning, many environmental disturbances would cease and some restoration of the natural habitat would occur. Thus, the "trade-off" between the production of electricity and changes in the local environment is reversible to some extent.

Experience with other experimental, developmental, and commercial nuclear plants has demonstrated the feasibility of decommissioning and dismantling such plants sufficiently to restore a site to its former use. The degree of dismantlement will take into account the intended new use of the site and a balance among health and safety considerations, salvage values, and environmental impact. However, decisions on the ultimate disposition of these lands have not yet been made. Continued operation for an additional 20 years would not increase the short-term productivity impacts described here.

6.6 TABLES

Table 6.1-1. Category 2 Environmental Impacts Related to License Renewal at Callaway Plant

No.	Issue	Environmental Impact
	Surface Water Quality, Hydrology, and Use (for all plants)	
13	Water use conflicts (plants with cooling ponds or cooling towers using make-up water from a small river with low flow)	SMALL - Callaway Plant use an open-cycle cooling system with a natural draft cooling tower that receives its makeup water from the Missouri River. Callaway Plant average annual use rate ranges from 31 to 38 cfs. This average water withdrawal rate is approximately 0.6 to 0.7 percent of the estimated lowest mean annual flow rate of the Missouri River at the Callaway intake.
	Aquatic Ecology (for plants with once-through and cooling pond heat dissipation systems)	
25	Entrainment of fish and shellfish in early life stages	None – Callaway Plant does not have a once-through cooling system. Therefore, this issue does not apply.
26	Impingement of fish and shellfish	None – Callaway Plant does not have a once-through cooling system. Therefore, this issue does not apply.
27	Heat shock	None – Callaway Plant does not have a once-through cooling system. Therefore, this issue does not apply.
	Groundwater Use and Quality	
33	Groundwater use conflicts (potable and service water, and dewatering; plants that use > 100 gpm)	SMALL - The two active groundwater wells at Callaway, Well #3 with an average pumping rate of 30 to 40 gpm, and Intake Well #1 with an average pumping rate of 120 gpm, are screened from the lower Cotter-Jefferson City Dolomite aquifer and terminate in the Eminence Dolomite aquifer. The nearest wells are a sufficient distance such that no drawdown effects are anticipated.
34	Groundwater use conflicts (plants using cooling towers or cooling ponds that withdraw make-up water from a small river)	SMALL - Withdrawals of surface water during low-flow periods would have a SMALL impact on recharge to the alluvial aquifer because the maximum Callaway Plant water use of 56 cfs minus the plant's average discharge rate of 7.5 cfs indicates that the plant's water use is approximately 0.86 percent of the estimated lowest daily mean flow of the Missouri River at the River Intake Structure. Furthermore, the alluvial aquifer is recharged by the Missouri River only during high flow periods.
35	Groundwater use conflicts (Ranney wells)	None - Callaway Plant do not use Ranney wells. Therefore, this issue does not apply.
39	Groundwater quality degradation (cooling ponds at inland sites)	None - Callaway Plant do not have a cooling pond. Therefore, this issue does not apply.
	Terrestrial Resources	
40	Refurbishment impacts	None - No impacts are expected because Callaway Plant will not undertake refurbishment.

Table 6.1-1. Category 2 Environmental Impacts Related to License Renewal at Callaway Plant. (Continued)

No.	Issue	Environmental Impact
		Threatened or Endangered Species
49	Threatened or endangered species	SMALL - No observed impacts from current operations and transmission line maintenance practices. Ameren has no plans to alter current operations over the license-renewal period, and resource agencies contacted by Ameren have indicated that license renewal is unlikely to affect any listed species.
		Air Quality
50	Air quality during refurbishment (nonattainment and maintenance areas)	None - No impacts are expected because Callaway Plant will not undertake refurbishment.
		Human Health
57	Microbiological organisms (plants using lakes or canals, or cooling towers or cooling ponds that discharge to a small river)	SMALL - Public exposures are limited to the small area of the Missouri River near the blowdown discharge. Recreational use of the river in this area is rare. Furthermore, only during the hottest days of the summer do blowdown temperatures approach the level that would enhance concentrations of naturally occurring organisms. Given the frequent chlorination of the circulating water system, thermophilic organisms are not expected in the blowdown water.
59	Electric shock from transmission line-induced currents	SMALL - Ameren calculations indicate that all lines are in compliance with the NESC limit on induced current.
		Socioeconomics
63	Housing impacts	None - Ameren does not plan to undertake refurbishment and does not plan to add employees during operations. Therefore, there will be no increased demand on housing because of license renewal.
65	Public services: public utilities	None - Ameren does not plan to undertake refurbishment and does not plan to add employees during operations. Therefore, there will be no increased demand on public utilities because of license renewal.
66	Public services: education (refurbishment)	None - No impacts are expected because Callaway Plant will not undergo refurbishment.
68	Offsite land use (refurbishment)	None - No impacts are expected because Callaway Plant will not undergo refurbishment.
69	Offsite land use (license renewal term)	SMALL - No plant-induced changes to offsite land use are expected from license renewal.
70	Public services: transportation	None - Ameren does not plan to undertake refurbishment and does not plan to add employees during operations. Therefore, there will be no increased demand on the local transportation infrastructure because of license renewal.

Table 6.1-1. Category 2 Environmental Impacts Related to License Renewal at Callaway Plant. (Continued)

No.	Issue	Environmental Impact
71	Historic and archaeological resources	SMALL - Ameren does not plan to undertake refurbishment or transmission-line corridor changes during the license renewal term. In addition, Ameren has developed corporate procedures to address discovery of cultural resources during activities. Continued plant site operations are not expected to impact cultural resources.
		Postulated Accidents
76	Severe accidents	SMALL – Ameren identified three potentially cost-beneficial SAMAs that are not aging related.

6.7 REFERENCES

NRC (U.S. Nuclear Regulatory Commission) 1982. Final Environmental statement related to the operation of Callaway Plant, Unit No. 1. NUREG-0813. Docket No 50-483. Office of Nuclear Reactor Regulation, Washington, D.C., January.

NRC (U.S. Nuclear Regulatory Commission) 1996. Generic Environmental Impact Statement for License Renewal of Nuclear Plants (GEIS), Volumes 1 and 2, NUREG-1437. Office of Nuclear Reactor Regulation, Washington, D.C., May.

NRC (U.S. Nuclear Regulatory Commission) 2008. Generic Environmental Impact Statement for License Renewal of Nuclear Plants, Supplement 3, Regarding Indian Point Nuclear Generating Units Nos. 2 and 3. NUREG-1437, Vol.1, Supplement 38. Office of Nuclear Reactor Regulation, Washington, D.C., December.

7.0 CHAPTER 7 – ALTERNATIVES TO THE PROPOSED ACTION

NRC

The environmental report shall discuss "Alternatives to the proposed action…" 10 CFR 51.45(b)(3), as adopted by reference at 10 CFR 51.53(c)(2)

"...The report is not required to include discussion of need for power or economic costs and benefits of ... alternatives to the proposed action except insofar as such costs and benefits are either essential for a determination regarding the inclusion of an alternative in the range of alternatives considered or relevant to mitigation...." 10 CFR 51.53(c)(2)

"While many methods are available for generating electricity, and a huge number of combinations or mixes can be assimilated to meet a defined generating requirement, such expansive consideration would be too unwieldy to perform given the purposes of this analysis. Therefore, NRC has determined that a reasonable set of alternatives should be limited to analysis of single, discrete electric generation sources and only electric generation sources that are technically feasible and commercially viable…" (NRC 1996).

"…The consideration of alternative energy sources in individual license renewal reviews will consider those alternatives that are reasonable for the region, including power purchases from outside the applicant's service area...." (NRC 1996).

Chapter 7 evaluates alternatives to Callaway Unit 1 license renewal. The chapter identifies actions that Ameren might take, and associated environmental impacts, if NRC chooses not to renew the plant's operating license, i.e., the no action alternative. The chapter also addresses other energy alternatives. In this regard, Ameren divided its alternatives discussion into two categories, "no-action" and "alternatives that meet system generating needs." In considering the level of detail and analysis that it should provide for each category, Ameren relied on the NRC decision-making standard for license renewal:

> …the NRC staff, adjudicatory officers, and Commission shall determine whether or not the adverse environmental impacts of license renewal are so great that preserving the option of license renewal for energy planning decision makers would be unreasonable. [10 CFR 51.95(c)(4)]

Ameren has determined that the analysis of alternatives should focus on comparative impacts, specifically whether an alternative's impacts would be greater, smaller, or similar to the proposed action.

Providing additional detail or analysis serves no function if it only brings to light additional adverse impacts of alternatives to license renewal. This approach is consistent with regulations of the Council on Environmental Quality, which provide that the consideration of alternatives (including the proposed action) should enable reviewers to evaluate their comparative merits (40 CFR 1500-1508). Ameren considers Chapter 7 sufficient with regard to providing detail

about alternatives to establish the basis for necessary comparisons to the Chapter 4 discussion of impacts from the proposed action.

In characterizing environmental impacts from alternatives, Ameren has used the same definitions of SMALL, MODERATE, and LARGE that are presented in the introduction to Chapter 4.

7.1 NO-ACTION ALTERNATIVE

Ameren uses "no-action alternative" to refer to a scenario in which NRC does not renew the Callaway Unit 1 operating license. Components of this alternative include replacing the baseload generating capacity of Callaway Unit 1 and decommissioning the facility, as described below. Callaway Unit 1 has a net electrical output of 1,190 megawatts (MWe) (NRC 2009). This power would be unavailable to customers in the event the Callaway Unit 1 operating license was not renewed. Ameren believes that any alternative would be unreasonable if it did not include replacing the baseload capacity of Callaway Unit 1. Replacement could be accomplished by (1) building new generating capacity, (2) purchasing power from the wholesale market, or (3) reducing power requirements through demand reduction. Section 7.2.1 describes each of these possibilities in detail, and Section 7.2.2 describes environmental impacts from feasible alternatives.

The Generic Environmental Impact Statement (GEIS) for license renewal (NRC 1996) defines decommissioning as the safe removal of a nuclear facility from service and the reduction of residual radioactivity to a level that permits release of the property for unrestricted use and termination of the license. NRC-evaluated decommissioning options include immediate decontamination and dismantlement and safe storage of the stabilized and defueled facility for a period of time, followed by additional decontamination and dismantlement. Regardless of the option chosen, decommissioning must be completed within a 60-year period. Under the no-action alternative, Ameren would continue operating Callaway Unit 1 until the existing license expires, then initiate decommissioning activities in accordance with NRC requirements. The GEIS describes decommissioning activities based on an evaluation of a smaller reactor than the unit at Callaway Unit 1 (the "reference" pressurized-water reactor is the 1,175 MWe Trojan Nuclear Plant). This description is applicable to decommissioning activities that Ameren would conduct at Callaway Unit 1.

As the GEIS notes, NRC has evaluated environmental impacts from decommissioning. NRC-evaluated impacts include impacts of occupational and public radiation dose, impacts of waste management, impacts to air and water quality, and ecological, economic, and socioeconomic impacts. NRC indicated in the Final Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities; Supplement 1 (NRC 2002) that the environmental effects of greatest concern (i.e., radiation dose and releases to the environment) are substantially less than the same effects resulting from reactor operations. Ameren adopts by reference the NRC conclusions regarding environmental impacts of decommissioning.

Ameren notes that decommissioning activities and their impacts are not discriminators between the proposed action and the no-action alternative. Ameren will have to decommission Callaway Unit 1 regardless of the NRC decision on license renewal; license renewal would only postpone decommissioning for another 20 years. NRC has established in the GEIS that the timing of decommissioning operations does not substantially influence the environmental impacts of decommissioning. Ameren adopts by reference the NRC findings (10 CFR 51, Appendix B, Table B 1, Decommissioning) to the effect that delaying decommissioning until after the renewal term would have small environmental impacts. The discriminators between the proposed action and the no-action alternative are to be found within the choice of generation replacement options. Section 7.2.2 analyzes the impacts from these options.

Ameren concludes that the decommissioning impacts under the no-action alternative would not be substantially different from those occurring following license renewal, as identified in the

GEIS and in the decommissioning generic environmental impact statement. These impacts would be temporary and would occur at the same time as the impacts from meeting system generating needs.

7.2 ALTERNATIVES THAT MEET SYSTEM GENERATING NEEDS

Callaway Unit 1 is a baseload facility with a net capacity of 1,190 MWe, and in 2008 generated approximately 9.4 terawatt-hours of electricity (EIA 2008c). If the operating license were not renewed, Ameren would need to build new generating capacity, purchase power, or reduce power requirements through demand reduction to ensure they meet the electric power requirements of their customers.

Because the Callaway Unit 1 operating license expires in 2024, any replacement alternative would need to be available at that time to meet the same system need. Moreover, as discussed by the NRC when it promulgated the license renewal rules, industry studies estimate that the lead time to build a new electric generation plant is 10 to 12 years for fossil fuels and 12 to 14 years for nuclear and other new technologies (56 FR 64963). Therefore, to be reasonable, any replacement alternative needs to be a technically feasible and commercially viable technology.

The current mix of power generation options in Missouri is one indicator of what have been considered to be feasible technologies for generating electricity within the Ameren service area although not necessarily reasonable alternatives for baseload power. Missouri's electric utilities had a total generating capacity of 19,621 MWe in 2008 (EIA 2008d). As Figure 7-1 indicates, this capacity includes units fueled by coal (56.8 percent); natural gas (24.4 percent); petroleum (6.5 percent); nuclear (6.1 percent); hydroelectric (6.2 percent); and renewables (0.03 percent). Approximately 1,085 MWe (5.2 percent of the State's generating capacity) was from non-utility sources in 2008. Missouri's non-utility generators also use a variety of energy sources (EIA 2008d).

The Ameren service territory includes the southeast portion of Missouri, the area surrounding Kansas City, and the majority of the eastern half of the state to include the areas surrounding Jefferson City and St. Louis. Ameren serves 57 Missouri counties and 500 towns. More than half (55 percent) of Ameren's electric customers and its largest power demand, as well as its load center, are located in the St. Louis Metropolitan Area (AmerenUE 2010c). In 2008, Ameren had a total generating capacity of approximately 9,973 MWe. As Figure 7-2 indicates, this capacity includes units fueled by coal (54 percent); natural gas (30 percent); nuclear (12 percent); and hydroelectric (4 percent) (AmerenUE 2010c).

Based on 2008 generation data, Missouri's electric utilities produced about 89 terawatt hours of electricity. As shown in Figure 7-3, electric generation by fuel type in Missouri was dominated by coal (82.2 percent), nuclear (10.5 percent) and natural gas (4.3 percent) followed by hydroelectric (2.9 percent), petroleum (0.1 percent) and renewables (0.04 percent) (EIA 2008d). As shown in Figure 7-4, Ameren electric generation by fuel type was dominated by coal (76 percent) and nuclear (19 percent) followed by hydroelectric (3 percent) and natural gas (2 percent) (AmerenUE 2010a).

The difference between capacity and utilization is the result of optimal usage. For example, in Missouri, coal represented 56.8 percent of utilities' installed capacity and nuclear energy represented 6.1 percent (Figure 7-1), but coal produced 82.2 percent of the electricity generated by utilities and nuclear produced 10.5 percent (Figure 7-3). This reflects Missouri's reliance on coal and nuclear energy as base-load generating sources. Conversely, petroleum and gas

together represented 30.9 percent of Missouri's utility generating capacity (Figure 7-1), but only 4.4 percent of the electricity generated by utilities (Figure 7-3). This reflects Missouri's reliance on petroleum and gas as fuels for intermediate-load and peaking power.

7.2.1 Alternatives Considered

Technology Choices

For the purposes of this environmental report, Ameren evaluated alternative generating technologies to identify candidate technologies that would be capable of replacing the net baseload capacity of Callaway Unit 1.

Based on these evaluations, it was determined that feasible new plant systems to replace the capacity of Callaway Unit 1 are limited to pulverized-coal, gas-fired combined-cycle, and new nuclear units for baseload operation. This conclusion is supported by the generation utilization information presented above that identifies coal as the most heavily utilized non-nuclear generating technology in the state. Ameren would use gas as the primary fuel in its combined-cycle turbines because of the economic and environmental advantages of gas over oil. Large standard sizes of combined-cycle gas turbines now manufactured are economically attractive and suitable for high-capacity baseload operation.

Mixture

NRC indicated in the license renewal GEIS that, while many methods are available for generating electricity and a large number of combinations or mixes can be assimilated to meet system needs, it would be impractical to analyze all the combinations. Therefore, NRC determined that a reasonable set of generation alternatives should be limited to analysis of single discrete electrical generation sources and only those electric generation technologies that are technically reasonable and commercially viable (NRC 1996). Consistent with the NRC determination, Ameren has focused primarily on single, discrete, feasible alternatives. The impacts from coal-fired, gas-fired, and nuclear generation presented in this chapter would bound the impacts from any combination of the three technologies.

Ameren has considered evaluating wind or solar power in combination with fossil fueled generation as alternatives. However, because of the intermittent nature of wind and solar power in the region, such combinations would require building fossil fueled plants with the full 1200 MWe capacity to replace Callaway Unit 1 when the solar or wind power is unavailable, as well as the solar and wind powered replacement units. As a result, this option would incur the full construction impacts associated with building a 1200 MWe baseload coal or gas-fired plant, as well as the full construction impacts associated with building 1200 MWe of solar or wind powered units. The land use impacts of such wind or solar units alone would be considerable. In addition, wind or solar units would only achieve a capacity factor of about 35 percent or 44 percent (for a concentrating thermal system), respectively. The fossil-fired units would have to operate at least 56 percent of the time, and thus, would incur at least this percentage of the operational impacts analyzed in Sections 7.2.2.1 and 7.2.2.2. Baseload fossil plants are designed to be operated at a consistent output level all the time, and cycling causes fossil-fired units to operate less efficiently which results in more fuel being used for every MWh generated. Cycling fossil-fired units also causes problems with the way the units interact with their associated emission control technologies reducing its effectiveness. Consequently, temporarily reducing fossil generation could result in greater sulfur dioxide (SO_2), nitrogen oxides (NO_x), and carbon dioxide (CO_2) emissions than if the plant had not been cycled and generation had

remained stable (Bentek Energy 2010). This combination of impacts would not be preferable to the single and discrete alternatives analyzed in this Report.

Ameren has also considered wind and solar alternatives in combination with energy storage facilities, as well as interconnected wind farms. As discussed later in this Environmental Report, such alternatives do not appear viable.

Regulatory Considerations

Nationally, the electric power industry has been undergoing a transition from a regulated industry to a competitive market environment. Efforts to deregulate the electric utility industry began with passage of the National Energy Policy Act of 1992. Provisions of this act required electric utilities to allow open access to their transmission lines and encouraged development of a competitive wholesale market for electricity. The Act did not mandate competition in the retail market, leaving that decision to the states (NEI 2000).

Missouri began studying restructuring its electric power industry in 1997 when the Missouri Public Service Commission (PSC) created an investigatory docket as a formal means to identify the risks and benefits of retail competition in Missouri. The Missouri PSC established a Retail Electric Competition Task Force to study these issues and prepare a report for the PSC. In 1998, the Task Force issued its Final Report to the Missouri PSC with recommendations on issues including public interest programs, stranded costs, taxes, reliability, and market power (EIA 2007).

Missouri's electrical utilities continue to function under a traditional state-regulated monopoly franchise system, and there have been no restructuring activities since July 2002. Missouri electrical utilities are regulated by the Missouri PSC. Ameren supplies all of its end-use customers within its certificated service territory with the three principal components of electric power service: generation, transmission, and distribution. Its transmission system is directly connected to all of the utilities that surround the Ameren service territory.

In 2002, Missouri passed the "Consumer Clean Energy Act," which required retail electric suppliers to set net metering standards by August 28, 2003. The act directed the Missouri PSC to develop contracts that allowed excess electricity produced by the consumer to be sold to the local utility. The seller would "receive credit for renewable energy generation and emission avoidance." The PSC would issue the contracts "on a first-come, first-served basis until statewide capacity equaled the lesser of 10,000 kilowatts or 0.1 percent of the peak demand for each supplier of electricity during the previous year" (EIA 2007).

Missouri Senate Bill 54 "Green Power Initiative" was signed by the Missouri governor in June 2007 and set energy "targets." In November 2008, Missouri voters approved the Missouri Clean Energy Initiative which created Renewables Portfolio Standards. It increased the goals previously set by the "Green Power Initiative" and requires the investor-owned utilities in Missouri to generate or purchase a percentage of their energy from renewable energy resources. Starting in 2011, two percent of a utility's total retail electric sales are to come from renewable resources, increasing to 5 percent by 2014, 10 percent by 2018 and 15 percent by 2021 (AmerenUE 2010d).

The Missouri Energy Efficiency Investment Act of 2009 (MEEIA) established a new standard in the state for electric utility investment in demand side management: The MEEIA allows electric companies to implement and recover costs related to Missouri Public Service Commission (PSC)-approved demand-side programs with a goal of achieving all cost-effective demand-side

management (DSM) savings. Provisions of the MEEIA allow certain commercial and industrial users to opt out of energy efficiency programs and any associated surcharges on their bills. In addition, the MEEIA calls for a number of administrative, filing, and tracking exercisesthat substantively increase the costs associated with demand-side programs. In 2010, the Missouri PSC submitted new rules to the Secretary of State to implement the MEEIA. The new rules require demand side and supply side measures to be evaluated on an equivalent basis during the Integrated Resource Planning process. These rules set forth the information that an electric utility must provide when it seeks to establish, continue, modify, or discontinue a demand-side programs investment mechanism (DSIM). The rules also set forth the information that an electric utility must provide when it seeks approval, modification, discontinuance of DSM programs; and establish the requirements and procedures for processing applications for approval, modification, discontinuance of DSM programs. In addition, the rules allow the establishment and operation of DSIM, which allow periodic rate adjustments related to recovery of costs and utility incentives for investments in DSM programs (Ameren 2011).

The CAA (CAA) established National Ambient Air Quality Standards (NAAQS) for SO_2, NO_x, particulate matter (PM_{10} and $PM_{2.5}$) ozone, carbon monoxide (CO) and lead. The NAAQS are managed through emission limits, ambient air monitoring, and air quality modeling conducted by each State as part of State Implementation Plans (SIP). Areas are analyzed and designated as Attainment or Nonattainment with each pollutant. Nonattainment areas are subject to increased pollution control measures.

Callaway Unit 1 is located in Callaway County, Missouri. Callaway County is in the Northern Missouri Intrastate Air Quality Control Region (AQCR) (40 CFR 81.116). Callaway County, Missouri, is in attainment for all of the NAAQS as is the rest of the Northern Missouri Intrastate AQCR (40 CFR 81.326). The closest non-attainment areas to Callaway Unit 1 are Franklin, Jefferson, St. Charles, St. Louis Counties and St. Louis City, all part of the Metropolitan St. Louis Interstate AQCR (40 CFR 81.18). All of these areas are non-attainment with respect to the $PM_{2.5}$ and 8-hour Ozone NAAQS. St. Louis County and St. Louis City are maintenance areas with respect to the CO NAAQS. Jefferson County, within the city limits of Herculaneum, is non-attainment with respect to lead NAAQS (40 CFR 81.326). The Metropolitan St. Louis Interstate AQCR is located approximately 25 miles to the east of Callaway Unit 1.

The acid rain requirements of the CAA Amendments establish a cap on the allowable SO_2 emissions from power plants. Each company with fossil-fuel-fired units was allocated SO_2 allowances. The SO_2 allowances can be bought, sold, traded, or banked. To be in compliance with the Act, the companies must hold enough allowances to cover their annual SO_2 emissions. In year 2008, Missouri was ranked 12th nationally in SO_2 emissions and 12th nationally in NO_x emissions from electric power plants (EIA 2008d).

In 1998, the U.S. Environmental Protection Agency (USEPA) finalized a rule known as the "NO_x State Implementation Plan (SIP) Call" requiring Missouri as well as 21 other eastern states to submit SIPs that addressed the regional transport of ground-level ozone. The states had to limit their total NO_x emissions during the NO_x ozone season (May 1 through September 30). In Missouri, this requirement applied only to 36 eastern counties and the City of St. Louis. To comply with the NO_x SIP Call, Missouri established a NO_x allowance cap and trade program in eastern Missouri. Missouri set aside 134 NO_x allowances to be awarded annually to eligible energy efficiency and renewable energy projects. The last date to apply for these awards was November 30, 2007. By improving air quality and reducing emissions of nitrogen oxides (a precursor to ozone formation known as NO_x), the actions directed by these plans were intended to decrease the transport of ozone across state boundaries in the eastern half of the United

States. The rule required emission reduction measures to be in place by May 1, 2003 (MDNR 2010 and USEPA 2007).

In 2005, USEPA issued the Clean Air Interstate Rule (CAIR). The CAIR required generating facilities in 28 states, including Missouri, to participate in cap−and−trade programs to reduce annual SO_2 emissions, annual NO_x emissions, and ozone season NO_x emissions. The USEPA had already allocated emission allowances for SO_2 to sources subject to the acid rain program. These allowances are used in the CAIR model SO_2 trading program. USEPA allocated emission allowances for NO_x to each state, according to the state budget for the model NO_x trading program. Sources have the choice of installing pollution control equipment, switching fuels, or buying excess allowances from other sources that have reduced their emissions. The cap−and−trade program for both annual and ozone season NO_x emissions went into effect on January 1, 2009. The SO_2 emissions cap−and−trade program went into effect on January 1, 2010. In December 2008, the United States Court of Appeals for the District of Columbia remanded the CAIR to the EPA for further action to remedy the rule's flaws, but allowed the CAIR's cap−and−trade programs to remain effective until they are replaced by the EPA (U.S. Court of Appeals 2008).

In July 2011, the USEPA finalized the Cross-State Air Pollution Rule (CSAPR) which addresses long range transport of particulate matter and ozone by requiring reductions in SO_2 and NO_x from utilities located in 23 eastern states, including Missouri. The CSAPR, which becomes effective on January 1, 2012, for SO_2 and annual NO_x reductions and on May 1, 2012, for ozone season NO_x reductions, replaces CAIR. In the CSAPR, the USEPA developed federal implementation plans for each state covered by this rule; however, each impacted state can develop its own implementation rule starting as early as 2013. The CSAPR set a pollution budget for each of the impacted states based on the USEPA's analysis of each upwind state's contribution to air quality in downwind states. For Missouri, emission reductions are required in two phases beginning in 2012, with further reductions in 2014. With the CSAPR, the USEPA adopted a cap−and−trade approach that allows intrastate and limited interstate trading of emission allowances with other sources within the same program, that is, either the SO_2, annual NO_x, or ozone season NO_x program (76 FR at 48208:48483).

In March 2011, the EPA issued proposed rules under the CAA that establish a "Maximum Achievable Control Technology" (MACT) standard to control mercury emissions and other hazardous air pollutants, such as acid gases, metals, and particulate matter. The MACT standard sets emission limits equal to the average emissions of the best performing 12 percent of existing coal and oil−fired electric generating units. The proposed MACT rule also requires reductions in hydrogen chloride emissions, which were not regulated previously. The MACT standard will apply to each unit at a coal−fired power plant; however, in certain circumstances, emission compliance can be averaged for the entire power plant. In conjunction with the proposed MACT rule, USEPA is also proposing to revise the new source performance standards (NSPS) that new coal- and oil-fired power plants must meet for particulate matter (PM), SO_2 and NO_x. The proposed rules are scheduled to be finalized in November 2011. Compliance is expected to be required no later than 2016 and potentially as early as late 2014 (76 FR 24976:25147).

In the future, there will likely be more stringent thresholds for greenhouse gas emissions as well as increases in permitting requirements. In December 2009, the USEPA issued its "endangerment finding" determining that greenhouse gas emissions, including CO_2, endanger human health and welfare and that emissions of greenhouse gases from motor vehicles contribute to that endangerment. In March 2010, the USEPA issued a determination that

greenhouse gas emissions from stationary sources, such as power plants, would be subject to regulation under the Clean Air Act in 2011. Recognizing the difficulties presented by regulating at once virtually all emitters of greenhouse gases, the USEPA finalized in May 2010 regulations known as the "Tailoring Rule," that would establish new higher thresholds for regulating greenhouse gas emissions from stationary sources, such as power plants. The Tailoring Rule became effective in January 2011. The rule requires any source that already has an operating permit to have greenhouse gas−specific provisions added to its permits upon renewal. The Tailoring Rule also provides that if projects performed at major sources result in an increase in emissions of greenhouse gases of at least 75,000 tons per year, measured in CO_2 equivalents, such projects could trigger permitting requirements under the New Source Review/Prevention of Significant Deterioration program and the application of best available control technology, if any, to control greenhouse gas emissions. New major sources also would be required to obtain such a permit and to install the best available control technology if their greenhouse gas emissions exceed the applicable emissions threshold. Separately, in December 2010, the USEPA announced it would establish NSPS for greenhouse gas emissions at new and existing fossil fuel−fired power plants. The USEPA has extended its deadline to issue its proposed standard for power plants, called the performance standard, until the end of September 2011, with final standards expected in 2012 (USEPA 2011). In addition, in January 2010, the EPA began requiring large emitters of greenhouse gases to begin collecting greenhouse gas data under a new reporting system. Under the rule, suppliers of fossil fuels or industrial greenhouse gases, manufacturers of vehicles and engines, and facilities that emit 25,000 metric tons or more per year of GHG emissions are required to submit annual reports to EPA. The first annual reports are due in 2011 (USEPA 2010).

In June 2010, the USEPA published a proposed rule seeking comment on whether to regulate coal combustion byproducts (often referred to as coal ash) as hazardous or nonhazardous waste. Coal ash is currently exempt from hazardous waste regulation. Either of the two regulatory alternatives would allow for some continued beneficial uses, such as recycling, of coal ash without classifying it as waste. As part of its proposal, the USEPA is considering alternative regulatory approaches that require coal−fired power plants to either close surface impoundments, such as ash ponds, or retrofit such facilities with liners. Existing impoundments and landfills used for the disposal of coal combustion byproducts would be subject to groundwater monitoring requirements and requirements related to closure and postclosure care under the proposed regulations. The USEPA has not announced a planned date for a final rule (75 FR 35128:35264).

Alternatives

The following sections present fossil-fuel-fired generation (Section 7.2.1.1) and an evolutionary power reactor (Section 7.2.1.2) as reasonable alternatives to license renewal. Section 7.2.1.3 considers the possibility of purchasing power from different electricity producers. Section 7.2.1.4 discusses reduced demand and presents the basis for concluding that it is not a reasonable alternative to license renewal. Section 7.2.1.5 discusses other alternatives that Ameren has determined are not reasonable and the basis for these determinations.

7.2.1.1 Construct and Operate Fossil-Fuel-Fired Generation

Ameren analyzed locating hypothetical new gas- and coal-fired units at the existing Callaway site and at an undetermined greenfield site. Ameren concluded that Callaway is the preferred site for new construction because this approach would minimize environmental impacts by building on previously disturbed land and by making the most use possible of existing facilities,

such as transmission lines, roads and parking areas, office buildings, and components of the cooling system. Locating hypothetical units at the existing site has, therefore, been applied to the coal- and gas-fired units.

For comparability, Ameren selected gas- and coal-fired units of equal electric power capacity. Two units, each with a net capacity of 593 MWe were assumed to replace the 1,190-MWe Callaway Unit 1 net capacity. It must be emphasized, however, that these are hypothetical scenarios. Ameren does not have plans for such construction at the Callaway site.

Gas-Fired Generation

NRC has routinely evaluated gas-fired generation alternatives for nuclear plant license renewal. In the GEIS Supplement for Wolf Creek Generating Station (NRC 2008), NRC analyzed 1,165 MWe of gas-fired generation capacity. Ameren has reviewed the NRC analysis, considers it to be sound, and notes that it analyzed slightly less generating capacity than the 1,190 MWe discussed in this analysis. In defining the Callaway Unit 1 gas-fired alternative, Ameren has used site- and Missouri-specific input and has applied the NRC analysis, where appropriate.

For purposes of this analysis, Ameren assumed development of a modern natural gas-fired combined-cycle plant. Ameren based its emission control technology and percent control assumptions on alternatives that the EPA has identified as being available for minimizing emissions (USEPA 2008). Ameren assumes that the representative plant would be located at the Callaway Unit 1 site, which offers potential advantages of existing infrastructure (e.g., cooling water system, transmission, roads, and technical and administrative support facilities). Table 7.2-1 presents the basic gas-fired alternative characteristics.

Coal-Fired Generation

NRC has routinely evaluated coal-fired generation alternatives for nuclear plant license renewal. In the GEIS Supplement for Wolf Creek Generating Station (NRC 2008), NRC analyzed 1,165 MWe of coal-fired generation capacity. Ameren has reviewed the NRC analysis, considers it to be sound, and notes that it analyzed slightly less generating capacity than the 1,190 MWe discussed in this analysis. In defining the Callaway Unit 1 coal-fired alternative, Ameren has used site- and Missouri-specific input and has applied the NRC analysis, where appropriate.

For purposes of this analysis, Ameren assumed development of an ultra-supercritical coal-fired plant. Ameren based its emission control technology and percent control assumptions on alternatives that the EPA has identified as being available for minimizing emissions (USEPA 1998). Table 7.2-2 presents the basic coal-fired alternative emission control characteristics. Ameren assumes that the representative plant would be located at the Callaway Unit 1 site, which offers potential advantages of existing infrastructure (e.g., cooling water system, transmission, roads, and technical and administrative support facilities). For the purposes of analysis, Ameren has assumed that coal and limestone (calcium carbonate) would be delivered to Callaway Unit 1 via an existing rail spur that would need reconstructing.

7.2.1.2 Construct and Operate New Nuclear Reactors

Starting in 1997, the NRC has certified four standard designs for nuclear power plants under 10 CFR 52, Subpart B; several other designs are under review or have vendor applications being prepared. These designs are the U.S. Advanced Boiling Water Reactor (ABWR)

(10 CFR 52, Appendix A), the System 80+ Design (10 CFR 52, Appendix B), the AP600 Design (10 CFR 52, Appendix C), and the AP1000 Design (10 CFR 52, Appendix D). All of these plants are light-water reactors.

Ameren submitted a combined license application (COLA) for a second nuclear unit at the Callaway site in July 2008. In April 2009, Ameren suspended its efforts to build the new unit due to pending state legislation which prevents Missouri investor-owned utilities from recovering any plant development costs, including financing costs until an energy plant is operating. In June 2009, at the request of Ameren, NRC suspended its review of the Callaway COLA. If the Callaway Unit 1 license is not renewed and Ameren pursued constructing a baseload power plant, it is possible that a new nuclear plant at the Callaway site would be pursued given the process has already been initiated. The NRC could resume its review of the Callaway COLA at Ameren's request.

The analysis of the new nuclear reactor alternative is based on the Callaway COLA. In the COLA environmental report for Callaway Unit 2 (AmerenUE 2009), Ameren evaluated the construction and operation of AREVA's U.S. Evolutionary Power Reactor (U.S. EPR) at the Callaway site. This design is undergoing design certification before the NRC and is currently used internationally and has similar features to NRC-certified PWRs. The U.S. EPR would have a net electrical output of approximately 1,600 MWe. In defining the new nuclear reactor alternative, Ameren assumed development of one U.S. EPR unit to replace Callaway Unit 1. While this U.S. EPR unit could provide more generating capacity than the 1,190-MWe capacity of Callaway Unit 1, Ameren's experience indicates that if this design is certified by the NRC, it would have inherent economic and schedule advantages over custom-sized nuclear units. Ameren assumes that the representative plant would be located at the Callaway site, which offers potential advantages of existing infrastructure (e.g., cooling water system, transmission, roads, and technical and administrative support facilities). For the purposes of analysis, Ameren has assumed that fuel would be delivered to Callaway via an existing rail spur.

7.2.1.3 Purchased Power

Ameren has evaluated conventional and prospective power supply options that could be reasonably implemented before the existing Callaway Unit 1 license expires. The source of this purchased power is speculative, but may reasonably include new generating facilities developed within the Ameren service territory, elsewhere in Missouri, or in neighboring states. The technologies that would be used to generate this purchased power are similarly speculative.

Ameren assumes that the generating technology used to produce purchased power would be one of those that NRC analyzed in the license renewal GEIS. For this reason, Ameren is adopting by reference the GEIS description of the alternative generating technologies as representative of the purchase power alternative. Of these technologies, facilities fueled by coal, combined-cycle facilities fueled by natural gas, and advanced light-water reactor facilities are the most cost effective for providing baseload capacity.

Ameren is a member of the Midwest Independent Transmission System Operator (ISO); which supports the delivery of wholesale electricity to 15 U.S. States and the Canadian province of Manitoba. There are three primary transmission systems providers within Missouri, MISO, Southwest Power Pool (SPP) and Associated Electric Cooperatives (AEIC). The Missouri PSC has noted the lack of direct interconnections between the Midwest ISO and SPP (Missouri PSC 2009). The Midwest ISO annually evaluates regional transmission needs, and coordinates with transmission owners, including Ameren, to address system reliability requirements, increase

market efficiency, connect new generation and electricity users to the grid, and provide other system benefits. Based on its annual evaluation, the Midwest ISO has approved 613 projects that will result in approximately 4,200 miles of new or upgraded transmission lines throughout its territory by the end of 2020. These projects include a new substation and upgrades to substations and transmission line in the Ameren service area. In addition, to improve system reliability and to meet the increasing electricity demand over the 20-year planning horizon, Ameren has plans for numerous upgrades to the distribution system within the Ameren service area (Ameren 2011). As a result, Ameren anticipates that additional transmission infrastructure would be needed in the event that Ameren purchases power to replace Callaway Unit 1 capacity.

Ameren regularly evaluates purchase power options to meet system demands. As a result of this process, Ameren executed an agreement to purchase of 102 MW of wind power from a wind farm in Iowa. The Purchase Power Agreement runs from September 2009 through August 2024 (Ameren 2011).

7.2.1.4 Demand Side Management

Demand-side management (DSM) is a utility program that seeks to reduce consumer energy consumption through efficiency initiatives, and demand response measures. Energy efficiency initiatives reduce the overall consumption of electricity; whereas, demand response measures reduce electricity consumption during the few periods of highest demand. DSM efforts can help minimize environmental effects by avoiding the construction and operation of new generation facilities. The impacts that would result from the construction of a new electric generating facility, or from the supply of electric power through other means, would be avoided if DSM were sufficient to reduce the need for additional power. As discussed in the license renewal GEIS (NRC 1996), the DSM alternative does not fulfill the stated purpose and need of the proposed action because it does not "provide power generation capability." Nevertheless DSM is considered here because energy efficiency and demand response are important energy management tools for meeting projected demand. Ameren has been implementing full-scale energy efficiency and demand response programs since 2009 and has programs for both residential and business customers. All of these programs are scheduled to end September 2011. The future level of investment in these programs is highly dependent on the regulatory framework applied to DSM. (Ameren 2011).

The Missouri PSC requires Missouri electric utilities to evaluate DSM and supply side measures on an equivalent basis and to take DSM energy savings into account in long-range planning. Ameren included an analysis of DSM resources in their 2011 Integrated Resource Plan (IRP) (Ameren 2011). The planning process included a robust screening of approximately 500 energy efficiency measures, and a review of utility program design best practices. Ameren also commissioned a DSM Market Potential Study that relied on primary market research within Ameren's service area. Several DSM portfolios were analyzed and considered during the planning process, including:

- a low risk portfolio (Low Risk) that minimizes Ameren's exposure to risk and uncertainty relative to the current DSM regulatory framework
- a capacity calibrated portfolio (CCP) that is tuned to meet only annual capacity needs during the planning horizon

- a realistic achievable portfolio (RAP) that represents realistic estimates of energy efficiency and demand response potential based on known program experience from around the country

- a maximum achievable portfolio (MAP) that represents the maximum target for energy efficiency and demand response potential based on customer preferences resulting from ideal implementation conditions that are not typically observed in real-world experience

Each DSM portfolio was initially measured by its cost-effectiveness using the Total Resource Cost (TRC) test, which measures benefits and costs from the perspective of the utility's customers and society as a whole. The results of the TRC test indicated that levelized cost of DSM is less than the levelized cost of the supply-side alternatives. The TRC is a screening-level assessment that does not reflect risk, and the results of integration and risk analysis determine cost-effectiveness on a risk-adjusted basis.

Ameren's analysis also quantified some of the unique risks associated with implementing demand-side programs. Customer acceptance is a key driver to successful implementation of DSM programs that presents a level of risk. The existing regulatory framework that provides an incentive for utilities to maximize sales of electricity poses another risk. Utility incentives in favor of energy efficiency require the use of alternative ratemaking approaches. Rate treatment related to utility energy efficiency programs can be separated into three categories – program cost recovery, lost revenue, and performance incentives. Of these, lost revenue represents the greatest hurdle which must be overcome to align utility incentives with promotion of energy efficiency. The reason for this is that for each kilowatt-hour (kWh) of reduced sales the utility loses revenue for that kWh until it is reflected in the development of rates in the utility's next general rate case. Over time the impact to utility earnings due to lost revenue associated with implementation of DSM programs can be substantial. Ameren determined that the lost revenues in the current DSM regulatory environment are a major obstacle to the aggressive pursuit of DSM. As a result, Ameren identified the Low Risk portfolio as the most cost effective DSM portfolio for the current planning horizon.

The Low Risk portfolio is expected to achieve an energy savings of 11,875 gigawatt-hours over the 2011 to 2030 timeframe, which is substantially less than the amount of energy that would be produced by Callaway Unit 1 over the same period. These DSM savings are an important part of Ameren's plan for meeting projected regional demand growth in the near-term (Ameren 2011). The 2011 IRP also indicates that in spite of DSM, a new baseload generation plant would be needed by 2029 (Ameren 2011).

Ameren's 2011 IRP analyzed the retirement of its Meramec coal plant in response to environmental regulations. To the extent environmental regulations become more stringent, it may be necessary to retire the Meramec facility by 2016. Unlike the previously mentioned natural gas and coal supply-side options that can be added ad infinitum, DSM has limited potential. If Callaway Unit 1 and Meramec were both retired then a DSM solution to meeting customer's needs would be even more problematic.

Ameren considers reducing demand as an essential part of their operations, and includes the energy savings from DSM programs in their long-range plans for meeting projected demand. However, in the current DSM regulatory environment, the available energy savings from DSM programs are insufficient as a substitute to Callaway Unit 1.

7.2.1.5 Other Alternatives

This section identifies alternatives that Ameren has determined are not reasonable for replacing Callaway Unit 1 and the bases for these determinations. Ameren accounted for the fact that Callaway Unit 1 is a base-load generator and that any feasible alternative to Callaway Unit 1 would also need to be able to generate base-load power. In performing this evaluation, Ameren relied heavily upon the NRC's license renewal GEIS (NRC 1996).

Petroleum-Fired Generation

The Energy Information Administration (EIA) projects that petroleum-fired plants will account for very little of the new generating capacity in the U.S. during the 2008 to 2030 time period. The variable costs of petroleum-fired generation tend to be greater than those of the nuclear or coal-fired operations, and petroleum-fired generation tends to have greater environmental impacts than natural gas-fired generation. In addition, future increases in oil process are expected to make petroleum-fired generation increasingly more expensive (EIA 2009). The high cost of oil has prompted a steady decline in its use for electricity generation. Thus, Ameren does not consider oil-fired generation to be a reasonable alternative to Callaway Unit 1 license renewal.

Wind

A wind energy system transforms the kinetic energy of the wind into mechanical or electrical energy that can be harnessed for practical use. Wind turbines are mounted on a tower to capture the most energy. The turbines consist of two or three blades which are mounted on a shaft to form a rotor. Wind causes the rotor to spin like a propeller which spins a generator to make electricity (NREL 2009). Ameren currently purchases 102 MW of wind power capacity from a wind farm in Iowa (Ameren 2011). In addition, through the joint state and federal Tall Towers Program, Ameren is working with other Missouri electric utilities to determine the region's potential for the next generation wind turbines.

As discussed in Section 8.3.1 of the license renewal GEIS (NRC 1996) wind power, due to its intermittent nature, is not suitable for baseload generation. Wind power systems produce power only when the wind is blowing at a sufficient velocity and duration. While recent advances in technology have improved wind turbine capacity, average annual capacity factors for wind power systems are relatively low (22 to 47 percent) compared to 90 to 97 percent industry average for a baseload plant such as a nuclear plant (DOE 2008b; NRRI 2007a). The average capacity factor for existing wind power systems in Missouri is 35 percent (DOE 2008a). The energy potential in the wind is expressed by wind generation classes that range from 1 (least energetic) to 7 (most energetic). In a Class 1 region, the average wind speed is less than 12.5 miles per hour (mph) and offers a wind power of less than 200 watts per square meter. A Class 7 region has an average of more than 19.7 mph and offers a wind power of more than 800 watts per square meter. These speed ranges are based on wind speeds measured at 164 feet above ground surface (AWEA 2007). Current wind technology can operate economically on Class 4, while Class 3 wind regimes will require further technical development for utility-scale application (APPA 2004). The majority of Missouri is classified as a Class 1 region with the northwest and western portion of the state classified between Class 2 and 3 (NREL 2008c). In open, flat terrain, a utility-scale wind plant requires about 60 acres per megawatt of installed capacity. However, about 5 percent (3 acres) of this area is actually occupied by turbines, access roads, and other equipment. The remaining area can be used for compatible activities such as farming or ranching (AWEA 2009). When the wind farm is located on land already used for intensive agriculture, the additional impact to wildlife and habitat will

likely be minor, while disturbance caused by wind farms in more remote areas may be more significant. Replacement of Callaway Unit 1 generating capacity (1,190 MWe) with wind power, assuming a capacity factor of 35 percent, would require a large greenfield site about 183,600 acres in size, of which approximately 9,180 acres would be disturbed and unavailable for other uses.

Recent studies have suggested that baseload power could be provided by an interconnected array of wind farms that are sufficiently separated so that they would not be affected by the same synoptic winds. One study (Archer and Jacobson 2007) used hourly and daily averaged wind speed measurements taken at 19 airports located in the Texas, New Mexico, Oklahoma, and Kansas to estimate generation duration curves and operational statistics of wind power arrays. Archer and Jacobson (2007) found that "an average of 33 percent and a maximum of 47 percent of yearly averaged wind power from interconnected farms can be used as reliable, baseload electric power". The area of interest the authors chose for their wind model (the lower Midwestern states) is one of the best locations in the country for harnessing wind energy. Wind farms in Missouri, however, would be in locations where conditions are not as good. The authors also use capacity factor as an indicator of reliability, but capacity factor and reliability are two separate and distinct parameters. During a scheduled outage of a conventional power plant, the power output is guaranteed to be zero, there is no uncertainty. Maintenance outages scheduled long in advance reduce a plant's capacity factor, not its reliability. Archer and Jacobson (2007) compare the scheduled down time of conventional power plants with the unscheduled unpredictable downtime of wind power. This comparison demonstrates that wind farms, even when interconnected in an array, are not as reliable as conventional power plants.

Another study (Katzenstein et al. 2010) used output data from 20 wind plants within the ERCOT region of Texas, as well as wind speed data to analyze of the geographic smoothing of wind power's variability. The Katzenstein study also used data from 19 Bonneville Power Authority (BPA) wind farms to determine if results similar to the ERCOT results are seen in another system. Katzenstein et al. (2010) determined that the variability of interconnected wind plants is less than that of individual wind plants and the reductions in variability diminish as more wind plants are interconnected. The Katzenstein study concluded that "these results do not indicate that wind power can provide substantial baseload power simply through interconnecting wind plants. ERCOT's generation duration curve shows wind power reliably provides 3-10 percent of installed capacity as firm power … while BPA's generation duration curve shows 0.5-3 percent of their wind power is firm power. The frequency domain analyses have shown that the power of interconnected wind plants will vary significantly from day to day and the results of the step change analyses show day-to-day fluctuations can be 75 to 85 percent of the maximum power produced by a wind plant." (Katzenstein et al. 2010). Based on this discussion, Ameren has determined that interconnected wind farms may have some advantages over a single large-scale wind farm, but the capacity factor and reliability of interconnected wind farms are inadequate to provide baseload power.

Some wind energy proponents have argued that wind power might serve as a means of providing baseload power, if used in conjunction with energy storage mechanisms. Several energy storage technologies have been tested in small scale, commercial applications. These storage technologies include batteries (conventional and advanced), superconducting magnetic energy storage (SMES), flywheels, pumped hydroelectric, and compressed-air energy storage (CAES). Cost limitations and technical constraints, including the need for larger storage capacities and longer life cycles, the availability of raw materials for battery and SMES development, safety issues related to flywheel deployment, and environmental issues related to recycling currently preclude using the first three technologies (i.e., batteries, SMES, flywheels)

for large-scale utility applications. Presently, pumped hydroelectric and CAES are the only practically available alternatives for large utility-scale energy storage applications (Denholm et al. 2010); however, both technologies have substantial geological limitations. Pumped hydroelectric systems require two large reservoirs with an elevation difference of roughly 400 feet or more. Also, pumped hydroelectric facilities have large construction and ecological impacts; and there are few suitable sites in Missouri for pumped hydroelectric systems. In the 2011 IRP, Ameren identified a potentially suitable site for a 600-MW pumped hydroelectric facility at Church Mountain, between Taum Sauk State Park and Johnson Shut-ins State Park (Ameren 2011). However, a 600-MW facility would provide roughly half of the storage capacity needed for a facility the size of Callaway Unit 1. Additional storage capacity would need to be developed and other suitable sites, if they exist. Consequently, a utility-scale pumped hydroelectric system the size of Callaway Unit 1 is not a feasible energy storage option in Missouri. CAES systems require an airtight underground storage volume such as a solution-mined cavern in a salt dome, a porous rock formation such as a depleted aquifer, or a hard rock cavern or abandoned mine (Schainker 2006). While Missouri does have some hard rock caverns and abandoned mines, extensive geological studies would be required to determine their suitability for CAES applications. Although several CAES plants have been proposed, there are only two CAES plants in operation in the world: the 290 MW Huntorf plant in Germany and the 110 MW McIntosh plant in Alabama. Both CAES plant are peak shaving facilities that do not provide baseload power. CAES is a relatively immature technology and the use of CAES for baseload wind generation has not been demonstrated. Also, CAES systems generate electrical power by supplying heated compressed air to combustion turbines. So their air quality impacts would be similar to the impacts of a gas-fired power plant. Ameren has determined that due to technical and environmental issues, and the limited availability of suitable sites, use of energy storage mechanisms to provide baseload wind generation is not a reasonable alternative for a facility the size of Callaway Unit 1. Ameren Missouri's 2011 IRP also showed that storage options were not cost effective compared to other alternatives such as combined cycle gas turbines.

Based on this analysis, Ameren has determined that wind energy is developed and proven; however, wind energy is not readily available in Missouri and the capacity factor and reliability for wind energy are inadequate to provide baseload power. In addition, wind energy has large land-use requirements and the associated construction and ecological impacts. Mechanisms for improving the reliability of wind energy systems have been proposed, but none have been demonstrated for a facility the size of Callaway Unit 1. For these reasons, wind power is not a feasible alternative for baseload power in Missouri.

Solar

There are two basic types of solar technologies that produce electrical power: photovoltaic and solar thermal power. Photovoltaics convert sunlight directly into electricity using semiconducting materials. Solar thermal power systems use mirrors to concentrate sunlight on a receiver holding a fluid or gas, heating it, and causing it to turn a turbine or push a piston coupled to an electric generator. Solar thermal systems can be equipped with a thermal storage tank to store hot heat transfer fluid, providing thermal energy storage. By using thermal storage, a solar thermal plant can provide dispatchable electric power (Leitner and Owens 2003). In December 2010, Ameren completed the installation of approximately 100 kilowatts of photovoltaic panels at its downtown St. Louis headquarters (Ameren 2011).

Solar technologies produce more electricity on clear, sunny days with more intense sunlight and when the sunlight is at a more direct angle (i.e., when the sun is perpendicular to the collector).

Cloudy days can significantly reduce output, and no solar radiation is available at night. To work effectively, solar installations require consistent levels of sunlight (solar insolation) (Leitner and Owens 2003).

The lands with the best solar resources are usually arid or semi-arid. In addition, the average annual amount of solar energy reaching the ground needs to be 6.75 kWh per square meter per day (kWh/m^2/day) or higher for solar thermal power systems (DOE 2009b). Missouri receives 4 to 5 kW-hr/m^2/day compared with 5.5 to 7.5 kW-hr/m^2/day in areas of the West, such as California, which are most promising for solar technologies (NREL 2008b).

Environmental advantages shared by both solar technologies are near-zero emissions and an unlimited supply of fuel (sunlight). Environmental disadvantages shared by both solar technologies are sizeable land use requirements, aesthetic intrusion, and potential use of hazardous materials (lead) to store energy.

Land requirements for solar plants are high. Estimates based on existing installations indicate that utility-scale plants would occupy approximately 4.5 to 8 acres per MWe for photovoltaic and 4 to 8 acres per MWe for solar thermal systems (SolarbytheWatt.com 2009 and DOE 2009b). Utility-scale solar plants have mainly been used in regions that receive high concentrations of solar radiation such as the western U.S. A utility-scale solar plant located in the region of interest would occupy about 3.3 acres per MWe for photovoltaic and 7.7 acres per MWe for solar thermal systems. To provide 1,190 MWe using these estimated land requirements, a solar photovoltaic system with a capacity factor of 23 percent would require nearly 15,342 acres. A concentrating thermal system operating at 40 percent capacity would require nearly 20,584 acres. These numbers are conservative estimates and could be considerably higher. Based on recent solar energy project applications to the BLM California Desert District, photovoltaic systems are averaging 11 acres per MWe and solar thermal systems are averaging 13 acres per MWe (BLM 2008).

Solar technologies do not currently compete with conventional technologies in grid-connected applications. Recent estimates indicate that the cost of electricity produced by photovoltaic cells is in the range of 21 to 38 cents per kWh, and electricity from solar thermal systems can be produced for a cost in the range of 12 to 17 cents per kWh (DOE 2008b).

Based on this analysis, Ameren has determined that solar power is developed and proven; however, Missouri is not well suited for large utility-scale solar power, since the solar energy intensity is below that needed; solar power is intermittent, has a low capacity factor, and is thus not suitable as a baseload source; energy storage technology is not available (see discussion of wind above) to allow solar power to be used as a source of baseload power; and the land use requirements for solar power are very large. Solar power would also be a very high cost alternative. For these reasons, solar power is not a feasible alternative for baseload power in Missouri.

Hydropower

Hydroelectric power uses the energy of falling water to turn turbines and generate electricity. Power production increases with both greater water flow and greater fall. The summer capacity for hydropower in Missouri is about 543 MWe, which represents roughly 2.7 percent of Missouri's electric generation capacity (EIA 2008d). According to a 1998 report by the Idaho National Engineering and Environmental Laboratory, Missouri has approximately 218.6 MW of undeveloped hydroelectric generating potential, which is less than what would be needed to

replace Callaway Unit 1 (INEEL 1998). Ameren has a hydroelectric generating capacity of 382 MW (Ameren 2011).

The GEIS estimates land use of 1,600 square miles per 1,000 MWe for hydroelectric power. Based on this estimate, replacement of Callaway Unit 1 generating capacity would require flooding approximately 1,904 square miles, resulting in a large impact on land use. Further, operation of a hydroelectric facility would alter aquatic habitats above and below the dam, which would impact existing aquatic communities.

Based on this analysis, Ameren has determined that although hydropower is developed and proven, the potential for future hydropower development in Missouri is inadequate to satisfy the need for power. In addition, hydropower has large land use requirements along with the associated environmental impacts. For these reasons, hydropower is not a feasible alternative for replacing Callaway's baseload power.

Tidal, Ocean Thermal, and Wave

The most developed technologies to harness electrical power from the ocean are tidal power, ocean thermal energy, and wave power conversion. These technologies are still in the early stages of development. Callaway Unit 1 is located in the Midwestern United States where these resources are not available. Therefore, tidal, ocean thermal and wave technologies are not reasonable alternatives to Callaway Unit 1 license renewal.

Geothermal

Geothermal energy is a proven resource for power generation. Geothermal power plants use naturally heated fluids as an energy source for electricity production. To produce electric power, underground high-temperature reservoirs of steam or hot water are tapped through wells and the steam rotates turbines that generate electricity. Typically, water is then returned to the ground to recharge the reservoir.

Geothermal energy can achieve capacity factors of 98 percent and can be used for baseload power where this type of energy source is available (DOE 2009a and REPP 2010). Widespread application of geothermal energy is constrained by the geographic availability of the resource. In the U.S., high-temperature hydrothermal reservoirs occur in the western continental U.S., Alaska, and Hawaii. Missouri has a low probability of containing developable geothermal resources. There are resources that can be tapped for direct heat or for geothermal heat pumps, but electricity generation is not feasible with these resources (NREL 2008a). Therefore, Ameren concludes that geothermal is not a reasonable alternative to Callaway Unit 1 license renewal.

Wood Energy

As discussed in the license renewal GEIS (NRC 1996), the use of wood waste to generate electricity is largely limited to those states with significant wood resources. The pulp, paper, and paperboard industries in states with adequate wood resources generate electric power by consuming wood and wood waste for energy, benefiting from the use of waste materials that could otherwise represent a disposal problem.

Further, as discussed in Section 8.3.6 of the GEIS, construction of a wood-fired plant would have an environmental impact that would be similar to that for a coal fired plant, although facilities using wood waste for fuel would be built on a smaller scale. Like coal-fired plants,

wood-waste plants require large areas for fuel storage, processing, and waste (i.e., ash) disposal. Additionally, operation of wood-fired plants has environmental impacts, including impacts on the aquatic environment and air. Wood has a low heat content that makes it unattractive for baseload applications. It is also difficult to handle and has high transportation costs.

Ameren has concluded that because of the lack of an environmental advantage, low heat content, handling difficulties, and high costs, wood energy is not a reasonable alternative to Callaway Unit 1 license renewal.

Municipal Solid Waste

The decision to burn municipal solid waste to generate energy is usually driven by the need for an alternative to landfills, rather than by energy considerations. Additionally, Renewable Portfolio Standards and other incentives have resulted in an increased number of waste to energy (WTE) facilities. The Solid Waste Association of North America reports that there are 89 WTE facilities operating in 27 states generating the equivalent of 2,500 MWh of electricity while disposing of 29 million tons of trash (SWANA 2010).

As discussed in Section 8.3.7 of the GEIS, the initial capital costs for municipal solid waste plants are greater than for comparable steam turbine technology at wood-waste facilities. This is due to the need for specialized waste separation and handling equipment.

Estimates in the GEIS suggest that the overall level of construction impacts from a waste-fired plant should be approximately the same as that for a coal-fired plant. Additionally, waste-fired plants have the same or greater operational impacts (including impacts on the aquatic environment, air, and waste disposal). Some of these impacts would be moderate, but still larger than the environmental effects of Callaway Unit 1 license renewal. Therefore, Ameren has concluded that municipal solid waste facilities at the scale required to replace Callaway Unit 1, are not a reasonable alternative to Callaway Unit 1 license renewal.

Other Biomass Related Fuels

In addition to wood and municipal solid waste fuels, there are several other biomass energy resources used for fueling electric generators including food crops, grassy and woody plants, residues from agriculture, oil-rich algae, and methane gas from landfills and manure. The capacity of plants using these resources for fuel is generally less than 20 MW (EIA 2008b). Ameren announced in 2009 an agreement to purchase methane from Fred Weber's Maryland Heights, MO, solid waste landfill. Beginning in 2011, Ameren will install combustion turbines that will be capable of generating about 15 MWs of electricity by burning methane gas at the landfill. The project is slated to be completed in 2012 (Ameren 2011). Though, as discussed in the GEIS, none of these technologies has progressed to the point of being competitive on a large scale or of being reliable enough to replace a baseload plant such as Callaway Unit 1. Ameren has concluded that other biomass-derived fuels do not yet offer a reasonable alternative to Callaway Unit 1 license renewal.

Fuel Cells

Fuel cells work without combustion and its environmental side effects. Power is produced electrochemically by passing a hydrogen-rich fuel over an anode and air over a cathode and separating the two by an electrolyte. The only by-products are heat, water, and carbon dioxide.

Hydrogen fuel can come from a variety of hydrocarbon resources by subjecting them to steam under pressure. Natural gas is typically used as the source of hydrogen.

Fuel cell power plants are in the initial stages of commercialization. Although more than 900 large stationary fuel cell systems have been built and operated worldwide, the global stationary fuel cell electricity generation capacity in 2008 was only 175 MWe (FCT 2008). The largest stationary fuel cell power plant ever built is the 50-MWe POSCO facility in Korea (FC2000 2009). Even so, fuel cell power plants typically generate much less (2 MWe or lower) power (NRRI 2007b).

One of the major barriers to full commercialization of stationary fuel cells is the product cost. To make fuel cells more competitive with other generating technologies, the Department of Energy formed the Solid State Energy Conversion Alliance (SECA), with the goal of producing new fuel cell technologies at a cost of $400/kW (DOE 2010). The most widely marketed fuel cell is currently about $4,500 per kW compared to $800 to $1,500 per kW for a diesel generator and about $400 per kW or less for a natural gas turbine. Though, SECA developed a small fuel cell system that achieved costs as low as $746/kW (DOE 2006).

Based on this analysis, Ameren believes that fuel cell technology has not matured sufficiently to support production for a baseload facility, and is therefore not a reasonable alternative for baseload capacity due to the cost and production limitations.

Delayed Retirement

As the NRC noted in the license renewal GEIS, extending the lives of existing non-nuclear generating plants beyond the time they were originally scheduled to be retired represents another potential alternative to license renewal. Though, fossil plants slated for retirement tend to be ones that are old enough to have difficulty in meeting today's restrictions on air contaminant emissions. In the face of increasingly stringent restrictions, delaying retirement in order to compensate for a plant the size of Callaway Unit 1 would appear to be unreasonable without major construction to upgrade or replace plant components.

In the current IRP, Ameren's preferred plan assumed that the Meramec coal fired steam generating plant would continue to operate through the planning horizon with no addition of significant environmental controls. However, Meramec would be retired and decommissioned in 2015 if Ameren is faced with aggressive environmental regulations (Ameren 2011). If the Meramec plant were retired, it would result in the loss of baseload generating capacity of about 900 MWe, which is less than the capacity of Callaway Unit 1. Ameren is making substantial investments in its newer fossil fuel generating units to maintain and install environmental controls necessary to keep them operational and in compliance with environmental requirements.

Ameren concludes that the environmental impacts of such a scenario are bounded by its coal- and gas-fired alternatives. For these reasons, the delayed retirement of non-nuclear generating units is not considered a reasonable alternative to Callaway Unit 1 license renewal.

7.2.2 Environmental Impacts of Alternatives

This section evaluates the environmental impacts from what Ameren has determined to be reasonable alternatives to the proposed project: pulverized coal-fired generation, gas-fired generation, construction and operation of new nuclear generation, and purchased power. Ameren has identified the significance of the impacts associated with each issue as SMALL,

MODERATE, or LARGE. This characterization is consistent with the criteria that NRC established criteria in 10 CFR 51, Appendix B, Table B-1, Footnote 3, and presented as follows:

- SMALL - Environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource. For the purpose of radiological impacts assessment, the Commission has concluded that those impacts that do not exceed permissible levels in the Commission's regulations are considered small.

- MODERATE - Environmental effects are sufficient to alter noticeably, but not to destabilize, any important attribute of the resource.

- LARGE - Environmental effects are clearly noticeable and are sufficient to destabilize any important attributes of the resource.

In accordance with National Environmental Policy Act (NEPA) practice, Ameren considered ongoing and potential additional mitigation in proportion to the significance of the impact to be addressed (i.e., impacts that are small receive less mitigative consideration than impacts that are large).

7.2.2.1 Gas-Fired Generation

NRC evaluated environmental impacts from gas-fired generation alternatives in the GEIS, focusing on combined-cycle plants. Section 7.2.1.1 presents Ameren's reasons for defining the gas-fired generation alternative as a two-unit combined-cycle plant at Callaway. Land-use impacts from gas-fired units on Callaway would be less than those from the existing plant. Reduced land requirements, due to a smaller facility footprint, would reduce impacts to ecological, aesthetic, and cultural resources. A smaller workforce could have adverse socioeconomic impacts due to loss of jobs. Combustion of natural gas would impact air quality to a degree much greater than nuclear power.

Air Quality

Natural gas is a relatively clean-burning fossil fuel that primarily emits nitrogen oxides (NO_x), a regulated pollutant, during combustion. A natural gas-fired plant would also emit small quantities of sulfur dioxide (SO_2), particulate matter, and carbon monoxide, all of which are regulated pollutants. Control technology for gas-fired turbines focuses on NO_x emissions. Ameren estimates the gas-fired alternative would use about 53.9 billion standard cubic feet of natural gas per year and would generate these emissions:

- SO_2 = 18.1 tons per year

- NO_x = 253 tons per year

- CO = 248 tons per year

- CO_2 = 3,219,670 tons per year

- PM = 121 tons per year (all particulates have a diameter of less than 2.5 microns, $PM_{2.5}$)

Table 7.2-3 presents the calculation of these emissions.

Both SO_2 and NO_x emissions would increase if a new gas-fired plant were operated at Callaway. As a result of the CAA Amendments (e.g. CSAPR, Acid Rain Program and NO_x SIP Call) as discussed in Section 7.2.1, to operate a fossil-fuel generation plant, Ameren would have to purchase SO_2 and NO_x allowances from the open market or shut down existing fossil-fired capacity and apply the credits from that plant to the new one.

In reference to local air quality as discussed in Section 7.2.1, NO_x effects on ozone levels, SO_2 allowances, and NO_x emission offsets could all be issues of concern for gas-fired combustion. While gas-fired turbine emissions are less than coal-fired boiler emissions, and regulatory requirements are less stringent, the emissions are still substantial. Ameren concludes that emissions from the gas-fired alternative at Callaway would noticeably alter local air quality, but would not destabilize regional resources (i.e., air quality). Air quality impacts would therefore be MODERATE.

Waste Management

The license renewal GEIS concludes that the solid waste generated from this type of facility would be minimal (NRC 1996). The only noteworthy waste would be from spent catalyst from selective catalytic reduction (SCR) and CO oxidation used for NO_x and CO control. Ameren concludes that gas-fired generation waste management impacts would be SMALL.

Other Impacts

The ability to construct the gas-fired alternative on the Callaway site would reduce construction-related impacts relative to construction on a greenfield site. A new gas pipeline would be required for the gas turbine generators in this alternative. To the extent practicable, Ameren would route the pipeline along existing, previously disturbed, rights-of-way to minimize impacts. The new pipeline of approximately 16-inch-diameter would need to be constructed from an existing transmission pipeline located about 12.0 miles northwest of the Callaway site (Platts 2008 and Tetra Tech 2010). Upgrades to the existing pipeline and gas storage facilities would also be required. To the extent practicable, new gas supply pipeline would routed in previously disturbed areas to minimize impacts. Based on a 75-foot easement, about 109 acres would need to be graded to permit the installation of the pipeline. Construction of the combined cycle plant would impact approximately 90 acres of land. Because this much previously disturbed acreage is available at the Callaway site, loss of terrestrial habitat would be minimal. Aesthetic impacts, erosion and sedimentation accumulation, fugitive dust, and construction debris impacts would be similar to the coal-fired alternative, but smaller because of the reduced site size. Socioeconomic impacts would result from the estimated peak construction workforce of 2,038 people to build the facilities and 97 people needed to operate the gas-fired facility. These impacts would be SMALL due to the influence of the nearby metropolitan area.

The additional stacks and boilers would increase the visual impact of the existing site. Impacts to cultural resources would be unlikely, due to the previously disturbed nature of the site.

Ameren estimates that other construction and operation impacts would be SMALL. In most cases, the impacts would be detectable, but they would not destabilize any important attribute of the resource involved. Due to the minor nature of these other impacts, mitigation would not be warranted beyond that previously mentioned.

7.2.2.2 Coal-Fired Generation

NRC evaluated environmental impacts from coal-fired generation alternatives in the license renewal GEIS. NRC concluded that construction impacts could be substantial, due in part to the large land area required (which can result in natural habitat loss) and the large workforce needed. NRC pointed out that siting a new coal-fired plant where an existing nuclear plant is located would reduce many construction impacts. NRC identified major adverse impacts from operations as human health concerns associated with air emissions, waste generation, and losses of aquatic biota due to cooling water withdrawals and discharges.

The coal-fired alternative that Ameren has defined in Section 7.2.1.1 would be located on the Callaway site.

Air Quality

A coal-fired plant would emit SO_2, NO_x, particulate matter, and carbon monoxide, all of which are regulated pollutants. As Section 7.2.1.1 indicates, Ameren has assumed a plant design that would minimize air emissions through a combination of boiler technology and post-combustion pollutant removal. Ameren estimates the coal-fired alternative emissions to be as follows:

- SO_2 = 1,182 tons per year
- NO_x = 869 tons per year
- CO = 1,206 tons per year
- CO_2 = 11.6 million tons per year
- Hg = 0.067 tons per year
- PM_{10} (particulates with a diameter of less than 10 microns) = 28 tons per year
- $PM_{2.5}$ (particulates with a diameter of less than 2.5 microns) = 7.4 tons per year

Table 7.2-4 shows how Ameren calculated these emissions.

The discussion in Section 7.2.1 of regional air quality is applicable to the coal-fired generation alternative. In addition, NRC noted in the GEIS that adverse human health effects from coal combustion have led to important federal legislation in recent years and that public health risks, such as cancer and emphysema, have been associated with coal combustion. NRC also mentioned global warming and acid rain as potential impacts.

Ameren concludes that federal legislation and large-scale concerns, such as climate change and acid rain, are indications of concerns about destabilizing important attributes of air resources. However, SO_2 emission allowances, mercury emission allowances, NO_x credits, low NO_x burners, overfire air, fabric filters or electrostatic precipitators, and scrubbers are now, or likely will be in the future, regulatory-imposed mitigation measures. As such, Ameren concludes that the coal-fired alternative would have MODERATE impacts on air quality and human health; the impacts would be noticeable and greater than those of the gas-fired alternative, but would not destabilize air quality in the area. In anticipation of more stringent regulations on CO_2 emissions, Ameren is participating in and funding research projects for large-scale CO_2 capture

and storage (CCS) tests on pulverized coal plants. Potential requirements for CCS or similar technologies would substantially increase the costs of constructing a new coal-fired plant.

Waste Management

Ameren concurs with the GEIS assessment that the coal-fired alternative would generate substantial solid waste. The coal-fired plant would annually consume approximately 4,825,833 tons of coal with an ash content of 5.1 percent (Tables 7.2-4 and 7.2-2, respectively). After combustion, Ameren assumed that 50 percent of this ash, approximately 122,936 tons per year, would be marketed for beneficial reuse. The remaining ash, approximately 122,936 tons per year, would be collected and disposed of onsite. In addition, approximately 32,523 tons of scrubber sludge would be disposed of onsite each year (based on annual limestone usage of nearly 42,176 tons). Ameren estimates that ash and scrubber waste disposal over a 40-year plant life would require approximately 95 acres. Table 7.2-5 shows how Ameren calculated ash and scrubber waste volumes. While only half this waste volume and acreage would be attributable to the 20-year license renewal period alternative, the total numbers are pertinent as a cumulative impact.

With proper facility placement, coupled with current waste management and monitoring practices, waste disposal would not destabilize any resources. There would be space within the current Callaway property for this disposal. After closure of the waste site and revegetation, the land would be available for other uses. For these reasons, Ameren concludes that waste disposal for the coal-fired alternative would have MODERATE impacts; the impacts of increased waste disposal would be clearly noticeable, but would not destabilize any important resource and further mitigation of the impact would be unwarranted.

Other Impacts

Ameren estimates that construction of the power block and coal storage area would impact about 164 acres of land and associated terrestrial habitat. Because most of this construction would be on previously disturbed land, impacts at the Callaway site would be SMALL to MODERATE but would be somewhat less than the impacts of using a greenfield site. Visual impacts would be consistent with the industrial nature of the site. As with any large construction project, some erosion, sedimentation, and fugitive dust emissions could be anticipated, but would be minimized through application of best management practices. Debris from clearing and grubbing could be disposed of on site. Ameren estimates a peak construction work force of 1,839. Due to the proximity of the site to the St. Louis metropolitan area, the surrounding communities would experience small demands on housing and public services. Ameren estimates an operational workforce of 162 for the coal-fired alternative. The reduction in workforce would result in adverse socioeconomic impacts. Ameren contends these impacts would be SMALL, due to Callaway's proximity to the St. Louis metropolitan area.

Coal delivery would add noise and transportation impacts associated with unit train traffic. Assuming a unit train has 125 cars and each car holds 100 tons, approximately 386 unit trains per year (about 7 trains per week) would be needed to deliver coal and limestone to the coal-fired plant. The additional stacks (approximately 600 feet each), boilers, and rail deliveries would increase the visual impact of the existing site. Impacts to cultural resources would be unlikely, due to the previously disturbed nature of the site.

Ameren estimates that other construction and operation impacts would be SMALL. In most cases, the impacts would be detectable, but they would not destabilize any important attribute of

the resource involved. Due to the minor nature of these other impacts, mitigation would not be warranted beyond that previously mentioned.

7.2.2.3 New Nuclear Reactor

As discussed in Section 7.2.1.2, under the new nuclear reactor alternative Ameren would construct and operate a one-unit nuclear plant. Ameren assumed that any new nuclear unit constructed to replace Callaway Unit 1 would be a U.S. EPR.

Air Quality

Air quality impacts would be minimal. Air emissions would be associated with diesel generators and other diesel-fired equipment and would be similar to the current impacts associated with operation Callaway Unit 1. Overall, emissions and associated impacts would be considered SMALL.

Waste Management

Low-level and high-level radioactive wastes would be similar to those associated with the continued operation of Callaway Unit 1 (Areva 2010). The overall impacts are characterized as SMALL.

Other Impacts

Based on the COL Application for Callaway Unit 2, Ameren estimates that construction of the reactors and auxiliary facilities would affect approximately 647 acres of land and associated terrestrial habitat. Because most of this construction would be on previously disturbed land, impacts at the Callaway site would be SMALL to MODERATE. For the purposes of analysis, Ameren has assumed that the existing rail line would be used for reactor vessel and other deliveries under this alternative. Visual impacts would be consistent with the industrial nature of the site. As with any large construction project, some erosion, sedimentation, and fugitive dust emissions could be anticipated, but would be minimized by using best management practices. Debris from clearing and grubbing could be disposed of on site.

Ameren estimates a peak construction work force of 3,950 and an operational workforce of 363 (AmerenUE 2009). Due to the proximity of the site to the St. Louis metropolitan area, Ameren thinks that the surrounding communities would experience small demands on housing and public services. Long-term job opportunities would be comparable to continued operation of Callaway Unit 1. Therefore, Ameren concludes that the socioeconomic impacts during operation would be SMALL.

Ameren estimates that other construction and operation impacts would be SMALL. In most cases, the impacts would be detectable, but they would not destabilize any important attribute of the resource involved. Due to the minor nature of these other impacts, mitigation would not be warranted beyond that previously mentioned.

7.2.2.4 Purchased Power

As discussed in Section 7.2.1.3, Ameren assumed that the generating technology used under the purchased power alternative would be one of those that NRC analyzed in the GEIS.

Ameren is also adopting by reference the NRC analysis of the environmental impacts from those technologies. Under the purchased power alternative, therefore, environmental impacts would still occur, but they would likely originate from a power plant located elsewhere in Midwest ISO.

As also indicated in Section 7.2.1.3, new transmission lines would likely be essential for Ameren to meet the growing demand for electricity. Long-term power purchases, therefore, would require the construction of additional transmission capacity. Additions and changes to the present transmission network would occur on previously undisturbed land either along existing transmission line rights-of-way or along new transmission corridors. Ameren concludes that the land use impact of such transmission line additions would be SMALL to MODERATE. In general, land use changes would be so minor that they would neither destabilize nor noticeably alter any important land use resources. Given the potential length of new transmission corridors into Missouri, it is reasonable to assume that, in some cases, land use changes would be clearly noticeable, which is a characteristic of an impact that is MODERATE. As indicated in the introduction to Section 7.2.1.1, the environmental impacts of construction and operation of new nuclear, coal- or gas-fired generating capacity for purchased power at a previously undisturbed greenfield site would exceed those of a new nuclear, coal- or gas-fired alternative located on the Callaway site.

Ameren believes that impacts associated with the purchase of power, including those to socioeconomics, waste management and aesthetics would be SMALL to MODERATE; the impacts could be noticeable, but would not destabilize any important resource, and further mitigation would not be warranted. Impacts to air quality could be SMALL to MODERATE, depending on the technologies used to replace the power.

7.3 TABLES AND FIGURES

Table 7.2-1. Gas-Fired Alternative

Characteristic	Basis
Plant size = 1,186 MWe ISO rating net Two 593 MWe 2X1 combined cycle units	Assumed
Plant size = 1,236 MWe ISO rating gross	Based on 4 percent onsite power usage
Fuel type = natural gas	Assumed
Fuel heating value = 1,021 Btu/ft^3	2008 value for gas used in Missouri (EIA 2010)
Fuel sulfur content = 0.0007%	INGAA (2000)
NO_x control = dry low NO_x with selective catalytic reduction (SCR)	Best available for minimizing NO_x emissions (Ameren 2011)
CO control = CO oxidation catalyst	Best available for minimizing CO emissions (Ameren 2011)
Fuel NO_x content = 0.0092 lb/MMBtu	Typical for dry low NO_x SCR-controlled gas fired units with CO oxidation catalyst (Ameren 2011)
Fuel CO content = 0.0090 lb/MMBtu	Typical for dry low NO_x SCR-controlled gas fired units with CO oxidation catalyst (Ameren 2011)
Fuel PM_{10} content = 0.0044 lb/MMBtu	Typical for dry low NO_x SCR-controlled gas fired units with CO oxidation catalyst (Ameren 2011)
Heat rate = 5,983 Btu/kWh	Typical for F-Class gas-fired combined-cycle plant (Siemens 2008)
Capacity factor = 0.85	Assumed based on performance of modern combined-cycle baseload plants (Ameren 2011)

[a] The difference between "net" and "gross" is electricity consumed onsite.

Btu	=	British thermal unit
CO	=	carbon monoxide
ft^3	=	cubic foot
ISO rating	=	International Standards Organization rating at standard atmospheric conditions of 59°F, 60 percent relative humidity, and 14.696 pounds of atmospheric pressure per square inch
kWh	=	kilowatt hour
lb	=	pound
MM	=	million
MWe	=	megawatt-electric
NO_x	=	nitrogen oxides
PM_{10}	=	particulates having diameter of 10 microns or less
SCR	=	selective catalytic reduction
SO_2	=	sulfur dioxide
≤	=	less than or equal to

Table 7.2-2. Coal-Fired Alternative

Characteristic	Basis
Plant size = 1,186 MWe ISO rating net consisting of two 593 MWe (net) Units	Assumed
Plant size = 1,262 MWe ISO rating gross	Based on 6 percent onsite power usage
Boiler type = tangentially fired, dry-bottom	Minimizes nitrogen oxides emissions (USEPA 1998)
Fuel type = sub-bituminous, pulverized coal	Typical for PRB coal
Fuel heating value = 8,699 Btu/lb	2008 value for PRB coal used in Missouri (EIA 2010)
Fuel ash content by weight = 5.10 percent	2008 value for PRB coal used in Missouri (EIA 2010)
Fuel sulfur content by weight = 0.28 percent	2008 value for PRB coal used in Missouri (EIA 2010)
Uncontrolled NO_x emission = 7.2 lb/ton	Typical for pulverized coal, tangentially fired, sub-bituminous, NSPS (USEPA 1998)
Uncontrolled CO emission = 0.5 lb/ton	Typical for pulverized coal, tangentially fired, sub-bituminous, NSPS (USEPA 1998)
Heat rate = 8,937 Btu/kWh	Estimated heat rate of ultra-supercritical coal-fired boilers using PRB coal (S&L 2009)
Capacity factor = 0.85	Assumed based on performance of large coal-fired units (Ameren 2011)
NO_x control = low NO_x burners, over-fire air and selective catalytic reduction (95 percent reduction)	Best available and widely demonstrated for minimizing NO_x emissions (USEPA 1998)
Particulate control = pulse-jet fabric filters (99.9 percent removal efficiency)	Best available for minimizing particulate emissions (USEPA 1998)
SO_2 control = wet scrubber - limestone (95 percent removal efficiency)	Best available for minimizing SO_2 emissions (USEPA 1998)
Hg control = activated carbon injection (90 percent removal efficiency)	Best available for minimizing Hg emissions (Ameren 2011)

[a] The difference between “net” and “gross” is electricity consumed onsite.

Btu	=	British thermal unit
CO	=	carbon monoxide
Hg	=	Mercury
ISO rating	=	International Standards Organization rating at standard atmospheric conditions of 59°F, 60 percent relative humidity, and 14.696 pounds of atmospheric pressure per square inch
kWh	=	kilowatt hour
lb	=	pound
MWe	=	megawatt-electric
NSPS	=	New Source Performance Standard
NO_x	=	nitrogen oxides
PRB	=	Powder River Basin
SO_2	=	sulfur dioxide
≤	=	less than or equal to

Table 7.2-3. Air Emissions from Gas-Fired Alternative

Parameter	Calculation	Result
Annual gas consumption	$\frac{1236\,\text{MW}}{\text{plant}} \times \frac{5983\,\text{Btu}}{\text{kWh}} \times \frac{1{,}000\,\text{kW}}{\text{MW}} \times \frac{\text{ft}^3}{1{,}021\,\text{Btu}} \times 0.85 \times \frac{(24 \times 365)\,\text{hr}}{\text{yr}}$	53,905,086,667 ft^3 of gas per year
Annual Btu input	$\frac{53{,}905{,}086{,}667\ \text{ft}^3}{\text{yr}} \times \frac{1{,}021\ \text{Btu}}{\text{ft}^3} \times \frac{\text{MMBtu}}{10^6\,\text{Btu}}$	55,037,093 MMBtu per year
SO_2[a]	$\frac{0.94 \times 0.0007\ \text{lb}}{\text{MMBtu}} \times \frac{\text{ton}}{2{,}000\ \text{lb}} \times \frac{55{,}037{,}093\ \text{MMBtu}}{\text{yr}}$	18.1 tons SO_2 per year
NO_x[b]	$\frac{0.0092\,\text{lb}}{\text{MMBtu}} \times \frac{\text{ton}}{2{,}000\,\text{lb}} \times \frac{55{,}037{,}093\ \text{MMBtu}}{\text{yr}}$	253 tons NO_x per year
CO[b]	$\frac{0.009\,\text{lb}}{\text{MMBtu}} \times \frac{\text{ton}}{2{,}000\,\text{lb}} \times \frac{55{,}037{,}093\ \text{MMBtu}}{\text{yr}}$	248 tons CO per year
PM_{10}[b,c]	$\frac{0.0044\,\text{lb}}{\text{MMBtu}} \times \frac{\text{ton}}{2{,}000\,\text{lb}} \times \frac{55{,}037{,}0937\ \text{MMBtu}}{\text{yr}}$	121 tons PM_{10} per year
CO_2[b]	$\frac{117\ \text{lb}}{\text{MMBtu}} \times \frac{\text{ton}}{2{,}000\,\text{lb}} \times \frac{55{,}037{,}093\ \text{MMBtu}}{\text{yr}}$	3,219,670 tons CO_2 per year

[a] USEPA 2000
[b] Ameren 2011
[c] All particulate emissions are $PM_{2.5}$ (USEPA 2000)

CO = carbon monoxide
CO_2 = carbon dioxide
NO_x = nitrogen oxides
PM_{10} = particulates having diameter of 10 microns or less
$PM_{2.5}$ = particulates having diameter of 2.5 microns or less
SO_2 = sulfur dioxide

Table 7.2-4. Air Emissions from Coal-Fired Alternative

Parameter	Calculation	Result
Annual coal consumption	$\frac{1262\,\text{MW}}{\text{plant}} \times \frac{1000\,\text{kW}}{\text{MW}} \times \frac{8937\,\text{Btu}}{\text{kMh}} \times \frac{\text{lb}}{8699\,\text{Btu}} \times \frac{\text{ton}}{2{,}000\,\text{lb}} \times 0.85 \times \frac{(365 \times 24)\,\text{hr}}{\text{yr}}$	4,825,833 tons of coal per year
SO_2[a,c]	$\frac{35 \times 0.28\,\text{lb}}{\text{ton}} \times \frac{\text{ton}}{2{,}000\,\text{lb}} \times \frac{100-95}{100} \times \frac{4{,}825{,}833\,\text{tons}}{\text{yr}}$	1,182 tons SO_2 per year
NO_x[b,c]	$\frac{7.2\,\text{lb}}{\text{ton}} \times \frac{\text{ton}}{2{,}000\,\text{lb}} \times \frac{100-95}{100} \times \frac{4{,}825{,}833\,\text{tons}}{\text{yr}}$	869 tons NO_x per year
CO[c]	$\frac{0.5\,\text{lb}}{\text{ton}} \times \frac{\text{ton}}{2{,}000\,\text{lb}} \times \frac{4{,}825{,}833\,\text{tons}}{\text{yr}}$	1,206 tons CO per year
PM_{10}[d]	$\frac{2.3 \times 5.1\,\text{lb}}{\text{ton}} \times \frac{\text{ton}}{2{,}000\,\text{lb}} \times \frac{100-99.9}{100} \times \frac{4{,}825{,}833\,\text{tons}}{\text{yr}}$	28 tons PM_{10} per year
$PM_{2.5}$[e]	$\frac{0.6 \times 5.1\,\text{lb}}{\text{ton}} \times \frac{\text{ton}}{2{,}000\,\text{lb}} \times \frac{100-99.9}{100} \times \frac{4{,}825{,}833\,\text{tons}}{\text{yr}}$	7.4 tons $PM_{2.5}$ per year
CO_2[f]	$\frac{4810\,\text{lb}}{\text{ton}} \times \frac{\text{ton}}{2{,}000\,\text{lb}} \times \frac{4{,}825{,}833\,\text{tons}}{\text{yr}}$	11,606,129 tons CO_2 per year
Hg[g]	$\frac{0.000016\,\text{lb}}{\text{MMBtu}} \times \frac{\text{MMBtu}}{10^6\,\text{Btu}} \times \frac{8699\,\text{Btu}}{\text{lb}} \times \frac{(100-90)}{100} \times \frac{4{,}825{,}833\,\text{tons}}{\text{yr}}$	0.067 tons Hg per year

[a] USEPA 1998, Table 1.1-1
[b] USEPA 1998, Table 1.1-2
[c] USEPA 1998, Table 1.1-3
[d] USEPA 1998, Table 1.1-4
[e] USEPA 1998, Table 1.1-6
[f] USEPA 1998, Table 1.1-20
[g] USEPA 1998, Table 1.1-17 and Ameren 2011

CO = carbon monoxide
CO_2 = carbon dioxide
NO_x = nitrogen oxides
PM_{10} = particulates having diameter less than 10 microns
$PM_{2.5}$ = particulates having diameter less than 2.5 microns
SO_2 = sulfur dioxide
Hg = mercury

Table 7-2.5. Solid Waste from Coal-Fired Alternative

Parameter	Calculation	Result
Annual SO_2 generated[a]	$\frac{0.28}{100} \times \frac{64.065 \text{ tons } SO_2}{32.066 \text{ tons S}} \times \frac{4{,}825{,}833 \text{ tons coal}}{\text{yr}}$	26,996 tons of SO_2 per year
Annual SO_2 removed	$\frac{26{,}996 \text{ tons } SO_2}{\text{yr}} \times \frac{95}{100}$	25,647 tons of SO_2 per year
Annual ash generated	$\frac{4{,}825{,}833 \text{ tons coal}}{\text{yr}} \times \frac{5.1 \text{ tons ash}}{100 \text{ tons coal}} \times \frac{99.9}{100}$	245,871 tons of ash per year
Annual ash recycled	$245{,}871 \text{ tons ash} \times \frac{50}{100}$	122,936 tons of ash recycled per year
Annual ash disposed	245,871 tons generated − 122,936 tons recycled	122,936 tons of ash disposed per year
Annual limestone consumption[b]	$\frac{26{,}966 \text{ tons } SO_2}{\text{yr}} \times \frac{100.087 \text{ tons } CaCO_3}{64.065 \text{ tons } SO_2}$	42,176 tons of $CaCO_3$ per year
Calcium sulfite[c]	$\frac{25{,}647 \text{ tons } SO_2}{\text{yr}} \times \frac{120.142 \text{ tons CaSO3}}{64.065 \text{ tons } SO_2}$	48,096 tons of $CaSO_3$ per year
Annual scrubber sludge generated[d]	$\frac{42{,}176 \text{ tons } CaCO_3}{\text{yr}} \times \frac{100 - 95}{100} + 48{,}096 \text{ tons } CaSO_3$	50,204 tons scrubber sludge per year
Annual scrubber sludge recycled	$50{,}204 \text{ tons} \times \frac{35}{100}$	17,681 tons scrubber sludge recycled per year
Annual scrubber sludge waste	50,204 tons - 17,681 tons	32,523 tons scrubber waste per year
Total volume of scrubber waste[e]	$\frac{32{,}523 \text{ tons}}{\text{yr}} \times 40 \text{ yr} \times \frac{2{,}000 \text{ lb}}{\text{ton}} \times \frac{\text{ft}^3}{102 \text{ lb}}$	25,508,316 ft^3 of scrubber waste
Total volume of ash disposed[f]	$\frac{122{,}936 \text{ tons}}{\text{yr}} \times 40 \text{ yr} \times \frac{2{,}000 \text{ lb}}{\text{ton}} \times \frac{\text{ft}^3}{100 \text{ lb}}$	98,348,548 ft^3 of ash
Total volume of solid waste	25,508,316 ft^3 + 98,348,548 ft^3	123,856,864 ft^3 of solid waste
Waste pile area (acres)	$\frac{123{,}856{,}864 \text{ ft}^3}{30 \text{ ft}} \times \frac{\text{acre}}{43{,}560 \text{ ft}^2}$	95 acres of solid waste

Table 7.2-5. Solid Waste from Coal-Fired Alternative (Continued)

Parameter	Calculation	Result
Waste pile area (ft x ft square)	$\sqrt{(123{,}856{,}864\ ft^3/30\ ft)}$	2032 feet by feet square of solid waste

Based on annual coal consumption of 4,825,833 tons per year (Table 7.2-4).
[a] Calculations assume 100 percent combustion of coal.
[b] Limestone consumption is based on total SO_2 generated.
[c] Calcium sulfite generation is based on total SO_2 removed.
[d] Total scrubber waste includes scrubbing media carryover.
[e] Density of scrubber sludge is 102 lb/ft^3 (FHWA 1998).
[f] Density of coal bottom ash is 100 lb/ft^3 (FHWA 1998)

S	=	sulfur
SO_2	=	sulfur dioxide
$CaCO_3$	=	calcium carbonate (limestone)
$CaSO_3$	=	calcium sulfite

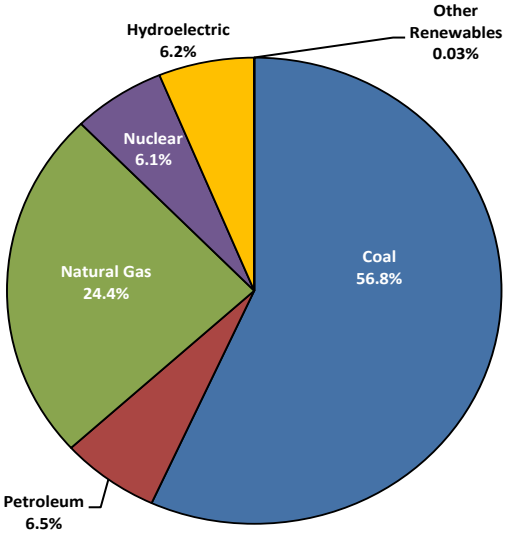

Figure 7-1. Missouri Generating Capacity by Fuel Type, 2008

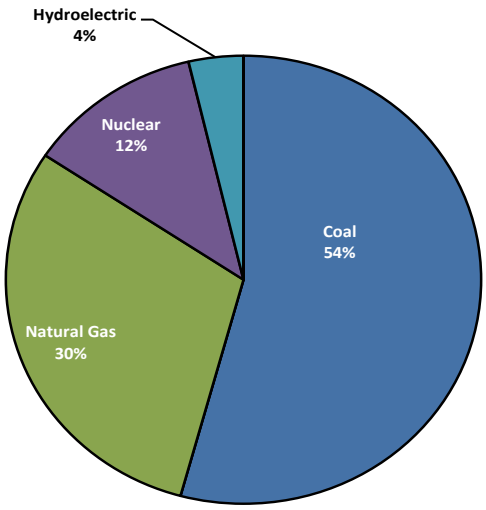

Figure 7-2. Ameren Generating Capacity by Fuel Type, 2008

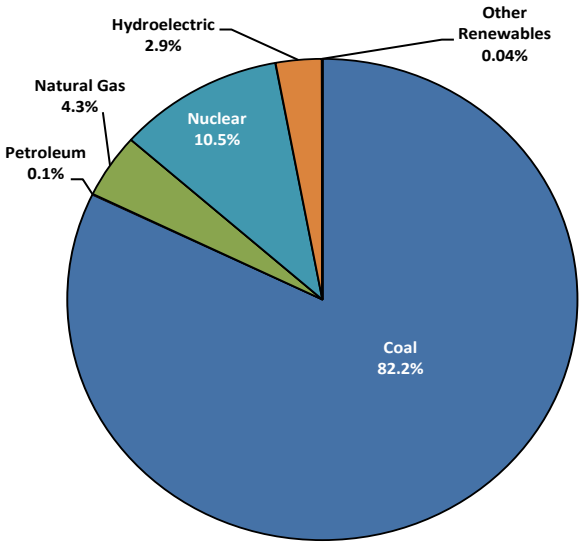

Figure 7-3. Missouri Generation by Fuel Type, 2008

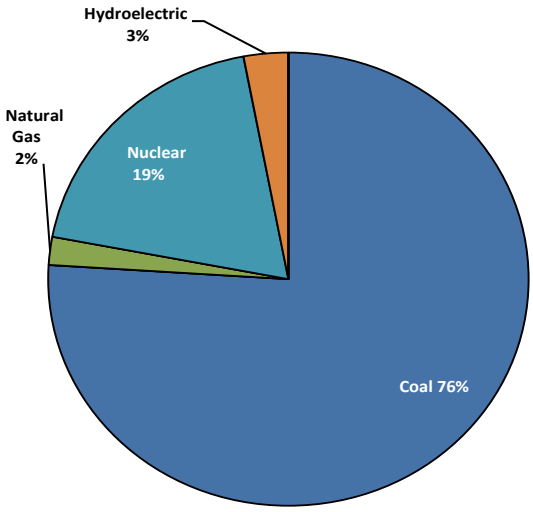

Figure 7-4. Ameren Generation by Fuel Type, 2008

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8.0 CHAPTER 8 – COMPARISON OF ENVIRONMENTAL IMPACTS OF LICENSE RENEWAL WITH THE ALTERNATIVES

NRC

"To the extent practicable, the environmental impacts of the proposal and the alternatives should be presented in comparative form..." 10 CFR 51.45(b)(3) as adopted by 51.53(c)(2)

Chapter 4 analyzes environmental impacts of Callaway Plant license renewal and Chapter 7 analyzes impacts of reasonable alternatives. Table 8.1-1 summarizes environmental impacts of the proposed action (license renewal) and the reasonable alternatives, for comparison purposes. The environmental impacts compared in Table 8.1-1 are those that are either Category 2 issues for the proposed action or are issues that the Generic Environmental Impact Statement for License Renewal of Nuclear Plants (GEIS) identified as major considerations in an alternatives analysis (NRC 1996). For example, although the NRC concluded that air quality impacts from the proposed action would be small (Category 1), the GEIS identified major human health concerns associated with air emissions from alternatives (Section 7.2.2). Therefore, Table 8.1-1 includes a comparison of the air impacts from the proposed action to those of the alternatives. Table 8.1-2 is a more detailed comparison of the alternatives.

8.1 TABLES

Table 8.1-1. Impacts Comparison Summary

Impact	Proposed Action (License Renewal)	Base (Decommissioning)	No-Action Alternatives			
			With New Nuclear Power	With Coal-Fired Generation	With Gas-Fired Generation	With Purchased Power
Land Use	SMALL	SMALL	SMALL to MODERATE	SMALL to MODERATE	SMALL	SMALL to MODERATE
Water	SMALL	SMALL	SMALL	SMALL	SMALL	SMALL to MODERATE
Air Quality	SMALL	SMALL	SMALL	MODERATE	MODERATE	SMALL to MODERATE
Ecological Resources	SMALL	SMALL	SMALL to MODERATE	SMALL to MODERATE	SMALL	SMALL to MODERATE
Threatened or Endangered Species	SMALL	SMALL	SMALL	SMALL	SMALL	SMALL
Human Health	SMALL	SMALL	SMALL	MODERATE	SMALL	SMALL to MODERATE
Socioeconomics	SMALL	SMALL	SMALL	SMALL	SMALL	MODERATE
Waste Management	SMALL	SMALL	SMALL	MODERATE	SMALL	SMALL to MODERATE
Aesthetics	SMALL	SMALL	SMALL	SMALL	SMALL	SMALL to MODERATE
Cultural Resources	SMALL	SMALL	SMALL	SMALL	SMALL	SMALL

SMALL - Environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource.
MODERATE - Environmental effects are sufficient to alter noticeably, but not to destabilize, any important attribute of the resource. 10 CFR 51, Subpart A, Appendix B, Table B-1, Footnote 3.

Table 8.1-2. Impacts Comparison Detail

Proposed Action (License Renewal)	Base (Decommissioning)	No-Action Alternatives			
		With New Nuclear Power	With Coal-Fired Generation	With Gas-Fired Generation	With Purchased Power
Alternative Descriptions					
Callaway Plant license renewal for 20 years, followed by decommissioning.	Decommissioning following expiration of current Callaway Plant licenses. Adopting by reference, as bounding Callaway Plant decommissioning, GEIS description (NRC 1996).	New construction at the existing site (Section 7.2.1.2).	New construction at the existing site (Section 7.2.1.1).	New construction at the existing site (Section 7.2.1.1).	Would involve construction of new generation capacity in the region. Adopting by reference GEIS description of alternate technologies (Section 7.2.1.3).
		Existing rail bed would be reconstructed for rail traffic.	Existing rail bed would be reconstructed for rail traffic.	Construct 16-inch-diameter gas pipeline in a 75-ft-wide corridor. May require upgrades to existing pipelines.	Construct new transmission lines to interconnect to the region.
		Two 1,600-MWe nuclear units using the USEPR, a design undergoing NRC certification review.	Two ultra-supercritical 593-MWe (net) tangentially fired, dry-bottom units producing a combined total of 1,262 MWe gross; capacity factor 0.85.	Two pre-engineered 593-MWe (net) gas-fired combined-cycle systems with heat recovery steam generators, producing combined total of 1,236 MWe gross; capacity factor: 0.85.	
			Pulverized sub-bituminous coal, 8,699 Btu/lb; 5.1% ash; 0.28% sulfur; 8,740 Btu/kWh; 7.2 lb/ton nitrogen oxides; 4.8×10^6 tons coal/yr.	Natural gas, 1,021 Btu/ft^3; 5,983 Btu/kWh; 0.00066 lb sulfur/MMBtu; 0.0092 lb NO_X/MMBtu; 5.5×10^7 MMBtu gas/yr.	

Table 8.1-2. Impacts Comparison Detail (Continued)

Proposed Action (License Renewal)	Base (Decommissioning)	No-Action Alternatives			
		With New Nuclear Power	With Coal-Fired Generation	With Gas-Fired Generation	With Purchased Power
			Low NO_X burners, over-fire air and selective catalytic reduction (95% NO_X reduction efficiency). Wet scrubber – limestone desulfurization system (95% SO_2 removal efficiency); 42,176 tons limestone/yr. Fabric filters 99.9% particulate removal efficiency). Activated carbon injection 90% mercury control efficiency	Dry low NOx burners with selective catalytic reduction and CO oxidation catalyst.	
970 permanent and long-term contract employees at Callaway Plant (Section 3.4).		363 workers (Section 7.2.2.3)	162 workers (Section 7.2.2.2).	97 workers (Section 7.2.2.1)	
Land Use Impacts					
SMALL – Adopting by reference Category 1 issue findings (Attachment A, Table A-1, Issues 52, 53).	SMALL – Not an impact evaluated by GEIS (NRC 1996).	SMALL to MODERATE – 647 acres required for the power block and associated facilities at Callaway Plant location (Section 7.2.2.3).	SMALL to MODERATE – 164 acres required for the power block and associated facilities at Callaway Plant location; 45.5 acres for ash disposal during 20-year license renewal term (Section 7.2.2.2).	SMALL– 90 acres for facility at Callaway Plant location (Section 7.2.2.1). 109 acres for a new gas pipeline that would be built to connect with existing gas pipeline corridor.	SMALL to MODERATE – Some transmission facilities could be constructed along existing transmission corridors. Adopting by reference GEIS description of land use impacts from alternate technologies. (NRC 1996).

Table 8.1-2. Impacts Comparison Detail (Continued)

Proposed Action (License Renewal)	Base (Decommissioning)	No-Action Alternatives			
		With New Nuclear Power	With Coal-Fired Generation	With Gas-Fired Generation	With Purchased Power
Water Impacts					
SMALL – Adopting by reference Category 1 issue findings (Table A-1, Issues 1-12, 31, 32, 36-38). Category 2 issues 35 (Section 4.7) and 39 (Section 4.8) do not apply. Water withdrawals from the Missouri River are not expected to affect surface or groundwater use (Section 4.1, Issue 13; Section 4.6, Issue 34). Groundwater use is not expected to impact use beyond the site boundary (Section 4.5, Issue 33).	SMALL – Adopting by reference Category 1 issue finding (Table A-1, Issue 89).	SMALL – Construction impacts minimized by use of best management practices. Operational impacts per unit similar to Callaway Unit 1. (Section 7.2.2.3)	SMALL – Construction impacts minimized by use of best management practices. Operational impacts similar to Callaway Plant by using the existing Main Cooling Reservoir. (Section 7.2.2.2)	SMALL – Water demands would be less than those from operation of Callaway Plant. (Section 7.2.2.1)	SMALL to MODERATE – Adopting by reference GEIS description of water quality impacts from alternate technologies.
Air Quality Impacts					
SMALL – Adopting by reference Category 1 issue finding (Table A-1, Issue 51). One Category 2 issue does not apply (Section 4.11, Issue 50).	SMALL – Adopting by reference Category 1 issue findings (Table A-1, Issue 88).	SMALL – Air emissions are primarily from non-facility equipment and diesel generators and are comparable to those associated with the continued operation of Callaway Plant. (Section 7.2.2.3).	MODERATE – 1,182 tons SO_2/yr 869 tons NO_X/yr 1,206 tons CO/yr $11.6x10^6$ tons CO_2/yr 7.4 tons $PM_{2.5}$/yr 28 tons PM_{10}/yr 0.067 tons mercury/yr. (Section 7.2.2.2).	MODERATE – 18 tons SO_2/yr 253 tons NO_X/yr 248 tons CO/yr $3.2x10^6$ tons CO_2/yr 121 tons $PM_{2.5}$/yr. (Section 7.2.2.1).	SMALL to MODERATE – Adopting by reference GEIS description of air quality impacts from alternate technologies (NRC 1996).

Table 8.1-2. Impacts Comparison Detail (Continued)

Proposed Action (License Renewal)	Base (Decommissioning)	No-Action Alternatives			
		With New Nuclear Power	With Coal-Fired Generation	With Gas-Fired Generation	With Purchased Power
Ecological Resource Impacts					
SMALL – Adopting by reference Category 1 issue findings (Table A-1, Issues 14-24, 28 – 30, and 41-48). Four Category 2 issues do not apply (Section 4.2, Issue 25; Section 4.3, Issue 26, Section 4.4, Issue 27, and Section 4.9, Issue 40).	SMALL – Adopting by reference Category 1 issue finding (Table A-1, Issue 90).	SMALL to MODERATE – 647 acres of land would be required for the power block and associated facilities at Callaway Plant location; some would be previously undisturbed land and associated terrestrial habitat (Section 7.2.2.3) .	SMALL to MODERATE – 164 acres of the existing site could be required for the power block and associated facilities at Callaway Plant location. Approximately 45.5 acres of the existing site could be required for ash/sludge disposal during 20-year license-renewal term (Section 7.2.2.2).	SMALL – 90 acres of land would be required for the power block and associated facilities at Callaway Plant location; some would be previously undisturbed land and associated terrestrial habitat. 109 acres disturbed during pipeline construction. Pipeline would be routed along previously disturbed areas to minimize impacts (Section 7.2.2.1).	SMALL to MODERATE – Adopting by reference GEIS description of ecological resource impacts from alternate technologies (NRC 1996).
Threatened or Endangered Species Impacts					
SMALL – Ameren has no plans to alter current operations and maintenance practices and there are no current impacts to threatened or endangered species. (Section 4.10, Issue 49)	SMALL – Not an impact evaluated by GEIS (NRC 1996).	SMALL – Federal and state laws prohibit destroying or adversely affecting protected species and their habitats.	SMALL – Federal and state laws prohibit destroying or adversely affecting protected species and their habitats.	SMALL – Federal and state laws prohibit destroying or adversely affecting protected species and their habitats.	SMALL – Federal and state laws prohibit destroying or adversely affecting protected species and their habitats.

Table 8.1-2. Impacts Comparison Detail (Continued)

Proposed Action (License Renewal)	Base (Decommissioning)	No-Action Alternatives			
		With New Nuclear Power	With Coal-Fired Generation	With Gas-Fired Generation	With Purchased Power
Human Health Impacts					
SMALL – Adopting by reference Category 1 issues (Table A-1, Issues 54-56, 58, 61, 62). Exposure to etiological agents at the Callaway discharge is not likely (Section 4.12, Issue 57). All transmission lines conform to the NESC standard (Section 4.13, Issue 59).	SMALL – Adopting by reference Category 1 issue finding (Table A-1, Issue 86).	SMALL – Impacts would be comparable to continued operation of Callaway Plant (Section 7.2.2.3).	MODERATE – Adopting by reference GEIS conclusion that risks such as cancer and emphysema from emissions are likely (NRC 1996).	SMALL – Adopting by reference GEIS conclusion that some risk of cancer and emphysema exists from emissions (NRC 1996).	SMALL to MODERATE – Adopting by reference GEIS description of human health impacts from alternate technologies (NRC 1996).
Socioeconomic Impacts					
SMALL – Adopting by reference Category 1 issue findings (Table A-1, Issues 64, 67). Five Category 2 issues findings are not applicable because there is no refurbishment or additional employment during the license renewal term (Section 4.14, Issue 63; Section 4.15, Issue 65 Section 4.16, Issue 66; Section 4.17.1, Issue 68; and Section 4.18, Issue 70). Plant property tax payments represent more than 20 percent of the taxes paid to Callaway County and the South Callaway County R-II School District. However, these significant payments historically have not driven land use changes. No population growth is expected. (Section 4.17.2, Issue 69).	SMALL – Adopting by reference Category 1 issue finding (Table A-1, Issue 91).	SMALL – Long-term job opportunities would be comparable to continued operation of Callaway Plant (Section 7.2.2.3).	SMALL – Reduction in permanent workforce at Callaway Plant would be minimized by the proximity to the St. Louis Metropolitan Area. (Section 7.2.2.2).	SMALL – Reduction in permanent workforce at Callaway Plant would be minimized by the proximity to the St. Louis Metropolitan Area. (Section 7.2.2.1).	MODERATE – Adopting by reference GEIS description of socioeconomic impacts from alternate technologies (NRC 1996).

Table 8.1-2. Impacts Comparison Detail (Continued)

Proposed Action (License Renewal)	Base (Decommissioning)	No-Action Alternatives			
		With New Nuclear Power	With Coal-Fired Generation	With Gas-Fired Generation	With Purchased Power
Waste Management Impacts					
SMALL – Adopting by reference Category 1 issue findings (Table A-1, Issues 77-85).	SMALL – Adopting by reference Category 1 issue finding (Table A-1, Issue 87).	SMALL – radioactive wastes would be similar to those associated with the continued operation of Callaway Plant (Section 7.2.2.3).	MODERATE –122,936 tons of coal ash and 32,523 tons of scrubber sludge annually would require 45.5 acres during 20-year license renewal term (Section 7.2.2.2).	SMALL – The only noteworthy waste would be from spent selective catalytic reduction (SCR) resin used for NO_X control and spent catalyst from CO oxidation (Section 7.2.2.1).	SMALL to MODERATE – Adopting by reference GEIS description of waste management impacts from alternate technologies (NRC 1996).
Aesthetic Impacts					
SMALL – Adopting by reference Category 1 issue findings (Table A-1, Issues 72, 73, 74).	SMALL – Not an impact evaluated by GEIS (NRC 1996).	SMALL – Visual impacts would be comparable to those from existing Callaway Plant facilities (Section 7.2.2.3).	SMALL – Steam turbines, stacks, and rail deliveries would be comparable to those from existing Callaway Plant facilities (Section 7.2.2.2).	SMALL– Steam turbines and stacks would create visual impacts comparable to those from existing Callaway Plant facilities (Section 7.2.2.1).	SMALL to MODERATE – Adopting by reference GEIS description of aesthetic impacts from alternate technologies (NRC 1996).

Table 8.1-2. Impacts Comparison Detail (Continued)

Proposed Action (License Renewal)	Base (Decommissioning)	No-Action Alternatives			
		With New Nuclear Power	With Coal-Fired Generation	With Gas-Fired Generation	With Purchased Power
Cultural Resource Impacts					
SMALL – SHPO consultation minimizes potential for impact (Section 4.19, Issue 71). No new facilities are planned and corporate procedures address discovery of cultural resources.	SMALL – Not an impact evaluated by GEIS (NRC 1996)	SMALL – Impacts to cultural resources would be unlikely due to developed nature of the site. (Section 7.2.2.3)	SMALL – Impacts to cultural resources would be unlikely due to developed nature of the site. (Section 7.2.2.2)	SMALL – Impacts to cultural resources would be unlikely due to developed nature of the site. (Section 7.2.2.1)	SMALL – Adopting by reference GEIS description of cultural resource impacts from alternate technologies (NRC 1996).

SMALL - Environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource.
MODERATE - Environmental effects are sufficient to alter noticeably, but not to destabilize, any important attribute of the resource. (10 CFR 51, Subpart A, Appendix B, Table B 1, Footnote 3).

a. All particulate matter for gas-fired alternative is $PM_{2.5}$.

Btu = British thermal unit
CO = carbon monoxide
CO_2 = carbon dioxide
ft^3 = cubic foot
gal = gallon
GEIS = Generic Environmental Impact Statement (NRC 1996)
kWh = kilowatt hour
lb = pound
MM = million
MW = megawatt
NO_X = nitrogen oxide
ISO-NE = regional electric distribution network
$PM_{2.5}$ = particulates having diameter less than 2.5 microns
PM_{10} = particulates having diameter less than 10 microns
SCR = selective catalytic reduction
SHPO = State Historic Preservation Officer
SO_2 = sulfur dioxide
yr = year

8.2 REFERENCES

NRC (U.S. Nuclear Regulatory Commission 1996. Generic Environmental Impact Statement for License Renewal of Nuclear Plants (GEIS), Volumes 1 and 2, NUREG-1437, Washington, DC. May.

9.0 CHAPTER 9 – STATUS OF COMPLIANCE

9.1 PROPOSED ACTION

NRC

"The environmental report shall list all federal permits, licenses, approvals and other entitlements which must be obtained in connection with the proposed action and shall describe the status of compliance with these requirements. The environmental report shall also include a discussion of the status of compliance with applicable environmental quality standards and requirements including, but not limited to, applicable zoning and land-use regulations, and thermal and other water pollution limitations or requirements which have been imposed by Federal, State, regional, and local agencies having responsibility for environmental protection…." 10 CFR 51.45(d), as adopted by 10 CFR 51.53(c)(2)

9.1.1 General

Table 9.1 lists environmental authorizations for current Callaway Unit 1 operations. In this context "authorizations" includes any permits, licenses, approvals, or other entitlements Ameren expects to continue renewing these authorizations during the current license period and through the U.S. Nuclear Regulatory Commission (NRC) license-renewal period. Based on the new and significant information identification process described in Chapter 5, Ameren concludes that Callaway Unit 1 is currently in compliance with applicable environmental standards and requirements.

Table 9.2 lists additional environmental authorizations and consultations related to renewal of the Callaway Unit 1 license to operate. As indicated, Ameren anticipates needing relatively few such authorizations and consultations. Sections 9.1.2 through 9.1.5 discuss some of these items in more detail.

9.1.2 Threatened or Endangered Species

Section 7 of the Endangered Species Act (16 USC 1536) requires federal agencies to ensure that agency action is not likely to jeopardize any species that is listed or proposed for listing as endangered or threatened. Depending on the action involved, the Act requires consultation with the U.S. Fish and Wildlife Service (USFWS) regarding effects on non-marine species, the National Oceanic and Atmospheric Administration (NOAA) Fisheries Service regarding effects on marine species, or both. USFWS and NOAA Fisheries Service have issued joint procedural regulations at 50 CFR 402, Subpart B, that address consultation, and USFWS maintains the joint list of threatened and endangered species at 50 CFR 17.

Although not required of an applicant by federal law or NRC regulation, Ameren has chosen to invite comment from both federal and state agencies regarding potential effects that Ameren Unit 1 license renewal might have on threatened and endangered species. Attachment C includes copies of Ameren correspondence with USFWS and the Missouri Department of Conservation.

9.1.3 Coastal Zone Management Program Compliance

The Federal Coastal Zone Management Act (16 USC 1451) imposes requirements on applicants for a federal license to conduct an activity that could affect a state's coastal zone. Callaway Unit 1 is located in Callaway County, Missouri, not within a coastal zone. Coastal zone management requirements are not applicable to Callaway Unit 1 license renewal.

9.1.4 Historic Preservation

Section 106 of the National Historic Preservation Act (16 USC 470f) requires federal agencies having the authority to license any undertaking, prior to issuing the license, to take into account the effect of the undertaking on historic properties and to afford the Advisory Committee on Historic Preservation an opportunity to comment on the undertaking. Committee regulations provide for establishing an agreement with any State Historic Preservation Officer (SHPO) to substitute state review for Committee review (36 CFR 800.7). Although not required of an applicant by federal law or NRC regulation, Ameren has chosen to invite comment by the Missouri SHPO. Attachment D includes copies of Ameren correspondence with the Missouri Historical Commission regarding potential effects that Callaway Unit 1 license renewal might have on historic or cultural resources.

9.1.5 Water Quality (401) Certification

Federal Clean Water Act Section 401 requires applicants for a federal license to conduct an activity that might result in a discharge into navigable waters to provide the licensing agency a certification from the state that the discharge will comply with applicable Clean Water Act requirements (33 USC 1341). NRC has indicated in its Generic Environmental Impact Statement for License Renewal of Nuclear Power Plants (GEIS) that issuance of a National Pollutant Discharge Elimination System (NPDES) permit implies certification by the state (NRC 1996). Callaway Unit 1 holds a National Pollutant Discharge Elimination System (NPDES) permit. This permit allows discharge to the Missouri River from the plant's discharge pipeline. Attachment B contains the first page of the current Callaway Unit 1 NPDES permit, which authorizes plant discharges. Consistent with the GEIS, Ameren is providing evidence of Callaway Unit 1 NPDES permit as evidence of water quality (401) certification.

9.2 ALTERNATIVES

NRC

"…The discussion of alternatives in the report shall include a discussion of whether the alternatives will comply with such applicable environmental quality standards and requirements." 10 CFR 54.45(d) as adopted by 10 CFR 51.53(c)(2)

Section 7.2 presents fossil-fuel-fired generation (Sections 7.2.1.1 and 7.2.1.2), U.S. Evolutionary Power Reactor (Section 7.2.1.3), and purchased power (Section 7.2.1.4) as reasonable alternatives to license renewal. These alternatives probably could be constructed and operated to comply with all applicable environmental quality standards and requirements. Ameren notes that increasingly stringent air quality protection requirements could make the construction of a large fossil-fueled power plant infeasible in many locations. Ameren also notes that the U.S. Environmental Protection Agency has new requirements for the design and operation of cooling water intake structures at new and existing facilities (40 CFR 125 Subparts I and J). The requirements could necessitate construction of cooling towers for the coal- and gas-fired alternatives if surface water were used for cooling.

9.3 TABLES

Table 9-1 Environmental Authorizations for Current Callaway Unit 1 Operations

Agency	Authority	Requirement	Number	Issue or Expiration Date	Activity Covered
Federal and State Requirements					
U.S. Nuclear Regulatory Commission	Atomic Energy Act (42 USC 2011, et seq.), 10 CFR 50.10	License to operate	NPF-30	Issued: 10.18.1984 Expires: 10.18.2024	Operation of Unit 1
U.S. Department of Transportation	49 USC 5108	Registration	061909550029RT	Issued: 06.19.2009 Expires: 06.30.2012	Hazardous waste materials shipment
U.S. Army Corps of Engineers	Section 10 of the Rivers and Harbors Act of 1899	Permit for maintenance dredging	NWP #3 2004-00468	Issued: 06.01.2011 Expires: 03.18.2012	Maintenance dredging of barge slip
Missouri Department of Natural Resources	Clean Water Act (33 USC Section 1251 et seq.). Missouri Clean Water Law (Chapter 644) and Federal Pollution Control Act (Public Law 92-500)	NPDES Permit	MO-0098001	Issued: 04.14.2010 Expires: 02.12.2014	Treat wastewater and discharge to the Missouri River
Missouri Department of Natural Resources	Federal Clean Air Act and Missouri Revised Statutes (RSMo) 643 and 621	Part 70 Air Permit	OP2008-045	Issued: 09.18.2008 Expires: 09.17.2013	Air permit for auxiliary boiler, emergency electrical generators and storage tanks
Missouri DNR US EPA	10 CSR Division 25 40 CFR 260 – 265	Registration of Industrial and Hazardous Waste	Solid Waste Registration No: 003518 EPA ID: MOD000687392	Issued: 06.17.2010 Expires: N/A	Registration of industrial and hazardous waste generation and management

Table 9-1 Environmental Authorizations for Current Callaway Unit 1 Operations (Continued)

Agency	Authority	Requirement	Number	Issue or Expiration Date	Activity Covered
Missouri DNR	10 CSR 60	Potable Water System	Permit No. 3182219	Issued: 05.19.1994 Expires: N/A	Operation of public potable water system
U.S. Department of Transportation	49 USC 5108	License to ship radioactive material	Permit No. 061909550029RT	Issued: 06.19.2009 Expires: 06.30.2012	Shipments of radioactive material
NPDES – National Pollutant Discharge Elimination System					

Table 9-2 Environmental Authorization for Callaway Unit 1 License Renewal

Agency	Authority	Requirement	Remarks
U.S. Nuclear Regulatory Commission	Atomic Energy Act (42 USC 2011 et seq.)	License renewal	Environmental Report submitted in support of license renewal application
Missouri Department of Natural Resources (MDNR)	Clean Water Act Section 401 (33 USC 1341)	Certification	Requires State certification that proposed action would comply with Clean Water Act standards (Attachment B)
U.S. Fish and Wildlife Service (FWS)	Endangered Species Act Section 7 (16 USC 1536)	Consultation	Requires federal agency issuing a license to consult with the FWS (Attachment C)
Missouri Department of Conservation (MDC)	Endangered Species Act Section 7 (16 USC 1536)	Consultation	MDC consulted for any concerns related to threatened and endangered species (Attachment C)
State Historic Preservation Officer (SHPO)	National Historic Preservation Act Section 106 (16 USC 470f)	Consultation	Requires federal agency issuing a license to consider cultural impacts and consult with State Historic Preservation Officer (Attachment D)
Missouri Department of Health & Senior Services (MDHSS)	Nuclear Regulatory Commission 10 CFR 51.53	Consultation	MDHSS consulted for any concerns related to public health from thermophilic organisms (Attachment E)
Missouri Department of Natural Resources (MDNR)	Nuclear Regulatory Commission 10 CFR 51.53	Consultation	MDNR consulted for any concerns related to public health from thermophilic organisms (Attachment E)

9.4 REFERENCES

NRC (U.S. Nuclear Regulatory Commission). 1996. Generic Environmental Impact Statement for License Renewal of Nuclear Plants. Volumes 1 and 2. NUREG-1437, Office of Nuclear Regulatory Research. Washington DC. May.

ATTACHMENT A

NRC NEPA ISSUES FOR LICENSE RENEWAL OF NUCLEAR POWER PLANTS

Ameren has prepared this environmental report in accordance with the requirements of NRC regulation 10 CFR 51.53. NRC included in the regulation a list of National Environmental Policy Act (NEPA) issues for license renewal of nuclear power plants.

Table A-1 lists these 92 issues and identifies the section in which Ameren addresses each applicable issue in this environmental report. For organization and clarity, Ameren has assigned a number to each issue and uses the issue numbers throughout the environmental report.

TABLES

Table A-1 Callaway Unit 1 Environmental Report Cross-Reference of License Renewal NEPA Issues

Issue[a]	Category	Section of this Environmental Report	GEIS Cross Reference (Section/Page)[b]
Surface Water Quality, Hydrology, and Use (for all plants)			
1. Impacts of refurbishment on surface water quality	1	NA	Issue applies to an activity, refurbishment, which Callaway does not plan to undertake.
2. Impacts of refurbishment on surface water use	1	NA	Issue applies to an activity, refurbishment, which Callaway does not plan to undertake.
3. Altered current patterns at intake and discharge structures	1	4.0	4.3.2.2/4-31
4. Altered salinity gradients	1	NA	Issue applies to an activity, discharge to saltwater, which Callaway does not plan to undertake.
5. Altered thermal stratification of lakes	1	NA	Issue applies to a plant feature, discharge to a lake, which Callaway does not have.
6. Temperature effects on sediment transport capacity	1	4.0	4.3.2.2/4-31
7. Scouring caused by discharged cooling water	1	4.0	4.3.2.2/4-31
8. Eutrophication	1	4.0	4.3.2.2/4-31
9. Discharge of chlorine or other biocides	1	4.0	4.3.2.2/4-31
10. Discharge of sanitary wastes and minor chemical spills	1	4.0	4.3.2.2/4-31
11. Discharge of other metals in waste water	1	4.0	4.3.2.2/4-31
12. Water use conflicts (plants with once-through cooling systems)	1	4.0	4.3.1.3/4-29
13. Water use conflicts (plants with cooling ponds or cooling towers using make-up water from a small river with low flow)	2	4.1	4.3.2.2/4-31
Aquatic Ecology (for all plants)			
14. Refurbishment impacts to aquatic resources	1	NA	Issue applies to an activity, refurbishment, which Callaway does not plan to undertake.

Table A-1. Callaway Environmental Report Cross-Reference of License Renewal NEPA Issues. (Continued)

Issue[a]	Category	Section of this Environmental Report	GEIS Cross Reference (Section/Page)[b]
15. Accumulation of contaminants in sediments or biota	1	4.0	4.3.3/4-33
16. Entrainment of phytoplankton and zooplankton	1	4.0	4.3.3/4-33
17. Cold shock	1	4.0	4.3.3/4-33
18. Thermal plume barrier to migrating fish	1	4.0	4.3.3/4-33
19. Distribution of aquatic organisms	1	4.0	4.3.3/4-33
20. Premature emergence of aquatic insects	1	4.0	4.3.3/4-33
21. Gas supersaturation (gas bubble disease)	1	4.0	4.3.3/4-33
22. Low dissolved oxygen in the discharge	1	4.0	4.3.3/4-33
23. Losses from predation, parasitism, and disease among organisms exposed to sublethal stresses	1	4.0	4.3.3/4-33
24. Stimulation of nuisance organisms (e.g., shipworms)	1	4.0	4.3.3/4-33
Aquatic Ecology (for plants with once-through and cooling pond heat dissipation systems)			
25. Entrainment of fish and shellfish in early life stages for plants with once-through and cooling pond heat dissipation systems	2	Identified as NA in Section 4.2	Issue applies to a once-through and cooling pond heat dissipation system, which Callaway does not have.
26. Impingement of fish and shellfish for plants with once-through and cooling pond heat dissipation systems	2	Identified as NA in Section 4.3	Issue applies to a once-through and cooling pond heat dissipation system, which Callaway does not have.
27. Heat shock for plants with once-through and cooling pond heat dissipation systems	2	Identified as NA in Section 4.4	Issue applies to a once-through and cooling pond heat dissipation system, which Callaway does not have.
Aquatic Ecology (for plants with cooling-tower-based heat dissipation systems)			
28. Entrainment of fish and shellfish in early life stages for plants with cooling-tower-based heat dissipation systems	1	4.0	4.3.3/4-33
29. Impingement of fish and shellfish for plants with cooling-tower-based heat dissipation systems	1	4.0	4.3.3/4-33

Table A-1. Callaway Environmental Report Cross-Reference of License Renewal NEPA Issues. (Continued)

Issue[a]	Category	Section of this Environmental Report	GEIS Cross Reference (Section/Page)[b]
30. Heat shock for plants with cooling-tower-based heat dissipation systems	1	4.0	4.3.3/4-33
Groundwater Use and Quality			
31. Impacts of refurbishment on groundwater use and quality	1	NA	Issue applies to an activity, refurbishment, which Callaway does not plan to undertake.
32. Groundwater use conflicts (potable and service water; plants that use < 100 gpm)	1	NA	Issue applies to a feature, use of <100 gpm of groundwater, which Callaway does not have.
33. Groundwater use conflicts (potable, service water, and dewatering; plants that use > 100 gpm)	2	4.5	4.8.1.1/4-116 4.8.2.1/4-119
34. Groundwater use conflicts (plants using cooling towers withdrawing make-up water from a small river)	2	4.6	4.8.1.3/4-117
35. Groundwater use conflicts (Ranney wells)	2	Identified as NA in Section 4.7	Issue applies to a plant feature, Ranney wells, which Callaway does not have.
36. Groundwater quality degradation (Ranney wells)	1	NA	Issue applies to a feature, Ranney wells, that Callaway does not have.
37. Groundwater quality degradation (saltwater intrusion)	1	4.0	4.8.2.1/4-118
38. Groundwater quality degradation (cooling ponds in salt marshes)	1	NA	Issue applies to a feature, cooling ponds, that Callaway does not have.
39. Groundwater quality degradation (cooling ponds at inland sites)	2	NA	Issue applies to a feature, cooling ponds, that Callaway does not have.
Terrestrial Resources			
40. Refurbishment impacts to terrestrial resources	2	Identified as NA in Section 4.9	Issue applies to an activity, refurbishment, which Callaway does not plan to undertake.
41. Cooling tower impacts on crops and ornamental vegetation	1	4.0	4.3.5/4-34
42. Cooling tower impacts on native plants	1	4.0	4.3.5/4-42
43. Bird collisions with cooling towers	1	4.0	4.3.5.2/4-45

Table A-1. Callaway Environmental Report Cross-Reference of License Renewal NEPA Issues. (Continued)

Issue[a]	Category	Section of this Environmental Report	GEIS Cross Reference (Section/Page)[b]
44. Cooling pond impacts on terrestrial resources	1	NA	Issue applies to a feature, cooling ponds, which Callaway does not have.
45. Power line right-of-way management (cutting and herbicide application)	1	4.0	4.5.6.1/4-71
46. Bird collisions with power lines	1	4.0	4.5.6.2/4-74
47. Impacts of electromagnetic fields on flora and fauna (plants, agricultural crops, honeybees, wildlife, livestock)	1	4.0	4.5.6.3/4-77
48. Floodplains and wetlands on power line right-of-way	1	4.0	4.5.7./4-81
Threatened or Endangered Species (for all plants)			
49. Threatened or endangered species	2	4.10	4.1/4-1
Air Quality			
50. Air quality during refurbishment (non-attainment and maintenance areas)	2	Identified as NA in Section 4.11	Issue applies to an activity, refurbishment, which Callaway does not plan to undertake.
51. Air quality effects of transmission lines	1	4.0	4.5.2/4-62
Land Use			
52. Onsite land use	1	4.0	3.2/3-1
53. Power line right-of-way land use impacts	1	4.0	4.5.3/4-62
Human Health			
54. Radiation exposures to the public during refurbishment	1	NA	Issue applies to an activity, refurbishment, which Callaway does not plan to undertake.
55. Occupational radiation exposures during refurbishment	1	NA	Issue applies to an activity, refurbishment, which Callaway does not plan to undertake.
56. Microbiological organisms (occupational health)	1	4.0	4.3.6/4-48
57. Microbiological organisms (public health) (plants using lakes or canals, or cooling towers or cooling ponds that discharge to a small river)	2	4.12	4.3.6/4-48
58. Noise	1	4.0	4.3.7/4-49

Table A-1. Callaway Environmental Report Cross-Reference of License Renewal NEPA Issues. (Continued)

Issue[a]	Category	Section of this Environmental Report	GEIS Cross Reference (Section/Page)[b]
59. Electromagnetic fields, acute effects	2	4.13	4.5.4.1/4-66
60. Electromagnetic fields, chronic effects	NA	4.0	4.5.4.2/4-67
61. Radiation exposures to public (license renewal term)	1	4.0	4.6.2/4-87
62. Occupational radiation exposures (license renewal term)	1	4.0	4.6.3/4-95
Socioeconomics			
63. Housing impacts	2	4.14	3.7.2/3-10 (refurbishment - not applicable to Callaway) 4.7.1/4-101 (renewable term)
64. Public services: public safety, social services, and tourism and recreation	1	4.0	Refurbishment (not applicable to Callaway) 3.7.4/3-14 (public service) 3.7.4.3/3-18 (safety) 3.7.4.4/3-19 (social) 3.7.4.6/3-20 (tour, rec) Renewal Term 4.7.3/4-104 (public safety) 4.7.3.3/4-106 (safety) 4.7.3.44-107 (social) 4.7.3.6/4-107 (tour, rec)
65. Public services: public utilities	2	4.15	3.7.4.5/3-19 (refurbishment - not applicable to Callaway) 4.7.3.5/4-107 (renewable term)
66. Public services: education (refurbishment)	2	Identified as NA in Section 4.16	Issue applies to an activity, refurbishment, which Callaway does not plan to undertake.
67. Public services: education (license renewal term)	1	4.0	4.7.3.1/4-106
68. Offsite land use (refurbishment)	2	Identified as NA in Section 4.17.1	Issue applies to an activity, refurbishment, which Callaway does not plan to undertake.
69. Offsite land use (license renewal term)	2	4.17.2	4.7.4/4-107
70. Public services: transportation	2	4.18	3.7.4.2/3-17 (refurbishment - not applicable to Callaway) 4.7.3.2/4-106 (renewal term)

Table A-1. Callaway Environmental Report Cross-Reference of License Renewal NEPA Issues. (Continued)

Issue[a]	Category	Section of this Environmental Report	GEIS Cross Reference (Section/Page)[b]
71. Historic and archaeological resources	2	4.19	3.7.7/3-23 (refurbishment - not applicable to Callaway) 4.7.7/4-114 (renewal term)
72. Aesthetic impacts (refurbishment)	1	NA	Issue applies to an activity, refurbishment, which Callaway does not plan to undertake.
73. Aesthetic impacts (license renewal term)	1	4.0	4.7.6/4-111
74. Aesthetic impacts of transmission lines (license renewal term)	1	4.0	4.5.8/4-83
Postulated Accidents			
75. Design basis accidents	1	4.0	5.3.2/5-11 (design basis) 5.5.1/5-114 (summary)
76. Severe accidents	2	4.20	5.3.3/5-12 (probabilistic analysis) 5.3.3.2/5-19 (air dose) 5.3.3.3/5-49 (water) 5.3.3.4/5-65 (groundwater) 5.3.3.5/5-95 (economic) 5.4/5-106 (mitigation) 5.5.2/5-114 (summary)
Uranium Fuel Cycle and Waste Management			
77. Offsite radiological impacts (individual effects from other than the disposal of spent fuel and high-level waste)	1	4.0	6.2/6-8
78. Offsite radiological impacts (collective effects)	1	4.0	Not in GEIS.
79. Offsite radiological impacts (spent fuel and high-level waste disposal)	1	4.0	Not in GEIS.
80. Nonradiological impacts of the uranium fuel cycle	1	4.0	6.2.2.6/6-20 (land use) 6.2.2.7/6-20 (water use) 6.2.2.8/6-21 (fossil fuel) 6.2.2.9/6-21 (chemical)
81. Low-level waste storage and disposal	1	4.0	6.4.2/6-36 (low-level def) 6.4.3/6-37 (low-level volume) 6.4.4/6-48 (renewal effects)
82. Mixed waste storage and disposal	1	4.0	6.4.5/6-63
83. Onsite spent fuel	1	4.0	6.4.6/6-70
84. Nonradiological waste	1	4.0	6.5/6-86

Table A-1. Callaway Environmental Report Cross-Reference of License Renewal NEPA Issues. (Continued)

Issue[a]	Category	Section of this Environmental Report	GEIS Cross Reference (Section/Page)[b]
85. Transportation	1	4.0	6.3/6-31, as revised by Addendum 1, August 1999
Decommissioning			
86. Radiation doses (decommissioning)	1	4.0	7.3.1/7-15
87. Waste management (decommissioning)	1	4.0	7.3.2/7-19 (impacts) 7.4/7-25 (conclusions)
88. Air quality (decommissioning)	1	4.0	7.3.3/7-21 (air) 7.4/7-25 (conclusions)
89. Water quality (decommissioning)	1	4.0	7.3.4/7-21 (water) 7.4/7-25 (conclusions)
90. Ecological resources (decommissioning)	1	4.0	7.3.5/7-21 (ecological) 7.4/7-25 (conclusions)
91. Socioeconomic impacts (decommissioning)	1	4.0	7.3.7/7-19 (socioeconomic) 7.4/7-24 (conclusions)
Environmental Justice			
92. Environmental justice	NA	2.6.2	not in GEIS

a. 10 CFR 51, Subpart A, Appendix A, Table B-1. (Issue numbers added to facilitate discussion.)
b. Generic Environmental Impact Statement for License Renewal of Nuclear Plants (NUREG-1437).
NA = not applicable
NEPA = National Environmental Policy Act

ATTACHMENT B

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM

AmerenUE Callaway Power Plant
MO-0098001, Callaway County

STATE OF MISSOURI
Jeremiah W. (Jay) Nixon, Governor • Mark N. Templeton, Director
DEPARTMENT OF NATURAL RESOURCES
www.dnr.mo.gov

APR 1 4 2010

Mr. Steven C. Whitworth
Ameren Services
One Ameren Plaza
P.O. Box 66149
St. Louis, MO 63166-6149

Dear Mr. Whitworth:

State Operating Permit M0-0098001 issued on February 13, 2009 is hereby modified as per the enclosed. This modification is to change the Whole Effluent Toxicity (WET) Acute and Chronic Testing to acknowledge the periodic and potential discharge of the algaecide BULAB 6060 from Outfall's 002 or/and 016. The attached permit is for your official record.

Please read your permit and attached Standard Conditions. They contain important information on monitoring requirements, effluent limitations, sampling frequencies and reporting requirements.

This permit is both your federal discharge permit and your new state operating permit and replaces previous state operating permits for this facility. In all future correspondence regarding this facility, please refer to your state operating permit number and facility name as shown on page one of the permit.

If you have any questions concerning this permit, please do not hesitate to contact Todd Blanc of my staff at P.O. Box 176, Jefferson City, MO 65102-0176 or by phone at (573) 522-2553.

Sincerely,

WATER PROTECTION PROGRAM

Refaat H. Mefrakis, P.E., Chief
NPDES Permits and Engineering Section

RM:tba

Enclosure

c: Northeast Regional Office
Gary Gail, Environmental Services, AmerenUE

Recycled Paper

AMERENUE, CALLAWAY PP
MO0098001, Callaway

STATE OF MISSOURI
Jeremiah W. (Jay) Nixon, Governor • Mark N. Templeton, Director
DEPARTMENT OF NATURAL RESOURCES
www.dnr.mo.gov

APR 1 4 2010

AMEREN UE
PO BOX 66149, MC-602
1AMEREN PLZ,1901 CHOUTEAU
ST LOUIS, MO 63166-6149

Dear Permittee:

Pursuant to the Federal Water Pollution Control Act, under the authority granted to the State of Missouri and in compliance with the Missouri Clean Water Law, we have issued and are enclosing your State Operating Permit to discharge from AMERENUE, CALLAWAY PP.

Please read your permit and attached Standard Conditions. They contain important information on monitoring requirements, effluent limitations, sampling frequencies and reporting requirements.

Monitoring reports required by the special conditions must be submitted on a periodic basis. Copies of the necessary report forms are enclosed and should be mailed to your regional office. Please contact that office for additional forms.

This permit is both your Federal NPDES Permit and your new Missouri State Operating Permit and replaces all previous State Operating Permits issued for this facility under this permit number. In all future correspondence regarding this facility, please refer to your State Operating Permit number and facility name as shown on page one of the permit.

If you were adversely affected by this decision, you may be entitled to an appeal before the administrative hearing commission pursuant to 10 CSR 20-1.020 and Section 621.250, RSMo. To appeal, you must file a petition with the administrative hearing commission within thirty days after the date this decision was mailed or the date it was delivered, whichever date was earlier. If any such petition is sent by registered mail or certified mail, it will be deemed filed on the date it is mailed; if it is sent by any method other than registered mail or certified mail, it will be deemed filed on the date it is received by the administrative hearing commission. Contact information for the AHC is: Administrative Hearing Commission, Truman State Office Building, Room 640, 301 W. High Street, P.O. Box 1557, Jefferson City, Missouri 65102, Phone: 573-751-2422, Fax: 573-751-5018, and Website: www.oa.mo.gov/ahc.

Please be aware that this facility may also be subject to any applicable county or other local ordinances or restrictions.

If you have any questions concerning this permit, please do not hesitate to contact the Water Protection Program at PO Box 176, Jefferson City, MO 65102, 573-751-1300.

Sincerely,
Water Protection Program

Refaat Mefrakis

Refaat Mefrakis, P.E.
Chief, NPDES Permits and Engineering Section

RM

Enclosure

Recycled Paper

STATE OF MISSOURI

DEPARTMENT OF NATURAL RESOURCES

MISSOURI CLEAN WATER COMMISSION

MISSOURI STATE OPERATING PERMIT

In compliance with the Missouri Clean Water Law, (Chapter 644 R.S. Mo. as amended, hereinafter, the Law), and the Federal Water Pollution Control Act (Public Law 92-500, 92nd Congress) as amended,

Permit No.	MO-0098001
Owner:	Ameren UE
Address:	One Ameren Plaza, 1901 Chouteau Avenue, PO Box 66149, MC-602, St. Louis, MO 63166-6149
Continuing Authority:	Same as above
Address:	Same as above
Facility Name:	Ameren UE, Callaway Power Plant
Address:	PO Box 620, Fulton, MO 65251
Legal Description:	See page 2
Receiving Stream:	See page 2
First Classified Stream and ID:	See page 2
USGS Basin & Sub-watershed No.:	See page 2

is authorized to discharge from the facility described herein, in accordance with the effluent limitations and monitoring requirements as set forth herein:

FACILITY DESCRIPTION
The Callaway Power Plant combined discharge line has a cumulative daily average flow of 5.64 MGD and a daily maximum flow of 14.4 MGD.

See next page for individual outfall descriptions

This permit authorizes only wastewater discharges under the Missouri Clean Water Law and the National Pollutant Discharge Elimination System; it does not apply to other regulated areas. This permit may be appealed in accordance with Section 644.051.6 of the Law.

February 13, 2009 — Effective Date
April 14, 2010 — Revised Date

Mark N. Templeton, Director, Department of Natural Resources

February 12, 2014 — Expiration Date

Scott B. Totten, Acting Director, Water Protection Program

ATTACHMENT C

SPECIAL STATUS SPECIES CORRESPONDENCE

Ameren Services

Environmental Services
314.554.2978 (Phone)
314.554.4182 (Facsimile)
klynn@ameren.com

One Ameren Plaza
1901 Chouteau Avenue
PO Box 66149
St. Louis, MO 63166-6149
314.621.3222

April 16, 2010

Charlie Scott, Field Supervisor
U.S. Fish and Wildlife Service
Columbia Missouri Field Office
101 Park DeVille Drive, Suite A
Columbia, MO 65203-0057

RE: Callaway Unit 1 License Renewal--Request for Information on Threatened or Endangered Species

Dear Mr. Scott:

In late fall 2011, AmerenUE plans to apply to the U.S. Nuclear Regulatory Commission (NRC) for renewal of the operating license for Callaway Unit 1 in Callaway County, Missouri. The existing operating license for Callaway Unit 1 was initially issued for a 40-year term that will expire in 2024. License renewal would extend the operating period for the plant by 20 years beyond the expiration of the existing license.

The NRC requires each applicant for renewal of an operating license to submit an Environmental Report describing potential environmental impacts from license renewal and from operation during the renewal term. Accordingly, the NRC requires [10 CFR 51.53(c)(3)(ii)(E)] that the Environmental Report for each license renewal application assess impacts to threatened and endangered species in accordance with the Endangered Species Act. The NRC will use this assessment in its review of the project pursuant to the National Environmental Policy Act (NEPA) and to determine the appropriate level of consultation (informal or formal) under Section 7 of the Endangered Species act.

We are contacting you now in order to obtain input regarding issues of concern to your office and to identify any information your staff believes would be helpful to expedite the Section 7 consultation.

Callaway Unit 1 is located in Callaway County (Figures 1 and 2), approximately five miles north of the Missouri River. The 7,350-acre site lies in a largely rural area dominated by deciduous forests, grassland/pasture, and cropland. Approximately 512 acres of the site property consists of the power generating facilities and associated infrastructure. Most of the remaining land consists of deciduous forest (approximately 47%), grassland/pasture (approximately 30%),

and cropland (13%) (Figure 3). Much of the Callaway site (approximately 6,300 acres) is managed by the Missouri Department of Conservation as the Reform Conservation Area. Most of the managed land is open to the public for multiple uses, including hiking, birding, hunting, and fishing. The MDC also manages this area by conserving natural habitats and removing invasive exotic plant species.

The transmission lines built to connect Callaway Unit 1 to the grid are approximately 72 miles in length and occupy three main corridors (Figure 4): identified here as Northern (2 lines combined in one corridor), Southwestern, and Southeastern (Figure 4). The two southerly corridors depart the site as a combined corridor that crosses the Missouri River prior to splitting into two divergent corridors. For the most part, all corridors pass through deciduous forests, agricultural lands and pasture/rangeland. No lands designated by the USFWS as "critical habitat" for endangered or threatened species are crossed by these corridors, nor do they cross any state or federal parks, wildlife refuges or preserves, or wildlife management areas, other than the Reform Conservation Area within the Callaway site.

Based on a review of information on the Missouri Department of Conservation (MDC) and U.S. Fish and Wildlife Service (USFWS) websites (county lists of threatened and endangered species) and previous on-site surveys, AmerenUE believes that only one special-status species, the federally-protected bald eagle, occurs on the Callaway site. The bald eagle is occasionally observed on the Callaway site, typically near the Missouri River, and nesting by the species has been documented in the four counties containing the site and its transmission lines. Two bat species, gray and Indiana bats, are federally endangered and occur in the four counties. Neither species has been observed on Callaway property, although a gray bat has been documented in a cave along an off-site segment of Auxvasse Creek. Three federally-listed fish species occur or have occurred in the four counties associated with the site/transmission corridors. The pallid sturgeon has been documented on occasion in the Missouri River near the Callaway Plant outfall. Topeka shiners were found in nearby Auxvasse Creek in 1945, but have not been found there since that time. Niangua darters are restricted to the Osage River watershed (Osage County, crossed by transmission corridor). Also, three species of federally-listed mussels may occur in the Missouri River and/or associated tributaries (Table 1), but none has been collected near Callaway property. Several other federal and state-protected plants and animals are listed for the counties containing Callaway and its associated transmission corridors (see Table 1).

AmerenUE does not expect Callaway Unit 1 operations during the license renewal term to adversely affect threatened or endangered species because license renewal will not alter existing operations. No expansion of existing facilities is planned, and no structural modifications or refurbishment activities have been identified that are necessary to support license renewal. Maintenance activities during the license renewal term would be restricted to previously disturbed areas. The company associated with transmission line maintenance and transmission corridor management has established procedures that involve minimal disturbance of land,

wetlands, and streams and thus are unlikely to adversely affect any threatened or endangered species.

After your review of the information provided in this letter, we would appreciate your sending a letter detailing any concerns you may have about any listed species or critical habitat in the area of the Callaway Unit 1 site and the associated transmission corridors, or alternatively, confirming our conclusion that operation of Callaway Unit 1 over the license renewal term would have no effect on any threatened or endangered species, if possible, no later than June 10, 2010. AmerenUE will include copies of this letter and your response in the Environmental Report that will be submitted to the NRC as part of the Callaway Unit 1 license renewal application.

Please do not hesitate to contact me if there are questions or you need additional information to complete a review of the proposed action. Thank you in advance for your assistance.

Sincerely,

Kenneth W. Lynn

Kenneth W. Lynn
Consulting Environmental Scientist

Attachments: Table 1, Figures 1, 2, 3 and 4

Table 1. Protected species in the counties containing the Callaway Plant and its associated transmission lines.

Group		Federal/State Status[1] By County			
Common Name	**Scientific Name**	**Callaway**	**Montgomery**	**Osage**	**Gasconade**
Amphibian					
Eastern Hellbender	*Cryptobranchus alleganiensis*	-/-	-/E	-/E	-/E
Bird					
Northern Harrier	*Circus cyaneus*	-/E	-/E	/E	-/E
Bald Eagle	*Haliaeetus leucocephalus*	P[2]/-	-/-	P[2]/-	-/-
Fish					
Lake Sturgeon	*Acipenser fulvescens*	-/E	-/E	-/E	-/E
Crystal Darter	*Crystallaria asprella*	-/-	-/-	-/-	-/E
Niangua Darter	*Etheostoma nianguae*	-/-	-/-	E/E	-/-
Topeka Shiner	*Notropis topeka*	T/-	-/-	-/-	-/-
Flathead Chub	*Platygobio gracilis*	-/E	-/E	-/E	-/E
Pallid Sturgeon	*Scaphirhynchus albus*	E/E	E/E	E/E	E/E
Mammals					
Gray Bat	*Myotis grisescens*	E/E	-/-	E/E	E/E
Indiana Bat	*Myotis sodalis*	E/E	E/E	-/-	E/E
Mollusks					
Spectaclecase	*Cumberlandia monodonta*	-/-	-/-	C/-	C/-
Elephantear	*Elliptio crassidens*	-/-	-/-	-/E	-/E
Ebonyshell	*Fusconaia ebera*	-/-	-/-	-/E	-/E
Pink Mucket	*Lampsilis abrupta*	-/-	-/-	E/E	E/E
Scaleshell	*Leptodea leptodon*	-/-	-/-	E/E	E/E
Plants					
Running Buffalo Clover	*Trifolium stoloniferum*	E/E	E/E	-/-	-/-

[1] Federal/State protected status: E = listed as endangered under federal/state law within this county, T = threatened, C = candidate species, and "-" = not listed.

[2] P: bald eagles are no longer protected under the Endangered Species Act, but still receive federal protection under the Bald and Golden Eagle Protection Act.

Figure 1: 50-Miles Radius Surrounding the Callaway Plant Site

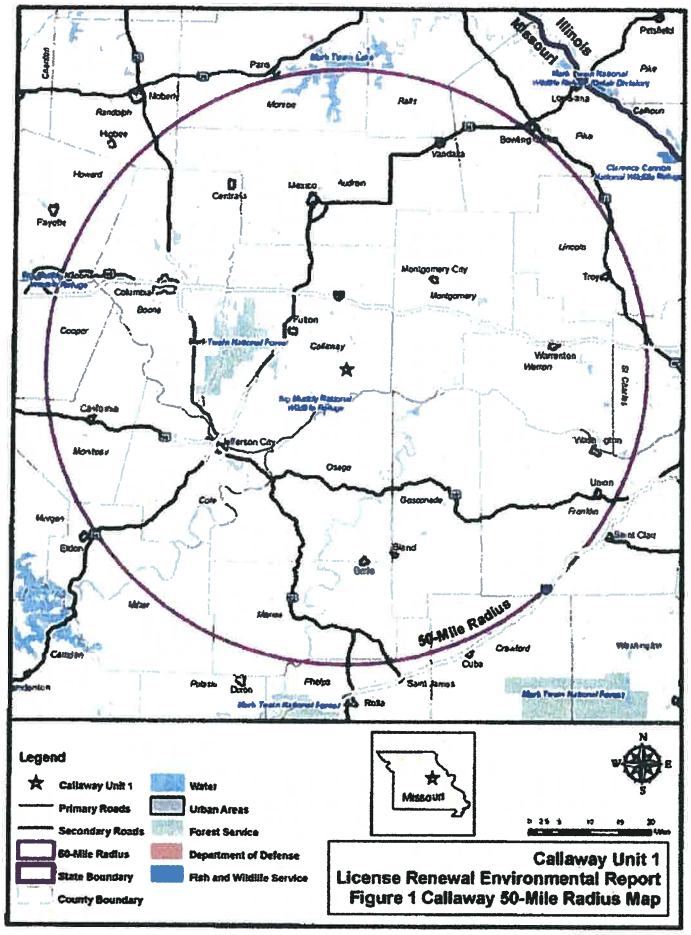


Figure 2: Callaway Plant Site Boundary

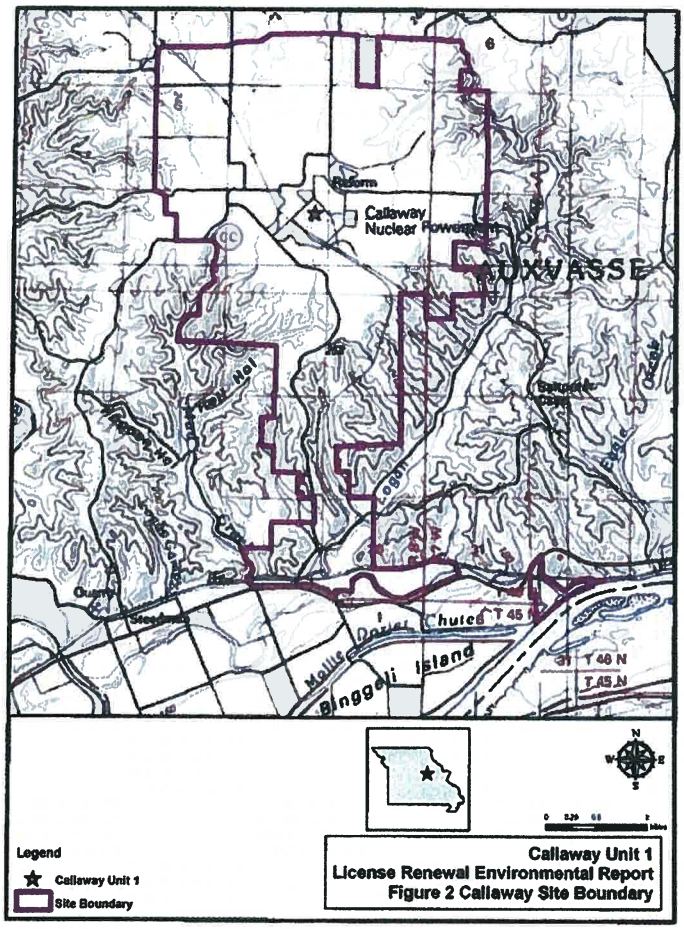


Figure 3: Callaway Plant Site Land Cover

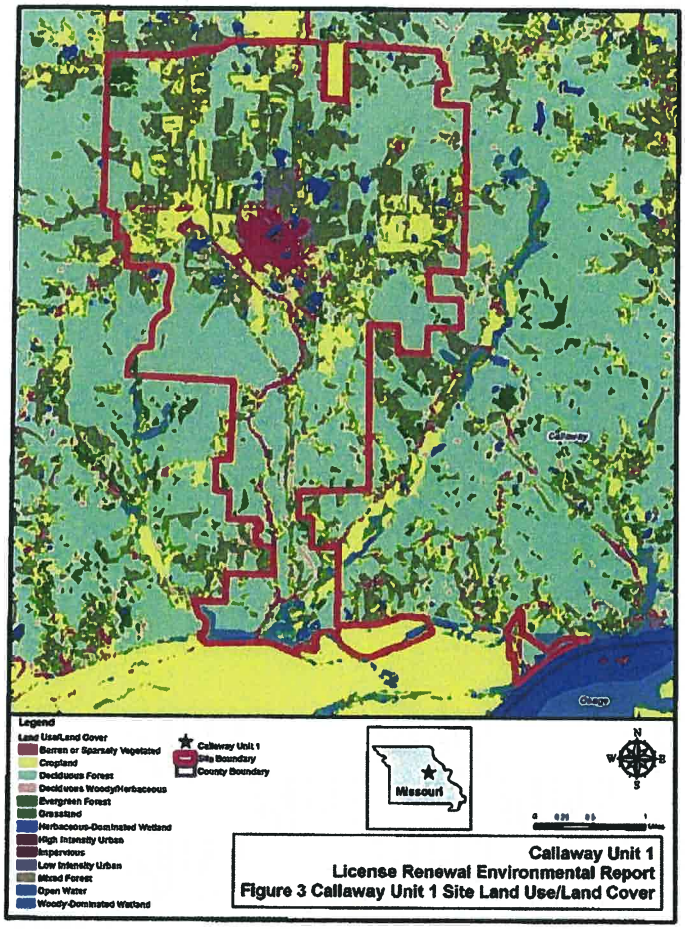
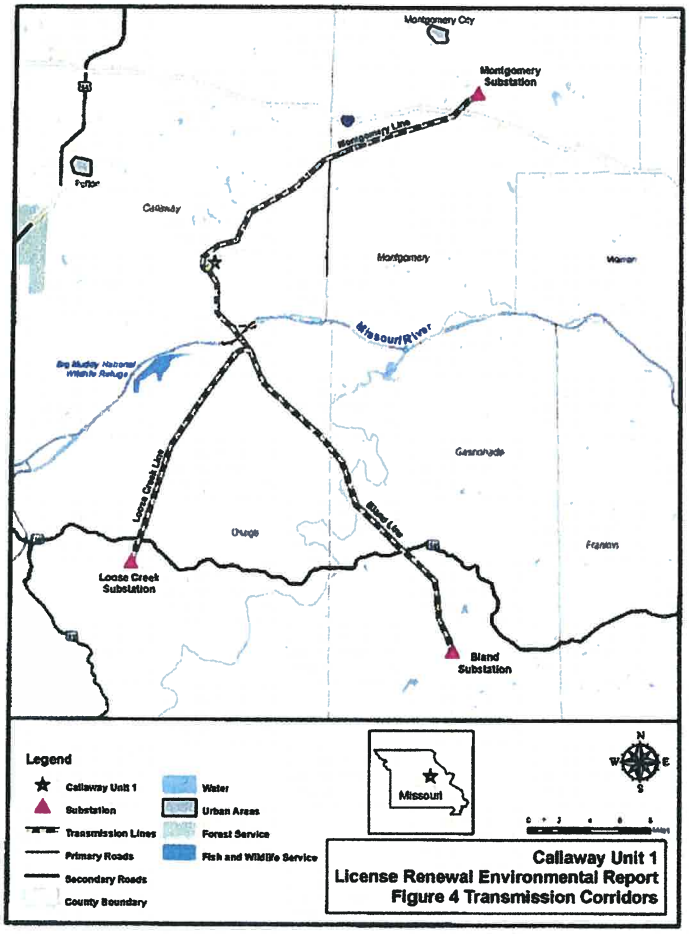


Figure 4: Callaway Plant Site Transmission Corridors



bcc: A. J. Burgess
JCP/BFH/KWL
FILE: WQ-3.1.1

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Columbia Ecological Services Field Office
101 Park DeVille Drive, Suite A
Columbia, Missouri 65203-0057
Phone: (573) 234-2132 Fax: (573) 234-2181

June 14, 2010

Kenneth W. Lynn
Consulting Environmental Scientist
AmerenUE
PO Box 66149
St. Louis, Missouri 63166-6149

Dear Mr. Lynn:

This is in response to your April 16, 2010, letter pertaining to the Callaway Unit 1 license renewal process. In late Fall 2011, AmerenUE plans to apply to the U.S. Nuclear Regulatory Commission (NRC) for renewal of the operating license for the Callaway Unit 1 in Callaway County, Missouri. Your letter specifically requested information from the U.S. Fish and Wildlife Service (Service) pertaining to species listed under the Endangered Species Act that may occur on the project site. This information will be used by NRC and AmerenUE in the environmental assessment of the license renewal, including consultation under section 7(a)(2) of the Endangered Species Act.

The Callaway Unit 1 site encompasses 7,350 acres of which 512 acres is occupied by the power generating facilities and associated infrastructure. The Missouri Department of Conservation manages 6,300 acres of the site as the Reform Conservation Area. The site is predominately rural lands composed of deciduous forests, grassland/pasture, and cropland.

During the term of the license renewal, there are no plans to expand beyond existing facilities and no structural modifications or refurbishment activities have been identified. Maintenance activities would be restricted to previously disturbed areas.

We have reviewed the information in your letter relating to threatened and endangered species. Based on this information you state that continued operation of the facility under the term of the license renewal is unlikely to adversely affect any threatened or endangered species. The Service has no major concerns with the effects of continued operation of the Callaway Unit 1 on federally listed species and concurs with your assessment that adverse effects are unlikely to occur.

We appreciate the opportunity to review this action. Please contact us if you have any questions or require additional assistance.

Sincerely,

Charles M. Scott
Field Supervisor

O:\STAFF Folders\Scott\Letters\AmerenUE.CallawayUnit1.TESpeciesResponse.doc

Ameren Services

Environmental Services
314.554.2978 (Phone)
314.554.4182 (Facsimile)
klynn@ameren.com

One Ameren Plaza
1901 Chouteau Avenue
PO Box 66149
St. Louis, MO 63166-6149
314.621.3222

April 16, 2010

Shannon Cave
Policy Coordination Unit
Missouri Department of Conservation
P.O. Box 180
2901 West Truman Boulevard
Jefferson City, MO 6102-080

RE: Callaway Unit 1 License Renewal--Request for Information on Threatened or Endangered Species

Dear Ms. Cave:

In late fall of 2011, AmerenUE plans to apply to the U.S. Nuclear Regulatory Commission (NRC) for renewal of the operating license for Callaway Unit 1 in Callaway County, Missouri. The existing operating license for Callaway Unit 1 was initially issued for a 40-year term that will expire in 2024. License renewal would extend the operating period for the plant by 20 years beyond the expiration of the existing license.

The NRC requires each applicant for renewal of an operating license to submit an Environmental Report describing potential environmental impacts from license renewal and from operation during the renewal term. Accordingly, the NRC requires [10 CFR 51.53(c)(3)(ii)(E)] that the Environmental Report for each license renewal application assess impacts to threatened and endangered species in accordance with the Endangered Species Act. The NRC will use this assessment in its review of the project pursuant to the National Environmental Policy Act (NEPA) and to determine the appropriate level of consultation (informal or formal) under Section 7 of the Endangered Species act.

We are contacting you now in order to obtain input regarding issues of concern to your office and to identify any information your staff believes would be helpful to expedite the Section 7 consultation.

Callaway Unit 1 is located in Callaway County (Figures 1 and 2), approximately five miles north of the Missouri River. The 7,350-acre site lies in a largely rural area dominated by deciduous forests, grassland/pasture, and cropland. Approximately 512 acres of the site property consists of the power generating facilities and associated infrastructure. Most of the remaining land consists of

deciduous forest (approximately 47%), grassland/pasture (approximately 30%), and cropland (13%) (Figure 3). Much of the Callaway site (approximately 6,300 acres) is managed by the Missouri Department of Conservation as the Reform Conservation Area. Most of the managed land is open to the public for multiple uses, including hiking, birding, hunting, and fishing. The MDC also manages this area by conserving natural habitats and removing invasive exotic plant species. The transmission lines built to connect Callaway Unit 1 to the grid are approximately 72 miles in length and occupy three main corridors (Figure 4): identified here as Northern (2 lines combined in one corridor), Southwestern, and Southeastern (Figure 4). The two southerly corridors depart the site as a combined corridor that crosses the Missouri River prior to splitting into two divergent corridors. For the most part, all corridors pass through deciduous forests, agricultural lands and pasture/rangeland. No lands designated by the USFWS as "critical habitat" for endangered or threatened species are crossed by these corridors, nor do they cross any state or federal parks, wildlife refuges or preserves, or wildlife management areas, other than the Reform Conservation Area within the Callaway site.

Based on a review of information on the Missouri Department of Conservation (MDC) and U.S. Fish and Wildlife Service (USFWS) websites (county lists of threatened and endangered species) and previous on-site surveys, AmerenUE believes that only one special-status species, the federally-protected bald eagle, occurs on the Callaway site. The bald eagle is occasionally observed on the Callaway site, typically near the Missouri River, and nesting by the species has been documented in the four counties containing the site and its transmission lines. Northern harriers have also been seen occasionally near the Missouri River. Two bat species, gray and Indiana bats, are federally endangered and occur in the four counties. Neither species has been observed on Callaway property, although a gray bat has been documented in a cave along an off-site segment of Auxvasse Creek. Three federally-listed fish species occur or have occurred in the four counties associated with the site/transmission corridors. The pallid sturgeon has been documented on occasion in the Missouri River near the Callaway Plant outfall. Topeka shiners were found in nearby Auxvasse Creek in 1945, but have not been found there since that time. Niangua darters are restricted to the Osage River watershed (Osage County, crossed by transmission corridor). Also, three species of federally-listed mussels may occur in the Missouri River and/or associated tributaries (Table 1), but none has been collected near Callaway property. Several other federal and state-protected plants and animals are listed for the counties containing Callaway and its associated transmission corridors (see Table 1).

AmerenUE does not expect Callaway Unit 1 operations during the license renewal term to adversely affect threatened or endangered species because license renewal will not alter existing operations. No expansion of existing facilities is planned, and no structural modifications or refurbishment activities have been identified that are necessary to support license renewal. Maintenance activities during the license renewal term would be restricted to previously disturbed areas. The company associated with transmission line maintenance and transmission corridor

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After your review of the information provided in this letter, we would appreciate your sending a letter detailing any concerns you may have about any listed species or critical habitat in the area of the Callaway Unit 1 site and the associated transmission corridors, or alternatively, confirming our conclusion that operation of Callaway Unit 1 over the license renewal term would have no effect on any threatened or endangered species, if possible no later than June 10, 2010. AmerenUE will include copies of this letter and your response in the Environmental Report that will be submitted to the NRC as part of the Callaway Unit 1 license renewal application.

Please do not hesitate to contact me if there are questions or you need additional information to complete a review of the proposed action. Thank you in advance for your assistance.

Sincerely,

Kenneth W. Lynn

Kenneth W. Lynn
Consulting Environmental Scientist

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Topeka Shiner	*Notropis topeka*	T/-	-/-	-/-	-/-
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Pallid Sturgeon	*Scaphirhynchus albus*	E/E	E/E	E/E	E/E
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Gray Bat	*Myotis grisescens*	E/E	-/-	E/E	E/E
Indiana Bat	*Myotis sodalis*	E/E	E/E	-/-	E/E
Mollusks					
Spectaclecase	*Cumberlandia monodonta*	-/-	-/-	C/-	C/-
Elephantear	*Elliptio crassidens*	-/-	-/-	-/E	-/E
Ebonyshell	*Fusconaia ebera*	-/-	-/-	-/E	-/E
Pink Mucket	*Lampsilis abrupta*	-/-	-/-	E/E	E/E
Scaleshell	*Leptodea leptodon*	-/-	-/-	E/E	E/E
Plants					
Running Buffalo Clover	*Trifolium stoloniferum*	E/E	E/E	-/-	-/-

[1] Federal/State protected status: E = listed as endangered under federal/state law within this county, T = threatened, C = candidate species, and "-" = not listed.

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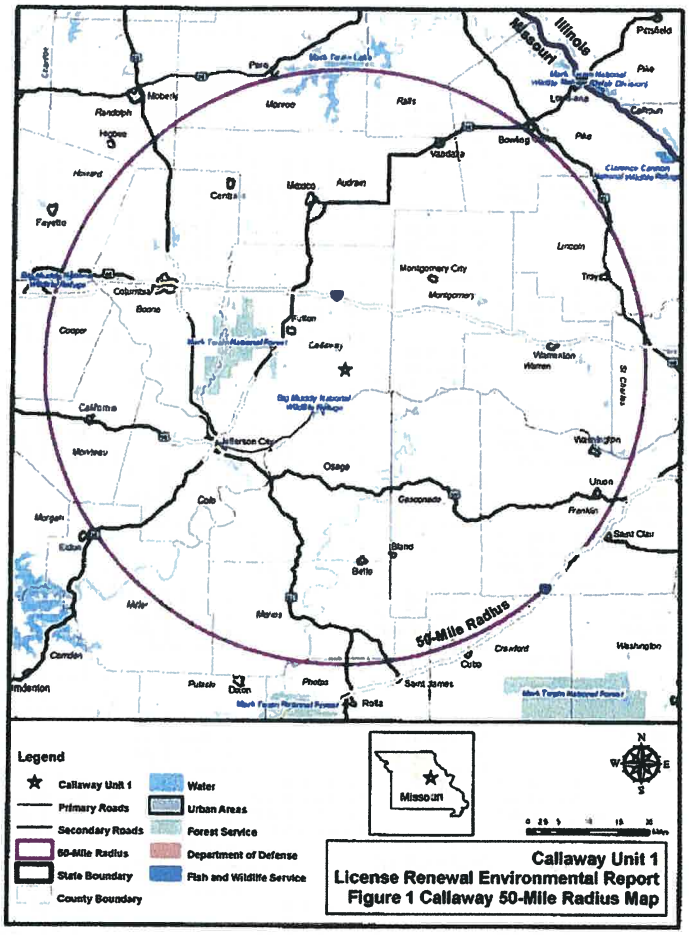

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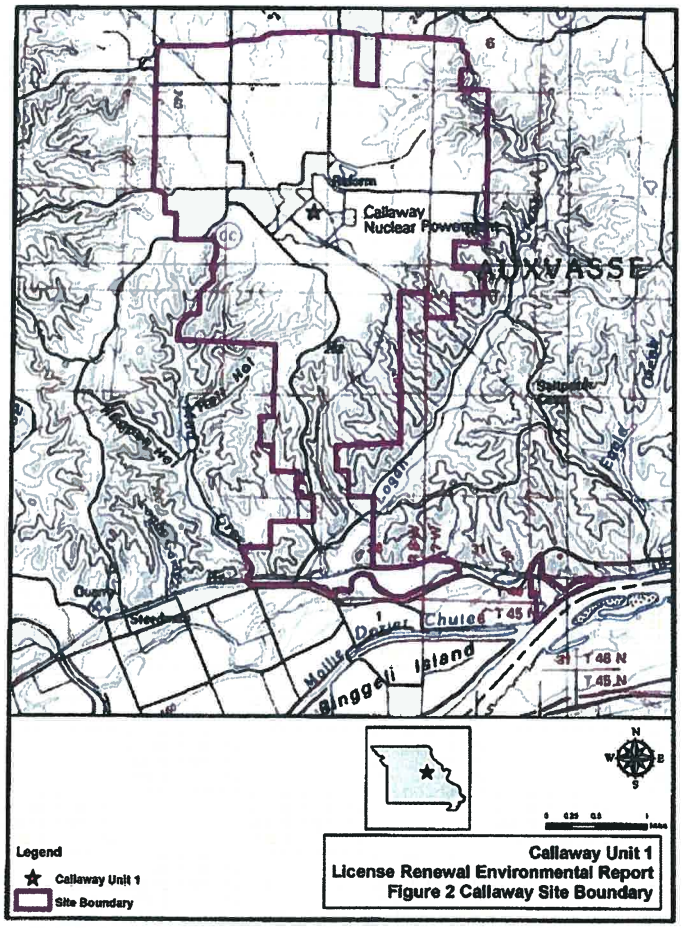

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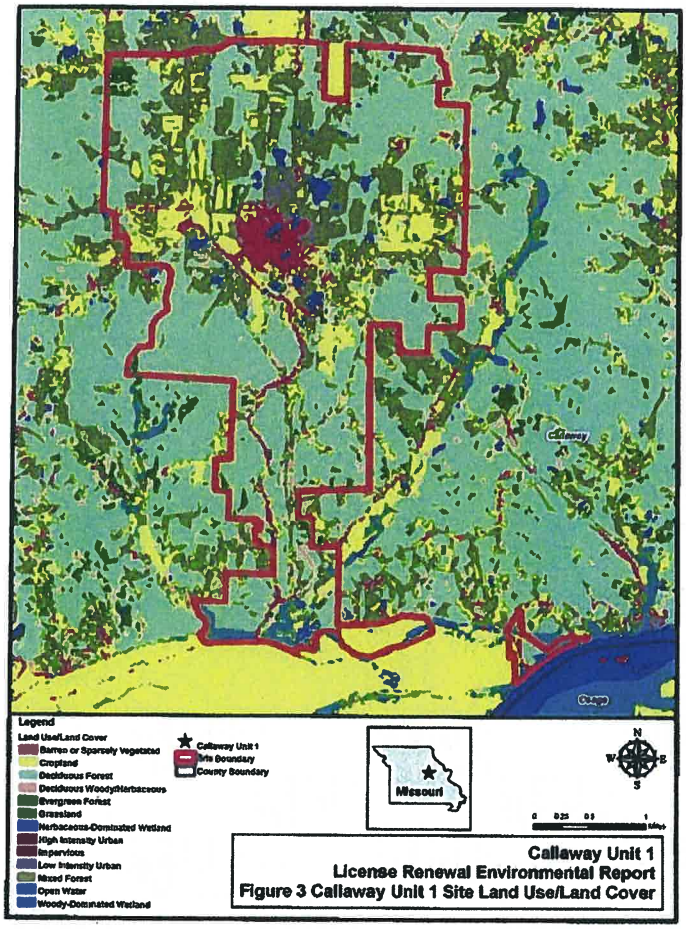

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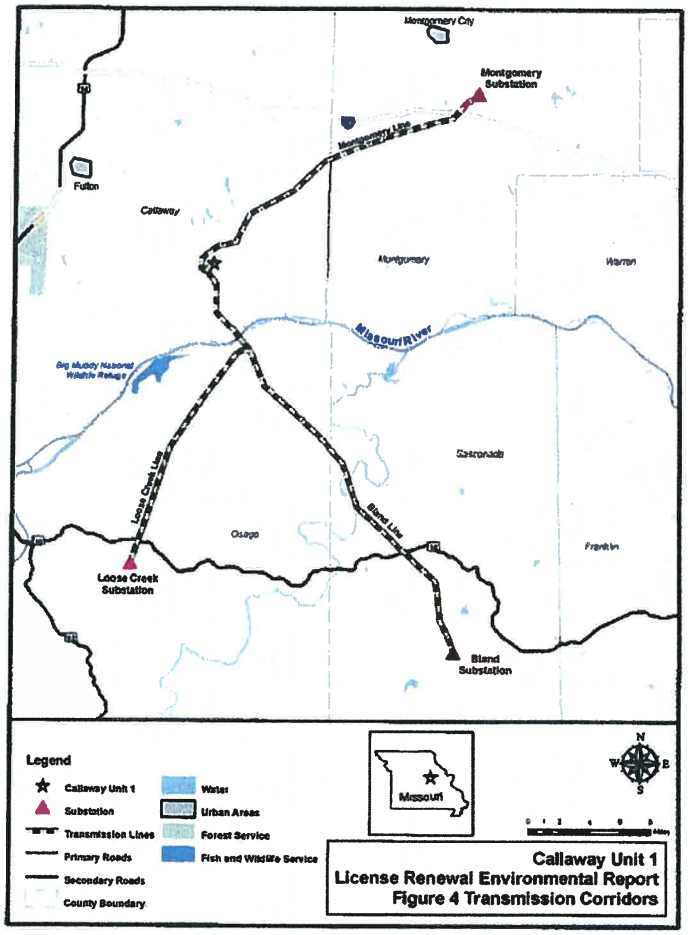


bcc: A. J. Burgess
JCP/BFH/KWL
FILE: WQ-3.1.1

Missouri Department of Conservation

Heritage Review Report

April 26, 2010 – Page 1 of 4

Policy Coordination Unit
P. O. Box 180
Jefferson City, MO 65102
heritage.review@mdc.mo.gov
573-522-4115 X 3367

Kenneth W. Lynn
One Ameren Plaza
1901 Chouteau Avenue
PO Box 66149
St. Louis, MO 63166
Copies: USFWS, Doyle Brown, Jeff Demand

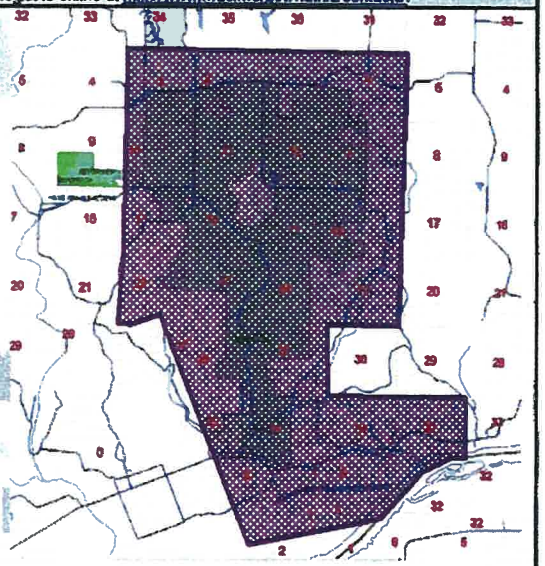
Project type:	Ameren License Renewal
Location/Scope:	Callaway County – 7,350 acres – see map
County:	Callaway
Query reference:	Callaway Unit 1 License Renewal
Query received:	April 20, 2010

This NATURAL HERITAGE REVIEW is not a site clearance letter. Rather, it identifies public lands and sensitive resources known to have been located close to and/or potentially affected by the proposed project. On-site verification is the responsibility of the project. Heritage records were identified at some date and location. This report considers records near but not necessarily at the project site. Animals move and, over time, so do plant communities. To say "there is a record" does not mean the species/habitat is still there. To say that "there is no record" does not mean a protected species will not be encountered. These records only provide one reference and other information (e.g. wetland or soils maps, on-site inspections or surveys) should be considered. Look for additional information about the biological and habitat needs of records listed in order to avoid or minimize impacts. More information may be found at www.mdc.mo.gov/nathis/endangered/ and mdc4.mdc.mo.gov/applications/mofwis/mofwis_search1.aspx. Contact information for the department's Natural History Biologist is online at http://www.mdc.mo.gov/nathis/contacts/.

4-26-2010
Prepared by: Shannon Cave

Level 3 and level 2 issues, plant site – Records of federal-listed or state-listed species or critical habitats near the plant site:

Heritage records identify no federal or state designated wildlife preserves, wilderness areas or critical habitats, or endangered-list species records within the public land survey sections indicated on the map at right.



The Missouri River is home to a number of species of state and federal concern, including pallid sturgeon (*Scaphirhynchus albus*, federal/state endangered), lake sturgeon (*Acipenser fulvescens*, state endangered), and others. Lake sturgeon have been recorded near the cooling plant outfall

- Pallid sturgeon are big river fish that range widely in the Mississippi and Missouri River system (including parts of major tributaries). Much is unknown about the habitat needs and range of the species, so any project that modifies big river habitat or impacts water quality should consider the possible impact to pallid sturgeon populations. See http://mdc.mo.gov/124 for best management recommendations.
- The river's banks and floodplain are places one might encounter gray bats (*Myotis grisescens*, federal & state endangered), Indiana bats (*Myotis sodalis*, federal & state endangered), bald eagles (*Haliaeetus leucocephalus*, state endangered) and others, although there are no specific records within a mile of

any of these sections.

- Terrestrial projects that manage construction and include operation plans to avoid runoff of sediment or pollutants are unlikely to affect the aquatic species. Projects that place fill in or discharge water to the river are subject to federal permits, and strict observance of conditions required in those permits is important to minimize risk of damage to endangered species.
- Reform Conservation Area and Hams Prairie Access are in or near the project zone.

FEDERAL LIST species/habitats are protected under the Federal Endangered Species Act. Consult with U.S. Fish and Wildlife Service, 101 Park DeVille Drive Suite A, Columbia, Missouri 65203-0007; 573-234-2132

Records along powerline corridors:

Species	Common Name	Federal Status	State Status	State Rank	Location/County	Quadrangle	Twp/Rng	Section	Last seen
Leptodea leptodon	Scaleshell	E	E	S1	Gasconade River		T44N R06W	29	2005
Lampsilis abrupta	Pink Mucket	E	E	S2	Gasconade River		T44N R06W	29	1994
Cumberlandia monodonta	Spectaclecase	C		S3	Gasconade River		T44N R06W	29	1994
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Elliptio crassidens	Elephantear		E	S1	Gasconade River		T44N R06W	29	1994
Fusconaia ebena	Ebonyshell		E	S1	Gasconade River		T44N R06W	29	1994
Ligumia recta	Black Sandshell			S2	Gasconade River		T44N R06W	29	1994
Ligumia recta	Black Sandshell			S2	Gasconade River		T44N R06W	29	2005
Nothocalais cuspidata	Prairie Dandelion			S2	Montgomery	Montgomery City	T48N R06W	36	2006
Hiodon tergisus	Mooneye			S3	Gasconade River		T45N R07W	6	1989
Macrhybopsis meeki	Sicklefin Chub			S3	Missouri River		T45N R08W	1	2003
Macrhybopsis meeki	Sicklefin Chub			S3	Missouri River		T45N R08W	1	2003
Macrhybopsis meeki	Sicklefin Chub			S3	Missouri River		T45N R08W	1	2003
Macrhybopsis meeki	Sicklefin Chub			S3	Missouri River		T45N R07W	6	2003
Malvastrum hispidum	Yellow False Mallow			S3	Montgomery	Montgomery City	T48N R06W	36	2007
Floerkea proserpinacoides	False Mermaid			SU	Montgomery	Montgomery City	T48N R06W	34	2000
Community	Limestone glade			S2	Montgomery	Montgomery City	T48N R06W	36	1999
Community	Wet-mesic bottomland forest			S2	Montgomery	Montgomery City	T48N R06W	33	2000
Community	Dry-mesic limestone/dolomite woodland			S3	Montgomery	Montgomery City	T48N R06W	36	1999
Community	Mesic limestone/dolomite forest			S3	Callaway	Mokane East	T46N R08W	36	1999

Federal status is coded E (Endangered), T (Threatened) or C (Candidate), regulated by the Endangered Species Act.
State Status is either E (endangered) or blank. Use and taking of all wildlife species are regulated by the Missouri Wildlife Code with endangered species subject to special restrictions.
State Rank codes: S1 (Critically imperiled); S2 (Imperiled) or S3 (Vulnerable). These are tracked due to their rarity and subject to general regulations in the Wildlife Code.

Level 1 recommendations: Unlisted species/habitats tracked due to their rarity, but not listed as endangered or threatened or subject to special regulations.

The following records occur in the section outlined above:

Species	Common Name	State Rank	Twp/Rng	Section	Last seen
Notropis heterolepis	Blacknose Shiner	S2	T46N R07W	19	1995
Dolomite glade		S3	T46N R08W	25	1999
Mesic limestone/dolomite forest		S3	T46N R08W	36	1999

State Rank codes: S1 (Critically imperiled); S2 (Imperiled) or S3 (Vulnerable). These are tracked due to their rarity and subject to general regulations in the Wildlife Code.

The state tracks many species not listed as endangered, but sufficiently rare or challenged that special efforts to conserve them may be important to their survival and to avoid future listing. We encourage conservation of them if encountered. The Missouri Wildlife Code protects all wildlife species and it includes no special regulatory requirements for these.

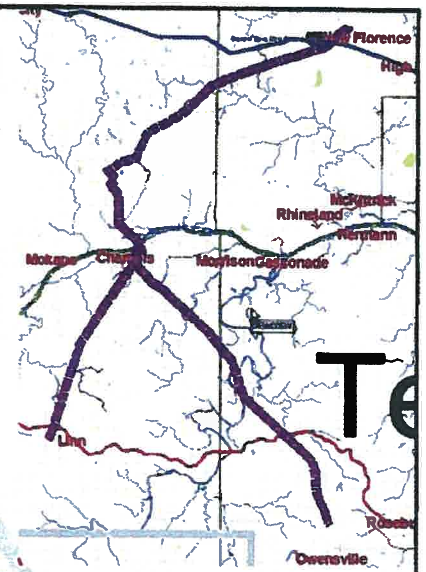
Ongoing coordination: ***This review provides a "snapshot" of natural heritage concerns as we have them recorded today in the vicinity of the plant premises. New species-related concerns may arise as the project matures, and there may be other conservation issues unrelated to at-risk species. Ongoing coordination of environmental issues should be conducted through Doyle Brown in MDC's Policy Coordination Unit (Doyle.Brown@mdc.mo.gov, 573-522-4115 ext. 3355). Issues that may affect public use of the Reform Conservation Area (managed under lease from Ameren) should be coordinated with area manager Jeff Demand (Jeff.Demand@mdc.mo.gov, 573-254-3330).***

General recommendations related to this project or site, or based on information about the historic range of species (unrelated to any specific heritage records):

- Bald eagles (*Haliaeetus leucocephalus*) may nest near streams or water bodies in the project area. Nests are large and fairly easy to identify. While no longer listed as endangered, eagles continue to be protected by the federal government under the Bald and Golden Eagle Protection Act. Work managers should be alert for nesting areas within 1500 meters of project activities, and follow federal guidelines at http://www.fws.gov/migratorybirds/issues/BaldEagle/NationalBaldEagleManagementGuidelines.pdf if eagle nests are seen. See also MDC's best management recommendations at http://mdc.mo.gov/87.
- Callaway County has known karst geologic features (e.g. caves, springs, and sinkholes, all characterized by subterranean water movement). Few karst features are recorded in heritage records, and ones not noted here may be encountered at the project site or affected by the project. Cave fauna (many of which are species of conservation concern) are influenced by changes to water quality, so check your project site for any karst features and make every effort to protect groundwater in the project area. See http://mdc.mo.gov/nathis/caves/manag_construc.htm for best management information.
- Gray bats (*Myotis grisescens*, federally and state listed "endangered") are likely to occur in the project area, as they forage over streams, rivers, and reservoirs in this part of Missouri. Avoid entry or disturbance of any cave inhabited by gray bats and when possible retain forest vegetation along the stream and from the gray bat cave opening to the stream. See http://mdc.mo.gov/104 for best management recommendations.
- The project should be managed to minimize erosion and sedimentation/runoff to nearby streams and lakes, including adherence to any "Clean Water Permit" conditions. Revegetate areas in which the natural cover is disturbed to minimize erosion using native plant species compatible with the local landscape and wildlife needs. Use silt fences and/or vegetative filter strips to buffer streams

and drainages, and monitor those after rain events and until a well-rooted ground cover is reestablished.

- Upstream from the powerline crossing point, the Gasconade River is known to include or to provide habitat suitable for Ozark hellbenders (*cryptobranchus alleganiensis bishopi*, state-listed endangered and candidates for federal listing) or eastern hellbenders (*cryptobranchus alleganiensis alleganiensis,* state-listed endangered). Hellbenders are strictly aquatic salamanders whose well-being is dependent on high-quality water systems with constant levels of dissolved oxygen, temperature, and flow. These unusual animals are in serious decline, and information about best-management is available at http://www.mdc.mo.gov/documents/nathis/endangered/hellbender.pdf. Activities that change physical characteristics of rivers and streams (especially introducing silt loads or destabilizing gravel bars) or alter the flow of water should be avoided.
- Streams in the area should be protected from soil erosion, water pollution and in-stream activities that modify or diminish aquatic habitats. Best management recommendations relating to streams and rivers may be found at http://mdc.mo.gov/79.
- Invasive exotic species are a significant issue for fish, wildlife and agriculture in Missouri. There is a 1999 record of purple loosestrife (*Lythrum salicaria*) in Mollie Dozier Chute, so the species could be encountered, especially in wetland sites, within the project boundaries. This is only one of several dangerous invasives of concern and it should be eliminated if encountered (see http://mdc.mo.gov/9633 and http://mdc.mo.gov/nathis/plantpage/flora/purple/ for more information). Seeds, eggs, and larvae of many invasives may be moved to new sites on boats or construction equipment, so inspect and clean equipment thoroughly before moving between project sites.
  - Remove any mud, soil, trash, plants or animals from equipment before leaving any water body or work area.
  - Drain water from boats and machinery that has operated in water, checking motor cavities, live-well, bilge and transom wells, tracks, buckets, and any other water reservoirs.
  - When possible, wash and rinse equipment thoroughly with hard spray or HOT water (≧104° F, typically available at do-it-yourself carwash sites), and dry in the hot sun before using again.



These recommendations are ones project managers might prudently consider based on a general understanding of species needs and landscape conditions. Heritage records largely reflect only sites visited by specialists in the last 30 years. This means that many privately owned tracts could host unknown remnants of species once but no longer common.

Pre-screen heritage review requests at http://tinyurl.com/heritagereview. A "Level 1 response" will make further submission to MDC or USFWS unnecessary.

Prepared by Shannon Cave, April 26, 2010, Lynn_Callaway_Ameren License Renewal.doc, page 4 of 4

ATTACHMENT D

CULTURAL RESOURCES CORRESPONDENCE

Ameren Services

Environmental Services
314.554.3574 (Phone)
314.554.4182 (Facsimile)
bholderness@ameren.com

One Ameren Plaza
1901 Chouteau Avenue
PO Box 66149
St. Louis, MO 63166-6149
314.621.3222

April 15, 2010

Mr. Mark Miles
Director and Deputy State
Historic Preservation Officer
P.O. Box 176
Jefferson City, MO 6102-0176

Ameren

SUBJECT: Callaway Unit 1 License Renewal
Section 106 review

Dear Mr. Miles:

In late fall of 2011, AmerenUE plans to apply to the U.S. Nuclear Regulatory Commission (NRC) for renewal of the operating license for Callaway Unit 1 in Callaway County, Missouri. The existing operating license for Callaway Unit 1 was initially issued for a 40-year term that will expire in 2024. License renewal would extend the operating period for the plant by 20 years beyond the expiration of the existing license. The NRC requires license application to assess impacts on historic and archaeological resources in accordance with the National Historic Preservation Act.

As part of the license renewal process, AmerenUE is consulting with your office to determine whether there is any concern about the historic and archaeological resources in the area of the Callaway plant. By contacting you early in the application process, we hope to identify any issues that we need to address or any information that we should provide to your office to expedite the NRC consultation.

Enclosed with this letter is the Section 106 Project Information Form (MO 780-1027) and project description for your review.

We would appreciate hearing from you by June 10, 2010, on any concerns you may have about the historic and archaeological resources in the area of the Callaway Unit 1 site and the associated transmission corridors, or alternatively, confirming our conclusion that operation of Callaway Unit 1 over the license renewal term would have no effect on historic and archaeological resources. AmerenUE will include copies of this letter and your response in the Environmental Report that will be submitted to the NRC as part of the Callaway Unit 1 license renewal application.

Please do not hesitate to contact me if there are questions or you need additional information to complete a review of the proposed action.

Sincerely,

Brian F. Holderness
Senior Environmental Health Physicist

Attachments: 1. Section 106 Project Information Form (MO 780-1027)
2. Project Description for Callaway Unit 1 Nuclear Power Plant

MISSOURI DEPARTMENT OF NATURAL RESOURCES
STATE HISTORIC PRESERVATION OFFICE
SECTION 106 PROJECT INFORMATION FORM

Submission of a completed Project Information Form with adequate information and attachments constitutes a request for review pursuant to Section 106 of the National Historic Preservation Act of 1966 (as amended). We reserve the right to request more information. Please refer to the CHECKLIST on Page 2 to ensure that all basic information relevant to the project has been included. For further information, refer to our Web site at: http://www.dnr.state.mo.us/shpo and follow the links to Section 106 Review.

NOTE: Section 106 regulations provide for a 30-day response time by the Missouri State Historic Preservation Office from the date of receipt.

PROJECT NAME
AmerenUE-Callaway Unit 1 License Renewal Application

FEDERAL AGENCY PROVIDING FUNDS, LICENSE, OR PERMIT
U.S. Nuclear Regulatory Commission

APPLICANT
AmerenUE

TELEPHONE

CONTACT PERSON
Andrew Burgess

TELEPHONE
(314) 225-1014

ADDRESS FOR RESPONSE
AmerenUE-Callaway
Junction Hwy CC & Hwy O
PO Box 620, Fulton, MO 65251

LOCATION OF PROJECT

COUNTY: Callaway

STREET ADDRESS: Junction Hwy CC & Hwy O PO Box 620 CITY: Fulton, MO 65251

GIVE LEGAL DESCRIPTION OF PROJECT AREA (TOWNSHIP, RANGE, SECTION, ¼ SECTION, ETC.)

*USGS TOPOGRAPHIC MAP QUADRANGLE NAME: Reform and Mokane East

YEAR: 1985, 1975 TOWNSHIP: T46N RANGE: R7W SECTION: S14

*SEE MAP REQUIREMENTS ON PAGE 2

PROJECT DESCRIPTION

- Describe the overall project in detail. If it involves excavation, indicate how wide, how deep, etc. If the project involves demolition of existing buildings, make that clear. If the project involves rehabilitation, describe the proposed work in detail. Use additional pages if necessary.

Please see Attachment 1.

MO 780-1027 (09-02)

ARCHAEOLOGY (Earthmoving Activities)

Has the ground involved been graded, built on, borrowed, or otherwise disturbed?
- Please describe in detail: (Use additional pages, if necessary.) Photographs are helpful.

Callaway Unit 1 is an existing nuclear power plant. Approximately 2,800-acres of the 7,354-acre site was disturbed during the construction of the plant facilities in the late 1970's and early 1980's.

Will the project require fill material? ☐ Yes ☑ No
- Indicate proposed borrow areas (source of fill material) on topographic map.

Are you aware of archaeological sites on or adjacent to project area? ☑ Yes ☐ No
- If yes, identify them on the topographic map.

STRUCTURES (Rehabilitation, Demolition, Additions to, or Construction near existing structures)

To the best of your knowledge, is the structure located in any of the following?

☐ An Area Previously Surveyed for Historic Properties ☐ A National Register District ☐ A Local Historic District

If yes, please provide the name of the survey or district:

- Please provide photographs of all structures, see photography requirements.
- NOTE: All photographs should be labeled and keyed to one map of the project area.
- Please provide a brief history of the building(s), including construction dates and building uses. (Use additional pages, if necessary)

ADDITIONAL REQUIREMENTS

Map Requirements: Attach a copy of the relevant portion (8½ x 11) of the current USGS 7.5 min. topographic map and, if necessary, a large scale project map. Please do not send an individual map with each structure or site. While an original map is preferable, a good copy is acceptable. USGS 7.5 min. topographic maps may be ordered from Geological Survey and Resource Assessment Division, Department of Natural Resources, 111 Fairground, Rolla, MO 65402, Telephone: (573) 368-2125, or printed from the website http://www.topozone.com.

Photography Requirements: Clear black & white or color photographs on photographic paper (minimum 3" x 5") are acceptable. Polaroids, photocopies, emailed, or faxed photographs are not acceptable. **Good quality photographs are important for expeditious project review.** Photographs of neighboring or nearby buildings are also helpful. All photographs should be labeled and keyed to one map of the project area.

CHECKLIST: Did you provide the following information?

☑ Topographic map 7.5 min. (per project, not structure)

☑ Thorough description (all projects)

☑ Photographs (all structures)

☑ Other supporting documents (If necessary to explain the project)

☐ For new construction, rehabilitations, etc., attach work write-ups, plans, drawings, etc.

☑ Is topographic map identified by quadrangle and year?

Return this Form and Attachments to:

MISSOURI DEPARTMENT OF NATURAL RESOURCES
STATE HISTORIC PRESERVATION OFFICE
Attn: Section 106 Review
P.O. BOX 176
JEFFERSON CITY, MISSOURI 65102-0176

MO 780-1027 (09-02)

Project Description
for Callaway Unit 1 Nuclear Power Plant

Description of the Proposed Undertaking

The proposed undertaking under consideration by the Nuclear Regulatory Commission (NRC) is whether to renew the license for continued operation and maintenance of the existing AmerenUE-Callaway Unit 1 Nuclear Power Plant. The license term would be an additional 20 years. Continued operation and maintenance of Callaway Unit 1 and its associated infrastructure would not involve any license-related construction, demolition, or refurbishment activities. Routine operation and maintenance activities would continue to occur as they have since the plant started operations in 1984. All such activities would occur in areas previously disturbed through original plant construction activities.

Description of Callaway Unit 1 and Associated Infrastructure

Callaway Unit 1 is situated on approximately 7,354 acres in Callaway County, approximately 10 miles southeast of Fulton, Missouri and 80 miles west of the St. Louis metropolitan area (Figures 1 and 2).

The Callaway plant exclusion boundary encloses approximately 2,765 acres. The site area contains the major power generation facilities, including the containment building and related structures, a natural draft cooling tower, a switchyard, a retention pond and cooling tower, a water treatment plant, administration buildings, warehouses, and other important features (Figure 3). There is also a 2,135-acre corridor area containing the intake and blowdown pipelines between the plant and the river intake structure. Finally, there is a peripheral area of 2,454 acres that is not used for power generation. Of the total 7,354 acres, AmerenUE has made available 6,300 acres for public access under agreement with the Missouri Department of Conservation. This is the Reform Conservation Area, which is managed by the Department of Conservation.

Existing infrastructure associated with operation of Callaway Unit 1 includes transmission lines and intake/discharge systems.

There are four transmission lines serving Callaway Unit 1 (Figure 4):

Montgomery #1 and #2 – These two 345-kilovolt lines extend northeast for approximately 11.9 miles in a 200-foot corridor and then turn more easterly for 11.3 miles to join with a corridor containing a 161-kilovolt line. The Montgomery share of the joint corridor is 150 feet. The overall length is 23.2 miles.

Bland – This 345-kilovolt line extends south for approximately 6.7 miles in a 200-foot corridor on double circuit towers shared with the Loose Creek line. It then continues for 2.5 miles in an unshared 200-foot corridor before joining a corridor shared by a 161 kilovolt line for 17.4 miles. The Bland share of the joint corridor is 150 feet. The line completes its 31.5-mile course with a 4.9-mile, 200-foot wide corridor into the Bland Substation. This final corridor is unshared with any other line.

Loose Creek – This 345-kilovolt line extends south for approximately 6.7 miles in a 200-foot corridor on double circuit towers shared with the Bland line. It then continues for 16.6 miles in a separate, 200-foot wide corridor into the Bland Substation. After diverging from the Bland line, the Loose Creek line is installed on wooden H-frame towers. The overall length is 23.3 miles.

In total, the transmission lines of interest are contained in approximately 71 miles of corridor occupying approximately 1,555 acres. The corridors pass through land that is primarily forest and farmland. The areas are mostly remote, with low population densities. The lines cross numerous county, state and U.S. highways as well as the Missouri and Gasconade Rivers. Corridors that pass through farmland generally continue to be used as farmland.

The cooling system for Callaway Unit 1 uses water from the Missouri River. Water is pumped to the plant through an underground 5.5-mile intake pipeline. Water is returned to the river through a 5.5-mile long discharge pipeline that shares the intake pipeline corridor (Figure 3).

Previous Cultural Resource Studies and Compliance

Union Electric Company (UEC) conducted an archaeological reconnaissance survey of proposed construction areas during preparation of the Final Environmental Statement (FES) for construction of the Callaway Unit 1 (Evans and Ives 1973). This survey included the plant site, as well as, the heavy haul road and railroad spur. Two archaeological sites were identified, but only one, site number 23CY20, was determined to be significant. Located on a terrace above Logan Creek, this site is a habitation and mound site, dating to Paleoindian through Late Woodland and possibly Mississippian periods. The site was recommended by the surveyors as significant due to the presence of intact subsurface archaeological deposits. This site is located adjacent to the then-proposed road and railroad spur. In the FES, the NRC states that the applicant stated that precaution would be used to preserve this resource, and thus the NRC concluded that the site would not be subject to significant impacts from construction of the plant or plant access (Rogers and Brown 2007). UEC commissioned archaeological testing of the site, which identified few subsurface remains located within the railroad corridor, and determined that construction of the railroad would not impact the site (Evans and Ives 1979c).

Since the publication of the FES, surveys have been conducted for additional construction areas. These areas include the intake structure, discharge pipeline, crossing of Logan Creek by the intake/discharge pipelines, and the barge dock facility (Evans 1977a). No additional historical or archaeological sites have been identified. Transmission line corridors have also been surveyed, including the Callaway-Bland line corridor (Evans 1977a; Evans and Ives 1979a; and Evans 1979b) and Callaway-Montgomery line corridor (Evans and Ives 1978), and no historical or archaeological sites have been identified.

During preparation of the FES for the operation phase (OP) of Callaway Unit 1, the NRC visited the Callaway Plant and recommended additional surveys of areas that would be impacted by operation and maintenance of the plant, and preparation of a cultural resource management plan in consultation with the Missouri Division of Parks and Historic

Preservation. The FES-OP concludes that with implementation of the plan, impacts to important sites from operation and maintenance of the Callaway Unit 1 will be avoided or mitigated (Traver 1985).

In 1981, UEC conducted a systematic Phase I survey of residual lands, lands outside of the exclusion boundary, at the Callaway Plant site (Ray et al 1984). This survey covered 5,848 acres, acreage that is managed by the Missouri Department of Conservation, plus some select areas that were planned for direct impacts. The survey identified 129 sites, of which 79 were prehistoric, 29 historic, and 21 historic architectural. Twenty-three of the prehistoric sites were recommended as potentially eligible for listing on the National Register of Historic Places, and 2 of the historic sites were recommended as potentially eligible. None of the historic architectural was considered potentially eligible. This Phase I survey effort included extensive background research, including research of General Land Office surveyor notes and plats, land records, journals, census records, county histories and atlases, and interviews with past residents of the study area. Fieldwork included pedestrian survey with shovel testing along parallel transects, and systematic survey of chert resources.

Prehistoric resources identified during this Phase I survey included limited activity sites, small habitations or field camps, large habitations or villages, and mound sites, and were located in all ecological zones in the study area. Historic resources included habitations, discard/dump areas, outbuildings, and cemeteries, and were generally located in the forested areas or at the edge of the upland prairies. Farmsteads were located throughout the plant site. Standing architecture was located in the southern "neck" of the study area near Logan Creek and in the northern and western portions of the upland prairie. Architecture included log and frame houses, garages, privies, cellars, cisterns, barns, sheds, and various other outbuildings. The prehistoric sites spanned the Paleoindian through Mississippian periods. The time period 1541 through 1830 was not represented in the historic sites, due to permanent settlement of the region not occurring until 1818. However, 1830 through the present was represented in the historic sites and architecture.

Three archaeological sites underwent Phase II archaeological testing because they were recommended as potentially eligible during the Phase I survey and were located within the operations and maintenance zone (Traver 1985). These sites included 23CY20, -352, and -359. All three sites were recommended as eligible for listing on the National Register and nomination forms were prepared.

In 2007, archaeological survey was conducted Pipeline in the corridor for installation of a new discharge pipeline from the plant – no archaeological materials were identified (Rogers and Brown 2007). Also, studies were conducted on a parcel located between the Missouri River channel and the AmerenUE property boundary for installation of test wells (Rogers 2007) in association with preparation of a Combined Operating License Application for a proposed second unit (Unit 2) at the Callaway Plant site. One area was determined to have possible remains of a shipwreck and was recommended for avoidance.

Finally, a Phase I survey was conducted of a corridor proposed for an access road and pipeline and a second corridor for a transmission line (Brown and Garrow 2009) as part of the Unit 2 Combined Operation License Application. The survey included deep testing at the crossing

of Logan Creek, which did not identify any archaeological materials; electromagnetic conductivity investigations near the river channel, which did not identify any shipwrecks; and pedestrian survey with shovel testing at 15 meter intervals along two segments of the transmission line corridor. Four archaeological sites were identified in this corridor. Three of the sites are small, ephemeral lithic reduction areas, and are recommended as not eligible for the National Register. The fourth site (site number 23OS1246) is a deeply buried, intact prehistoric deposit located off the plant property. This site is recommended as eligible for the National Register and is planned for avoidance.

Designated Resources Near Callaway Unit 1

As of February 2010, the National Register of Historic Places listed 19 properties in Callaway County (NPS 2010a). Most of them are located in Fulton, over six miles northwest of the Callaway site. Of the 19 listed properties, two properties are located with six miles of the Callaway Plant (Table 1). One of the sites, Arnold Research Cave (site number 23CY64), is also a National Historic Landmark (NPS 2010b).

Table 1: Properties listed in the National Register of Historic Places that fall with a six-mile radius of the Callaway Plant

Property	Location
Arnold Research Cave (23CY64)	East of Callaway
Mealy Mounds Archeological Site	Approx. 5 to 6 miles southwest of Callaway

Assessment of Effect of Current Operations and License Renewal

UEC prepared a cultural resource management plan for the Callaway Unit 1 in 1983 (AmerenUE 2006). In 1992, the plan was revised because National Historic Preservation Act regulations had changed. The plan was revised, again, in 2006, due to landownership changes to some parcels. Based on the Phase I and Phase II archaeological studies conducted at Callaway, three prehistoric sites are considered eligible for the National Register; 20 prehistoric sites and 2 historic sites are considered potentially eligible for the National Register; and the remaining 104 prehistoric and historic archaeological sites and architectural resources are considered not eligible for listing on the National Register. None of these sites are located within the exclusion boundary.

Two of the eligible archaeological sites are located in transmission line corridors. The third eligible site (23CY20) is located adjacent to an abandoned railroad spur. This site has been fenced, and activity (including vehicular traffic) is prohibited within the fence, with the exception of routine grass maintenance. In accordance with the cultural resource management plan, no activities are allowed on the three eligible sites (AmerenUE 2006). The 22 potentially eligible sites are protected from adverse impact by placement of a conservation protection boundary zone, ranging from 50 meters to 100 meters, around each site. Limited agriculture can continue at those sites already being used for agricultural purposes, including shallow discing to sow grass seed and grazing. Land altering activities are not allowed on potentially eligible sites (AmerenUE 2006). Agriculture, such as growing corn, wheat or soybeans, is allowed in the areas of the ineligible sites; however, AmerenUE would consult

with the State Historic Preservation Officer (SHPO) regarding these sites, should project activities be proposed that could impact them.

In accordance with Callaway Unit 1 procedures, any new construction or change in procedures requires an assessment of whether there will be a physical change to site grounds or any excavation of AmerenUE property. If the result of the assessment includes either of these activities, then a Final Environmental Evaluation is required. This evaluation includes a full evaluation of potential cultural resources impacts. If it is determined that any cultural resource could be impacted, regardless of previous eligibility recommendations, then the proposed project is altered to avoid the impact or SHPO is contacted for consultation prior to implementation of the proposed project (AmerenUE 2006). If artifacts or cultural features are encountered during construction projects, supervisors are instructed to notify the Ameren Environmental Services Department immediately. These procedures have been formalized through incorporation into AmerenUE's *Excavation Construction and Safety Standards* procedure (AmerenUE 2010).

The Missouri Department of Conservation has been notified that recreational activities must be planned to minimize opportunities for vandalism, looting, or uninformed collecting by not directing attention to potentially significant cultural resources (AmerenUE 2006). The Department is also required to submit all plans for any land disturbing activities to AmerenUE for review prior to implementation.

AmerenUE concludes that there would be no effect to historic properties from license renewal and associated operation and maintenance activities.

References

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Evans David R. 1977a. Letter to John K. Bryan, Union Electric Company, Subject: Archaeological Survey of Four Areas at the Callaway Plant. June 27, 1977.

Evans David R. 1977b. Letter to John K. Bryan, Union Electric Company, Subject: Archaeological Survey Callaway-Bland Transmission Line, Callaway Plant. June 28, 1977.

Evans, David R., and David J. Ives. 1978. A Cultural resources Survey of the Proposed Union Electric Company Electric 345 kV Transmission Line Right-of–Way, Callaway and Montgomery Counties, Missouri. March 1978.

Evans, David R., and David J. Ives. 1979a. A Cultural Resources Survey of the Proposed Union Electric Company Electric 345 kV Transmission Line Right-of-Way, Gasconade and Osage Counties, Missouri. June 1979.

Evans, David R. 1979b. A Cultural Resources Survey of the Proposed Bland Substation Site, Gasconade County, Missouri. June 1979.

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Ray, Jack H., Edward M. Martin, Michael J. McNerney, and Gail White. 1984. Final Draft Report: A Phase I Cultural Resources Survey and Assessment on Residual Lands at Union Electric Company's Callaway Nuclear Power Plant, Callaway County, Missouri. American resources Group, Ltd., Carbondale, Illinois. Cultural resources Management Report #52. April 1984.

Rogers, LaDonna A., and J. Emmett Brown. 2007. Management Summary: Phase I Archaeological Survey, Blowdown Discharge Pipeline, Callaway County, Missouri. MACTEC Engineering and Consulting Inc., Knoxville, Tennessee. Project 3250-07-5219. August 30, 2007.

Rogers, LaDonna A. 2007. Letter to Melissa Dubinsky, Rizzo Associates, Inc., Subject: Letter Report of Cultural Resources Monitoring, Installation of Test Wells, Callaway Nuclear Power Facility, Callaway County, Missouri. MACTEC Engineering and Consulting, inc., Knoxville, Tennessee. Project 3250-07-5219. September 4, 2007.

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National Park Service. 2010b. Properties in Callaway County, MO, Listed on the National Register of Historic Places. National Register Information System. Available at http://nrhp.focus.nps.gov/natregadvancedsearch.do.

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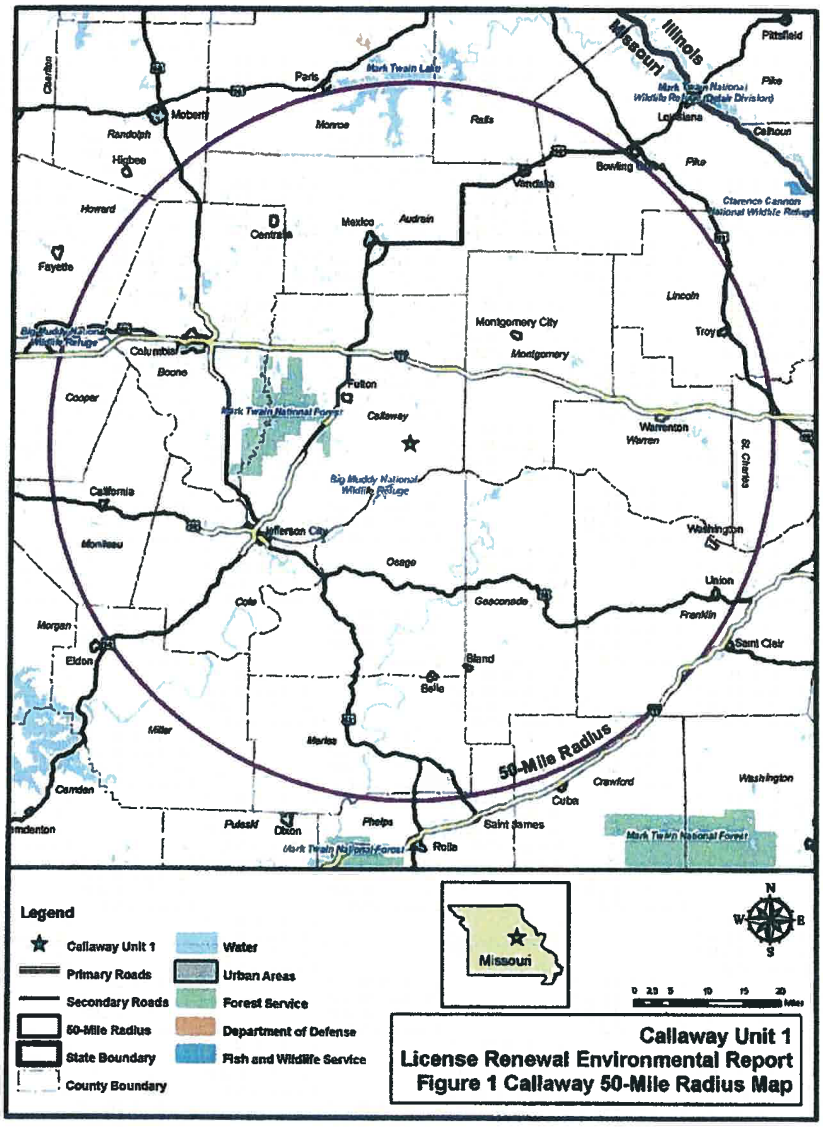
Missouri
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Mark Twain Lake
Paris
Monroe
Ralls
Pike
Calhoun
Randolph
Moberly
Higbee
Howard
Fayette
Centralia
Mexico
Audrain
Vandalia
Clarence Cannon National Wildlife Refuge
Lincoln
Troy
Montgomery City
Montgomery
Columbia
Boone
Cooper
Fulton
Callaway
Mark Twain National Forest
Warrenton
Warren
St Charles
Big Muddy National Wildlife Refuge
California
Jefferson City
Moniteau
Osage
Washington
Union
Franklin
Gasconade
Cole
Morgan
Eldon
Saint Clair
Bland
Belle
Miller
Maries
50-Mile Radius
Crawford
Washington
Camden
Cuba
Phelps
Saint James
Rolla
Dixon
Pulaski
Mark Twain National Forest
Legend
Callaway Unit 1
Primary Roads
Secondary Roads
50-Mile Radius
State Boundary
County Boundary
Water
Urban Areas
Forest Service
Department of Defense
Fish and Wildlife Service
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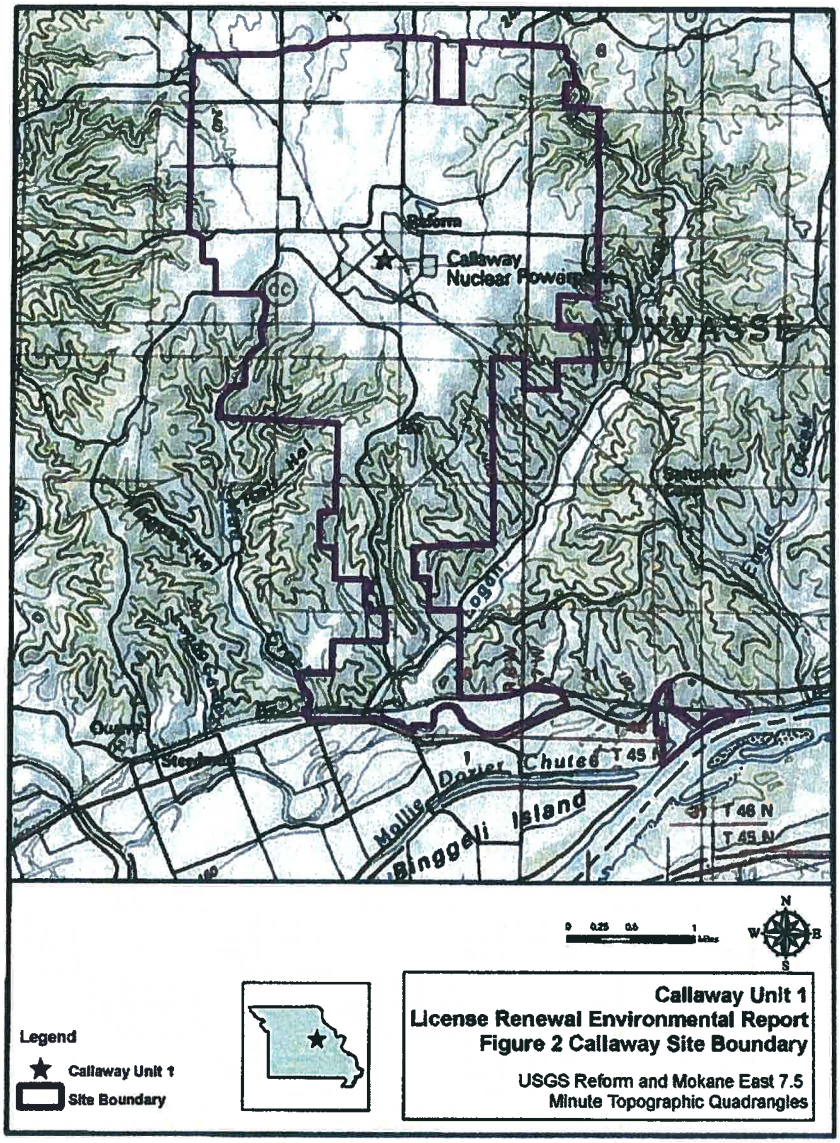
Callaway Unit 1
License Renewal Environmental Report
Figure 1 Callaway 50-Mile Radius Map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Site Boundary
Callaway Unit 1
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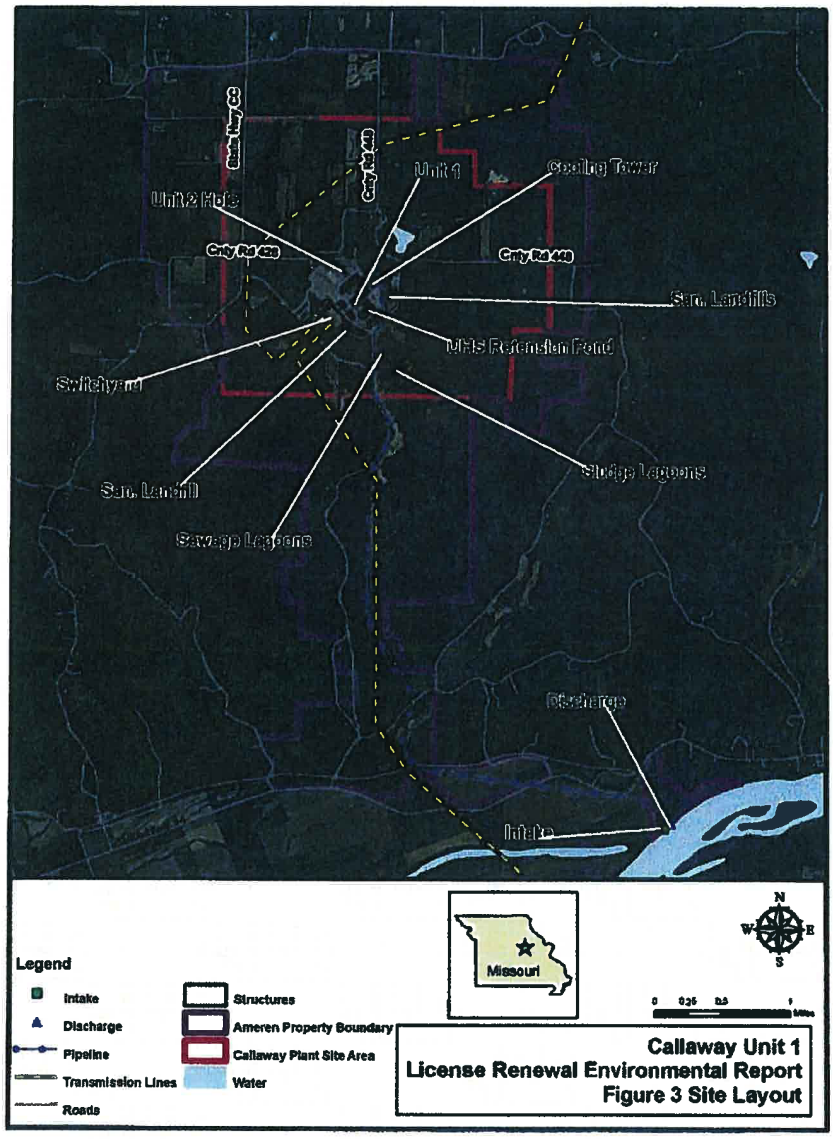
Figure 2 Callaway Site Boundary
USGS Reform and Mokane East 7.5
Minute Topographic Quadrangles


Unit 1
Cooling Tower
Unit 2 Site
San. Landfills
UHS Retension Pond
Switchyard
Sludge Lagoons
San. Landfill
Sewage Lagoons
Discharge
Intake
Legend
Intake
Discharge
Pipeline
Transmission Lines
Roads
Structures
Ameren Property Boundary
Callaway Plant Site Area
Water
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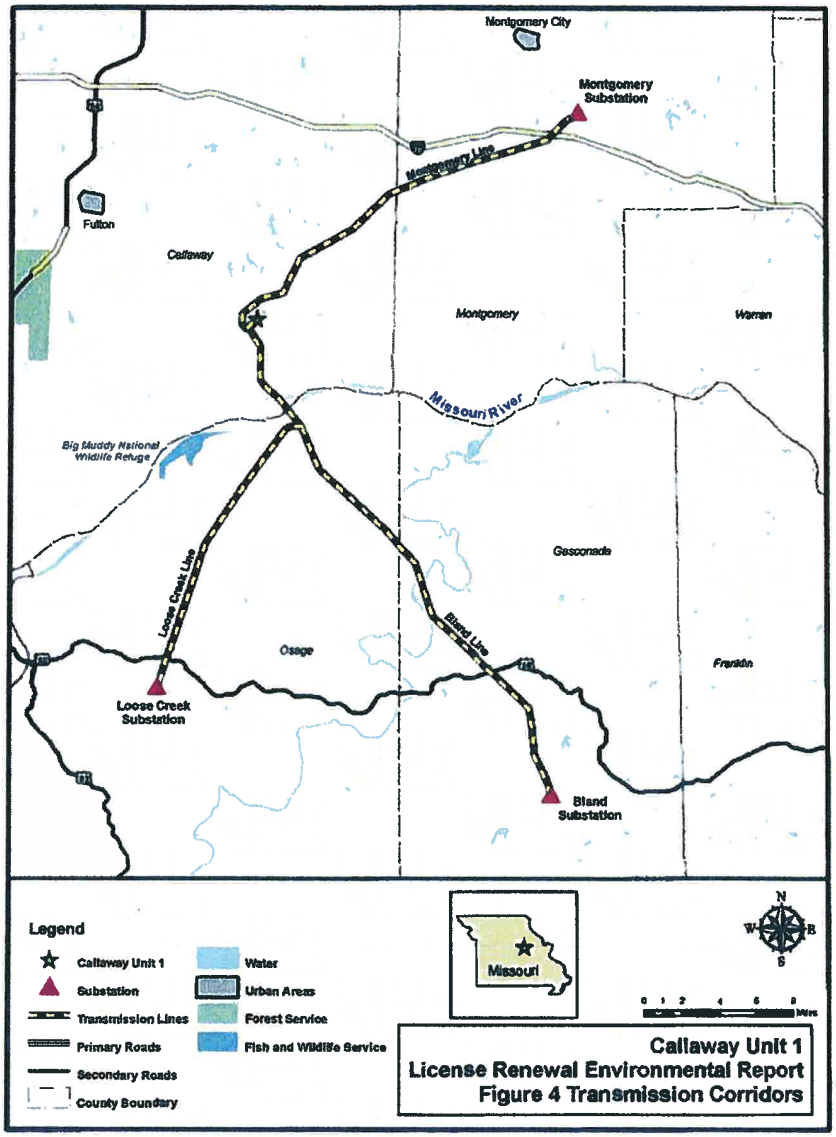
Callaway Unit 1
License Renewal Environmental Report
Figure 3 Site Layout


Montgomery City
Montgomery Substation
Montgomery Line
Fulton
Callaway
Montgomery
Warren
Missouri River
Big Muddy National Wildlife Refuge
Gasconade
Loose Creek Line
Bland Line
Osage
Franklin
Loose Creek Substation
Bland Substation
Legend
Callaway Unit 1
Substation
Transmission Lines
Primary Roads
Secondary Roads
County Boundary
Water
Urban Areas
Forest Service
Fish and Wildlife Service
Missouri
N
W
E
S
Callaway Unit 1
License Renewal Environmental Report
Figure 4 Transmission Corridors

bcc: Andrew Burgess (CA-460)
JCP/BFH
File WQ 3.1.6

STATE OF MISSOURI
Jeremiah W. (Jay) Nixon, Governor • Mark N. Templeton, Director
DEPARTMENT OF NATURAL RESOURCES
www.dnr.mo.gov

May 12, 2010

Brian F. Holderness
Senior Environmental Health Physicist
Ameren UE
P.O. Box 66149
St. Louis, Missouri 63166-6149

Re: Callaway Unit 1 License Renewal (NRC) Callaway County, Missouri

Dear Mr. Holderness:

Thank you for submitting information about the above referenced project for our review pursuant to Section 106 of the National Historic Preservation Act (P.L. 89-665) and the Advisory Council on Historic Preservation's regulation 36 CFR Part 800, which require identification and evaluation of cultural resources.

We have reviewed the information provided concerning the above referenced project. We have determined that the renewal of the operating permit for the Callaway Unit No. 1 will have **no adverse effect** on the archaeological sites that had previously been determined eligible for inclusion in the National Register of Historic Places, with the condition that the provisions of the cultural resources plan are complied with, and that the plan continues to be updated.

Please be advised that, should project plans change, information documenting the revisions should be submitted to this office for further review and comment on possible effects to historic properties. In the event that cultural materials are encountered during project activities, all construction should be halted, and this office notified as soon as possible in order to determine the appropriate course of action.

If you have any questions, please write Judith Deel at State Historic Preservation Office, P.O. Box 176, Jefferson City, Missouri 65102 or call 573/751-7862. Please be sure to include the SHPO Log Number **(008-CY-10)** on all future correspondence or inquiries relating to this project.

Sincerely,

STATE HISTORIC PRESERVATION OFFICE

Mark A. Miles
Director and Deputy
State Historic Preservation Officer

MAM:jd

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