8.0 Environmental Impacts of Alternatives to Operating-License Renewal

This chapter examines the potential environmental impacts associated with denying the renewal of the operating license (OL) (i.e., the no-action alternative), the potential environmental impacts from electricity-generating sources other than Fort Calhoun Station, Unit 1, the possibility of purchasing electric power from other sources to replace power generated by Fort Calhoun Station, Unit 1 and the associated environmental impacts, the potential environmental impacts from a combination of generating and conservation measures, and other generation alternatives that were deemed unsuitable for replacement of the power generated by Fort Calhoun Station, Unit 1. The environmental impacts are evaluated using the U.S. Nuclear Regulatory Commission's (NRC's) three-level standard of significance—SMALL, MODERATE, or LARGE—developed using the Council on Environmental Quality guidelines and set forth in a footnote to Table B-1 of 10 CFR Part 51, Subpart A, Appendix B:

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, important attributes of the resource.

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

The impact categories evaluated in this chapter are the same as those used in the *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS) NUREG-1437, Volumes 1 and 2 (NRC 1996; 1999),[(a)] with the additional impact category of environmental justice.

8.1 No-Action Alternative

The NRC's regulations implementing the National Environmental Policy Act (NEPA) specify that the no-action alternative be discussed in an NRC environmental impact statement (EIS) (10 CFR Part 51, Subpart A, Appendix A(4)). For license renewal, the no-action alternative refers to a scenario in which the NRC would not renew the Fort Calhoun Station, Unit 1 OL, and the Omaha Public Power District (OPPD) would then decommission Fort Calhoun Station,

(a) The GEIS was originally issued in 1996. Addendum 1 to the GEIS was issued in 1999. Hereafter, all references to the "GEIS" include the GEIS and its Addendum 1.

Unit 1 when plant operations cease. Replacement of Fort Calhoun Station, Unit 1 electricity-generating capacity would be met by (1) demand-side management (DSM) and energy conservation, (2) power purchased from other electricity providers, (3) generating alternatives other than Fort Calhoun Station, Unit 1, or (4) some combination of these options. The OPPD will be required to comply with NRC decommissioning requirements whether or not the OL is renewed. If the Fort Calhoun Station, Unit 1 OL is renewed, decommissioning activities may be postponed for up to an additional 20 years. If the OL is not renewed, the OPPD would conduct decommissioning activities according to the requirements in 10 CFR 50.82.

The environmental impacts associated with decommissioning under both license renewal and the no-action alternative would be bounded by the discussion of impacts in Chapter 7 of the GEIS, Chapter 7 of this supplemental environmental impact statement (SEIS), and the *Final Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities*, *Supplement 1, Regarding the Decommissioning of Nuclear Power Reactors,* NUREG-0586, dated November 2002. The impacts of decommissioning after 60 years of operation are not expected to be significantly different from those occurring after 40 years of operation.

The environmental impacts for the socioeconomic, historic-and-archaeological-resources, and environmental-justice impact categories are summarized in Table 8-1 and are discussed in the following paragraphs.

Table 8-1. Summary of Environmental Impacts of the No-Action Alternative

Impact Category	Impact	Comment
Socioeconomic	SMALL TO MODERATE	SMALL, if growth projections for the Omaha Metropolitan Statistical Area materialize. MODERATE, if not offset by normal growth. In lieu tax payments would continue.
Historic and Archaeological Resources	SMALL	Disturbance of the Fort Calhoun site due to decommissioning will likely be confined to the site operational area and impacts on cultural, historic, and archaeological resources would not be considered detectable or destabilizing. Significant ground disturbance outside the site operational area would require consultation with the State Historic Preservation Office (SHPO).
Environmental Justice	SMALL	Very few minority/low-income persons live in the immediate vicinity of Fort Calhoun Station. Economic offset due to the general size and availability of other employment opportunities in the region.

- Socioeconomic. When Fort Calhoun Station, Unit 1 ceases operation, there will be a decrease in employment associated with the closure. These impacts would be most concentrated in Washington County, with smaller impacts in Douglas and Sarpy counties and much smaller impacts in other counties. Most secondary employment impacts and impacts on population would also be concentrated in Washington, Douglas, and Sarpy counties. Approximately 86 percent of the employees who work at Fort Calhoun Station, Unit 1 live in Washington, Douglas, or Sarpy counties, and the remainder live in other locations (OPPD 2002). The extent of impacts on the Omaha Metropolitan Statistical Area (MSA) will depend to some degree on the extent to which economic and population growth projected for the Omaha MSA materializes (Bureau of Business Research 1999).

  The OPPD is considered a political subdivision responsible for the production and distribution of electricity within its 13-county service area (OPPD 2002). The OPPD is exempt from paying State-occupational, personal-property, and real-estate taxes. Instead, the OPPD makes six payments in lieu of taxes each year to the municipalities and 12 Nebraska counties in which the OPPD sold power in 1957. In addition, each county receives 5 percent of the total gross revenues the OPPD receives from electricity sales within the county, irrespective of whether the power is purchased from another generator or produced at OPPD power plants. The counties and municipalities then distribute the money to the appropriate cities, school districts, and agencies. Closure of Fort Calhoun Station, Unit 1 will not have an impact on these payments.

  Most of the revenue losses that would result from the closure of Fort Calhoun Station, Unit 1 would occur as a result of the loss of the plant payroll. The no-action alternative may result in the loss of plant payrolls 20 years earlier than if the OL were renewed.

  There would be some adverse impacts on local housing values; the local economy in Omaha MSA; and employment in Washington, Douglas, and Sarpy counties if Fort Calhoun Station, Unit 1 were to cease operations. Other employers may be able to absorb the OPPD staff, but it is unlikely that these employers will be able to pay the same average salary.

  OPPD employees working at Fort Calhoun Station, Unit 1 currently contribute time and money toward community involvement, including schools, churches, charities, and other civic activities. It is likely that with a reduced presence in the community following permanent cessation of operations, the OPPD's community-involvement efforts in the region would be reduced.

  If normal economic growth continues in Washington, Douglas, and Sarpy counties, the socioeconomic consequences of nonrenewal of the OL could be partially or entirely offset by the new jobs created by such growth. What is not known is the types of jobs, pay scales,

and locations of the future employment increases. If some of the new jobs are skilled, higher-paying jobs, then the impacts of nonrenewal of the Fort Calhoun Station, Unit 1 OL could be significantly mitigated, and the socioeconomic consequence of closure would be SMALL. If not offset by normal growth, impacts would be MODERATE.

- Historic and Archaeological Resources. The potential for adverse impacts to archaeological and cultural resources at Fort Calhoun Station during site decommissioning will likely not be detectable or destabilizing. The staff has determined (NRC 2002) that activities that result in ground disturbances occurring during decommissioning and within the site operational area would result in a SMALL impact to historic and archaeological resources. The operational area is defined as that portion of the plant site where most or all of the site activities occur, such as reactor operations, materials and equipment storage, parking, substation operations, and facility service and maintenance. This includes all areas within the protected-area fence, the intake and discharge structures, the cooling system, and other site structures, as well as associated paved, graveled, and maintained landscaped areas.

  If ground disturbance beyond the Fort Calhoun operational area is planned for decommissioning, the impacts may or may not be detectable or destabilizing, depending on site-specific factors and the licensee's plans for decommissioning. Before the licensee conducts any decommissioning activities that might result in the disturbance of historic or archaeological resources outside the site operational area, consultation with the appropriate SHPO to evaluate potential impacts will occur. Following license termination it is expected that OPPD or the successive owners of the Fort Calhoun site will comply with the requirements of the National Historic Preservation Act of 1966 as amended (16 USC 470 et seq.) thereby minimizing the impacts to site historic and archaeological resources. Therefore, the overall impact of the no-action alternative on historic and archaeological resources is considered SMALL.

- Environmental Justice. Current operations at Fort Calhoun Station, Unit 1 have no disproportionate impacts on the minority and low-income populations of the surrounding counties, and no environmental pathways have been identified that would cause disproportionate impacts. Closure of Fort Calhoun Station, Unit 1 would result in decreased employment opportunities and possible negative and disproportionate impacts on minority and low-income populations. Because Fort Calhoun Station is located in a relatively high-population area with extensive employment opportunities, these effects are likely to be offset by projected growth in the local economy so that the impacts of closure on minority and low-income populations would be mitigated, regardless of whether the created jobs are low- or high-paying jobs. The environmental-justice impacts under the no-action alternative are considered SMALL.

Impacts for all other impact categories would be SMALL, as shown in Table 9-1. In some cases, impacts associated with the no-action alternative would be positive. For example, closure of Fort Calhoun Station would eliminate any impingement and entrainment of fish and shellfish and would also eliminate any negative impacts resulting from thermal discharges.

8.2 Alternative Energy Sources

This section discusses the environmental impacts associated with alternative sources of electric power to replace the power generated by Fort Calhoun Station, Unit 1, assuming that the OL for Unit 1 is not renewed. The order of presentation of alternative energy sources in Section 8.2 does not imply which alternative would be most likely to occur or to have the least environmental impacts. The following generation alternatives are considered in detail:

- coal-fired generation at Fort Calhoun Station and at an alternate site (Section 8.2.1)
- natural-gas-fired generation at Fort Calhoun Station and at an alternate site (Section 8.2.2)
- nuclear generation at Fort Calhoun Station and at an alternate site (Section 8.2.3)

The alternative of purchasing power from other sources to replace power generated at Fort Calhoun Station, Unit 1 is discussed in Section 8.2.4. Other power-generation alternatives and conservation alternatives considered by the staff and found not to be reasonable replacements for Fort Calhoun Station, Unit 1 are discussed in Section 8.2.5. Section 8.2.6 discusses the environmental impacts of a combination of generation and conservation alternatives.

Coal- and natural-gas-fired generation at greenfield sites are not considered, as the applicant has identified existing sites for coal-fired (Nebraska City site) and natural-gas-fired (Cass County site) generation. Development of generation capacity at the greenfield sites would have greater impacts than developing these existing sites. Therefore, the staff did not discuss the environmental impacts at greenfield sites for coal or natural gas alternatives. However, for nuclear generation, the alternative was a greenfield site.

Each year, the Energy Information Administration (EIA), a component of the U.S. Department of Energy (DOE), issues an Annual Energy Outlook. The *Annual Energy Outlook 2002 with Projections to 2020* was issued in December 2001 (DOE/EIA 2001a). In this report, the EIA projects that combined-cycle[(a)] or combustion-turbine technology fueled by natural gas is likely

(a) In the combined-cycle unit, hot combustion gases in a combustion turbine rotate the turbine to generate electricity. Waste combustion heat from the combustion turbine is routed through a heat-recovery boiler to make steam to generate additional electricity.

to account for approximately 88 percent of new electricity-generating capacity through the year 2020 (DOE/EIA 2001a). Both technologies are designed primarily to supply peak and intermediate capacity, but combined-cycle technology can also be used to meet base-load[(a)] requirements. Coal-fired plants are projected by the EIA to account for approximately 9 percent of new capacity during this period. Coal-fired plants are generally used to meet base-load requirements. Renewable energy sources, primarily wind, geothermal, and municipal solid-waste units, are projected by the EIA to account for the remaining 3 percent of capacity additions. The EIA's projections are based on the assumption that providers of new generating capacity will seek to minimize cost while meeting applicable environmental requirements. Combined-cycle plants are projected by the EIA to have the lowest generation cost in 2005 and 2020, followed by coal-fired plants and then wind generation (DOE/EIA 2001a).

The EIA projects that oil-fired plants will account for very little new generation capacity in the United States through the year 2020 because of higher fuel costs and lower efficiencies (DOE/EIA 2001a). However, oil as a backup fuel to natural-gas-fired generation (combined cycle) is considered.

The EIA also projects that new nuclear power plants will not account for any new generation capacity in the United States through the year 2020 because natural-gas- and coal-fired plants are projected to be more economical (DOE/EIA 2001a). However, there has been an increased interest in constructing new nuclear power facilities, as evidenced by the recent certification of three standard nuclear power plant designs and the recent activities involving the review of other plant designs and potential sites. Therefore, despite the EIA projection, a new nuclear plant alternative for replacing power generated by the OPPD is considered in this SEIS.

8.2.1 Coal-Fired Generation

The coal-fired alternative is analyzed for Fort Calhoun Station and an alternate site in Nebraska City, Nebraska. The Nebraska City site consists of 642 ha (1587 ac) on river bottomlands bordering the Missouri River in rural Otoe County, Nebraska, approximately 8 km (5 mi) southeast of Nebraska City, Nebraska. The western boundary of the site borders a dedicated rail line. A major 345-kV transmission north-south intertie and a 161-kV transmission line connect through the Nebraska City substation. The OPPD estimates that approximately 121 km (75 mi) of new transmission line may be required.

(a) A base-load plant normally operates to supply all or part of the minimum continuous load of a system and consequently produces electricity at an essentially constant rate. Nuclear power plants are commonly used for base-load generation; that is, these units generally run near full load.

Although the NRC pointed out that siting a new coal-fired plant where an existing nuclear plant is located would reduce many construction impacts (NRC 1996), the OPPD has already licensed and built a coal plant at its Nebraska City location. The site was originally planned as a multiunit coal site.

The staff assumes construction of one standard 500-MW(e) unit[(a)] as a potential replacement for Fort Calhoun Station, Unit 1, which is consistent with the OPPD's ER (OPPD 2002). Unless otherwise indicated, the assumptions and numerical values used in Section 8.2.1 are from the OPPD ER (OPPD 2002). The staff reviewed this information and compared it to environmental-impact information in the GEIS. Although the OL renewal period is only 20 years, the impact of operating the coal-fired alternative for 40 years is considered (as a reasonable projection of the operating life of a coal-fired plant).

The coal-fired plant would consume approximately 1,900,000 MT (2,061,000 tons) per year of pulverized subbituminous coal with an ash content of approximately 6 percent (OPPD 2002). The OPPD assumes a heat rate[(b)] of 10,000 Btu/kWh and a capacity factor[(c)] of 0.8 in its ER (OPPD 2002). After combustion, approximately 66,600 MT (74,000 tons) would be collected and disposed of at the plant site; the remaining ash would be recycled. In addition, approximately 32,500 MT (36,000 tons) of scrubber sludge would be disposed of at the plant site.

For purposes of this SEIS, the staff assumed a coal-fired plant could use either a closed-cycle or a once-through cooling system, which are discussed in the following sections.

8.2.1.1 Once-Through Cooling System

The overall impacts of the coal-fired generating system using a once-through cooling system are discussed in this section and are summarized in Table 8-2.

(a) The coal-fired units would have a rating of 500 gross MW and 475 net MW. The difference between "gross" and "net" is the electricity consumed onsite.
(b) Heat rate is a measure of generating station thermal efficiency. It is generally expressed in British thermal units (Btu) per net kilowatt-hour (kWh). It is computed by dividing the total Btu content of fuel burned for electricity generation by the resulting net kWh generation.
(c) The capacity factor is the ratio of electricity generated, for the period of time considered, to the energy that could have been generated at continuous full-power operation during the same period.

Table 8-2. Summary of Environmental Impacts of Coal-Fired Generation at Fort Calhoun Station and an alternate site (the Nebraska City Site) Using Once-Through Cooling

	Fort Calhoun Station		Nebraska City Site	
Impact Category	**Impact**	**Comments**	**Impact**	**Comments**
Land Use	SMALL to LARGE	Use of 127 ha (313 ac) for power block, reconfiguration of land, and waste disposal. Additional impact if the land cannot accommodate an ash-scrubber sludge landfill.	SMALL to MODERATE	Use of 46 ha (114 ac) additional land at existing site for plant infrastructure and waste disposal. Use of 370 ha (910 ac) for offsite transmission lines. Additional land impacts for coal and limestone mining.
Ecology	SMALL	Uses undeveloped but low-quality habitats at Fort Calhoun Station. Additional 127 ha (313 ac) needed for new facilities.	SMALL to MODERATE	Uses undeveloped but low-quality habitats at current Nebraska City site. Uses 370 ha (910 ac) for offsite transmission lines. Terrestrial impacts may be SMALL to MODERATE, depending on the location of the new transmission lines.
		Uses a once-through cooling system already in place. Based on past studies, the aquatic impacts of this system are considered SMALL.		Uses a once-through cooling system. Similar impacts as Fort Calhoun Station. Impacts considered SMALL.
Water Use and Quality (Surface Water)	SMALL	Uses existing once-through cooling system.	SMALL to MODERATE	Increased water withdrawal could lead to possible water-use conflicts. Thermal load would be higher than with closed-cycle cooling.
Water Use and Quality (Groundwater)	SMALL to MODERATE	Waste disposal (e.g., sewage treatment lagoons) could potentially leach to groundwater.	SMALL to MODERATE	Waste disposal (e.g., sewage treatment lagoons) could potentially leach to groundwater.

Table 8-2 (contd)

Impact Category	Fort Calhoun Station		Nebraska City Site	
	Impact	**Comments**	**Impact**	**Comments**
Air Quality	MODERATE	Sulfur oxides • 1100 MT/yr (1200 tons/yr) Nitrogen oxides • 390 MT/yr (430 tons/yr) Particulates • 56 MT/yr (62 tons/yr) Carbon monoxide • 470 MT/yr (520 tons/yr) Small amounts of mercury and other hazardous air pollutants, as well as naturally occurring radioactive materials (mainly uranium and thorium).	MODERATE	Same impacts as at Fort Calhoun Station.
Waste	MODERATE	Coal combustion generates waste in the form of ash, and the equipment for controlling air pollution generates additional ash and scrubber sludge.	MODERATE	Same impacts as at Fort Calhoun Station.
Human Health	SMALL	Impacts are uncertain but are considered SMALL in the absence of more quantitative data.	SMALL	Same impacts as at Fort Calhoun Station.
Socioeconomics	SMALL to MODERATE	During construction, impacts would be SMALL to MODERATE. Up to 1200 additional workers during the peak of the 5-year construction period at the alternate site. The Fort Calhoun Station workforce would drop to 0 after decommissioning. Impacts during operation would be SMALL to MODERATE. Employee local tax and wage contributions would decrease because of the smaller workforce, which would decrease from 772 operating staff to 250.	SMALL to MODERATE	During construction, impacts would be SMALL to MODERATE. Up to 1200 additional workers during the peak of the 5-year construction period at the alternate site. The Fort Calhoun Station workforce would drop to 0 after decommissioning. Impacts during operation would be SMALL to MODERATE. Employee local tax and wage contributions would increase because of the larger workforce, which would increase by 15 operating staff.

Table 8-2 (contd)

Impact Category	Fort Calhoun Station		Nebraska City Site	
	Impact	**Comments**	**Impact**	**Comments**
	SMALL to MODERATE	Transportation impacts during operation would be SMALL. Transportation impacts associated with construction workers could be SMALL to MODERATE.	SMALL to MODERATE	Transportation impacts during operation would be SMALL. Transportation impacts associated with construction workers could be SMALL to MODERATE.
	MODERATE to LARGE	For rail transportation of coal and lime/limestone, the impact is considered MODERATE to LARGE.	SMALL to MODERATE	For rail transportation of coal and lime/limestone, the impact is considered SMALL to MODERATE due to an existing coal plant at the site.
Aesthetics	SMALL to MODERATE	Development would consume large areas that are currently used for agriculture. Infrastructure would be clearly visible, but the aesthetic impacts would be similar to the current Fort Calhoun Station, Unit 1.	SMALL	Impact would be SMALL due to existing land use in the region.
Historic and Archaeological Resources	SMALL	Some construction would affect previously disturbed or lightly disturbed parts of Fort Calhoun Station; cultural-resources studies would likely be needed to identify, evaluate, and address the mitigation of potential impacts of new plant construction on lands at the existing site and offsite corridors, as necessary.	SMALL	Some construction would affect previously disturbed or lightly disturbed parts of the Nebraska City site; cultural-resources studies would likely be needed to identify, evaluate, and address the mitigation of potential impacts of new plant construction on lands at the existing site and offsite corridors, as necessary.

Table 8-2 (contd)

Impact Category	Fort Calhoun Station		Nebraska City Site	
	Impact	Comments	Impact	Comments
Environmental Justice	SMALL	Impacts on minority and low-income communities should be similar to those experienced by the population as a whole. Some impacts on housing may occur during construction; loss of about 522 operating jobs at Fort Calhoun Station could slightly reduce employment prospects for minority and low-income populations in Washington, Douglas, and Sarpy counties and could be offset by projected economic growth and the ability of affected workers to commute to other jobs.	SMALL	Impacts on minority and low-income communities should be similar to those experienced by the population as a whole. Some impacts on housing may occur during construction; loss of about 772 operating jobs at Fort Calhoun Station could slightly reduce employment prospects for minority and low-income populations in Washington, Douglas, and Sarpy counties and could be offset by projected economic growth and the ability of affected workers to commute to other jobs.

- **Land Use**

  The coal-fired generation alternative identified by the OPPD for analysis would be located at its existing Nebraska City site. The Nebraska City site was located and planned as a multi-unit base load generating facility, and the infrastructure for coal delivery, storage and handling, storm-water management, ash handling and disposal, plant access, and administrative support for multiple units is currently in place on 642 ha (1587 ac). The NRC estimates that developing the representative coal-fired alternative at the Nebraska City site would require approximately 10 ha (25 ac) for the power block and related support facilities. Onsite disposal of ash and flue-gas desulfurization waste would require an estimated 36 ha (90 ac) of the site, which is currently active cropland. Most of the onsite acreage that this alternative would affect is currently farmed; however, these changes would be consistent with the planned incremental development of the site. The OPPD expects that an additional 121 km (75 mi) of 345-kV transmission lines with 30-m-wide (100-ft-wide) right-of-way would result in use of 370 ha (910 ac) for offsite transmission lines. The predominant land use in the area is agriculture, which would be the most affected, but agricultural land use could continue in areas unoccupied by tower footings. Depending on the location of the transmission lines, this alternative would result in SMALL to MODERATE land-use impacts.

No offsite development (e.g., for transmission lines) would likely be needed for the development of a coal-fired plant at Fort Calhoun Station. However, the OPPD estimates that in addition to the 10 ha (25 ac) required for the power block, a minimum of 81 ha (200 ac) would be needed to reconfigure the existing rail spur and construct the necessary facility for coal, limestone, and ash storage and handling. An additional 36 ha (90 ac) is estimated to be required for waste disposal, and although potentially developable land is available at Fort Calhoun Station, additional acreage may be acquired to efficiently configure the plant. Land disturbance of currently cultivated crops or natural vegetation at Fort Calhoun Station may be necessary to recontour the site to ensure the protection of the ash-scrubber sludge landfill from flood flows. Depending on the amount of onsite land disturbance, this alternative would result in SMALL to MODERATE land-use impacts. If the land could not accommodate the ash-scrubber sludge landfill, the waste would have to be disposed of elsewhere, resulting in a possible LARGE land-use impact.

Additional land-use changes would occur offsite in an undetermined coal-mining area to supply coal for the plant. In the GEIS, the staff estimated that approximately 8900 ha (22,000 ac) would be affected for mining coal and disposing waste to support a coal plant during its operation life (NRC 1996). This offsite land use would be partially offset by eliminating the need for uranium mining to supply fuel for Fort Calhoun Station, Unit 1. In the GEIS, the staff estimated that approximately 400 ha (1000 ac) would be affected by mining the uranium and processing it during the operating life of a 1000-MW(e) nuclear power plant.

- **Ecology**

The development of a coal-fired plant using a once-through cooling system at the existing Nebraska City site would alter ecological resources because of the need to convert about 46 ha (114 ac) of marginal onsite terrestrial habitat to industrial use (plant, coal storage, ash and scrubber-sludge disposal). Approximately 120 km (75 mi) of new transmission line may be required. Assuming a 30-m-wide (100-ft-wide) right-of-way, the transmission line would result in disturbance to about 370 ha (910 ac) of land. The magnitude of impacts would depend on the types of habitats crossed; a routing study would be used to avoid high-value habitat. Based on current land-use patterns, the transmission line would most likely cross agricultural land.

Construction and overall operational activities of the plant may result in some disturbance to water quality and to the habitats of aquatic species (e.g., erosion of sediments and/or contaminant spills) in the local and downstream vicinity of the plant. A once-through cooling system would have similar impacts on the aquatic ecology as those noted for Fort Calhoun Station. The magnitude of impacts on the species (i.e., impingement, entrainment, and heat shock) should be SMALL given a similar operational system, permits, and

environmental context. Overall aquatic impacts may involve habitat loss and/or fragmentation; changes to aquatic species' diversity, composition, and abundance; and the mortality of juveniles and early life stages of aquatic species.

Siting a coal-fired plant at the existing Nebraska City site would have a SMALL to MODERATE ecological impact, depending on the location of the new transmission lines.

A coal-fired plant could be located at Fort Calhoun Station. Although additional transmission lines would not be required if Fort Calhoun Station were used, an estimated 127 ha (313 ac) would be needed on the site for development of a coal-fired plant including new coal and limestone delivery, storage, and handling facilities, which would not be required for a new plant at the Nebraska City site. In addition, the limited additional acreage at Fort Calhoun Station could necessitate the acquisition of land to achieve an appropriate plant configuration. Terrestrial habitat potentially affected by the construction of a coal-fired plant at Fort Calhoun Station is mostly agricultural land and areas maintained as part of current site operations, which are of marginal ecological value. Regrading the site to ensure protection from flood flows could eliminate as much as 16 ha (40 ac) of additional habitat.

Construction and operational activities for developing a coal-fired plant at Fort Calhoun Station may result in impacts to aquatic habitats and their species through the erosion of sediments and/or the introduction of other contaminants into the water. These potential impacts should be limited through the appropriate use of National Pollutant Discharge Elimination System (NPDES) permits, pollution-prevention plans, and related regulatory requirements. Also, the use of an existing intake and discharge system, to which the area aquatic communities have become acclimated, would limit operational impacts. Therefore, siting a coal-fired plant using once-through cooling at Fort Calhoun Station would have a SMALL ecological impact.

- **Water Use and Quality**

The coal-fired generation alternative at Fort Calhoun Station is assumed to use the existing once-through cooling system, which would minimize incremental surface water use and quality impacts. Surface water impacts are expected to remain SMALL; the impacts would be sufficiently minor so that they would not noticeably alter any important attribute of the resource.

The Nebraska City site is assumed to use a once-through cooling system with intake from the Missouri River. The impact on the surface water would depend on the volume of water

needed for cooling, the discharge volume, and the characteristics of the receiving body of water. Intake from and discharge to any surface body of water would be regulated by the Nebraska Department of Environmental Quality (NDEQ). The impacts would be SMALL to MODERATE.

No groundwater is currently used for the cooling operation at Fort Calhoun Station, Unit 1. Groundwater is occasionally used for volume adjustment in sewage treatment lagoons. The use of groundwater at the Nebraska City site is also a possibility. Increased water withdrawal could lead to possible water-use conflicts; however groundwater withdrawal would require a permit from the appropriate permitting authority. The impacts of withdrawal for the coal-fired plant on the aquifer would be dependent on aquifer recharge and other withdrawals. Minimal leaching of wastes from sewage treatment lagoons to groundwater is possible for both Fort Calhoun Station and the Nebraska City site, but the leaching would not be large enough to have a major impact on the resource. The impacts on the groundwater for both Fort Calhoun Station and the Nebraska City site would be SMALL to MODERATE.

- **Air Quality**

  The air-quality impacts of coal-fired generation vary considerably from those of nuclear generation due to emissions of sulfur oxides (SO_x), nitrogen oxides (NO_x), particulates, carbon monoxide, hazardous air pollutants such as mercury, and naturally occurring radioactive materials.

  A new coal-fired generating plant would likely need a prevention-of-significant-deterioration permit and an operating permit under the Clean Air Act (CAA). The plant would need to comply with the new source-performance standards for such plants set forth in 40 CFR Part 60 Subpart Da. The standards establish limits for particulate matter and opacity (40 CFR 60.42a), SO_2 (40 CFR 60.43a), and NO_x (40 CFR 60.44a).

  Fort Calhoun Station is located within the Nebraska Intrastate Air Quality Control Region (AQCR). In addition, portions of the Metropolitan Omaha–Council Bluffs Interstate AQCR, the Metropolitan Sioux City Interstate AQCR, the Lincoln–Beatrice–Fairbury Intrastate AQCR, and the Southwest Iowa Intrastate AQCR are found within 80 km (50 mi) of Fort Calhoun Station. Portions of the Nebraska Intrastate AQCR, the Metropolitan Omaha–Council Bluffs Interstate AQCR, the Southwest Iowa Intrastate AQCR, the Northern Missouri Intrastate AQCR, and the Northeast Kansas Intrastate AQCR are found within 80 km (50 mi) of the Nebraska City site. The air quality in these regions is designated in

40 CFR 81.316, 40 CFR 81.317, 40 CFR 81.326, and 40 CFR 81.328 as better than national standards, in attainment, or unclassified for all criteria pollutants.[(a)]

The U.S. Environmental Protection Agency (EPA) has various regulatory requirements for visibility protection in 40 CFR Part 51, Subpart P, including a specific requirement for the review of any new major stationary source in an area designated as attainment or unclassified under the CAA. Section 169A of the CAA (42 USC 7491) establishes a national goal of preventing future and remedying existing impairment of visibility in mandatory class I Federal areas when impairment results from man-made air pollution. In addition, the EPA issued a new regional haze rule in 1999 (64 FR 35714 [EPA 1999]). The rule specifies that for each mandatory class I Federal area located within a State, the State must establish goals that provide for reasonable progress towards achieving natural visibility conditions. The reasonable progress goals must provide for an improvement in visibility for the most-impaired days over the period of the implementation plan and ensure no degradation in visibility for the least-impaired days over the same period (40 CFR 51.308(d)(1)). If a new coal-fired power station were located close to a mandatory class I area, additional air-pollution-control requirements could be imposed. However, there are no mandatory class I Federal areas in which visibility is an important value designated in 40 CFR Part 81 within 160 km (100 mi) of either the Fort Calhoun Station or the Nebraska City site.

Impacts for particular pollutants are as follows:

Sulfur oxides. The OPPD states in its ER that an alternative coal-fired plant would use wet-scrubber technology using lime/limestone for flue-gas desulfurization (OPPD 2002). A new coal-fired power plant would be subject to the requirements in Title IV of the CAA. Title IV was enacted to reduce emissions of SO_2 and NO_x, the two principal precursors of acid rain, by restricting emissions of these pollutants from power plants. Title IV caps aggregate annual power-plant SO_2 emissions and imposes controls on SO_2 emissions through a system of marketable allowances. The EPA issues one allowance for each ton of SO_2 that a unit is allowed to emit. New units do not receive allowances, but they are required to have allowances to cover their SO_2 emissions. Owners of new units must, therefore, reduce SO_2 emissions at other power plants that they own or purchase allowances from owners of other power plants. Allowances can be banked for use in future years. Thus, a new coal-fired power plant would not add to net regional SO_2 emissions, although it might do so locally. Regardless, SO_2 emissions would be greater for the coal alternative than the OL renewal alternative.

(a) Existing criteria pollutants under the CAA are ozone, carbon monoxide, particulates, sulfur dioxide, lead, and nitrogen oxides. Emission standards for criteria pollutants are specified in 40 CFR Part 50.

The OPPD estimates that by using the best technology to minimize SO_x emissions, the total annual stack emissions would be approximately 1100 MT (1200 tons) of SO_x (OPPD 2002). In addition, the OPPD ER states that recent integrated-resource-planning studies indicate that the OPPD would be required to purchase additional SO_2 allowances or achieve SO_2 emission reductions by other means, which could include additional SO_2 emission controls beyond those mandated in the New Source Performance Standards in 40 CFR Part 60, Subpart Da.

Nitrogen oxides. Section 407 of the CAA establishes technology-based emission limitations for NO_x emissions. The market-based allowance system used for SO_2 emissions is not used for NO_x emissions. A new coal-fired power plant would be subject to the new source-performance standards for such plants at 40 CFR 60.44a(d)(1). This regulation, issued on September 16, 1998 (63 FR 49453 [EPA 1998]), limits the discharge of any gases that contain nitrogen oxides (expressed as NO_2) in excess of 200 ng/J of gross energy output (1.6 lb/MWh), based on a 30-day rolling average.

The OPPD estimates that by using NO_x burners with overfire air and selective catalytic reduction, the total annual NO_x emissions for a new coal-fired power plant would be approximately 390 MT (430 tons) (OPPD 2002). This level of NO_x emissions would be greater than the OL renewal alternative.

Particulates. The OPPD estimates that the total annual stack emissions would include 56 MT (62 tons) of filterable total suspended particulates (particulates that range in size from less than 0.1 micrometer [μm] up to approximately 45 μm). The 56 MT (62 tons) would include 13 MT (14 tons) of particulate matter having an aerodynamic diameter less than or equal to 10 μm (PM_{10}). Fabric filters would be used for control (OPPD 2002). In addition, coal-handling equipment would introduce fugitive particulate emissions. Particulate emissions would be greater under the coal alternative than the OL renewal alternative.

During the construction of a coal-fired plant, fugitive dust would be generated. In addition, exhaust emissions would come from vehicles and motorized equipment used during the construction process.

Carbon monoxide. The OPPD estimates that the total carbon monoxide emissions would be approximately 470 MT (520 tons) per year (OPPD 2002). This level of emissions is greater than the OL renewal alternative.

Hazardous air pollutants, including mercury. In December 2000, the EPA issued a regulatory finding on the emissions of hazardous air pollutants from electric utility steam-generating units (65 FR 79825 [EPA 2000b]). The EPA determined that coal- and oil-fired electric utility steam-generating units are significant emitters of hazardous air pollutants. Coal-fired power plants were found by the EPA to emit arsenic, beryllium, cadmium, chromium, dioxins, hydrogen chloride, hydrogen fluoride, lead, manganese, and mercury (65 FR 79825 [EPA 2000b]). The EPA concluded that mercury is the hazardous air pollutant of greatest concern. The EPA found that (1) there is a link between coal consumption and mercury emissions, (2) electric utility steam-generating units are the largest domestic source of mercury emissions, and (3) certain segments of the U.S. population (e.g., the developing fetus and subsistence fish-eating populations) are believed to be at potential risk of adverse health effects due to mercury exposures resulting from the consumption of contaminated fish (65 FR 79825 [EPA 2000b]). Accordingly, the EPA added coal- and oil-fired electric utility steam-generating units to the list of source categories under Section 112(c) of the CAA for which emission standards for hazardous air pollutants will be issued (65 FR 79825 [EPA 2000b]).

Uranium and thorium. Coal contains uranium and thorium. Uranium concentrations are generally in the range of 1 to 10 parts per million. Thorium concentrations are generally about 2.5 times greater than uranium concentrations (Gabbard 1993). One estimate is that a typical coal-fired plant released roughly 4.7 MT (5.2 tons) of uranium and 11.6 MT (12.8 tons) of thorium in 1982 (Gabbard 1993). The population dose equivalent from the uranium and thorium releases and daughter products produced by the decay of these isotopes has been calculated to be significantly higher than that from nuclear power plants (Gabbard 1993).

Carbon dioxide. A coal-fired plant would also have unregulated carbon dioxide emissions that could contribute to global warming.

Summary. The GEIS analysis did not quantify emissions from coal-fired power plants, but the analysis implied that air impacts would be substantial. The GEIS also mentioned global warming from unregulated carbon dioxide emissions and acid rain from SO_x and NO_x emissions as potential impacts (NRC 1996). Adverse human-health effects such as cancer and emphysema have been associated with the products of coal combustion. The appropriate characterization of air impacts from coal-fired generation would be MODERATE. The impacts would be clearly noticeable, but they would not destabilize air quality.

- **Waste**

  In addition to construction-related debris, coal combustion generates waste in the form of ash, and equipment for controlling air pollution generates additional ash and scrubber sludge. During the operating life of the coal-fired plant, this waste would be disposed onsite by spreading the waste across a significant land-surface area. Waste impacts to groundwater and surface water could extend beyond the operating life of the plant if leachate and runoff from the waste-storage area were to occur. Disposal of the waste could noticeably affect land use and groundwater quality; however, with appropriate management and monitoring, the waste disposal would not destabilize any resources. The land used for a waste site could eventually be available for other uses once the waste site had been closed and revegetation had occurred.

  In May 2000, the EPA issued a "Notice of Regulatory Determination on Wastes From the Combustion of Fossil Fuels" (65 FR 32214 [EPA 2000a]). The EPA concluded that some form of national regulation is warranted to address coal-combustion waste products because (1) the composition of these wastes could present danger to human health and the environment under certain conditions; (2) the EPA has identified 11 documented cases of proven damages to human health and the environment by improper management of these wastes in landfills and surface impoundments; (3) present disposal practices are such that in 1995, these wastes were being managed in 40 to 70 percent of landfills and surface impoundments without reasonable controls in place, particularly in the area of groundwater monitoring; and (4) the EPA identified gaps in the State oversight of coal-combustion wastes. Accordingly, the EPA announced its intention to issue regulations for the disposal of coal-combustion waste under Subtitle D of the Resource Conservation and Recovery Act.

  For all of the preceding reasons, the appropriate characterization of impacts from waste generated from burning coal is MODERATE; the impacts would be clearly noticeable, but they would not destabilize any important resource.

Siting the facility at a site other than Fort Calhoun Station would not alter the waste generated. Therefore, for both the Nebraska City site and the Fort Calhoun Station, Unit 1 site, the impacts would be MODERATE.

- **Human Health**

  Coal-fired power generation introduces worker risks from coal and limestone mining, worker and public risks from coal and lime/limestone transportation, worker and public risks from disposal of coal-combustion wastes, and public risks from the inhalation of stack emissions. Emission impacts can be widespread, and health risks can be difficult to quantify. The coal alternative also introduces the risk of coal-pile fires and attendant inhalation risks.

  The staff stated in the GEIS that there could be human-health impacts (cancer and emphysema) from the inhalation of toxins and particulates from coal-fired plants, but the staff did not identify the significance of these impacts (NRC 1996). In addition, the discharges of uranium and thorium from coal-fired plants can potentially produce radiological doses in excess of those arising from nuclear-power-plant operations (Gabbard 1993).

  Regulatory agencies, including the EPA and State agencies, set air-emission standards and requirements based on human-health impacts. These agencies also impose site-specific emission limits as needed to protect human health. The EPA has recently concluded that certain segments of the U.S. population (e.g., the developing fetus and subsistence fish-eating populations) are believed to be at potential risk of adverse health effects due to mercury exposures from sources such as coal-fired power plants. However, in the absence of more quantitative data, human-health impacts from radiological doses and inhaling toxins and particulates generated by burning coal are characterized as SMALL for either the Fort Calhoun Station or the Nebraska City site.

- **Socioeconomics**

  Construction of the coal-fired alternative would take approximately 5 years. The staff assumed that construction would take place while Fort Calhoun Station, Unit 1 continues operation and would be completed by the time Fort Calhoun Station, Unit 1 permanently ceases operations. The workforce would be expected to vary between 450 and 1200 workers during the 5-year construction period (NRC 1996). These workers would be in addition to the approximately 772 workers employed at Fort Calhoun Station. During construction, the surrounding communities would experience demands on housing and public services that could have MODERATE impacts. These impacts would be tempered by construction workers commuting to the site from other parts of the Omaha MSA or from other counties. After construction, the nearby communities would be impacted by the loss of the construction jobs.

If a coal-fired replacement plant were constructed at Fort Calhoun Station and if Fort Calhoun Station, Unit 1 were decommissioned, there would be a loss of approximately 522 permanent, high-paying jobs (from 772 for the nuclear unit to 250 for the coal-fired plant), with a reduction in payroll taxes and contributions to the regional economy. For these reasons, the appropriate characterization of nontransportation socioeconomic impacts for a coal-fired plant constructed at Fort Calhoun Station would be SMALL to MODERATE.

During the 5-year construction period for the replacement coal-fired units, up to 1200 construction workers would be working at the Nebraska City site in addition to the 772 workers at Fort Calhoun Station. The addition of these workers at the Nebraska City site could place increased traffic loads on U.S. Highway 75. Such impacts would be SMALL to MODERATE.

For transportation related to the commuting of plant-operating personnel, the impacts are considered SMALL. The estimated number of additional plant-operating personnel is approximately 15 for the Nebraska City site. Traffic impacts associated with plant personnel commuting to a coal-fired plant would be expected to be SMALL.

For rail transportation related to coal and lime delivery to Fort Calhoun Station, the impacts are considered MODERATE to LARGE. Approximately 166 trains per year would be needed to deliver the coal and lime for the coal-fired unit. Each train would consist of 100 railcars. The impacts at the Nebraska City site would be SMALL to MODERATE due to an existing coal plant at that site. This would be in addition to the deliveries for the existing coal plant. Barge delivery of coal and lime/limestone would likely have SMALL socioeconomic impacts.

- **Aesthetics**

Development of the coal-fired alternative plant at the Nebraska City site would involve an incremental addition to an existing similar facility that is remotely located. Noise from plant operations presents a potential annoyance to nearby residents. Based on existing land use in the region, the aesthetic impacts from the representative coal-fired alternative would be SMALL.

Locating the plant at Fort Calhoun Station would also represent development at an existing industrial site. However, the development of the plant would consume a large area of the site that is presently agricultural land, and the boiler building, stack, and coal-storage areas would be visually prominent from Highway 75 and residences along and near this highway in the site vicinity. It is expected that offsite noise from plant operations would also be apparent but not destabilizing, considering the present industrial status of the plant site and the adjacent Cargill facility. This impact would be considered SMALL to MODERATE.

- **Historic and Archaeological Resources**

  At the Nebraska City site or Fort Calhoun Station, a cultural-resources evaluation would be necessary to identify, assess, and address the mitigation of potential impacts of new plant construction on cultural resources. Such areas would include all areas of potential disturbance at the proposed plant site and along associated corridors where new construction would occur (e.g., roads, transmission line rights-of-way, rail lines, or other rights-of-way). Based on the results of these studies, historic and archaeological impacts can generally be effectively managed by adhering to existing historic-preservation laws and guidelines and, as such, are considered SMALL for the existing Nebraska City site or Fort Calhoun Station.

- **Environmental Justice**

  No environmental pathways or locations have been identified that would result in disproportionately high and adverse environmental impacts on minority and low-income populations if a replacement coal-fired plant were built at the Nebraska City site or at Fort Calhoun Station. Some impacts on housing may occur during construction; loss of over 750 operating jobs at Fort Calhoun Station could slightly reduce employment prospects for minority and low-income populations in Washington, Douglas, and Sarpy counties and could be offset by projected economic growth and the ability of affected workers to commute to other jobs. Overall, impacts would be SMALL.

8.2.1.2 Closed-Cycle Cooling System

The environmental impacts of constructing a coal-fired generation system at the Nebraska City site using closed-cycle cooling with cooling towers are essentially the same as the impacts for a coal-fired plant using a once-through system. However, there are some environmental differences between closed-cycle and once-through cooling systems. Table 8-3 summarizes the incremental differences.

Table 8-3. Summary of Environmental Impacts of Coal-Fired Generation at the Nebraska City Site with a Closed-Cycle Cooling System Using Cooling Towers

Impact Category	Change in Impacts from Once-Through Cooling System
Land Use	10 to 12 additional ha (25 to 30 ac) required for cooling towers.
Ecology	Land disturbance associated with the construction of cooling towers and associated infrastructure would affect the additional 10 to 12 ha (25 to 30 ac) of terrestrial habitats. Possible reduction in the impacts associated with the entrainment of fish and shellfish in early life stages, the impingement of fish and shellfish, and heat shock.
Surface Water Use and Quality	Water withdrawals would be reduced; however, cooling towers associated with closed-cycle cooling could potentially increase water losses from evaporation. Thermal loading would likely be reduced; however, there would be a greater potential for water-quality impacts from the dissolved constituents.
Groundwater Use and Quality	No change.
Air Quality	No change.
Waste	No change.
Human Health	No change.
Socioeconomics	No change.
Aesthetics	Introduction of cooling towers and associated plume. Natural-draft towers could be up to 159 m (520 ft) high. Mechanical-draft towers could be up to 30 m (100 ft) high and would have an associated noise impact.
Historic and Archaeological Resources	Some construction would affect previously disturbed or lightly disturbed parts of the Nebraska City site; cultural-resources studies would likely be needed to identify, evaluate, and address the mitigation of potential impacts of new plant construction on lands at the existing site and offsite corridors, as necessary. The studies would likely be needed to identify, evaluate, and address the mitigation of potential impacts of new plant construction on lands on undeveloped sites and offsite corridors.
Environmental Justice	No change.

8.2.2 Natural-Gas-Fired Generation

The environmental impacts of the natural-gas-fired alternative are examined in this section for the Cass County and Fort Calhoun sites. For the Cass County site, the OPPD evaluated the site for a closed-cycle cooling system. A once-through cooling system is not considered a viable option for the Cass County site because an adequate source of water for such a system is not available. The OPPD concluded in its ER that the Cass County site would be a reasonable site for the location of a natural-gas-fired generating unit.

If a new natural-gas-fired plant were built in Cass County to replace Fort Calhoun Station, Unit 1, approximately 120 km (75 mi) of new 345-kV transmission lines between the plant and other points in the system would be required. The Cass County site is within 1.6 km (1 mi) of seven large natural-gas-supply pipelines.

The OPPD assumed that a replacement natural-gas-fired plant would use combined-cycle technology (OPPD 2002). In a combined-cycle unit, hot combustion gases in a combustion turbine rotate the turbine to generate electricity. Waste combustion heat from the combustion turbine is routed through a heat-recovery boiler to make steam to generate additional electricity. The following additional assumptions are made for the natural-gas-fired plant (OPPD 2002):

- one 480-MW(e) unit that consists of two 160-MW combustion turbines and a 160-MW heat-recovery boiler
- natural gas with an average heating value of 1000 Btu/ft^3 as the primary fuel
- heat rate of 7000 Btu/kWh
- capacity factor of 0.80

Unless otherwise indicated, the assumptions and numerical values used throughout this section are from the OPPD ER (OPPD 2002). The staff reviewed this information and compared it to environmental-impact information in the GEIS. Although the OL renewal period is only 20 years, the impact of operating the natural-gas-fired alternative for 40 years is considered (as a reasonable projection of the operating life of a natural-gas-fired plant).

8.2.2.1 Once-Through Cooling at Fort Calhoun Station and Closed-Cycle Cooling at Cass County Site

The overall impacts of the natural-gas-fired generating system are discussed in the following sections and are summarized in Table 8-4.

Table 8-4. Summary of Environmental Impacts of Natural-Gas-Fired Generation at Fort Calhoun Station Using a Once-Through Cooling System and the Cass County Site using a Closed-Cycle Cooling System

	Fort Calhoun Station		Cass County Site	
Impact Category	**Impact**	**Comments**	**Impact**	**Comments**
Land Use	SMALL to MODERATE	10 ha (25 ac) for power block and related facilities. Additional impact of 195 ha (484 ac) for the construction of a new gas-supply pipeline.	SMALL to MODERATE	10 ha (25 ac) for additional power block and related facilities. Additional impact for construction and/or upgrade of an underground makeup-water pipeline, if required. Additional impact of 370 ha (910 ac) for new transmission-line corridor.
Ecology	SMALL to MODERATE	Uses 10 ha (25 ac) of undeveloped but low-quality habitats at Fort Calhoun Station. Impact of a new gas-supply pipeline, which would occupy 195 ha (484 ac) would depend on the chosen route.	SMALL to MODERATE	Uses 10 ha (25 ac) of undeveloped but low-quality habitats at current Cass County site for infrastructure development. New transmission line would affect 370 ha (910 ac). Impact would depend on the chosen route.
Water Use and Quality (Surface Water)	SMALL	Uses existing cooling system.	SMALL	Cooling towers could potentially increase water losses from evaporation. Thermal loading would likely be reduced; however, there would be a greater potential for water-quality impacts from the dissolved constituents.

Table 8-4 (contd)

Impact Category	Fort Calhoun Station		Cass County Site	
	Impact	**Comments**	**Impact**	**Comments**
Water Use and Quality (Groundwater)	SMALL	Does not use groundwater for cooling; However, minimal leaching of the wastes, such as from sewage treatment lagoons, is possible, but the leaching would not be large enough to have a major impact on the resource.	SMALL	Although groundwater could be used as makeup water in the closed-cycle cooling and surface water discharge could percolate to the water table, relatively small impacts to groundwater are anticipated.
Air Quality	MODERATE	Sulfur oxides • 7.0 MT/yr (7.7 tons/yr) Nitrogen oxides • 110 MT/yr (120 tons/yr) Carbon monoxide • 160 MT/yr (180 tons/yr) PM_{10} particulates • 21 MT/yr (23 tons/yr) Some hazardous air pollutants	MODERATE	Same emissions as at Fort Calhoun Station.
Waste	SMALL	Small amount of ash produced.	SMALL	Same waste produced as if produced at Fort Calhoun Station.
Human Health	SMALL	Impacts considered to be minor.	SMALL	Impacts considered to be minor.
Socioeconomics	SMALL to MODERATE	During construction, impacts would be SMALL to MODERATE. Up to 450 additional workers during the construction period. After construction, the communities would be impacted by the loss of construction jobs and the loss of over 750 jobs due to the decommissioning of Fort Calhoun Station. If projected growth for the area materializes, the impact would be SMALL. If not offset by normal growth, then the impact would be MODERATE.	SMALL to MODERATE	During construction, impacts would be SMALL to MODERATE. Up to 450 additional workers during the construction period. After construction, the communities would be impacted by the loss of construction jobs and the loss of over 750 jobs due to the decommissioning of Fort Calhoun Station. If projected growth for the area materializes, the impact would be SMALL. If not offset by normal growth, then the impact would be MODERATE.
Aesthetics	SMALL to MODERATE	Stacks and infrastructure would be clearly visible.	SMALL	The aesthetic impact would be small due to existing land use in region.

Table 8-4 (contd)

Impact Category	Fort Calhoun Station		Cass County Site	
	Impact	**Comments**	**Impact**	**Comments**
Historic and Archaeological Resources	SMALL	Some construction would affect previously disturbed or lightly disturbed parts of Fort Calhoun Station; cultural-resources studies would likely be needed to identify, evaluate, and address the mitigation of potential impacts of new plant construction on lands at the existing site and offsite corridors, as necessary.	SMALL	Some construction would affect previously disturbed or lightly disturbed parts of the Cass County site; cultural-resources studies would likely be needed to identify, evaluate, and address the mitigation of potential impacts of new plant construction on lands at the existing site and offsite corridors, as necessary.
Environmental Justice	SMALL	Impacts on minority and low-income communities should be similar to those experienced by the population as a whole.	SMALL	Impacts on minority and low-income communities should be similar to those experienced by the population as a whole.

- **Land Use**

  For the same reasons discussed in Section 8.2.1.1, the natural-gas-fired generation alternative identified by the OPPD for analysis is a representative plant located at the OPPD's existing Cass County site. This Cass County site is a multiunit site, which is being developed for combustion-turbine peaking units; some of these units will eventually be converted to combined-cycle operation. The current site design accommodates six 160-MW combustion turbines on approximately 36 ha (90 ac) of the site's 96 ha (237 ac). The area surrounding the site is predominantly agricultural land and is sparsely populated. The OPPD estimates that the new facility would not require new gas pipelines; however, the new facility would occupy 10 ha (25 ac) of the total 36 ha (90 ac) planned for development, and approximately an additional 121 km (75 mi) of 345-kV transmission lines with 30-m-wide (100-ft-wide) rights-of-way resulting in use of 370 ha (910 ac) for offsite transmission lines. Additionally, a new pipeline, which is assumed to be 8-km (5-mi) long, may need to be constructed to provide makeup water for cooling; this pipeline would be routed along existing road and utility rights-of-way. Depending on the locations of the transmission lines and water pipeline, the impacts would be SMALL to MODERATE.

  As noted previously for the coal-fired generation alternative, a 475-MW natural-gas-fired plant could be located at Fort Calhoun Station. However, locating the plant at Fort Calhoun

Station would require installing a new gas-supply pipeline that would be approximately 64-km (40-mi) long, resulting in some impact to offsite land use. Also, the potential onsite and offsite impacts of other infrastructure (e.g., power block and support buildings) would result in new land-use impacts. Depending on the amount of land disturbance, this alternative would result in SMALL to MODERATE land-use impacts.

For all options, additional land could be required for natural-gas wells and collection stations. In the GEIS, the staff estimated that approximately 1500 ha (3600 ac) would be needed for a 1000-MW(e) plant (NRC 1996).

Proportionately less land would be needed for a natural-gas-fired plant replacing the 476-MW Fort Calhoun Station, Unit 1. These offsite land requirements would be partially offset by eliminating the need for uranium mining to supply fuel for Fort Calhoun Station, Unit 1. In the GEIS (NRC 1996), the staff estimated that approximately 400 ha (1000 ac) would be affected by mining the uranium and processing it during the operating life of a 1000-MW(e) nuclear-powered plant. Overall, land-use impacts at both Fort Calhoun Station and the alternative Cass County site would be SMALL to MODERATE.

- **Ecology**

The development of a natural-gas-fired plant using a closed cooling system at the existing Cass County site would require developing about 10 ha (25 ac) of land that is currently used for agriculture or that already has been modified for industrial use. Approximately 120 km (75 mi) of new transmission line may be required. Assuming a 30-m-wide (100-ft-wide) right-of-way, the transmission line would result in disturbance to about 370 ha (910 ac) of land. The magnitude of impacts would depend on the types of habitats crossed; a routing study would be used to avoid high-value habitat. Based on current land-use patterns, the transmission line would most likely cross agricultural land.

Construction and overall operational activities of the plant may result in some disturbance to water quality and to the habitats of aquatic species (e.g., erosion of sediments and/or contaminant spills) in the local and downstream vicinity of the plant. The magnitude of impacts on the species (i.e., impingement, entrainment, and heat shock) would be SMALL for a closed-cycle cooling system.

Siting a natural-gas-fired plant with closed-cooling at the existing Cass County site would likely have a SMALL to MODERATE ecological impact, depending on the location of the new transmission lines.

A natural-gas-fired plant with once-through cooling could be located at Fort Calhoun Station. Developing the plant at Fort Calhoun Station would disturb about the same amount of land on Fort Calhoun Station as on the Cass County site. However, a new gas-supply line (about 65 km long [40 mi long]) to Fort Calhoun Station would be needed and would result in the disturbance of about 195 ha (484 ac). New transmission lines would not be needed if Fort Calhoun Station were used. The terrestrial habitat potentially affected by construction at Fort Calhoun Station is mostly agricultural land and areas maintained as part of current site operations, which are of marginal ecological value. Based on current land-use patterns, the new gas-supply line would most likely cross agricultural land.

Construction and operational activities for developing a natural-gas-fired plant at Fort Calhoun Station may result in impacts to aquatic habitats and their species through the erosion of sediments and/or the introduction of other contaminants into the water. The estimated cooling-water flows for a once-through cooling system is lower than the system currently used by Fort Calhoun Station. The magnitude of impacts on the species (i.e., impingement, entrainment, and heat shock) should be SMALL given a similar operational system, permits, and the lower volume of cooling water needed.

Siting a natural-gas-fired plant with once-through cooling at Fort Calhoun Station would have a SMALL to MODERATE ecological impact, depending on the location of the new gas-supply line.

- **Water Use and Quality**

Each of the natural-gas-fired units would include a heat-recovery boiler from which steam would turn an electric generator. Steam would be condensed and circulated back to the boiler for reuse. A natural-gas-fired plant sited at Fort Calhoun Station is assumed to use the existing once-through cooling system. Therefore, the impacts are considered to be SMALL at Fort Calhoun Station.

For the Cass County site, the impact on the surface water would depend on the volume of water needed for makeup water, the discharge volume, and the characteristics of the receiving body of water. Intake from and discharge to any surface body of water would be regulated by the State of Nebraska. The use of groundwater for a natural-gas-fired plant is also a possibility. Any groundwater withdrawal would require a permit from the local permitting authority. The impacts on groundwater would depend on the volume and other characteristics of the source-water budget. Minimal leaching of wastes, such as from sewage treatment lagoons, to groundwater is possible for both Fort Calhoun Station, Unit 1 and the alternate site. Such impacts should be SMALL.

Water-quality impacts from sedimentation during construction were characterized in the GEIS as SMALL. The staff also noted in the GEIS that operational water-quality impacts would be similar to, or less than, those from other generating technologies. Overall, water-use and -quality impacts at an alternate site are considered SMALL.

- **Air Quality**

Natural gas is a relatively clean-burning fuel. The natural-gas-fired alternative would release similar types of emissions, but in lesser quantities, than the coal-fired alternative. A new combined-cycle, natural-gas-fired generating plant would be subject to the new source-performance standards for such units in 40 CFR Part 60, Subpart Da. Subpart Da establishes emission limits for particulates, opacity, SO_2, and NO_x. A new natural-gas-fired plant would also be subject to the visibility and NO_x emission-reduction provisions discussed in Section 8.2.1.

The OPPD projects the following emissions for the natural-gas-fired alternative (OPPD 2002):

Sulfur oxides – 7.0 MT/yr (7.7 tons/yr)
Nitrogen oxides – 110 MT/yr (120 tons/yr)
Carbon monoxide – 160 MT/yr (180 tons/yr)
PM_{10} particulates – 21 MT/yr (23 tons/yr)

A natural-gas-fired plant would also have unregulated carbon dioxide emissions that could contribute to global warming.

In December 2000, the EPA issued regulatory findings on emissions of hazardous air pollutants from electric utility steam-generating units (65 FR 79825 [EPA 2000b]). Natural-gas-fired power plants were found by the EPA to emit arsenic, formaldehyde, and nickel (65 FR 79825 [EPA 2000b]). Unlike coal- and oil-fired plants, the EPA did not determine that emissions of hazardous air pollutants from natural-gas-fired power plants should be regulated under Section 112 of the CAA.

Construction activities would result in temporary fugitive dust. Exhaust emissions would also come from vehicles and motorized equipment used during the construction process.

The preceding emissions would likely be the same at Fort Calhoun Station or at the alternate site. Impacts from the above emissions would be clearly noticeable, but they would not be sufficient to destabilize air resources as a whole. The overall air-quality impact for a new natural-gas-fired plant sited at Fort Calhoun Station or at the alternate site is considered MODERATE.

- **Waste**

  There will be small amounts of solid-waste products (i.e., ash) from burning natural-gas fuel. In the GEIS, the staff concluded that waste generation from natural-gas-fired technology would be minimal (NRC 1996). Gas firing results in very few combustion by-products because of the clean nature of the fuel. Waste generation at an operating natural-gas-fired plant would be largely limited to typical office wastes. Waste-generation impacts would be so minor that they would not noticeably alter any important resource attribute. Construction-related debris would be generated during construction activities. Overall, the waste impacts would be SMALL for a natural-gas-fired plant sited at Fort Calhoun Station or at the alternate site.

  During the winter, a replacement base-load, natural-gas-fired plant may need to operate on fuel oil because of a lack of gas supply. Oil combustion generates waste in the form of ash, and the equipment for controlling air pollution generates additional ash and scrubber sludge. The amount of ash and sludge generated would depend on the type and quantity of fuel oil combusted. No. 2 fuel oil does not produce any appreciable ash, while the heavier No. 6 fuel oil does. Overall, the waste impacts associated with fuel-oil combustion at a combined-cycle plant are expected to be SMALL because the amount of oil combusted is expected to be relatively small. When natural gas is available, fuel oil is generally not price-competitive with natural gas.

- **Human Health**

  In the GEIS, the staff identifies cancer and emphysema as potential health risks from natural-gas-fired plants (NRC 1996). The risk may be attributable to NO_x emissions that contribute to ozone formation, which in turn contributes to health risks. NO_x emissions from the plant would be regulated by the NDEQ or a comparable agency in another state. Human-health effects are not expected to be detectable or would be sufficiently minor that they would neither destabilize nor noticeably alter any important attribute of the resource. Overall, the impacts on human health of the natural-gas-fired alternative sited at Fort Calhoun Station or at the Cass County alternate site are considered SMALL.

- **Socioeconomics**

  Construction of a natural-gas-fired plant at either Fort Calhoun Station or the Cass County site would take approximately 2 to 3 years. Peak employment would be approximately 450 workers (OPPD 2002). During construction, the communities surrounding either site would experience demands on housing and public services. These impacts would be tempered by construction workers commuting to the site from other parts of the Omaha

MSA or from other counties. After construction, the communities would be impacted by the loss of jobs resulting from both the completion of construction of the natural-gas-fired plant and the loss of over 750 jobs due to the decommissioning of Fort Calhoun Station. The 10 operating jobs, at the natural-gas-fired plant would be an insignificant replacement. In lieu tax payments would continue to be made by OPPD. However for both sites, if growth projections for the Omaha Metropolitan Statistical Area materialize, the impact would be SMALL. If not offset by normal growth, then the impact would be MODERATE.

Transportation impacts associated with construction and operating personnel commuting to either site can be classified as SMALL.

- **Aesthetics**

The potential aesthetics impacts from constructing and operating a natural-gas-fired plant include visual impairment and offsite noise. At the Cass County site, the representative gas-fired plant would be an incremental addition to an existing plant with similar characteristics that is remotely located relative to major thoroughfares and residential developments. In addition, based on existing land use in the region, the associated transmission line would be routed overland through sparsely populated areas. The aesthetic impacts would be SMALL due to existing land use in the area.

Locating the plant at Fort Calhoun Station would also represent development at an existing industrial site. In addition, the boiler building and stack, which are assumed to be approximately 76-m (250-ft) high, would be less prominent than for the coal-fired plant alternative. Potential noise impacts would also be less than for the coal-fired plant alternative, although noise and light would be detectable offsite and from Highway 75. These impacts would result in SMALL to MODERATE aesthetic impacts.

- **Historic and Archaeological Resources**

At the Cass County site or at Fort Calhoun Station, a cultural-resources evaluation would be necessary to identify, assess, and address the mitigation of potential impacts of new plant construction on cultural resources. Such areas would include all areas of potential disturbance at the proposed plant site and along associated corridors where new construction would occur (e.g., roads, gas-supply pipelines, transmission line rights-of-way, or other rights-of-way). Based on the results of these studies, historic and archaeological impacts can generally be effectively managed by adhering to existing historic-preservation laws and guidelines and, as such, are considered SMALL for both the existing Cass County site or Fort Calhoun Station.

- **Environmental Justice**

  No environmental pathways or locations have been identified that would result in disproportionately high and adverse environmental impacts on minority and low-income populations if a replacement natural-gas-fired plant were built at the Cass County site. Overall impacts are expected to be SMALL.

8.2.2.2 Closed-Cycle Cooling at Fort Calhoun Station

This section discusses the environmental impacts of constructing a natural-gas-fired generation system at the Fort Calhoun Station site using closed-cycle cooling with cooling towers. The impacts of this option are essentially the same as the impacts for a natural-gas-fired plant using once-through cooling. However, there are minor environmental differences between the closed-cycle and once-through cooling systems. Table 8-5 summarizes these incremental differences.

Table 8-5. Summary of Environmental Impacts of Natural-Gas-Fired Generation at the Fort Calhoun Station Site with Closed-Cycle Cooling Towers

Impact Category	Change in Impacts from Once-Through Cooling System
Land Use	10 to 12 additional ha (25 to 30 ac) required for cooling towers and associated infrastructure.
Ecology	Land disturbance associated with the construction of cooling towers and associated infrastructure would affect the additional 10 to 12 ha (25 to 30 ac) of terrestrial habitats. Possible reduction in impacts at Fort Calhoun Station associated with the entrainment of fish and shellfish in their early life stages, the impingement of fish and shellfish, and heat shock.
Surface Water Use and Quality	Water withdrawals would be reduced; however, cooling towers associated with closed-cycle cooling could potentially increase water losses from evaporation. Thermal loading would likely be reduced; however, there would be a greater potential for water-quality impacts from the dissolved constituents.
Groundwater Use and Quality	No change.
Air Quality	No change.
Waste	No change.
Human Health	No change.

Table 8-5 (contd)

Impact Category	Change in Impacts from Once-Through Cooling System
Socioeconomics	No change.
Aesthetics	Introduction of cooling towers and associate plumes. Natural-draft towers could measure up to 159 m (520 ft) high. Mechanical-draft towers could measure up to 30 m (100 ft) high and would have an associated noise impact.
Historic and Archaeological Resources	No change.
Environmental Justice	No change.

8.2.3 Nuclear Power Generation

Since 1997, the NRC has certified three new standard designs for nuclear power plants under 10 CFR Part 52, Subpart B. These designs are the U.S. Advanced Boiling-Water Reactor (10 CFR Part 52, Appendix A), the System 80+ Design (10 CFR Part 52, Appendix B), and the AP600 Design (10 CFR Part 52, Appendix C). All of these plants are light-water reactors. Although no applications for a construction permit or a combined license based on these certified designs have been submitted to the NRC, the submission of these design-certification applications indicates continuing interest in the possibility of licensing new nuclear power plants. In addition, the recent volatility of natural gas and electricity have made new nuclear-power-plant construction more attractive from a cost standpoint. Consequently, the construction of a new nuclear power plant at Fort Calhoun Station using the existing cooling system and at an alternate Nebraska/greenfield site using both closed- and open-cycle cooling are considered in this section. The staff assumed that the new nuclear plant would have a 40-year lifetime. Consideration of a new nuclear generating plant to replace Fort Calhoun Station, Unit 1 was not included in the OPPD ER because it was too expensive.

The NRC summarized environmental data associated with the uranium fuel cycle in Table S-3 of 10 CFR 51.51. The impacts shown in Table S-3 are representative of the impacts that would be associated with a replacement nuclear power plant built to one of the certified designs, sited at Fort Calhoun Station or an alternate site. The impacts shown in Table S-3 are for a 1000-MW(e) reactor and would need to be adjusted to reflect the replacement of Fort Calhoun Station, Unit 1, which has a capacity of 475 MW(e). The environmental impacts associated with transporting fuel and waste to and from a light-water-cooled nuclear power reactor are summarized in Table S-4 of 10 CFR 51.52. The summary of the NRC's findings on NEPA issues for license renewal of nuclear power plants in Table B-1 of 10 CFR Part 51, Subpart A, Appendix B, is also relevant, although not directly applicable, for considering the environmental impacts associated with the operation of a replacement nuclear power plant. Additional

environmental-impact information for a replacement nuclear power plant using once-through cooling is presented in Section 8.2.3.1 and using closed-cycle cooling in Section 8.2.3.2.

8.2.3.1 Once-Through Cooling System

The overall impacts of the nuclear generating system are discussed in the following sections. The impacts are summarized in Table 8-6. The extent of impacts at an alternate Nebraska/greenfield site will depend on the location of the particular site selected.

Table 8-6. Summary of Environmental Impacts of New Nuclear Power Generation at Fort Calhoun Station and an Alternate Nebraska/Greenfield Site Using Once-Through Cooling

	Fort Calhoun Station		Alternate Nebraska/Greenfield Site	
Category	**Impact**	**Comments**	**Impact**	**Comments**
Land Use	MODERATE	Additional 100 to 300 ha (240 to 740 ac) of new land, some of which was previously undeveloped.	LARGE	200 to 400 ha (500 to 1000 ac) plus the possible need for land for a new transmission line, resulting in an additional 260 ha (640 ac) needed.
Ecology	MODERATE	Uses undeveloped areas at Fort Calhoun Station and some additional offsite areas. Uses a once-through cooling system already in place.	MODERATE to LARGE	Impact depends on location and ecology of the site, surface-water body used for intake and discharge, and transmission line route; potential habitat loss and fragmentation; reduced productivity and biological diversity.
Water Use and Quality	SMALL	Uses existing cooling system.	SMALL to MODERATE	Impact will depend on the volume of water withdrawn and discharged and the characteristics of the surface-water body.
Air Quality	SMALL	Fugitive emissions and emissions from vehicles and equipment during construction. Small amount of emissions from diesel generators and possibly other sources during operation.	SMALL	Same impacts as at Fort Calhoun Station.

Table 8-6 (contd)

Impact Category	Fort Calhoun Station		Alternate Nebraska/Greenfield Site	
	Impact	**Comments**	**Impact**	**Comments**
Waste	SMALL	Waste impacts for an operating nuclear power plant are set out in 10 CFR Part 51, Appendix B, Table B-1. Debris would be generated and removed during construction.	SMALL	Same impacts as at Fort Calhoun Station.
Human Health	SMALL	Human-health impacts for an operating nuclear power plant are set out in 10 CFR Part 51, Appendix B, Table B-1.	SMALL	Same impacts as at Fort Calhoun Station.
Socioeconomics	SMALL to MODERATE	During construction, impacts would be MODERATE. Up to 2500 workers during the peak period of the 5-year construction period. Operating workforce is assumed to be similar to Fort Calhoun Station; tax and wage impacts from employee earnings would be preserved. Impacts during operation would be SMALL.	LARGE	Construction impacts depend on location. Impacts at a rural location could be LARGE.
	SMALL to LARGE	Transportation impacts associated with construction workers could be MODERATE to LARGE. Transportation impacts of commuting workers during operations would be SMALL.	SMALL to LARGE	Transportation impacts associated with construction workers could be MODERATE to LARGE. Transportation impacts of commuting workers during operations could be SMALL to MODERATE.
Aesthetics	SMALL to MODERATE	No exhaust stacks or cooling towers would be needed. Visual impact at night could be mitigated by the reduced use of lighting and appropriate shielding. Noise impacts would be relatively small and could be mitigated.	SMALL to LARGE	Impacts would depend on the characteristics of the alternate site. Impacts would be SMALL if the plant is located adjacent to an industrial area. New transmission lines would add to the impacts and could be MODERATE. If a rural site is selected, the impacts could be LARGE.

Table 8-6 (contd)

Impact Category	Fort Calhoun Station		Alternate Nebraska/Greenfield Site	
	Impact	**Comments**	**Impact**	**Comments**
Historic and Archaeological Resources	SMALL	A cultural-resources evaluation would be necessary to identify, assess, and address the mitigation of potential impacts of new plant construction. Historic and archaeological impacts can generally be effectively managed through adherence to existing historic-preservation laws and guidelines.	SMALL	Same impacts as at Fort Calhoun Station.
Environmental Justice	SMALL	Impacts on minority and low-income communities should be similar to those experienced by the population as a whole.	SMALL	Same as at Fort Calhoun Station.

- **Land Use**

  The existing facilities and infrastructure at Fort Calhoun Station would be used to the extent practicable, limiting the amount of new construction that would be required. Specifically, the staff assumed that a replacement nuclear power plant would use the existing cooling system, switchyard, offices, and transmission line right-of-way. A replacement nuclear power plant at Fort Calhoun Station would require approximately an additional 100 to 300 ha (240 to 740 ac) of new land, some of which may be previously undeveloped land. It is not clear whether there is enough usable land for a replacement unit at Fort Calhoun Station. Additional land beyond the Fort Calhoun Station boundary may be needed to construct a new nuclear power plant while the existing Fort Calhoun Station, Unit 1 continues to operate.

  There would be no net change in land needed for uranium mining because land needed to supply the new nuclear plant would offset the land needed to supply uranium for fueling the existing Fort Calhoun Station, Unit 1 reactor.

  The impact of a replacement nuclear generating plant on land use at Fort Calhoun Station is best characterized as MODERATE. The impact would be greater than the OL renewal alternative.

Land-use requirements at an alternate site would be 200 to 400 ha (500 to 1000 ac) plus the possible need for land for a new transmission line. Assuming a 25-km (15-mi) transmission line, an additional 260 ha (640 ac) would be needed. In addition, it may be necessary to construct a rail spur to an alternate site to bring in equipment during construction. Siting a new nuclear plant at an alternate site would result in LARGE land-use impacts.

- **Ecology**

  Locating a replacement nuclear power plant at Fort Calhoun Station would alter ecological resources because of the need to convert additional land to industrial use. Additional offsite land would be required to meet the needs of this alternative. Some of this land, however, would have been previously disturbed by Fort Calhoun Station activities or agricultural practices. Development of this additional land is expected to result in MODERATE impacts to terrestrial ecology.

  Construction and operational activities for developing the replacement nuclear power plant may result in impacts to aquatic habitats and their species through the erosion of sediments and/or the introduction of other contaminants into the water. The magnitude of impact on the aquatic ecology would depend upon the cooling-water system operations. The impacts (i.e., impingement, entrainment, and heat shock) to aquatic species would be SMALL if operated with the same cooling system that is in place for Fort Calhoun Station and with minor water withdrawals and discharges. Impacts may increase if the once-through cooling system requires higher volumes of withdrawals and/or discharges.

  Overall, siting at Fort Calhoun Station would have a MODERATE ecological impact that would be greater than renewal of the Unit 1 OL.

  At an alternate site, there would be construction impacts and new incremental operational impacts. Even assuming siting at a previously disturbed area, the impacts would alter the terrestrial and aquatic ecology. Impacts could include wildlife-habitat loss, reduced productivity, habitat fragmentation, and a local reduction in biological diversity. Construction and maintenance of the transmission line would have ecological impacts. Overall, the ecological impacts at an alternate site would be MODERATE to LARGE and would depend on the ecological characteristics of the area to be developed.

- **Water Use and Quality**

  The replacement nuclear plant alternative at Fort Calhoun Station is assumed to use the existing once-through cooling system, which would minimize incremental water-use and quality impacts. Surface-water impacts are expected to remain SMALL; the impacts would

be sufficiently minor so that they would not noticeably alter any important attribute of the resource.

The staff assumed that a new nuclear power plant located at Fort Calhoun Station would obtain potable, process, and fire-protection water from the City of Blair public water system similarly to the current practice for Fort Calhoun Station (see Section 2.2.2).

Cooling towers would likely be used at alternate sites. For alternate sites, the impact on the surface water would depend on the volume of water needed for makeup water, the discharge volume, and the characteristics of the receiving body of water. Intake from and discharge to any surface body of water would be regulated by the State of Nebraska. The impacts would be SMALL to MODERATE.

No groundwater is currently used for operation or cooling at Fort Calhoun Station, Unit 1. It is unlikely that groundwater would be used for an alternative nuclear power plant sited at Fort Calhoun Station. Use of groundwater for a nuclear power plant sited at an alternate site is a possibility. Any groundwater withdrawal would require a permit from the local permitting authority.

- **Air Quality**

  Construction of a new nuclear plant at Fort Calhoun Station or an alternate site would result in fugitive emissions during the construction process. Exhaust emissions would also come from vehicles and motorized equipment used during the construction process. An operating nuclear plant would have minor air emissions associated with diesel generators. These emissions would be regulated by the NDEQ or the appropriate agency in another state. Overall, emissions and associated impacts are considered SMALL.

- **Waste**

  The waste impacts associated with the operation of a nuclear power plant are set out in Table B-1 of 10 CFR Part 51, Subpart A, Appendix B. In addition to the impacts shown in Table B-1, construction-related debris would be generated during construction activities and would be removed to an appropriate disposal site. Overall, waste impacts are considered SMALL.

  Siting the replacement nuclear power plant at a site other than Fort Calhoun Station would not alter waste generation. Therefore, the impacts would be SMALL.

- **Human Health**

Human-health impacts for an operating nuclear power plant are set out in 10 CFR Part 51, Subpart A, Appendix B, Table B-1. Overall, human-health impacts are considered SMALL.

Siting the replacement nuclear power plant at a site other than Fort Calhoun Station would not alter human-health impacts. Therefore, the impacts would be SMALL.

- **Socioeconomics**

The construction period and the peak workforce associated with the construction of a new nuclear power plant are currently unquantified (NRC 1996). In the absence of quantified data, the staff assumed a construction period of 5 years and a peak workforce of 2500. The staff assumed that construction would take place while the existing nuclear unit continues operation and would be completed by the time Fort Calhoun Station, Unit 1 permanently ceases operations. During construction, the communities surrounding Fort Calhoun Station would experience demands on housing and public services that could have SMALL to MODERATE impacts. These impacts would be tempered by construction workers commuting to the site from other counties. After construction, the communities would be impacted by the loss of the construction jobs, although this loss could be offset by other growth currently being projected for Douglas and Sarpy counties.

The replacement nuclear unit is assumed to have an operating workforce comparable to the approximately 772 workers currently working at Fort Calhoun Station. In lieu tax payments would remain unaffected. The appropriate characterization of non-transportation socioeconomic impacts for operating replacement nuclear units constructed at Fort Calhoun Station would be SMALL to MODERATE.

During the 5-year construction period, up to 2500 construction workers would be working at Fort Calhoun Station in addition to the approximately 772 workers at Fort Calhoun Station. The addition of the construction workers could place significant traffic loads on existing highways, particularly those leading to Fort Calhoun Station. Such impacts would be MODERATE to LARGE. Transportation impacts related to the commuting of plant operating personnel would be similar to current impacts associated with operation of Fort Calhoun Station, Unit 1 and are considered SMALL.

Construction of a replacement nuclear power plant at an alternate site would relocate some socioeconomic impacts but would not eliminate them. The communities around Fort Calhoun Station would still experience the impact of Fort Calhoun Station operational job loss (although potentially tempered by projected economic growth), and the communities around the new site would have to absorb the impacts of a large, temporary workforce (up to 2500 workers at the peak of construction) and a permanent workforce of approximately 772 workers. Alternate sites would need to be analyzed on a case-by-case basis.

Socioeconomic impacts at an alternate site could be LARGE. Transportation-related impacts associated with commuting workers at an alternate site are site-dependent, but such impacts could be MODERATE to LARGE. Transportation impacts related to the commuting of plant operating personnel would also be site-dependent, but these impacts can be characterized as SMALL.

- **Aesthetics**

  The containment buildings for a replacement nuclear power plant sited at Fort Calhoun Station and other associated buildings would be visible in daylight hours. The nuclear unit would also likely be visible at night because of outside lighting. The replacement plant would be visible from Highway 75 and from the Missouri River. However, with appropriate mitigation, the visual impact could be kept SMALL to MODERATE.

  Noise from operating a replacement nuclear power plant would potentially be audible by recreationists on the Missouri River, but this noise could have a SMALL impact.

  At an alternate site, depending on placement, there would be an aesthetic impact from the buildings. There would also be a significant aesthetic impact associated with constructing a new 25-km (15-mi) transmission line to connect to other lines to enable the delivery of electricity. Noise and light from the plant would be detectable offsite. The impact of noise and light would be mitigated if the plant were located in an industrial area adjacent to another power plant, in which case the impact could be SMALL. The impact could be MODERATE if a transmission line needs to be built to the alternate site. The impact could be LARGE if a greenfield site is selected.

- **Historic and Archaeological Resources**

  At Fort Calhoun Station or an alternate site, a cultural-resources evaluation would be necessary to identify, assess, and address the mitigation of potential impacts of new plant construction on cultural resources. Such areas would include all areas of potential disturbance at the proposed plant site and along associated corridors where new construction would occur (e.g., roads, transmission line rights-of-way, rail lines, or other rights-of-way). Based on the results of these studies, historic and archaeological impacts can generally be effectively managed by adhering to existing historic-preservation laws and guidelines and, as such, are considered SMALL for Fort Calhoun Station or an alternate site.

- **Environmental Justice**

No environmental pathways or locations have been identified that would result in disproportionately high and adverse environmental impacts on minority and low-income populations if a replacement nuclear plant were built at Fort Calhoun Station or an alternate greenfield site. Overall, impacts at Fort Calhoun Station or at an alternate/greenfield site are expected to be SMALL.

8.2.3.2 Closed-Cycle Cooling System

This section discusses the environmental impacts of constructing a nuclear power plant at an alternate site using closed-cycle cooling. The impacts of this option are essentially the same as the impacts for a nuclear power plant using once-through cooling. However, there are minor environmental differences between the closed-cycle and once-through cooling systems. Table 8-7 summarizes the incremental differences.

Table 8-7. Summary of Environmental Impacts of a New Nuclear Power Plant Sited at an Alternate Site with Closed-Cycle Cooling

Impact Category	Change in Impacts from Once-Through Cooling System
Land Use	10 to 12 additional ha (25 to 30 ac) required for cooling towers and associated infrastructure.
Ecology	Land disturbance associated with the construction of cooling towers and associated infrastructure would affect some additional terrestrial habitats. Impacts would depend on ecology at the site. Possible reduction in impacts associated with the entrainment of fish and shellfish in their early life stages, impingement of fish and shellfish, and heat shock.
Surface Water Use and Quality	Water withdrawals would be reduced; however, cooling towers associated with closed-cycle cooling could potentially increase water losses from evaporation. Thermal loading would likely be reduced; however, there would be a greater potential for water-quality impacts from the dissolved constituents.
Groundwater Use and Quality	No change.
Air Quality	No change.
Waste	No change.
Human Health	No change.
Socioeconomics	No change.

Impact Category	Change in Impacts from Once-Through Cooling System
Aesthetics	Introduction of cooling towers and associated plumes. Natural-draft towers could be up to 159 m (520 ft). Mechanical-draft towers could be up to 30 m (100 ft) high and would have an associated noise impact.
Historic and Archaeological Resources	No change.
Environmental Justice	No change.

8.2.4 Purchased Electrical Power

If available, purchased power from other sources could potentially obviate the need to renew the Fort Calhoun Station, Unit 1 OL. It is unlikely, however, that sufficient base-load, firm power supply would be available to replace the capacity of Fort Calhoun Station, Unit 1.

The OPPD has evaluated conventional and prospective power-supply options that could be reasonably implemented before the current Fort Calhoun Station Unit, 1 OL expires in 2013.

Any discussion of the potential sources of purchased power to replace the capacity of Fort Calhoun Station, Unit 1 at a future date is conjectural. Out-of-state utilities (e.g., members of the Mid-Continent Area Power Pool) and independent power producers represent potential sources of such power. Nebraska has been a net exporter of electricity in recent years (OPPD 2002), suggesting that power also could be available from instate sources. If present conditions persist, these potential instate sources would be limited to other utilities. Nebraska is unique in that it is the only state in the country served entirely by publicly owned power entities, which include public power districts such as the OPPD, cooperatives, and municipalities. In view of the relatively low-cost power and nonprofit services from these consumer-owned systems, Nebraska's utility industry remains regulated, and the State is pursuing a "condition certain" approach to deregulation. Under this framework, Nebraska would continue to monitor industry deregulation in the nation and wholesale market prices, and would implement a public process to assess and adopt retail competition in the event that a deregulated market is determined to offer assured benefits and protections to Nebraska consumers (OPPD 2002). Non-utility generating capability in Nebraska amounted to only 16 MW in 1999, and no additions are planned through 2004 (OPPD 2002).

Any predictions regarding the technologies that would be used to generate purchased power at a future date are similarly speculative and conjectural. However, the OPPD assumes one or more of the technologies evaluated by the NRC in the GEIS would be used. The OPPD also considers the GEIS descriptions of these technologies to be appropriately representative.

It is similarly unclear at present what, if any, additional transmission infrastructure would be required in the event the OPPD purchased power to replace the capacity of Fort Calhoun Station. The transmission system in eastern Nebraska is inherently secure and stable because approximately 80 percent of the state's electrical load is there. The bulk 345-kV transmission system in this area has sufficient redundancy, and strong electrical ties exist between major load centers in eastern Nebraska (OPPD 2002). Importing power from the west would be relatively more likely to require additional transmission. Western Nebraska is characterized by low local area loads, high base-load generation, and no synchronous ties to the western interconnected system of the United States. This mismatch creates a heavy reliance on the transmission system to transport power to load centers in eastern Nebraska (OPPD 2002). In any event, importing power could result in the need for additional transmission facilities (OPPD 2002), although supply from multiple diverse sources would minimize the amount of transmission needed. The OPPD assumes for this option that 56 km (35 mi) of new 345-kV transmission line could be required on a 80-m (100-ft) right-of-way and that this line would be routed according to the results of an appropriate routing study to minimize potential environmental impacts, including land-use incompatibilities.

8.2.5 Other Alternatives

Other generation technologies considered by NRC are discussed in the following subsections.

8.2.5.1 Oil-Fired Generation

The EIA projects that oil-fired plants will account for very little of the new generation capacity in the United States through the year 2020 because of higher fuel costs and lower efficiencies (DOE/EIA 2001a). Nevertheless, an oil-fired generating alternative at Fort Calhoun Station for replacing the power generated by Fort Calhoun Station, Unit 1 is considered in this section.

The OPPD has determined that oil-fired operation is more expensive than nuclear or coal-fired operation. In addition, future increases in oil prices are expected to make oil-fired generation increasingly more expensive than coal-fired generation. The high cost of oil has prompted a steady decline in its use for electricity generation. For these reasons, oil-fired generation is not an economically feasible alternative to the license renewal of Fort Calhoun Station, Unit 1.

Also, construction and operation of an oil-fired plant would have environmental impacts. In Section 8.3.11 of the GEIS, the staff estimated that construction of a 1000-MW(e) oil-fired plant would require about 49 ha (120 ac). Additionally, operation of oil-fired plants would have environmental impacts (including impacts on the aquatic environment and air) that would be similar to those from a coal-fired plant.

8.2.5.2 Wind Power

Wind-energy potential is generally rated on a scale of 1 through 7; areas that have a rating of 3 or higher are suitable for wind-energy applications (Elliott et al. 1986). Although the wind-energy resource in much of Nebraska and Iowa is rated 3, the wind-energy resource in the vicinity of Fort Calhoun Station is rated 2. Wind energy is intermittent, and as a result, wind turbines operate at a 30 to 35 percent capacity factor (NWPPC 2000). The staff concludes that wind energy is not a feasible alternative to energy generated by Fort Calhoun Station, Unit 1 because of the intermittency of wind energy and the limited wind-energy resource in the vicinity of Fort Calhoun Station.

8.2.5.3 Solar Power

Solar technologies use the sun's energy and light to provide heat and cooling, light, hot water, and electricity for homes, businesses, and industry. Solar-power technologies, both photovoltaic and thermal, cannot currently compete with conventional fossil-fueled technologies in grid-connected applications due to higher capital costs per kW of capacity. The average capacity factor of photovoltaic cells is about 25 percent (NRC 1996), and the capacity factor for solar thermal systems is about 25 to 40 percent (NRC 1996). Energy-storage requirements limit the use of solar-energy systems as base-load electricity supply.

In the GEIS, the staff noted that by its nature, solar power is intermittent. Therefore, solar power by itself is not suitable for base-load capacity and is not a feasible alternative to the license renewal of Fort Calhoun Station, Unit 1. Solar power, in conjunction with energy-storage mechanisms, might serve as a means of providing base-load power. However, current energy-storage technologies are too expensive to permit solar power to serve as a large base-load generator. Even without storage capacity, solar-power technologies (photovoltaic and thermal) cannot currently compete with conventional fossil-fueled technologies in grid-connected applications, due to high costs per kW of capacity (NRC 1996).

There are substantial impacts to natural resources (wildlife-habitat, land-use, and aesthetic impacts) from the construction of solar-generating facilities. As stated in the GEIS, land requirements are high—14,000 ha (35,000 ac) per 1000 MW(e) for photovoltaic and approximately 5700 ha (14,000 ac) per 1000 MW(e) for solar thermal systems (NRC 1996). Since Fort Calhoun Station, Unit 1 generates 475-MW(e) the land impacts would be approximately half the value estimated for a 1000 MW(e) replacement facility. Neither type of solar electric system would fit at Fort Calhoun Station, and both would have large environmental impacts at a greenfield site.

Fort Calhoun Station receives approximately 4.07 to 4.24 kWh of solar radiation per m^2 per day (OPPD 2002), compared to 6 to 8 kWh/m^2 per day in areas of the West, such as California, which are the most promising for solar technologies (NRC 1996). Because of the area's low rate of solar radiation and high technology costs, solar power is not deemed a feasible base-load alternative to the license renewal of Fort Calhoun Station, Unit 1.

Some solar power may substitute for electric power in rooftop and building applications. Implementation of non-rooftop solar generation on a scale large enough to replace Fort Calhoun Station, Unit 1 would likely result in LARGE environmental impacts.

8.2.5.4 Hydropower

Nebraska has an estimated 167 MW of hydroelectric generating capacity (OPPD 2002). As stated in Section 8.3.4 of the GEIS, hydropower's percentage of the country's generating capacity is expected to decline because hydroelectric facilities have become difficult to site as a result of public concern over flooding, destruction of natural habitat, and alteration of natural river courses.

The staff estimated in the GEIS that land requirements for hydroelectric power are approximately 400,000 ha (1 million ac or about 1600 mi^2) per 1000 MW(e). Based on this estimate, replacing the generating capacity of Fort Calhoun Station, Unit 1 would require flooding approximately 202,300 ha (500,000 ac) or more to generate 500 MW. Due to the relatively low amount of undeveloped hydropower resource in Nebraska and the large land-use and related environmental and ecological-resource impacts associated with siting hydroelectric facilities large enough to replace Fort Calhoun Station, Unit 1, the staff concludes that local hydropower is not a feasible alternative to Fort Calhoun Station, Unit 1 OL renewal. Any attempts to site hydroelectric facilities large enough to replace Fort Calhoun Station, Unit 1 would result in LARGE environmental impacts.

8.2.5.5 Geothermal Energy

Geothermal energy has an average capacity factor of 90 percent and can be used for base-load power where available. However, geothermal technology is not widely used as base-load generation due to the limited geographical availability of the resource and the immature status of the technology (NRC 1996). As illustrated by Figure 8.4 in the GEIS, geothermal plants are most likely to be sited in the western continental United States, Alaska, and Hawaii, where hydrothermal reservoirs are prevalent. There is no feasible central location for geothermal capacity to serve as an alternative to Fort Calhoun Station, Unit 1. The staff concludes that geothermal energy is not a feasible alternative to renewing the Fort Calhoun Station, Unit 1 OL.

8.2.5.6 Wood Waste

A wood-burning facility can provide base-load power and can operate with an average annual capacity factor of around 70 to 80 percent and with 20 to 25 percent efficiency (NRC 1996). The fuels required are variable and site-specific. A significant barrier to the use of wood waste to generate electricity is the high delivered-fuel cost and high construction cost per MW of generating capacity. The larger wood-waste power plants are only 40 to 50 MW(e) in size. Estimates in the GEIS suggest that the overall level of construction impact per MW of installed capacity should be approximately the same as that for a coal-fired plant, although facilities using wood waste for fuel would be built at smaller scales (NRC 1996). Like coal-fired plants, wood-waste plants require large areas for fuel storage and processing and involve the same type of combustion equipment.

Due to uncertainties associated with obtaining sufficient wood and wood waste to fuel a base-load generating facility, the ecological impacts of large-scale timber cutting (e.g., soil erosion and loss of wildlife habitat), and high inefficiency, the staff has determined that wood waste is not a feasible alternative to renewing the Fort Calhoun Station, Unit 1 OL.

8.2.5.7 Municipal Solid Waste

Municipal waste combustors incinerate the waste and use the resultant heat to generate steam, hot water, or electricity. The combustion process can reduce the volume of waste by up to 90 percent and the weight of the waste by up to 75 percent (EPA 2001). Municipal waste combustors use three basic types of technologies: mass burn, modular, and refuse-derived fuel (DOE/EIA 2001b). Mass-burning technologies are most commonly used in the United States. This group of technologies process raw municipal solid waste “as is,” with little or no sizing, shredding, or separation before combustion. Because of the need for specialized waste-separation and handling equipment for municipal solid waste, the initial capital costs for municipal solid-waste plants are greater than for comparable steam-turbine technology at wood-waste facilities (NRC 1996).

Growth in the municipal waste-combustion industry slowed dramatically during the 1990s after rapid growth during the 1980s. The slower growth was due to three primary factors: (1) the Tax Reform Act of 1986, which made capital-intensive projects such as municipal waste-combustion facilities more expensive relative to less capital-intensive, waste-disposal alternatives such as landfills; (2) the 1994 Supreme Court decision *C & A Carbone, Inc. v. Town of Clarkstown*), which struck down local flow-control ordinances that required waste to be delivered to specific municipal waste-combustion facilities rather than landfills that may have had lower fees; and (3) increasingly stringent environmental regulations that increased the capital cost necessary to construct and maintain municipal waste-combustion facilities (DOE/EIA 2001b).

Municipal solid-waste combustors generate an ash residue that is buried in landfills. The ash residue is composed of bottom ash and fly ash. Bottom ash refers to the portion of unburned waste that falls to the bottom of the grate or furnace. Fly ash represents the small particles that rise from the furnace during the combustion process. Fly ash is generally removed from flue-gases using fabric filters and/or scrubbers (DOE/EIA 2001b).

Currently, there are approximately 102 waste-to-energy plants operating in the United States. These plants generate approximately 2800 MW(e), or an average of approximately 28 MW(e) per plant (Integrated Waste Services Association 2001), much smaller than the amount needed to replace the 450-MW(e) base-load capacity of Fort Calhoun Station, Unit 1. Therefore, the staff concludes that municipal solid waste would not be a feasible alternative to renewing the Fort Calhoun Station, Unit 1 OL, particularly at the scale required.

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 for municipal solid waste (NRC 1996). Furthermore, estimates in the GEIS suggest that the overall level of construction impact 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 they would still be LARGER than the environmental effects of renewing the Fort Calhoun Station, Unit 1 OL. Therefore, municipal solid waste would not be a feasible alternative to the renewal of the Fort Calhoun Station, Unit 1 OL, particularly at the scale required.

8.2.5.8 Other Biomass-Derived Fuels

In addition to wood and municipal solid-waste fuels, there are several other concepts for fueling electric generators, including burning crops, converting crops to a liquid fuel such as ethanol, and gasifying crops (including wood waste). In the GEIS, the staff points out that none of these technologies have progressed to the point of being competitive on a large scale or of being reliable enough to replace a base-load plant such as Fort Calhoun Station, Unit 1 (NRC 1996). Further, estimates in the GEIS suggest that the overall level of construction impact from a crop-fired plant should be approximately the same as that for a wood-fired plant. Additionally, crop-fired plants would have similar operational impacts (including impacts on the aquatic environment and air). In addition, these systems have large impacts on land use, due to the acreage needed to grow the energy crops. For these reasons, such fuels do not offer a feasible alternative to renewing the Fort Calhoun Station, Unit 1 OL.

8.2.5.9 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. Phosphoric-acid fuel cells are the most mature fuel-cell technology, but they are only in the initial stages of commercialization. Phosphoric-acid fuel cells are generally considered first-generation technology. These are commercially available today at a cost of approximately $4500 per kW of installed capacity (DOE 2002). Higher-temperature, second-generation fuel cells achieve higher fuel-to-electricity and thermal efficiencies. The higher temperatures contribute to improved efficiencies and give the second-generation fuel cells the capability to generate steam for cogeneration and combined-cycle operations.

DOE has a performance target that by 2003, two second-generation, fuel-cell technologies using molten-carbonate and solid-oxide technology, respectively, will be commercially available in sizes of approximately 3 MW at a cost of $1000 to $1500 per kW of installed capacity (DOE 2002). For comparison, the installed capacity cost for a natural-gas-fired combined-cycle plant is on the order of $500 to $600 per kW (NWPPC 2000). As market acceptance and manufacturing capacity increase, natural-gas-fueled, fuel-cell plants in the 50- to 100-MW range are projected to become available (DOE 2002). At the present time, however, fuel cells are not economically or technologically competitive with other alternatives for base-load electricity generation. Fuels cells are, consequently, not a feasible alternative to renewing the Fort Calhoun Station, Unit 1 OL.

8.2.5.10 Delayed Retirement

The OPPD has no current plans to retire any existing generating units. The OPPD expects all of its existing non-nuclear base-load units to remain in service until at least 2020 (OPPD 2002). For this reason, delayed retirement of other OPPD generating units would not be a feasible alternative to renewing the Fort Calhoun Station, Unit 1 OL.

8.2.5.11 Utility-Sponsored Conservation

As part of its integrated resource planning process, the OPPD annually reviews DSM measures that could be taken to influence customer use of OPPD-supplied electricity, which in turn would reduce overall demand and make more efficient use of the existing generating capacity. To the extent that these measures reduce system demand, they can offset or delay the need for new generation capability, and the NRC thus considered them to be an alternative to license renewal in the GEIS. The OPPD has implemented the following DSM programs and has included associated changes in net demand into its projected base-load forecast (OPPD 2002):

- **Residential Energy Conservation Program**

  The OPPD's residential energy conservation program is designed to conserve energy and save money throughout the year by providing energy-credit refunds and/or special rates to customers who install high-efficiency heat pumps or high-efficiency electric heating and cooling systems.

- **Curtailable Rates**

  The OPPD offers five rate schedules wherein it can conditionally discontinue or reduce service to customers during periods of high demand, thus reducing system peak loads.

- **Load Curtailment/Standby Generation Agreements**

  The OPPD has agreements with several customers to use their own onsite generation sources to reduce or eliminate load at the OPPD's request, which acts to reduce OPPD system peak loads.

- **Commercial Heating, Ventilation, and Air Conditioning**

  The OPPD offers rebates to commercial and industrial customers who install a water-source or air-source heat pump. Additional incentives are offered with the installation of an electric boiler as a backup heat source. This measure results in off-peak (winter) load building and reduction in peak (summer) demand.

The OPPD has screened additional DSM programs and is currently considering implementing the following measures. Upon full implementation, these programs would have the following program impacts and potential system-demand reductions (OPPD 2002):

Proposed Program	Program Impact	Target Demand Reduction (MW)
Air Conditioner (A/C) Cycling	Peak Clipping	100.0
A/C Setback Thermostat	Peak Clipping/Conservation	39.5
A/C Tune-Up/Cleaning	Peak Clipping/Conservation	15.8
Commercial Efficient Lights	Conservation	4.9
Total		160.2

Source: OPPD 2002

The OPPD has achieved and continues to pursue substantial load reductions through the use of DSM efforts. However, as noted above, currently implemented measures are already credited into the OPPD's load forecast and are not available to offset generating capability attributable to Fort Calhoun Station, Unit 1. While the OPPD intends to achieve additional demand reductions of approximately 160 MW in the next few years, the OPPD considers these potential reductions to be a contingency to its overall resource plans. In any event, the potential reductions would be insufficient to replace the capacity of Fort Calhoun Station, Unit 1. On the basis of its annual screening of potentially viable DSM measures, the OPPD is unaware of additional viable opportunities. Based on these considerations, the staff does not consider DSM measures to be a feasible alternative to renewing the Fort Calhoun Station, Unit 1 OL.

8.2.6 Combination of Alternatives

Even though individual alternatives to Fort Calhoun Station, Unit 1 might not be sufficient on their own to replace the capacity of Fort Calhoun Station, Unit 1 due to the small size of the resource or the lack of cost-effective opportunities, it is conceivable that a combination of alternatives might be cost-effective.

As discussed in Section 8.2, Fort Calhoun Station, Unit 1 has a combined net summer rating of 470 MW(e). For the coal- and natural-gas-fired alternatives, the OPPD ER assumes one standard 475-MW(e) unit as a potential replacement for Unit 1. It may be possible to replace the natural-gas alternative with a 320-MW unit combined with the DSM potential of 160 MW. This would likely lead to a higher unit gas-generation cost over a larger plant due to economies of scale.

Table 8-8 contains a summary of the environmental impacts if one assumed a combination of alternatives consisting of 320 MW(e) of combined-cycle, natural-gas-fired generation using closed-cycle cooling and 160 MW(e) gained from additional DSM measures. The impacts are based on the natural-gas-fired-generation impact assumptions discussed in Section 8.2.2, adjusted for the reduced generating capacity. While the DSM measures would have few environmental impacts, operation of the new natural-gas-fired plant would result in increased emissions and environmental impacts. The environmental impacts associated with power purchased from other generators would still occur but would be located elsewhere within the region or nation, as discussed in Section 8.2.4. The impacts of purchased power are not shown in Table 8-8. The staff concludes that it is very unlikely that the environmental impacts of any reasonable combination of generating and conservation options could be reduced to the level of impacts associated with renewing the Fort Calhoun Station, Unit 1 OL.

Table 8-8. Summary of Environmental Impacts of 320 MW(e) of Natural-Gas-Fired Generation and 160 MW(e) from DSM Measures

Impact Category	Fort Calhoun Station		Cass County Site	
	Impact	**Comments**	**Impact**	**Comments**
Land Use	SMALL to MODERATE	10 ha (25 ac) for power block and related facilities. Additional impact of 195 ha (484 ac) for the construction of a new gas-supply pipeline.	SMALL to MODERATE	10 ha (25 ac) for additional power block and related facilities. Additional impact for construction and/or upgrade of an underground makeup-water pipeline, if required. Additional impact of 370 ha (910 ac) for new transmission-line corridor.
Ecology	SMALL to MODERATE	Uses undeveloped but low-quality habitats at Fort Calhoun Station. The impact of a new gas-supply pipeline would depend on the chosen route.	MODERATE to LARGE	Uses undeveloped but low-quality habitats at current Cass County site for infrastructure development. Impacts of new cooling pond would depend on the ecology of the chosen area.
Water Use and Quality (Surface Water)	SMALL	Uses existing cooling system.	SMALL to MODERATE	Impact depends on the volume of water withdrawal and discharge and the characteristics of the surface-water body.
Water Use and Quality (Groundwater)	SMALL	Minimal leaching of wastes produced is possible, but the leaching would not be large enough to have a major impact on the resource.	SMALL	Minimal leaching of wastes produced is possible, but the leaching would not be large enough to have a major impact on the resource.
Air Quality	MODERATE	Sulfur oxides • 4.7 MT/yr (5.1 tons/yr) Nitrogen oxides • 72 MT/yr (79 tons/yr) Carbon monoxide • 110 MT/yr (120 tons/yr) PM_{10} particulates • 14 MT/yr (15 tons/yr) Some hazardous air pollutants	MODERATE	Same as at Fort Calhoun Station.
Waste	SMALL	Small amount of ash produced.	SMALL	Same as at Fort Calhoun Station.
Human Health	SMALL	Impacts considered to be SMALL.	SMALL	Same as at Fort Calhoun Station.

Impact Category	Fort Calhoun Station		Cass County Site	
	Impact	**Comments**	**Impact**	**Comments**
Socioeconomics	SMALL to MODERATE	During construction, impacts would be SMALL to MODERATE. Up to 450 additional workers during the peak of the 2- to 3-year construction period, followed by a reduction from the current Fort Calhoun Station workforce. The tax and wage impacts from employee earnings would be reduced proportionally to the number of workers. In lieu payments would be unchanged. Impacts during operation would be SMALL.	SMALL to MODERATE	During construction, impacts would be SMALL to MODERATE. Up to 450 additional workers during the peak of the 2- to 3-year construction period. The payroll tax and wage impacts would be reduced proportionally to the number of workers, which could be potentially offset by projected economic growth. Cass County would add an additional 10 jobs. Impacts during operation would be SMALL.
Aesthetics	SMALL to MODERATE	Development would consume large areas that are currently used for agriculture. Stacks and infrastructure would be clearly visible, but the aesthetic impact would be similar to the current Fort Calhoun Station, Unit 1.	SMALL	The aesthetic impact would be SMALL due to existing land use in the region.
Historic and Archaeological Resources	SMALL	Any potential impacts can likely be effectively managed.	SMALL	Any potential impacts can likely be effectively managed.
Environmental Justice	SMALL	Impacts on minority and low-income communities should be similar to those experienced by the population as a whole. Some impacts on housing may occur during construction; the loss of 772 operating jobs at Fort Calhoun Station could reduce employment prospects for minority and low-income populations. Impacts could be offset by projected economic growth and the ability of affected workers to commute to other jobs.	SMALL	Impacts on minority and low-income communities should be similar to those experienced by the population as a whole. Ten additional jobs would have little impact on minority and low-income communities.

8.3 Summary of Alternatives Considered

The environmental impacts of the proposed action, renewal of the Fort Calhoun Station, Unit 1 OL, are SMALL for all impact categories (except collective offsite radiological impacts from the fuel cycle and from high-level waste and spent fuel disposal, for which a single significance level was not assigned). The alternative actions, i.e., the no-action alternative (discussed in Section 8.1), new generation alternatives (from coal, natural gas, and nuclear discussed in Sections 8.2.1 through 8.2.3, respectively), purchased electrical power (discussed in Section 8.2.4), alternative technologies (discussed in Section 8.2.5), and the combination of alternatives (discussed in Section 8.2.6) were considered.

The no-action alternative would require replacing electricity-generating capacity by (1) DSM and energy conservation, (2) power purchased from other electricity providers, (3) generating alternatives other than Fort Calhoun Station, Unit 1, or (4) some combination of these options and would result in decommissioning Fort Calhoun Station, Unit 1. For each of the new generation alternatives (coal, natural gas, and nuclear), the environmental impacts would not be less than the impacts of license renewal. For example, the land-disturbance impacts resulting from the construction of any new facility would be greater than the impacts of continued operation of Fort Calhoun Station, Unit 1. The impacts of purchased electrical power would still occur, but they would occur elsewhere. Alternative technologies are not considered feasible at this time, and it is very unlikely that the environmental impacts of any reasonable combination of generation and conservation options could be reduced to the level of impacts associated with renewing the Fort Calhoun Station, Unit 1 OL.

The staff concludes that the alternative actions, including the no-action alternative, may have environmental effects in at least some impact categories that reach MODERATE or LARGE significance.

8.4 References

10 CFR Part 50. Code of Federal Regulations, Title 10*, Energy,* Part 50, “Domestic Licensing of Production and Utilization Facilities.”

10 CFR Part 51. Code of Federal Regulations, Title 10, *Energy*, Part 51, “Environmental Protection Regulations for Domestic Licensing and Related Functions.”

10 CFR Part 52. Code of Federal Regulations, Title 10, *Energy,* Part 52, “Early Site Permits; Standard Design Certifications; and Combined Licenses for Nuclear Power Plants.”

40 CFR Part 51. Code of Federal Regulations, Title 40, *Protection of Environment*, Part 51, "Requirements for Preparation, Adoption, and Submittal of Implementation Plans."

40 CFR Part 60. Code of Federal Regulations, Title 40, *Protection of Environment*, Part 60, "Standards of Performance for New Stationary Sources."

40 CFR Part 81. Code of Federal Regulations, Title 40, *Protection of Environment*, Part 81, "Designation of Areas for Air Quality Planning Purposes."

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