1.0 Introduction

Under the U.S. Nuclear Regulatory Commission's (NRC's) environmental protection regulations in Title 10 of the *Code of Federal Regulations* (CFR) Part 51, which implement the National Environmental Policy Act (NEPA), renewal of a nuclear power plant operating license (OL) requires the preparation of an environmental impact statement (EIS). In preparing the EIS, the NRC staff is required first to issue the statement in draft form for public comment, and then issue a final statement after considering public comments on the draft. To support the preparation of the EIS, the staff has prepared a *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS), NUREG-1437, Volumes 1 and 2 (NRC 1996; 1999).[a] The GEIS is intended to (1) provide an understanding of the types and severity of environmental impacts that may occur as a result of license renewal of nuclear power plants under 10 CFR Part 54, (2) identify and assess the impacts that are expected to be generic to license renewal, and (3) support 10 CFR Part 51 to define the number and scope of issues that need to be addressed by the applicants in plant-by-plant renewal proceedings. The GEIS guides the preparation of complete plant-specific information in support of the OL renewal process.

Nuclear Management Company, LLC (NMC), operates the Monticello Nuclear Generating Plant (Monticello) in central Minnesota under OL No. DPR-22, which was issued by the NRC. NMC is a licensee for the purposes of its current OL and an applicant for the renewal of the OL. Monticello is owned by Northern States Power Company (NSP) which is a wholly owned utility operating subsidiary of Xcel Energy Inc. (Xcel Energy). This OL will expire on September 8, 2010. NMC submitted an application dated March 16, 2005, to the NRC to renew the Monticello OL for an additional 20 years beyond the expiration of the current license pursuant to 10 CFR Part 54. Pursuant to 10 CFR 54.23 and 51.53(c), NMC submitted an Environmental Report (ER; NMC 2005a) in which NMC analyzed the environmental impacts associated with the proposed license renewal action, considered alternatives to the proposed action, and evaluated mitigation measures for reducing adverse environmental effects.

This report is the plant-specific supplement to the GEIS (the supplemental EIS [SEIS]) for the NMC license renewal application. This SEIS is a supplement to the GEIS because it relies, in part, on the findings of the GEIS. The staff will also prepare a separate safety evaluation report in accordance with 10 CFR Part 54.

1.1 Report Contents

The following sections of this introduction (1) describe the background for the preparation of this SEIS, including the development of the GEIS and the process used by the staff to assess the environmental impacts associated with license renewal, (2) describe the proposed Federal action to renew the Monticello OL, (3) discuss the purpose and need for the proposed action,

[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.

and (4) present the status of NMC's compliance with environmental quality standards and requirements that have been imposed by Federal, State, regional, and local agencies that are responsible for environmental protection.

The ensuing chapters of this SEIS closely parallel the contents and organization of the GEIS. Chapter 2 describes the site, power plant, and interactions of the plant with the environment. Chapters 3 and 4, respectively, discuss the potential environmental impacts of plant refurbishment and plant operation during the renewal term. Chapter 5 contains an evaluation of potential environmental impacts of plant accidents and includes consideration of severe accident mitigation alternatives. Chapter 6 discusses the uranium fuel cycle and solid waste management. Chapter 7 discusses decommissioning, and Chapter 8 discusses alternatives to license renewal. Finally, Chapter 9 summarizes the findings of the preceding chapters and draws conclusions about the adverse impacts that cannot be avoided; the relationship between short-term uses of man's environment and the maintenance and enhancement of long-term productivity; and the irreversible or irretrievable commitment of resources. Chapter 9 also presents the staff's recommendation with respect to the proposed license renewal action.

Additional information is included in appendixes. Appendix A contains public comments received on the environmental review for license renewal and staff responses to the public comments. Appendixes B through G, respectively, list the following:

- the preparers of the supplement
- the chronology of NRC staff's environmental review correspondence related to this SEIS
- the organizations contacted during the development of this SEIS
- NMC's compliance status in Table E-1 (this appendix also contains copies of consultation correspondence prepared and sent during the evaluation process)
- GEIS environmental issues that are not applicable to Monticello
- NRC staff evaluation of severe accident mitigation alternatives (SAMAs).

1.2 Background

Use of the GEIS, which examines the possible environmental impacts that could occur as a result of renewing individual nuclear power plant OLs under 10 CFR Part 54, and the established license renewal evaluation process supports the thorough evaluation of the impacts of renewal of OLs.

1.2.1 Generic Environmental Impact Statement

The NRC initiated a generic assessment of the environmental impacts associated with the license renewal term to improve the efficiency of the license renewal process by documenting the assessment results and codifying the results in the Commission's regulations. This assessment is provided in the GEIS, which serves as the principal reference for all nuclear power plant license renewal EISs.

The GEIS documents the results of the systematic approach that was taken to evaluate the environmental consequences of renewing the licenses of individual nuclear power plants and operating them for an additional 20 years. For each potential environmental issue, the GEIS (1) describes the activity that affects the environment, (2) identifies the population or resource that is affected, (3) assesses the nature and magnitude of the impact on the affected population or resource, (4) characterizes the significance of the effect for both beneficial and adverse effects, (5) determines whether the results of the analysis apply to all plants, and (6) considers whether additional mitigation measures would be warranted for impacts that would have the same significance level for all plants.

The NRC's standard of significance for impacts was established using the Council on Environmental Quality (CEQ) terminology for "significantly" (40 CFR 1508.27, which requires consideration of both "context" and "intensity"). Using the CEQ terminology, the NRC established three significance levels—SMALL, MODERATE, or LARGE. The definitions of the three significance levels are set forth in the footnotes to Table B-1 of 10 CFR Part 51, Subpart A, Appendix B, as follows:

> SMALL—Environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource.
>
> 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 GEIS assigns a significance level to each environmental issue, assuming that ongoing mitigation measures would continue.

The GEIS includes a determination of whether the analysis of the environmental issue could be applied to all plants and whether additional mitigation measures would be warranted. Issues are assigned a Category 1 or a Category 2 designation. As set forth in the GEIS, **Category 1** issues are those that meet all of the following criteria:

(1) The environmental impacts associated with the issue have been determined to apply either to all plants or, for some issues, to plants having a specific type of cooling system or other specified plant or site characteristics.

(2) A single significance level (i.e., SMALL, MODERATE, or LARGE) has been assigned to the impacts (except for collective offsite radiological impacts from the fuel cycle and from high-level waste and spent fuel disposal).

(3) Mitigation of adverse impacts associated with the issue has been considered in the analysis, and it has been determined that additional plant-specific mitigation measures are likely not to be sufficiently beneficial to warrant implementation.

For issues that meet the three Category 1 criteria, no additional plant-specific analysis is required in this SEIS unless new and significant information is identified.

Category 2 issues are those that do not meet one or more of the criteria of Category 1, and therefore, additional plant-specific review for these issues is required.

In the GEIS, the staff assessed 92 environmental issues and determined that 69 qualified as Category 1 issues and 21 qualified as Category 2 issues. Two issues, environmental justice and chronic effects of electromagnetic fields, were not categorized and are addressed in plant-specific analysis. Environmental justice was not evaluated on a generic basis in the GEIS and information on the chronic effects of electromagnetic fields was not conclusive at the time the GEIS was prepared. Of the 92 issues, 11 are related only to refurbishment, 6 are related only to decommissioning, 67 apply only to operation during the renewal term, and 8 apply to both refurbishment and operation during the renewal term. A summary of the findings for all 92 issues in the GEIS is codified in Table B-1 of 10 CFR Part 51, Subpart A, Appendix B.

1.2.2 License Renewal Evaluation Process

An applicant seeking to renew its OL is required to submit an ER as part of its application. The license-renewal evaluation process involves careful review of the applicant's ER as well as assurance that all new and potentially significant information not already addressed in or available during the GEIS evaluation is identified, reviewed, and assessed to verify the environmental impacts of the proposed license renewal.

In accordance with 10 CFR 51.53(c)(2) and (3), the ER submitted by the applicant must

- provide an analysis of the Category 2 issues in Table B-1 of 10 CFR Part 51, Subpart A, Appendix B in accordance with 10 CFR 51.53(c)(3)(ii)

- discuss actions to mitigate any adverse impacts associated with the proposed action and environmental impacts of alternatives to the proposed action.

In accordance with 10 CFR 51.53(c)(2), the ER does not need to

- consider the economic benefits and costs of the proposed action and alternatives to the proposed action except insofar as such benefits and costs are either (1) essential for making a determination regarding the inclusion of an alternative in the range of alternatives considered, or (2) relevant to mitigation
- consider the need for power and other issues not related to the environmental effects of the proposed action and the alternatives
- discuss any aspect of the storage of spent fuel within the scope of the generic determination in 10 CFR 51.23(a) in accordance with 10 CFR 51.23(b)
- contain an analysis of any Category 1 issue unless there is significant new information on a specific issue—this is pursuant to 10 CFR 51.23(c)(3)(iii) and (iv).

New and significant information is (1) information that identifies a significant environmental issue not covered in the GEIS and codified in Table B-1 of 10 CFR Part 51, Subpart A, Appendix B, or (2) information that was not considered in the analyses summarized in the GEIS and that leads to an impact finding that is different from the finding presented in the GEIS and codified in 10 CFR Part 51.

In preparing to submit its application to renew the Monticello OL, NMC developed a process to ensure that (1) information not addressed in or available during the GEIS evaluation regarding the environmental impacts of license renewal for Monticello would be properly reviewed before submitting the ER and (2) such new and potentially significant information related to renewal of the license for Monticello would be identified, reviewed, and assessed during the period of NRC review. NMC reviewed the Category 1 issues that appear in Table B-1 of 10 CFR Part 51, Subpart A, Appendix B, to verify that the conclusions of the GEIS remained valid with respect to Monticello. This review was performed by personnel from NMC and its support organization who were familiar with NEPA issues and the scientific disciplines involved in the preparation of a license renewal ER.

The NRC staff also has a process for identifying new and significant information. That process is described in detail in NUREG-1555, *Standard Review Plans for Environmental Reviews for Nuclear Power Plants, Supplement 1: Operating License Renewal* (ESRP), (NRC 2000). The search for new information includes (1) review of an applicant's ER and the process for discovering and evaluating the significance of new information; (2) review of records of public comments; (3) review of environmental quality standards and regulations; (4) coordination with Federal, State, and local environmental protection and resource agencies; and (5) review of the technical literature. New information discovered by the staff is evaluated for significance using the criteria set forth in the GEIS. For Category 1 issues where new and significant information is identified, reconsideration of the conclusions for those issues is limited in scope to the

assessment of the relevant new and significant information. The scope of the assessment does not include other facets of the issue that are not affected by the new information.

Chapters 3 through 7 discuss the environmental issues considered in the GEIS that are applicable to Monticello. At the beginning of the discussion of each set of issues, a table identifies the issues to be addressed and lists the sections in the GEIS where the issue is discussed. Category 1 and Category 2 issues are listed in separate tables. For Category 1 issues for which there is no new and significant information, the table is followed by a set of short paragraphs that state the GEIS conclusion codified in Table B-1 of 10 CFR Part 51, Subpart A, Appendix B, followed by the staff's analysis and conclusion. For Category 2 issues, in addition to the list of GEIS sections where the issue is discussed, the tables list the subparagraph of 10 CFR 51.53(c)(3)(ii) that describes the analysis required and the SEIS sections where the analysis is presented. The SEIS sections that include discussions of the Category 2 issues are presented immediately following the table.

The NRC prepares an independent analysis of the environmental impacts of license renewal and compares these impacts with the environmental impacts of alternatives. The evaluation of the NMC license renewal application began with publication of a notice of acceptance for docketing in the *Federal Register* (FR); (70 FR 25117 [NRC 2005a]) on May 12, 2005. The staff published a notice of intent to prepare an EIS and conduct scoping (70 FR 32381 [NRC 2005b]) on June 2, 2005. Two public scoping meetings were held on June 30, 2005, in Monticello, Minnesota. Comments received during the scoping period were summarized in the *Environmental Impact Statement Scoping Process: Summary Report, Monticello Nuclear Generating Plant, Monticello, Minnesota* (NRC 2005c) dated October 7, 2005. These comments are also presented in Part 1 of Appendix A.

The staff followed the review guidance contained in NUREG-1555, Supplement 1 (NRC 2000). The staff and contractors retained to assist the staff visited the Monticello site on June 28 and 29, 2005, to gather information and to become familiar with the site and its environs. The staff also reviewed the comments received during scoping, and consulted with Federal, State, regional, and local agencies. A list of the organizations consulted is provided in Appendix D. Other documents related to Monticello were reviewed and are referenced in this report.

A 75-day comment period to allow members of the public to comment on the preliminary results of the NRC staff's review began on the date of publication of the U.S. Environmental Protection Agency Notice of Filing of the draft SEIS. During this comment period, two public meetings were held in Monticello, Minnesota, on March 22, 2006. During these meetings, the staff described the preliminary results of the NRC environmental review and answered questions related to it to provide members of the public with information to assist them in formulating their comments.

This SEIS presents the staff's analysis that considers and weighs the environmental effects of the proposed renewal of the OL for Monticello, the environmental impacts of alternatives to license renewal, and mitigation measures available for avoiding adverse environmental effects. Chapter 9, "Summary and Conclusions," provides the NRC staff's recommendation to the Commission on whether or not the adverse environmental impacts of license renewal are so great that preserving the option of license renewal for energy-planning decisionmakers would be unreasonable.

1.3 The Proposed Federal Action

The proposed Federal action is renewal of the OL for Monticello. Monticello is located in central Minnesota on the southern bank of the Mississippi River, approximately 22 mi southeast of St. Cloud, and 30 mi northwest of Minneapolis, St. Paul. The plant has one General Electric Company-designed boiling-water reactor, with a design power level of 1670 megawatts thermal (MW[t]) and a net power output of 545 megawatts electric (MW[e]). An authorized power uprate in 1998 increased power levels to approximately 1775 MW(t) (600 MW[e]). Plant cooling is primarily provided by an open-cycle system that draws and discharges water to the Mississippi River. Monticello is also equipped with two mechanical draft cooling towers which enable complete or partial recirculation of the cooling water when required by special permit conditions. Monticello produces electricity to supply the needs of more than 585,000 homes. The current OL for Monticello expires on September 8, 2010. By letter dated March 16, 2005, NMC submitted an application to the NRC (NMC 2005b) to renew this OL for an additional 20 years of operation (i.e., until September 8, 2030).

1.4 The Purpose and Need for the Proposed Action

Although a licensee must have a renewed license to operate a reactor beyond the term of the existing OL, the possession of that license is just one of a number of conditions that must be met for the licensee to continue plant operation during the term of the renewed license. Once an OL is renewed, State regulatory agencies and the owners of the plant will ultimately decide whether the plant will continue to operate based on factors such as the need for power or other matters within the State's jurisdiction or the purview of the owners.

Thus, for license renewal reviews, the NRC has adopted the following definition of purpose and need (GEIS Section 1.3):

> The purpose and need for the proposed action (renewal of an operating license) is to provide an option that allows for power generation capability beyond the term of a current nuclear power plant operating license to meet future system generating needs, as such needs may be determined by State, utility, and where authorized, Federal (other than NRC) decisionmakers.

This definition of purpose and need reflects the Commission's recognition that, unless there are findings in the safety review required by the Atomic Energy Act of 1954 or findings in the NEPA environmental analysis that would lead the NRC to reject a license renewal application, the NRC does not have a role in the energy-planning decisions of State regulators and utility officials as to whether a particular nuclear power plant should continue to operate. From the perspective of the licensee and the State regulatory authority, the purpose of renewing an OL is to maintain the availability of the nuclear plant to meet system energy requirements beyond the current term of the plant's license.

1.5 Compliance and Consultations

NMC is required to hold certain Federal, State, and local environmental permits, as well as meet relevant Federal and State statutory requirements. In its ER, NMC provided a list of the authorizations from Federal, State, and local authorities for current operations as well as environmental approvals and consultations associated with Monticello license renewal. Authorizations and consultations relevant to the proposed renewal action are included in Appendix E of this SEIS.

The staff has reviewed the list and consulted with the appropriate Federal, State, and local agencies to identify any compliance or permit issues or significant environmental issues of concern to the reviewing agencies. These agencies did not identify any new and significant environmental issues. The ER states that NMC is in compliance with applicable environmental standards and requirements for Monticello. The staff has not identified any environmental issues that are both new and significant.

1.6 References

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

10 CFR Part 54. Code of Federal Regulations, Title 10, *Energy*, Part 54, "Requirements for Renewal of Operating Licenses for Nuclear Power Plants."

40 CFR Part 1508. Code of Federal Regulations, Title 40, *Protection of Environment*, Part 1508, "Terminology and Index."

Atomic Energy Act of 1954 (AEA). 42 USC 2011, et seq.

Nuclear Management Company (NMC). 2005a. *Applicant's Environmental Report—Operating License Renewal Stage, Monticello Nuclear Generating Plant.* Docket No. 50-263, License No. DPR-22. Monticello, Minnesota.

Nuclear Management Company (NMC). 2005b. *Application for Renewed Operating License, Monticello Nuclear Generating Plant.* Monticello, Minnesota.

National Environmental Policy Act of 1969 (NEPA), as amended. 42 USC 4332, et seq.

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

U.S. Nuclear Regulatory Commission (NRC). 1999. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants, Main Report,* Section 6.3 – Transportation, Table 9.1, Summary of findings on NEPA issues for license renewal of nuclear power plants, Final Report. NUREG-1437, Volume 1, Addendum 1, Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 2000. *Standard Review Plans for Environmental Reviews for Nuclear Power Plants, Main Report, Supplement 1: Operating License Renewal.* NUREG-1555, Supplement 1, Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 2005a. "Notice of Acceptance for Docketing of the Application and Notice of Opportunity for a Hearing Regarding Renewal of License No. DPR-22 for an Additional Twenty-Year Period." *Federal Register,* Vol. 70, No. 91, pp. 25117-25119. Washington, D.C. May 12, 2005.

U.S. Nuclear Regulatory Commission (NRC). 2005b. "Notice of Intent to Prepare an Environmental Impact Statement and Conduct Scoping Process." *Federal Register,* Vol. 70, No. 105, pp. 32381-32382. Washington, D.C. June 2, 2005.

U.S. Nuclear Regulatory Commission (NRC). 2005c. *Environmental Impact Statement Scoping Process: Summary Report, Monticello Nuclear Generating Plant, Monticello, Minnesota.* Washington, D.C. October 7, 2005.

2.0 Description of Nuclear Power Plant and Site and Plant Interaction with the Environment

Monticello Nuclear Generating Plant (Monticello) is located in the City of Monticello, Wright County, Minnesota, on the southern bank of the Mississippi River (River Mile [RM] 900). The plant consists of one unit. The unit is a boiling-water reactor that produces steam which passes through turbines to generate electricity. Plant cooling is primarily provided by an open-cycle system that draws and discharges water to the Mississippi River. Monticello is also equipped with two mechanical draft cooling towers which enable complete or partial recirculation of the cooling water when required by special permit conditions. The plant and its environs are described in Section 2.1, and the plant's interaction with the environment is presented in Section 2.2.

2.1 Plant and Site Description and Proposed Plant Operation During the Renewal Term

Monticello is located in central Minnesota on the southern bank of the Mississippi River, approximately 22 mi southeast of St. Cloud, and 30 mi northwest of Minneapolis/St. Paul. The area within 6 mi of Monticello includes portions of Wright and Sherburne counties and is primarily agricultural. The Monticello site is located in a region dominated by rivers, streams, and lakes, with numerous public recreational and natural areas located within 50 mi of the site. The site consists of 2150 ac with approximately 2 mi of frontage on the north and south banks of the Mississippi River. Approximately 50 ac are occupied by the plant and its supporting facilities (NMC 2005a). Figures 2-1 and 2-2 show the site location and features within 50 mi and 6 mi, respectively.

2.1.1 External Appearance and Setting

Site structures include a reactor building, a turbine building, a radioactive-waste building, an off-gas stack, two mechanical draft cooling towers, a diesel emergency generator building, and the Monticello Substation. Transmission lines and corridors are also prominent features on and near the Monticello site. The site's exclusion zone has been designated as being within the Owner Controlled Area fence. Of the site's 2150 ac, approximately 450 ac are located on the northern bank of the Mississippi River, with the majority of the acreage on the southern bank. Approximately 50 ac on the southern bank are occupied by the facility structures, and the remaining acres are undeveloped with land leased by local farmers for growing row crops, and under lease for recreational use.

50-MILE REGION

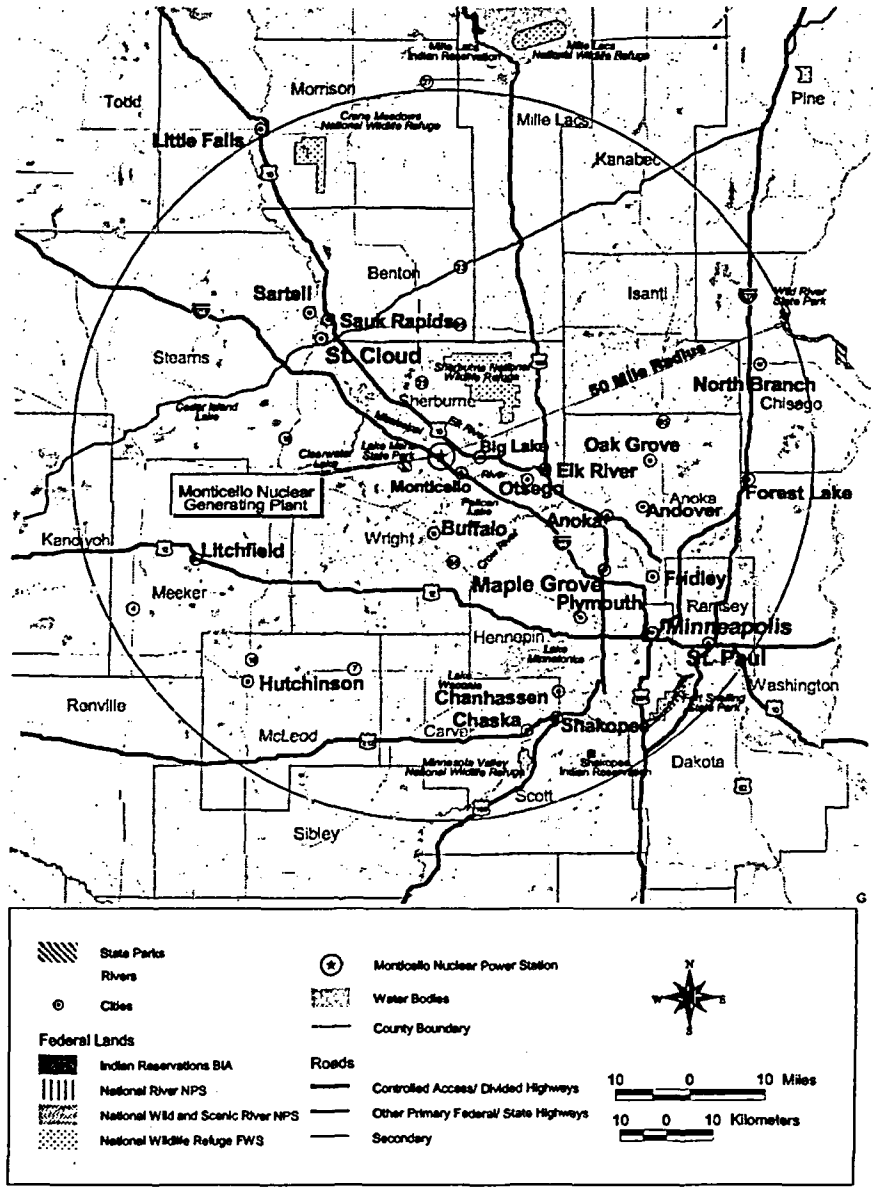

Figure 2-1. Location of Monticello, 50-mi Region

6-MILE SITE VICINITY

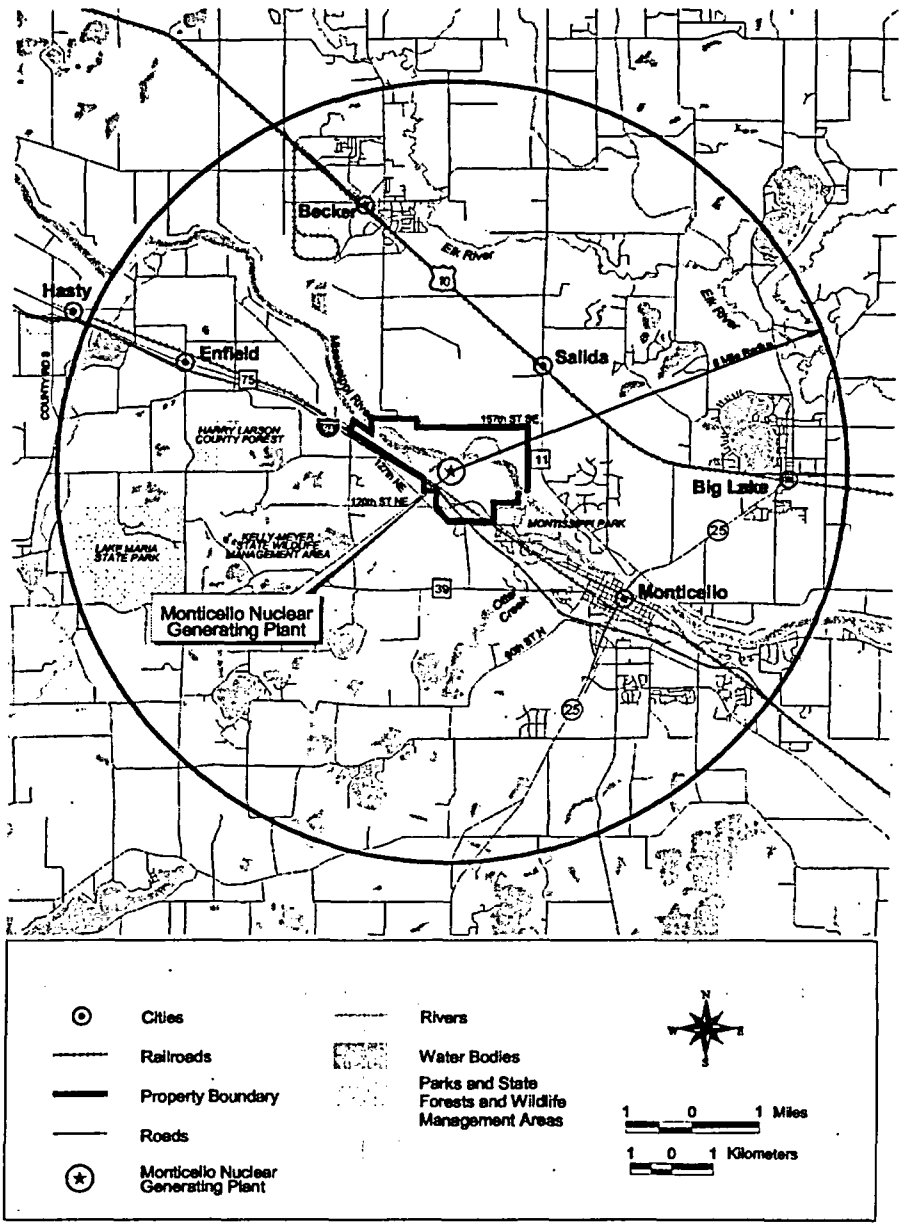

Figure 2-2. Location of Monticello, 6-mi Region

Natural surface drainage of the Monticello site is generally to the southwest at a 2- to 3-percent grade away from the Mississippi River. The land cover of the site is predominated by formerly cultivated fields in various stages of ecological succession (NMC 2005a).

2.1.2 Reactor Systems

Monticello is a single-unit electric generating plant. The unit is a single-cycle, forced circulation, low-power density boiling water reactor. General Electric Company designed and supplied the nuclear steam supply system, the initial reactor fuel, and the turbine-generator unit and its related systems. Monticello was designed for operation at power levels up to 1670 megawatts thermal (MW[t]) and an electrical output of up to 545 megawatts electric (MW[e]) (AEC 1972). However, an uprate license amendment was submitted and subsequently approved by the Nuclear Regulatory Commission (NRC) on January 21, 1998 (NRC 1998). The current rated thermal power level for the unit is 1775 MW(t) and 600 MW(e).

The Monticello facility is depicted in Figure 2-3. The reactor containment structure consists of a drywell, which encloses the reactor vessel and recirculation pumps; a pressure suppression chamber, which stores a large volume of water; a connecting vent system between the drywell and the suppression chamber; and isolation valves. The concrete reactor building serves as a radiation shield and fulfills a secondary containment function. The reactor building is maintained under a slight negative pressure, with the building exhaust monitored prior to release to the atmosphere through the reactor building ventilation exhaust stack. The containment for the unit is designed to withstand an internal pressure of 56 pounds per square inch above atmospheric pressure (NMC 2005b). Monticello uses low-enriched uranium dioxide fuel with enrichments below 5.0 percent by weight uranium-235, with peak fuel-rod burn-up levels less than 62,000 megawatt-days per metric ton uranium (MWd/MTU) (NMC 2005c).

2.1.3 Cooling and Auxiliary Water Systems

The Mississippi River is the source of water at Monticello for plant condenser cooling and some auxiliary water systems, such as service water cooling, screen wash, and fire protection. Five groundwater wells provide water for other auxiliary systems, such as water for the reverse osmosis/make-up demineralizer system used to produce purified water for the plant primary systems and seal water to pumps located at the intake structure. Groundwater is also used for domestic potable use, including drinking water, lavatories, and showers at the plant. Figure 2-4 shows the locations of the two induced-draft cooling towers and the discharge canal.

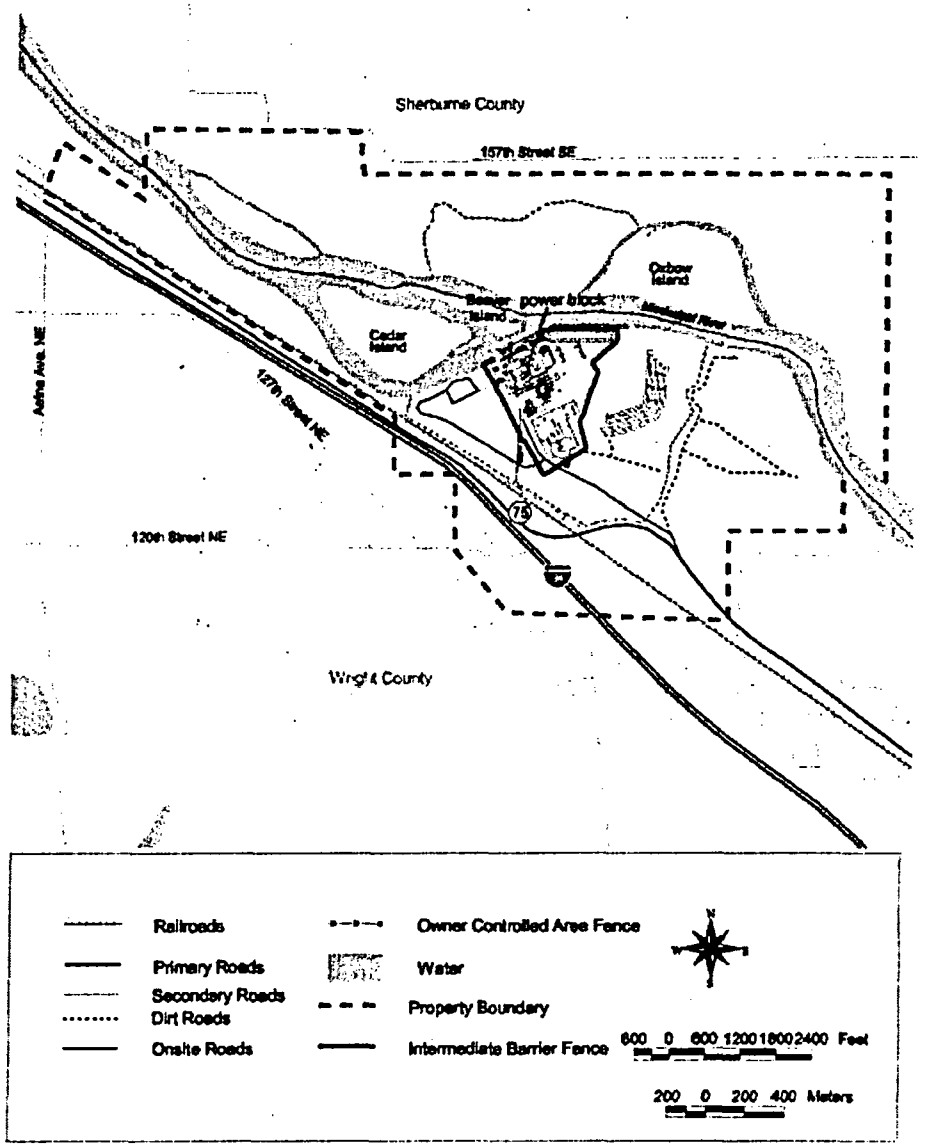

Figure 2-3. Monticello Site Powerblock Area

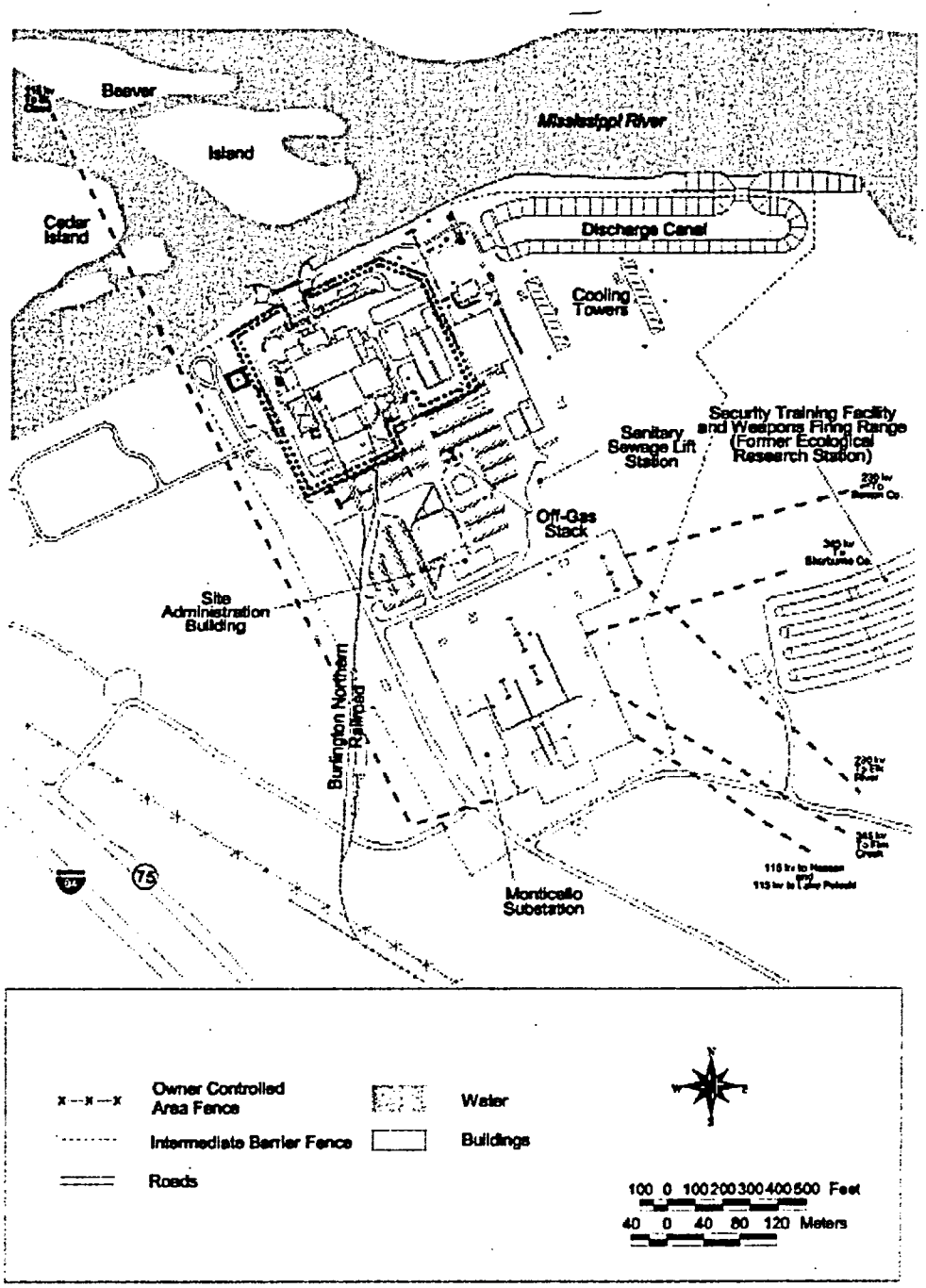

Figure 2-4. Monticello Cooling and Auxiliary Water System

Mississippi River water enters the intake structure through an approach channel formed by sheet pile structures that are 98 ft apart and extend 59 ft into the river, angled at 81 degrees to

the shoreline. At the intake structure, the approach channel reduces to approximately 63 ft wide. Water enters the intake structure over a 63-ft wide concrete sill that serves as a sediment barrier. At the center of the sill is a 12.5-ft wide stop log section that can be removed during low river levels to allow water to flow unobstructed. On the plant side of the sill is a concrete apron extending the width of the approach channel and 16 ft upstream of the bar rack. The bar rack includes a motor-operated bar rack rake that prevents large debris from entering the intake structure. The bar rack rake lifts debris into a trash hopper to prevent the debris from re-entering the river. After the bar rack, the water is divided into two separate streams that pass through two parallel traveling screens located 10 ft behind the bar racks. The traveling screens have 3/8-in. mesh that removes fine debris. The traveling screens are normally rotated and rinsed every 12 hours and are run continuously when the river temperature is above 50°F. The debris, as well as any impinged organisms, are rinsed from the traveling screens into a common sluiceway that extends back to the river downstream of the intake structures. From the traveling screens, water passes through the service water pump bay and two parallel motor-operated sluice gates before reaching the circulating water pumps.

The circulating water system consists of two circulating water pumps, each rated 140,000 gpm, mounted over each end of the intake structure. These pumps are designed to circulate 292,000 gpm of cooling water through the main condenser. The plant service water system consists of three service water pumps each with 6000 gpm capacity. These pumps supply over 10,000 gpm to meet all nonreactor requirements during normal operating conditions.

Effluent from the condenser and service water system is piped approximately 600 ft through two 108-in. steel pipes to the discharge structure at the head of the discharge canal. The discharge structure is constructed of reinforced concrete and measures 50 ft by 54 ft by 38 ft high, with the roof approximately 5 ft above grade. The discharge structure includes two isolation and two sluice gates. The motor-operated sluice gates can isolate the discharge flow from the discharge canal. During once-through or open-cycle operation, the sluice gates are open and the circulating water is returned to the Mississippi River through the discharge canal. The bottom of the discharge canal was constructed on a 0.25 percent slope in an easterly direction approximately 1000 ft to where it enters the river. An overflow weir was added in 1980 to allow normal outflow of cooling water from the discharge canal, re-establishing the previously existing shoreline of the river. The weir inhibits fish from entering the canal. The discharge weir consists of an earth filled dike and a vertical sheet-pile overflow section.

Monticello also has the capability of utilizing two mechanical draft cooling towers to meet surface water appropriations limits and thermal discharge limits as needed (see Section 2.2.2.). Two cooling tower pumps are located at the discharge structure and are designed to deliver 151,000 gpm to each cooling tower. In this mode of operation, control gates can isolate the Mississippi River from the main intake structure and the discharge structure. Cooled water from the cooling tower basins is then allowed to flow by gravity to the circulating water pumps in the intake structure. Cooling tower blowdown is piped by gravity to the discharge canal. Makeup water to replace water lost from cooling tower evaporation, drift, and blowdown is

serviced by two designated pumps, each rated 14,000 gpm, located at the intake structure. Cooling towers are normally operated in May through September, when Mississippi River temperatures have typically exceeded 68°F, or during periods of extremely low flow. One tower is used occasionally during the winter to provide a flow path of heated water to the intake to keep the intake area free of ice.

Five groundwater wells at Monticello provide water for domestic potable use and some auxiliary systems. Two wells, each equipped with a 100-gpm capacity pump, are manifold together and provide raw water to the reverse osmosis/make-up demineralizer system, and seal water to pumps at the plant intake structure. Two other wells provide additional domestic water as needed. The final well was installed in 2004 at the Security Training Facility for potable water use.

2.1.4 Radioactive Waste Management Systems and Effluent Control Systems

The Monticello radioactive waste (radwaste) systems are designed to collect and treat radioactive materials that are produced as a byproduct of plant operations. The design objective for the radwaste systems is to provide equipment, instrumentation, and operating procedures such that the discharge of radioactivity from the plant will not exceed the limits set forth in 10 CFR Part 20. The radwaste systems are also designed and operated to meet the dose design objectives of 10 CFR Part 50, Appendix I, to meet the criterion "as low as reasonably achievable," or ALARA.

Radioactive material produced from fission of uranium-235 and neutron activation of metals in the reactor coolant system is the primary source of liquid, gaseous, and solid radioactive waste. The radioactive fission products build up within the fuel and are contained in the fuel pellets and sealed fuel rods, but small quantities escape from the fuel rods into the reactor coolant. Neutron activation of trace concentrations of metals entrained in reactor coolant such as zirconium, iron, and cobalt creates radioactive isotopes of these metals. Both fission and activation products in liquid and gaseous forms are continuously removed from reactor coolant and captured on filter media followed by demineralization. Monticello operates separate liquid, solid, and gaseous radwaste processing systems (NMC 2005b).

Fuel rods that have exhausted a certain percentage of their fuel and that are removed from the reactor core for disposal are called spent fuel. Spent fuel assemblies, removed from the reactor core, are stored in a spent fuel pool located on the refueling floor of the reactor building. Xcel Energy has applied for a Certificate of Need from Minnesota Public Utilities Commission that would authorize construction of a dry fuel storage area for additional spent fuel assemblies. Dry active waste includes contaminated protective clothing, paper, rags, and other trash generated during operation and maintenance activities. Filter media include paper and glass fiber cartridge filters, resin beads or powder, and metallic filters. Class A, B, and C solid waste, as defined in 10 CFR Part 61, may be processed for volume reduction, or is shipped to a licensed disposal facility.

The Monticello *Offsite Dose Calculation Manual* (ODCM) (NMC 2004b) contains the methodology and parameters used in the calculation of off-site doses resulting from radioactive gaseous and liquid effluents, in the calculation of gaseous and liquid effluent monitoring alarm and trip set points, and in the conduct of the Radiological Environmental Monitoring Program (REMP). The ODCM also contains the radioactive effluent controls and radiological environmental monitoring activities and descriptions of the information that should be included in the Radiological Environmental Operating Program report and Radioactive Effluent Release reports required by 10 CFR Part 50, Appendix I, and 10 CFR Part 50.36a.

2.1.4.1 Liquid Waste Processing Systems and Effluent Controls

Liquid waste from various equipment and floor drains and discharges from the reactor process and auxiliary systems is processed through the radwaste system. Final disposition of processed liquid includes either return of the liquid to the condensate system for plant re-use, or solidification of chemical liquid waste and shipment of the resulting solid to an off-site location.

Liquid waste is collected in sumps and drain tanks in the various buildings and then transferred to the appropriate subsystem collection tanks in the radwaste building for subsequent treatment, re-use, and disposal. In order to keep the releases to a minimum, modifications were made to the liquid radwaste system to allow reclaiming of floor drains as well as equipment drains. The modified system limits the release of liquid effluents to the minimum practicable extent and to satisfy the design objectives of Appendix I to 10 CFR Part 50. The radioactive and chemical contaminants are removed from the liquid waste streams by either filtration or filtration followed by mixed deep-bed demineralization. The filters remove insoluble particulate contaminants and the demineralizer removes soluble materials. The filter and demineralizer sludge are backwashed into receiving tanks, dewatered to less than 0.5 percent liquid and packaged as solid waste for disposal off-site at NRC-approved sites.

NMC manages the radwaste system at Monticello so that there are no routine releases of liquid radioactive effluents from the plant. Therefore, NMC states that there are no radioactive liquid effluents during normal operations. However, in some years, the plant may release a small amount of liquid containing radioactive material. NMC considers these releases as abnormal, but they are controlled, monitored, reported, and within Federal release limits and guidelines.

A review of the 2004 *Radioactive Effluent Release Report* (NMC 2005e) confirmed that no liquid waste was released from Monticello. A review of previous years release reports (NMC 2004a, 2003, 2002, 2001) also confirmed that no liquid effluents were released during normal operations; however, abnormal releases occurred during this five-year period. For example, in 2nd Quarter 2003, one abnormal release of 904 liters of liquid effluent diluted with 66,600 liters of water was released from Monticello. A total of 5.07×10^{-7} curies (Ci) of fission and activation products (with average diluted concentration of 7.61×10^{-9} μCi/ml) and 1.06×10^{-3} Ci of tritium (with average diluted concentration of 1.59×10^{-5} μCi/ml) were released. Since issuance of the

draft SEIS, NMC issued the effluent release report for 2005 (NMC 2006) and reported no abnormal liquid effluent releases during the calendar year.

Based on the system description above, design, and previous performance, no liquid effluents, other than occasional abnormal releases, are expected from Monticello during the renewal period. If abnormal releases were to occur, they would result in doses to members of the public that are well below the dose design objectives of 10 CFR Part 50, Appendix I, as discussed in Section 2.2.7.

2.1.4.2 Gaseous Waste Processing Systems and Effluent Controls

The gaseous radwaste system provides for sufficient off-gas holdup time to allow decay of the short-lived radioisotopes (such as nitrogen-16 and oxygen-19) and fission product noble gases (primarily xenon and krypton). The gaseous radwaste system also removes radioactive particulates and iodine from the off-gas stream, and recombines radiolytic hydrogen and oxygen to form liquid water to be treated in the liquid radwaste system. Radioactive gases are then filtered and released through the plant off-gas stack. During normal operations, the gaseous radwaste system operates on a continuous basis with effective monitoring and control provided so as not to exceed the limits of 10 CFR Part 20 or the dose objectives of Appendix I to 10 CFR Part 50 (NMC 2005b).

Off gas from the main condenser air ejector effluent passes through a 42-in. diameter delay line and is stored in the compressed gas storage system near the base of the off-gas stack. Five compressed gas storage tanks, approximately 1250 ft^3 each, provide for a minimum total holdup time of approximately 50 hours at a design off-gas release rate of 28 standard cubic feet per minute (scfm). For typical off-gas rate of 10 scfm, the holdup time could be as high as 140 hours. Off gases from the steam packing exhaust system, the mechanical vacuum pump effluent, and the high-pressure coolant injection (HPCI) gland seal effluent are all collected and processed in the steam packing exhauster off-gas subsystem. These gases are discharged on a continuous basis into a 1.75-minute holdup line and mixed with the air ejector off-gases at the stack base. The off-gas stack provides for mixing, dilution with fresh makeup air, monitoring, and release of the off gas to the atmosphere at an elevation of 328 ft above ground. The stack height and plume buoyancy aids in the dispersion of the gases into the atmosphere (NMC 2005b).

A review of the 2004 *Radioactive Effluent Release Report* (NMC 2005e) provided data on radioactive effluent release rates for Monticello. For calendar year 2004, releases included 1371 Ci of fission and activation gases, 1.5×10^{-3} Ci of iodine-131, 1.2×10^{-3} Ci of particulates, and 16.2 Ci of tritium. These activities are typical of past years, and are expected during the renewal period. See Section 2.2.7 for a discussion of the theoretical doses to the maximally exposed individual as a result of these releases. Since issuance of the draft SEIS, NMC issued the effluent release report for 2005 (NMC 2006) and gaseous releases were consistent with past years.

2.1.4.3 Solid Waste Processing

The solid radwaste system is designed to process, package, store, monitor, and provide shielded storage facilities for solid waste to allow for radioactive decay and/or temporary storage prior to shipment from the plant for off-site disposal. The solid radioactive waste is shipped off-site in vehicles equipped with adequate shielding to comply with Department of Transportation (DOT) regulations. Radioactive solid waste generated from the plant includes: process waste filter sludge and spent resins from the liquid processing systems; reactor system spent control rod blades, temporary control curtains, fuel channels, and in-core ion chambers; maintenance waste contaminated clothing, tools, rags and small pieces of equipment; operating waste laundry cartridge filters, paper, rags, off-gas filters, and ventilation filters; and miscellaneous solidified chemical and liquid wastes.

A rapid dewatering system (RDS) is a waste processing system installed for use at Monticello. This self-contained system is used for accelerated dewatering of particulate waste material. Extracted water from this system is routed to the liquid drains and subsequently routed back to the plant for processing. Radioactive sludge from the RDS unit is stored in the radwaste storage building and shipped offsite to a licensed facility in accordance with applicable DOT and NRC regulations (NMC 2005b).

In 2004, Monticello made a total of five low-level waste shipments. The solid waste volumes were 3.41 m^3 of spent resins, filter sludge, evaporator bottoms, etc., with an activity of approximately 264 Ci; and 151 m^3 of dry compressible waste, contaminated equipment, etc., with an activity of approximately 3.81 Ci. No irradiated components or control rods were shipped. These solid waste volumes and radioactive material activity levels are typical of annual waste shipments for Monticello and are not expected to increase during the renewal period.

2.1.5 Nonradioactive Waste Systems

Nonradioactive liquid waste at Monticello consists of wastewater from lavatories, showers, and sinks. These wastewaters are discharged from the Monticello sanitary sewer system to the City of Monticello sanitary sewage disposal system. A lift station and forced main were installed in 1983 to connect the plant to the city system. Nonradioactive solid waste at Monticello consists of hazardous waste (such as oils) and nonhazardous waste (such as office waste, garbage, and demolition debris materials). The Nuclear Management Company, LLC (NMC), is required to manage its hazardous waste in accordance with the Hazardous Waste Generator License from the State of Minnesota Pollution Control Agency (MPCA).

2.1.6 Plant Operation and Maintenance

Maintenance activities conducted at Monticello include inspection, testing, and surveillance to maintain the current licensing basis of the facility and to ensure compliance with environmental

and safety requirements. Certain activities can be performed while the reactor is operating, while others require that the facility be shut down. Long-term outages are scheduled for refueling and for certain types of repairs or maintenance, such as replacement of a major component. NMC refuels Monticello on a nominal 22- to 24-month fuel cycle. During refueling outages, site employment increases by as many as 600 workers for temporary duty (NMC 2005a).

The updated safety analysis report (USAR) (NMC 2005b) regarding the effects of aging on systems, structures, and components was included as part of the Monticello application for renewal of its operating license (OL), in accordance with 10 CFR Part 54. Appendix A of the application includes a supplement to the facility USAR that describes the programs and activities that will manage the effects of aging during the license renewal period. NMC expects to conduct activities related to the management of aging effects during normal plant operation, or refueling and other outages, but plans no outages specifically for the purpose of refurbishment. NMC does not plan to add additional full-time staff (non-outage workers) at Monticello during the period of the renewed license.

2.1.7 Power Transmission System

The transmission corridors of concern for license renewal are the corridors that were constructed for the specific purpose of connecting the plant to the electrical grid. Thus, for this license renewal, the transmission lines subject to review are the Monticello-Coon Creek 345-kV line and the Monticello-Parkers Lake 345-kV line (see Figure 2-5 and Table 2-1).

The Monticello-Coon Creek 345-kV line (Line #0991) exits the substation to the northeast and continues 5.9 mi northwest to the Sherburne County Substation on a 240-ft wide easement (the Sherburne County corridor). It then extends 37.2 mi to the southeast to connect to the Coon Creek Substation on an easement that varies in width from 125 ft to 150 ft (Xcel Energy 2005a). The original Monticello to Coon Creek Line was modified in 1975 to connect the Sherburne County Generating Plant to the 345-kV system. The NRC addressed the configuration of the Monticello to Coon Creek Substation line in its environmental review for the initial Monticello operating license application.

The Monticello-Parkers Lake 345-kV line (Line #0978) exits the substation to the southeast on a 240-ft wide easement for approximately 23.8 mi and then continues approximately 13.3 mi on a 165-ft-wide easement to the Parkers Lake Substation (Xcel Energy 2005a). The line was originally constructed to connect Monticello directly to Parkers Lake and was energized in 1971. The NRC also addressed the line's impacts in its environmental review for the initial Monticello operating license application. The Elm Creek Substation was installed on the Monticello-Parkers Lake line in 1996 (NMC 2005a).

MONTICELLO 345-KV TRANSMISSION CORRIDORS

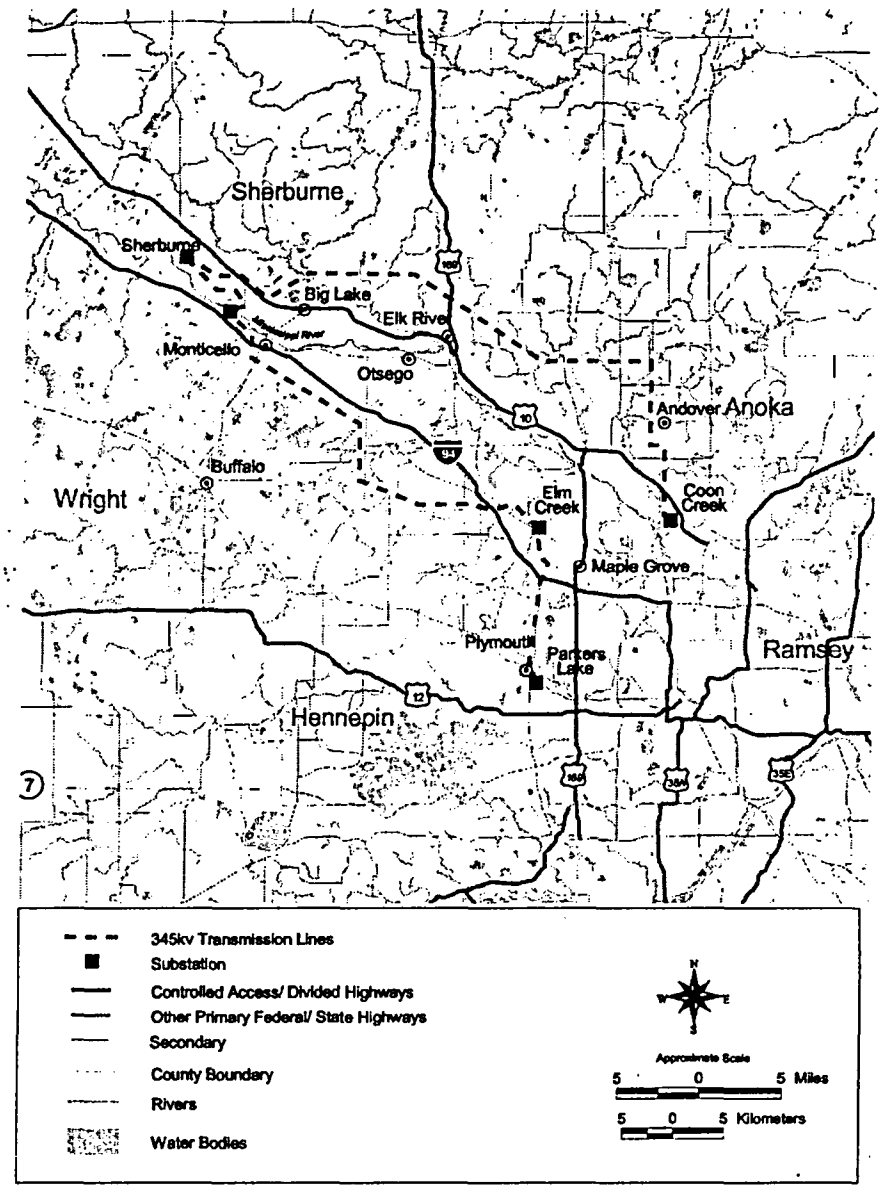

Figure 2-5. Monticello Transmission Lines

Table 2-1. Monticello Transmission Line Rights-of-Way

Substation	No. of Lines	kV	Approximate Distance (mi)	Corridor	Corridor Width (ft)	Corridor Area (ac)
Sherburne County	1	345	43	Monticello-Coon Creek	Varies from 125 to 240	750
Elm Creek	1	345	37	Monticello-Parkers Lake	Varies from 165 to 240	957

Source: Xcel Energy 2005a

Major portions of both corridors pass through rural areas, utilizing railroad rights-of-way and highways where possible. The Monticello-Coon Creek corridor is predominantly cultivated fields with scattered forests and some wetlands. The Monticello-Parkers Lake corridor is a mix of agriculture, rural residential, scattered forests, and wetlands (NMC 2005a). Vegetation control within the transmission line corridors is performed every four years to ensure the continued reliability of the lines. Vegetation control includes removing or trimming woody vegetation to ensure adequate line clearance and to allow vehicle access along the corridor. Qualified line-clearance tree trimmers manually cut and prune using approved mechanical equipment and perform selective application of approved herbicides to remove all tall-growing trees and brush from the complete width of the corridor (Xcel Energy 2005b).

2.2 Plant Interaction with the Environment

Sections 2.2.1 through 2.2.8 provide general descriptions of the environment near Monticello as background information. They also provide detailed descriptions where needed to support the analysis of potential environmental impacts of refurbishment and operation during the renewal term, as discussed in Chapters 3 and 4. Section 2.2.9 describes the historic and archaeological resources in the area, and Section 2.2.10 describes possible impacts associated with other Federal project activities.

2.2.1 Land Use

The Monticello site is located in the City of Monticello, Wright County, Minnesota, on the southern bank of the Mississippi River. The nearest large city is St. Cloud, 22 mi northwest and upstream of the Monticello site. The Twin Cities area of Minneapolis/St. Paul, and its surrounding suburbs, is approximately 30 mi southeast and downstream of the site. This is the largest urban area within 50 mi of the site exerting a strong influence on the region as the surrounding cities and townships respond to the Twin City area's demand for suburban development.

The Monticello site is located in an upland region of gently rolling hills dominated by rivers, streams, and lakes. The site consists of approximately 2150 ac, with roughly 2 mi of frontage on the north and south banks of the Mississippi River in Wright and Sherburne Counties. The majority of the acreage is located on the southern side of the river, with approximately 450 ac on the northern side of the river. Approximately 50 ac are occupied by the plant and its supporting facilities. The remaining acres are undeveloped, with approximately 174 ac leased by local farmers for growing row crops, and 144 ac under lease for recreational use (NMC 2005a).

2.2.2 Water Use

Monticello draws water from the Mississippi River for plant condenser cooling and auxiliary water systems, such as service water cooling, intake screen wash, and fire protection. Under typical river conditions, the circulating water system removes heat from the Monticello condenser by the once-through circulating water system. Under certain discharge canal temperature, river temperature, and river flow conditions, the circulating water system can utilize the two mechanical draft cooling towers in partial or complete recirculation of the cooling water in compliance with permit limits. The operating modes for the circulating water system are required by the National Pollutant Discharge Elimination System (NPDES) permit discharge limits and the Surface Water Appropriations Permit. The Surface Water Appropriations Permit allows NMC to withdraw up to 645 cfs (or 290,000 gpm) of water from the Mississippi River, with special operating conditions if the river flow is less than 860 cfs, and further restrictions if river flow is 240 cfs or less (see Table 2-2). The NPDES permit specifies maximum daily average temperature at the end of the discharge canal depending on the month: 95°F in April through October; 85°F in November and March; and 80°F in December through February. The operating modes and conditions are summarized in Table 2-2.

Five groundwater wells provide domestic water for potable use, including drinking water, lavatories, and showers at the plant, and raw water to the reverse osmosis/make-up demineralizer system which is used to produce purified water for the plant primary systems and seal water to pumps located at the intake structure. Two wells, each equipped with a 100-gpm capacity pump, are connected together and are regulated under a single water appropriations permit with a withdrawal limit of 200 gpm. From 1998 to 2000, actual usage averaged less than 30 gpm. These two wells provide domestic potable water to the plant administration building, raw water to the reverse osmosis/make-up demineralizer system, and seal water to pumps at the plant intake structure. Two other wells, each equipped with a 45-gpm pump, provide additional domestic water to a warehouse and the site administration building. The fifth well, equipped with a 10-gpm pump, provides domestic water to a security training facility. Annual usage for these wells is less than 1.9 gpm, for which water appropriation permits are not required.

2.2.3 Water Quality

Potential environmental issues associated with water quality at the Monticello plant include surface water quality in the Mississippi River. During 2002 and 2003, the MPCA conducted stream assessments under Section 305b of the Clean Water Act to estimate the extent to which Minnesota water bodies meet the goals of the Clean Water Act and attain state water quality standards (MPCA 2004a). The Mississippi River in the area of the Monticello plant is identified as impaired; however, the MPCA is still developing its strategy for addressing these findings.

Table 2-2. Circulating Water System Operating Modes

Operating Mode	Temperature and River Flow Conditions
OPEN CYCLE OR ONCE-THROUGH:	**WHEN:**
Water is withdrawn from and discharged directly to the Mississippi River.	- Discharge canal temperature is below permit limits, and - River flow exceeds 860 cfs.
HELPER CYCLE:	**WHEN:**
Water is withdrawn from and discharged directly to the Mississippi River. Cooling towers cool water prior to discharge to the river.	- Discharge canal temperature approaches permit limits, and - Upstream river temperatures are consistently at or above 68°F.
PARTIAL RECIRCULATION:	**WHEN:**
75% of the Mississippi River flow is withdrawn. Cooling towers are operating. A portion of the cooled water is recirculated to the intake and the remainder is discharged to the river.	- River flow is less than 860 cfs but greater than 240 cfs, and - River temperature is elevated.
Operating Mode	**Temperature and River Flow Conditions**
CLOSED CYCLE:	**WHEN:**
Cooling towers are operating and all cooled water is recirculated to the intake, except for cooling tower blowdown, which is discharged to the discharge canal.	- River is at or less than 240 cfs, and - River temperature is elevated.

Water quality discharges at Monticello are regulated by a NPDES permit with the MPCA. This NPDES permit regulates effluent water quality to the Mississippi River and discharges from certain in-plant processes. The NPDES permit also has monitoring, reporting, and permit limit requirements on water quality parameters including chlorine, pH, temperature, total suspended solids, oil and grease, and oxidants. Based on these monitoring reports, plant discharges are

typically within MPCA limits. Discharges from the Monticello sanitary sewer system to the City of Monticello sanitary sewer system is covered under a separate permit with the City of Monticello.

NMC applies biocides at the service water and circulating water pump bays located in the intake structure to control biofouling in the circulating water system and service water systems. NMC applies a non-oxidizing biocide at the service water header to control biofouling in several service water systems that are only operated intermittently (residual heat removal service water, emergency diesel generator service water, and fire water protection). NMC also applies anti-scalant during warm summer months to control scale buildup in the condenser tubes. NMC uses these approved chemicals in accordance with all the use and discharge requirements of the NPDES permit.

2.2.4 Air Quality

The climate surrounding the Monticello site has wide seasonal variations in temperature, with relatively light winter precipitation, and substantial summer rainfall. Representative weather data was found at the nearby Buffalo, Minnesota, weather station located 10 mi southwest of the plant. Average total annual precipitation is approximately 30 in. per year, with 54 percent falling in the months of May through August. For the period of 1948-2004, rainfall ranged from a monthly average high of 4.25 in. in June, to a monthly average low of 0.89 in. in December. Average total annual snowfall is approximately 43 in. per year, with 94 percent falling in the months of November through March. For the period of 1948-2004, the highest average monthly snowfall was 9.6 in. in the month of January (HPRCC 2004).

Minnesota lies along the north edge of the region of maximum tornado occurrence in the United States. Tornadoes have occurred in Minnesota in every month from March through November. Nearly three quarters of all tornadoes in Minnesota have occurred during the three months of May (16 percent), June (33 percent), and July (27 percent) (SCO 2004). Between 1950 and 2004, eighteen tornados were reported in Wright County (NMC 2005a). The tornado strike probability for the Monticello Plant is approximately 6×10^{-4} (Ramsdell 2005).

The strongest winds typically occur in the early spring and the lightest winds in late summer. The topography of the region is generally flat plains to rolling hills and uplands, with few obstructions to wind. Wind energy potential is generally rated on a scale of Class 1 through Class 7. The western part of Minnesota has Class 3 and 4 wind resources at exposed areas. Areas suitable for wind turbine applications have a rating of 3 or higher. The wind power class for the Monticello site is Class 2 (Elliot et al. 1987).

Nonradioactive air emissions from the Monticello site are regulated by the Minnesota Pollution Control Agency. With respect to National Ambient Air Quality Standards (NAAQS), there are currently no non-attainment areas in the state of Minnesota. In prior years, some areas of the state have been designated non-attainment, but were later re-designated as attainment based

on improved air quality data. The most recent re-designation by U.S. Environmental Protection Agency (EPA) became effective on September 24, 2002. Areas that were previously non-attainment areas are now referred to as maintenance areas (MPCA 2005). The Monticello plant is located in Wright County, a portion of which was in non-attainment for carbon monoxide (CO) during the 1990s, and therefore continues to be a maintenance area for CO.

In 1997, the EPA revised the national standard for ground-level ozone from a 0.12 ppm 1-hour "peak" standard to a 0.08 ppm 8-hour "average" standard, now commonly called the 8-hour standard. In April 2004, EPA published the 8-hour ozone non-attainment designations, and announced that the 1-hour "peak" standard will be phased out. The entire state of Minnesota is in attainment with the new 8-hour ozone standard (EPA 2004).

There are no mandatory Class I Federal areas, in which visibility is an important value designated in 40 CFR Part 81, within 100 mi of the Monticello site.

Diesel engines, a boiler, and other sources associated with the Monticello site emit various nonradioactive air pollutants to the atmosphere, such as NO_x, SO_2 and CO. Air emissions from these sources are subject to the terms and conditions of a Title V air pollution control operation permit issued by the MPCA (Air Emission Permit No. 17100019-003). The Monticello plant must comply with the associated conditions of the permit, including fuel specifications, source testing, emissions limitations, record-keeping, and reporting requirements. Plant compliance with the air permit conditions has been good, and some minor compliance issues were successfully resolved in the mid-1990s. Permitted equipment with nonradioactive air emissions at the facility includes:

A. EU 001 Boiler

B. EU 002 Diesel Generator 11

C. EU 003 Diesel Generator 12

D. EU 004 Security Diesel Generator

E. EU 005 Fire Pump Diesel Engine

F. EU 006 Diesel Generator 13

G. EU 007 Temporary Engine > 600 Hp

H. EU 008 Temporary Engine < 600 Hp

In calendar year 2003, the total annual NO_x emission was 5.55 tons and the total annual CO emission was 1.32 tons, while all other emission constituents were less than one ton (MPCA 2004b). There are no significant changes proposed for nonradioactive air emissions from the

Monticello site, and there are no significant changes proposed to the limits and conditions of the air permit.

2.2.5 Aquatic Resources

The principal aquatic resource in the vicinity of Monticello is the Mississippi River, which is the source and receiving body of the water for the Monticello cooling system. The main aquatic habitats on the Monticello site are the Mississippi River and the cooling-system discharge canal. The discharge canal is approximately 1000 ft long by 200 ft wide at the surface, sloping down to a width of 92 ft on the bottom. It is 18 ft deep at the center. In 1980, an overflow weir was added to the discharge canal that closely approximates the shoreline of the Mississippi River. The weir was added to minimize cold shock mortality from sudden plant shutdowns within the discharge canal and in the river area adjacent to the discharge (MPCA 1979). It allows normal outflow of water while reducing the movement of fish into the discharge canal (NMC 2005a).

The transmission lines associated with Monticello cross several streams and rivers. The Monticello-Elm Creek-Parkers Lake line crosses Otter Creek, County Ditch #9, Crow River, Rush Creek, and Elm Creek; while the Monticello-Sherburne County-Coon Creek line crosses the Mississippi River, Elk River, St. Francis River, Tibbits Brook, Trott Brook, and the Rum River. Transmission line right-of-way maintenance activities in the vicinity of stream and river crossings employ procedures to minimize erosion and shoreline disturbance while encouraging vegetative cover.

The Monticello plant facilities are located on the southern bank of the Mississippi River in Wright County at Mississippi River Mile 900. Near Monticello, the Mississippi River is broad and turbulent. The average river velocity varies from about 1.5 to 2.5 ft/s. The river 1.5 mi upstream to 1.5 mi downstream of the plant loses 10 ft in elevation, resulting in rapids and current velocities that exceed 4.9 ft/s (NMC 2005a). The main channel of the Mississippi River is approximately 980 ft wide in the vicinity of the Monticello site. This portion of the river is also shallow, averaging about 6.2 ft deep (Knutson et al. 1976). Within backwaters and protected shoreline areas, the river is less than 2 ft deep with silt and mud substrates, whereas the main channel substrates consist of gravel, rubble, and boulders with some sand (Afzal et al. 1975).

River flow past Monticello averages 7217 cfs, which meets the NRC's annual flow criterion for classification as a small river. Flow has ranged from a minimum of 240 cfs to a maximum of 51,000 cfs. It exceeds 1100 cfs 90 percent of the time, and 300 cfs 99 percent of the time. Ambient river temperature in summer averages 71°F, while winter temperatures are at freezing (32°F) (NMC 2005b).

A number of physical and chemical stresses have caused major changes and modifications to the aquatic resources within the Upper Mississippi River Basin. Dams and six associated headwater reservoirs occur on the Mississippi River between its headwaters at Lake Itasca and St. Anthony Falls Lock and Dam (river mile [RM] 854) near the Twin Cities. However, as the

river is not used for commercial navigation above the Twin Cities, there are no locks on these headwater dams (NMC 2005a). The Mississippi River in Minnesota is used for a variety of purposes, including drinking water, industrial use, irrigation, recreation, tourism, and conservation. The warm water discharges from Monticello provide year-round fishing opportunities at Montissippi County Park (the nearest point of access to the river downstream from Monticello) (NMC 2005a).

Fish consumption guidelines have been established in Minnesota due to the high levels of mercury and polychlorinated biphenyls (PCBs) found in some species (Minnesota Department of Health 2005). The guidelines are more restrictive for pregnant women, women who may become pregnant, and children under age 15 than for the general population. Consumption guidelines exist within the reach of the Mississippi River that includes Monticello for various species of sunfish, suckers, catfish, and other game fish mainly due to the presence of mercury; although guidelines for common carp (*Cyprinus carpio*) and channel catfish (*Ictalurus punctatus*) are also associated with potential PCB contamination (Minnesota Department of Health 2005).

Despite the modifications and multiple competing uses of the Upper Mississippi River, the overall fish biodiversity has been persistent and resilient (USGS 1999). In Minnesota, 75 species of fish have been reported within the upper portion of the Mississippi River (Hatch and Schmidt 2004). Fifty-one species have been collected by electroshocking and seining in the Monticello site vicinity (Xcel Energy 2004). The fish community in the Monticello area has remained about the same since before the plant became operational, with only minor differences occurring between areas upstream and downstream from the Monticello discharge (Xcel Energy 2004). Among the 27 species collected by electroshocking, the major species include the shorthead redhorse (*Moxostoma macrolepidotum*), silver redhorse (*M. anisurum*), common carp, smallmouth bass (*Micropterus dolomieu*), northern hog sucker (*Hypentelium nigricans*), white sucker (*Catostomus commersoni*), channel catfish, and walleye (*Sander vitreus*). The channel catfish was first collected in electroshocking samples in 1988, and has been consistently collected since then (Xcel Energy 2004). Forty-four species have been collected in seining samples since 1970. The major species collected included the sand shiner (*Notropis stramineus*), spotfin shiner (*Cyprinella spiloptera*), bluntnose minnow (*Pimephales notatus*), and bigmouth shiner (*N. dorsalis*) (Xcel Energy 2004).

The Monticello area is considered rough fish habitat due to the prevalence of shorthead redhorse, silver redhorse, white sucker, and common carp (Afzal et al. 1975). The spotfin and sand shiners are the major forage fish species in the area (Xcel Energy 2004); common game species included smallmouth bass, black crappie (*Pomoxis nigromaculatus*), yellow perch (*Perca flavescens*), and walleye. Other sport fish include northern pike (*Esox lucius*), common carp, and black bullhead (*Ameiurus melas*) (Amish et al. 1978). There is no commercial fishery near Monticello (Amish et al. 1978).

Some Mississippi River species such as quillback (*Carpiodes cyprinus*), gizzard shad (*Dorosoma cepedianum*), lake sturgeon (*Acipenser fulvescens*), and paddlefish (*Polyodon*

spathula) were absent in the upper reaches of the Mississippi River due to river blockage at St. Anthony Falls. However, the construction of St. Anthony Falls Lock and Dam in 1963 removed this barrier to fish passage. As a result, species such as channel catfish, flathead catfish (*Pylodictis olivaris*), gizzard shad, northern hog sucker, golden redhorse (*Moxostoma erythrurum*), and white crappie (*Pomoxis annularis*) now occur above St. Anthony Falls. The Coon Rapids Dam (RM 866), located approximately 12 mi upstream from St. Anthony Falls, remains a barrier to upstream movement; although some fishes can circumvent the dam at times (e.g., during floods) (Hatch et al. 2003). This may account for the presence of channel catfish, northern hog sucker, white crappie, and, most recently, flathead catfish near Monticello.

The major primary producers within the Monticello area are periphyton. The periphyton community consists of diatoms, blue-green algae, green algae, and golden algae; periphyton contributes an estimated 60 to 82 percent of the primary production in the Monticello area. Nearly 150 species of periphyton were collected near Monticello between 1968 and 1976, and were dominated by diatom species throughout the year. During the summer, blue-green algae were co-dominant with diatoms (Amish et al. 1978). Peak periphyton production occurs in summer. Species composition was found to be similar between preoperational and operational years (Amish et al. 1978). Phytoplankton is generally not abundant in flowing waters. Most of the phytoplankton that occurs in the main river channel originates from backwater areas and from periphyton scour. Phytoplankton in the Upper Mississippi River is dominated by diatoms and green algae, and contributes 18 to 40 percent of the primary productivity in the Monticello area (Amish et al. 1978).

Between 1968 and 1970, the only macrophytes found in the immediate area near Monticello were the American pondweed (*Potamogeton nodosus*), sago pondweed (*Stuckenia pecinatus*), and antifever fontinalis moss *(Fontinalis antipyretica*). The macroscopic green alga *Cladophora glomerata* also occurs in the area. Overall, macrophytes abundance is low in the Monticello area due to fast-moving currents and shifting sand and gravel substrates (Amish et al. 1978).

Zooplankton populations are limited within the main channel of the Mississippi River near Monticello due to high gradients. Near Monticello, the zooplankton community is comprised of protozoans, rotifers, cladocerans, and copepods (Afzal et al. 1975; Amish et al. 1978).

The benthic macroinvertebrate community near Monticello includes oligochaetes (aquatic annelid worms), mayflies, caddisflies, aquatic beetles, midges, black flies, aquatic snails, and fingernail clams (Amish et al. 1978). The non-channel areas of the Upper Mississippi River consistently support more species than the main channel area (USGS 1999). Near Monticello, 66 genera of macroinvertebrates were collected in the backwaters, while only 24 genera were collected from the main channel (Amish et al. 1978).

The Upper Mississippi River contains a rich assemblage of freshwater mussels. Historically, as many as 50 species of mussels have been documented from the Upper Mississippi River, but only 30 species have been reported in recent surveys. Many are rare (e.g., listed as endangered, threatened, or of special concern by one or more states [USGS 1999]). The

freshwater mussels within the Upper Mississippi River have been adversely impacted by activities such as collection for the pearl button and cultured pearl industries, siltation (associated with agriculture, poor land management, and impoundments), pollution from agriculture and industrial chemicals, establishment and maintenance of the navigation channel, dams, loss of appropriate fish host species, and competition from exotic species, particularly the non-native zebra mussel (*Dreissena polymorpha*) (USGS 1999; Weitzell et al. 2003).

The range of some mussel species has been expanding above St. Anthony Falls as fish hosts for mussel glochidia (ectoparasitic larvae of native freshwater mussels) can now circumnavigate the two navigation locks at this location (Kelner and Davis 2002). Approximately 13 mussel species currently occur upstream of St. Anthony Falls (Siteman 2003). Only six species were recently collected above Coon Rapids Dam: white heelsplitter (*Lasmigona complanata*), giant floater (*Pyganodon grandis*), plain pocketbook (*Lampsilis cardium*), fatmucket (*Lampsilis. siliquoidea*), black sandshell (*Ligumia recta*), and pink heelsplitter (*Potamilus alatus*) (Kelner and Davis 2002). No information on mussel species within the immediate area of Monticello is available.

The zebra mussel became established in the Upper Mississippi River by 1992 and has continued to spread throughout the river system. Its increase causes a decline among many native mussels, as it can out-compete native species for oxygen and food and is so prolific that it can smother native mussel beds (FWS 2001). Until recently, populations of the zebra mussel within the Mississippi River had not been observed above the Twin Cities area (St. Anthony Falls Lock and Dam) (MNDNR 2005). They were not observed between RM 854 and RM 848 (Pool 1) and were found to be sparse between RM 848 and RM 797 (pools 2 and 3) (Kelner and Davis 2002). However, in October 2005, it was reported that zebra mussels had been found in Rice Lake, an impoundment of the Mississippi River, in Brainerd, Crow Wing County, Minnesota (MNDNR 2006). Brainerd is about 94 mi upstream of Monticello. The Asiatic clam (*Corbicula fluminea*), another invasive mollusc species that can cause condenser tube clogging problems, has been found at the Monitcello site (e.g., in the discharge canal), but was not observed in the traveling screen forebays that were recently dredged (NMC 2006).

Few Federally or State-listed aquatic species are known to occur in the four counties in which Monticello and the related transmission lines of concern occur (i.e., Wright, Sherburne, Hennepin, and Anoka counties) (see Table 2-3). No Federally or State-listed fish species have been collected from the Mississippi River near the Monticello site (Xcel Energy 2004). The Higgins' eye pearlymussel (*Lampsilis higginsii*) is the only Federally listed aquatic species reported from the four-county area (Hennepin County), and this species is both Federally and State-listed as endangered (FWS 2005a,c). Two State-listed mussel species of special concern (MNDNR 2005), the creek heelsplitter (*Lasmigona compressa*) and black sandshell, have been reported downstream from the Monticello site within the Coon Rapids Pool of the Mississippi River and within the Rum River in the Hennepin and Anoka counties area (Kelner and Davis 2002).

Table 2-3. Threatened or Endangered Aquatic Species Potentially Occurring in the Vicinity of Monticello and the Associated Transmission Corridors

Scientific Name	Common Name	Status[a]	
		Minnesota	U.S.
Lampsilis higginsii	Higgins' eye pearlymussel	E	E
Lasmigona compressa	creek heelsplitter	SPC	—
Ligumia recta	black sandshell	SPC	—

Source: FWS 2005a,c; MNDNR 2005; Kelner and Davis 2002
[a]E = endangered, SPC = species of concern, — = no listing.

The Higgins' eye pearlymussel was Federally listed as an endangered species on June 14, 1976 (FWS 1976). It is only found in the Mississippi River, the St. Croix River in Wisconsin, the Wisconsin River, and the Rock River in Illinois. It was never abundant, historically comprising approximately 0.5 percent of the mussel population. At the time the original recovery plan was written in 1982, the Higgins' eye pearlymussel had undergone a 53 percent decrease in its known range (FWS undated). The Higgins' eye pearlymussel most frequently occurs in medium to large rivers with current velocities of approximately 0.5 to 1.5 ft/s and in depths of 3 to 20 ft, with firm, coarse sand or mud-gravel substrates (FWS 2000, 2001). It is generally found in mussel beds with at least 15 other species present (Hornbach 2004).

Much of the historic habitat for the Higgins' eye pearlymussel has been altered from a free-flowing river system to an impounded river system. This has altered flow patterns, substrates, and fish host habitats and movements (FWS 2001). Other impacts to the species have included water quality degradation from municipal, industrial, and agricultural run-off; dredging; waterway traffic; and, particularly, zebra mussels (FWS 2004a; Hornbach 2004).

No critical habitat has been designated for the Higgins' eye pearlymussel. However, ten Essential Habitat Areas (EHAs) for the Higgins' eye pearlymussel occur within the Upper Mississippi River watershed. EHAs are locations known to contain reproducing populations of the Higgins' eye pearlymussel in association with a healthy and diverse unionid community (e.g., mussel beds) (Hornbach 2004). No EHAs within the Mississippi River occur close to the Monticello site (RM 900). The most upstream area is at Whiskey Rock, Iowa, (RM 656) which is over 240 RM downstream of the Monticello site. However, three EHAs occur in the St. Croix River, which flows into the Mississippi River at RM 811, downstream from Lock and Dam 2 (Hornbach 2004). The furthest upstream Essential Habitat Area on the St. Croix River is the only EHA that is free of zebra mussels (Hornbach 2004).

Suitable fish hosts for the glochidia of the Higgins' eye pearlymussel include freshwater drum (*Aplodinotus grunniens*), largemouth bass (*Micropterus salmoides*), black crappie, yellow perch, sauger (*Sander canadensis*), and walleye; while marginal fish hosts include northern pike, bluegill (*Lepomis macrochirus*), and green sunfish (*L. cyanellus*) (Hornbach 2004).

In 2000-2001, an empty Higgins' eye pearlymussel shell was collected from Upper Pool 3 (RM 815) of the Mississippi River (near the area where the St. Croix River enters the Mississippi River) (Kelner and Davis 2002). Since 2000, individual Higgins' eye pearlymussels have been transplanted from areas near Cassville, Wisconsin, and Cordova, Illinois, to Pools 2 and 3 near Minneapolis and Hastings, Minnesota, respectively. Additionally, cleaning of mussels infested with zebra mussels and artificial propagation and release have been conducted to alleviate the effects of zebra mussels on the Higgins' eye pearlymussel (Hornbach 2004).

The State-listed creek heelsplitter is a widespread but generally uncommon species. It generally occurs in fine gravel or sand substrates of small- or medium-sized rivers (NPS 2004). Host fish species for the creek heelsplitter include the spotfin shiner, guppy (*Poecilia reticulata*), slimy sculpin (*Cottus cognatus*), black crappie, and yellow perch (NPS 2004). It is most common, but seldom abundant, in headwater streams (Siteman 2003).

The black sandshell, which is also State-listed, is a widespread but generally uncommon species. It occurs in medium to large rivers, in gravel or firm sand substrates (NPS 2004). Host fish species include common carp, green sunfish, bluegill, largemouth bass, rock bass (*Ambloplites rupestris*), and white crappie (NPS 2004). It can be common to abundant where it occurs (Siteman 2003).

2.2.6 Terrestrial Resources

The plant site comprises approximately 2150 ac and has roughly 2 mi of shoreline on the north and south banks of the Mississippi River in Wright and Sherburne counties (NMC 2005a,b). The Monticello site is located in an upland region of low relief dominated by rivers, streams, and lakes (NMC 2005a). Land use within the region is primarily agricultural; therefore, natural deciduous climax vegetation communities previously found within the city limits of Monticello have been reduced to remnant patches of maple (*Acer* spp.), basswood (*Tilia americana*), elm (*Ulmus* spp.), oak (*Quercus* spp.), and hackberry (*Celtis occidentalis*). These remnants are restricted mostly to larger river islands and small isolated pockets along the river banks (AEC 1972). Prior to European settlement, the southern sections of the Upper Mississippi River Basin, where Monticello and its associated transmission line corridors are located, were a mix of prairie, wetland prairie, oak woodland, brushland, and maple-basswood forest (MPCA 2000).

Terrestrial habitats on the Monticello site include formerly cultivated fields in various stages of ecological succession, with remnant climax hardwood forest in isolated pockets along the river and on the larger islands, and some actively cultivated fields (AEC 1972). Of the 2150 ac encompassed by the Monticello site, the majority of acreage is located on the southern side of the Mississippi River, with approximately 450 ac on the northern side of the river (NMC 2005a). Approximately 50 ac are developed and occupied by the Monticello plant and supporting facilities, with an additional 174 ac leased to local farmers for row crop production (NMC 2005a). Approximately 144 ac are leased for recreational purposes, while the remainder is undeveloped.

The terrestrial habitats near the Monticello site support a variety of plant and animal species that are typical of free-flowing, upper-midwestern rivers (NMC 2005a). In general, facilities in use at the Monticello site are located on previously cultivated areas and consist of early succession forbs and grasses. Upland forests on the Monticello site are predominately northern pin oak (*Quercus ellipsoidalis*), green ash (*Fraxinus pennsylvanica*), basswood, and prickly ash (*Zanthosxylum americanum*). Forested wetlands on the northeast bank of the river and the river islands include American elm (*Ulmus americana*), box elder (*Acer negundo*), silver maple (*A. saccharinum*), cottonwood (*Populus deltoides*), and black willow (*Salix nigra*) (MCBS 1998).

MNDNR has identified the following native plant communities as occurring on the Monticello site: floodplain forest, silver maple–Virginia creeper floodplain forest, bur oak woodland, oak woodland brushland, willow swamp, dry oak savannah, and dry prairie. Representative localities are as follows: the floodplain forest community is known to occur on the northeast bank of the Mississippi River and on the portion of the Monticello site in Wright County. The silver maple–Virginia creeper floodplain forest community is found to occur on Cedar Island (NMC 2005a). Patches of bur oak woodland community occur south and west of the power block (Hoffman 2004). Two patches of oak woodland brushland occur adjacent to the river in Sherburne county (Hoffman 2004; Delaney and Epp 1993; MNDNR 1993). The willow swamp community, dominated by shrubby willow (*Salix* spp.), occurs on Oxbow Island located on the north side of the Mississippi River and downstream of the station. An area of dry oak savannah occurs on the Sherburne County side of the site, on the first terrace north of the Mississippi River (NMC 2005a). An area of dry prairie occurs to the west of the power block on the narrow sloping area between the railroad right-of-way and the Mississippi River (NMC 2005a).

Extensive farming, logging, and grazing have occurred throughout these plant communities, which are, therefore, much changed from the original climax condition (AEC 1972). There are no public waters or wetlands within the Monticello site that are designated as protected under Minnesota Statute 103G.005 (MNDNR 1983, 1984, 2004a), although the U.S. Fish and Wildlife Service (FWS) National Wetland Inventory indicated that wetlands exist along the Mississippi River and on islands as seasonally flooded patches of scrub-scrub, deciduous forest, and emergent vegetation (DOI 1991).

Mammals typical of the area and identified within the Monticello site include white-tailed deer (*Odocoileus virginianus*), red fox (*Vulpes vulpes*), raccoon (*Procyon lotor*), red squirrel (*Tamiasciurus hudsonicus*), grey squirrel (*Sciurus carolinensis*), short-tailed shrew (*Blarina brevicauda*), southern red-backed vole (*Cleithrionomys gapperi*), meadow vole (*Microtus pennsylvanicus*), mice (*Peromyscus* spp.), pocket gopher (*Geomys bursarius*), white-tailed jackrabbit (*Lepus townsendii*), beaver (*Castor canadensis*), muskrat (*Ondatra zibethicus*), gray fox (*Urocyon cinereoargenteus*), coyote (*Canis latrans*), fox squirrel (*Sciurus niger*), chipmunk (*Tamias striatus*), mink (*Mustela vison*), weasels (*Mustela frenata, M. erminea, M. nivalis*), and striped skunk (*Mephitis mephitis*) (AEC 1972; NMC 2005b).

Furthermore, the Sherco Environmental Monitoring and Ecological Studies Program identified 99 avian species over a ten-year monitoring period during breeding season road transects surveys and in a floodplain near the Monticello site. The most abundant species observed during these surveys were mourning dove (*Zenaida macroura*), cliff swallow (*Petrochelidon pyrrhonota*), barn swallow (*Hirundo rustica*), American robin (*Turdus migratorius*), European starling (*Sturnus vulgaris*), vesper sparrow (*Pooecetes gramineus*), red-winged blackbird (*Agelaius phoeniceus*), common grackle (*Quiscalus quicula*), American goldfinch (*Carduelis tristis*), and house sparrow (*Passer domesticus*). Game species commonly harvested within the vicinity of Monticello are ruffed grouse (*Bonasa umbellus*), grey partridge (*Perdix perdix*) and ring-necked pheasant (*Phasianus colchicus*) (NMC 2005a). Waterfowl commonly encountered along the river shoreline are Canada goose (*Branta canadensis*), mallard (*Anas platyrhynchos*), and wood duck (*Aix sponsa*). Grassland/woodland ecotone avian species include eastern meadowlark (*Sturnella magna*), western meadowlark (*Sturnella neglecta*), American robin, blue jay (*Cyanocitta cristata*), eastern bluebird (*Sialia sialis*), northern flicker (*Colaptes auratus*), red-tailed hawk (*Buteo jamaicensis*), and American kestrel (*Falco sparverius*) (NMC 2005a).

Two transmission lines in two corridors that are within scope of the license renewal review originate from the Monticello site. These are discussed in Section 2.1.7. Major portions of both corridors pass through rural areas, utilizing railroad rights-of-way (ROW) and highways where possible. The Monticello-Coon Creek corridor is predominantly cultivated fields with scattered forests and some wetlands. The Monticello-Parkers Lake corridor is a mix of agriculture, rural residential, scattered forests, and wetlands (NMC 2005a). MNDNR identified native plant communities of significant biodiversity associated with transmission corridors, as shown in Table 2-4. The majority of transmission corridors are adjacent to the areas where native plant communities occur and do not traverse them (NMC 2005a).

There are no Federally designated critical habitats for threatened or endangered species within the Monticello site or along the associated transmission corridors (FWS 2004b). The FWS has designated 13 species known to occur in Minnesota as threatened or endangered, and 4 species known to occur in the state have been designated as candidates for such listing. However, only 2 of these species, the bald eagle (*Haliaeetus leucocephalus*) and the gray wolf (*Canis lupus*) are indicated by the FWS as potentially occurring on or in the vicinity of the site or transmission lines associated with Monticello (Table 2-5) (FWS 2005c).

The bald eagle, listed as Federally threatened, is known to occur in the vicinity of the Monticello site. Originally listed as endangered by the FWS in 1967, the bald eagle was down-listed to threatened in 1995, and is currently proposed for delisting (Hoffmann 2004). The State's first bald eagle survey in 1973 found 115 active nests; by 1995 the survey found over 600 (NMC 2005a). MNDNR has concluded that Minnesota's bald eagle population is growing slowly but is at a healthy level (MNDNR 2004b). Bald eagles are typically associated with forested areas near rivers and lakes where nest sites are readily available near food sources. One nest site is known to occur just north-northwest of the power block on Beaver Island (NMC 2005a). One additional nest occurs on a transmission tower on the Monticello-Coon Creek transmission line.

Table 2-4. State of Minnesota Identified Natural Communities in the Vicinity of the Transmission Corridors

General Location	Communities	Site Biodiversity Significance
WRIGHT COUNTY		
Immediately south of Monticello—ROW passes through area	Dry prairie	High
SHERBURNE COUNTY		
Approximately 3 mi northeast of Monticello and south of the Thompson Lake Area—ROW adjacent to southernmost edge of area	Alder swamp Rich fen Dry oak savanna	Moderate
Approximately 4 mi northeast of City of Elk River—ROW adjacent to southwest corner of area	Oak forest Mixed hardwood swamp Alder swamp Tamarack swamp Willow swamp	High
Approximately 1 mi northeast of City of Elk River—ROW adjacent to northern boundary of area	Oak forest	Moderate
ANOKA COUNTY		
Approximately 3.5 mi southwest of Andover and immediately west of Bunker Hills Regional Park—ROW runs through area	Oak forest Dry oak savanna	Outstanding
Approximately 1 mi south of Andover along State Highway 78—ROW is adjacent to area	Dry oak savanna Dry prairie	High
HENNEPIN COUNTY		
Approximately .5 mi north of intersection of I-494 and Highway 9 in Plymouth—ROW adjacent to area	Maple-basswood forest	High

Source: Hoffman 2004

Table 2-5. Threatened or Endangered Terrestrial Species Potentially Occurring in the Vicinity of Monticello and the Associated Transmission Corridors

Scientific Name	Common Name	Status[a] Minnesota	Status[a] U.S.
	Birds		
Haliaeetus leucocephalus	bald eagle	SPC	T
Lanius ludovicianus	loggerhead shrike	T	—
Falco peregrinus	peregrine falcon	T	—
Cygnus buccinator	trumpeter swan	T	—
	Mammal		
Canis lupus	gray wolf	—	T
	Reptile		
Emydoidea blandingii	Blanding's turtle	T	—
	Insect		
Hesperia uncas	Uncas skipper	E	—
	Plant		
Scleria triglomerata	tall nut-rush	E	—

Source: Hoffman 2004

[a]E = endangered, T = threatened, SPC = species of concern, — = no listing.

The gray wolf was listed in Minnesota as Federally endangered in 1974 as a result of human persecution and reduced prey availability. Gray wolves in Minnesota were reclassified from endangered to threatened in 1978, to allow for special regulation under Section 4(d) of the Endangered Species Act. Since 1977, gray wolf populations in Minnesota have expanded. Population recovery goals of 1250 to 1400 individuals have been achieved, with populations at or above that level since the late 1970s (FWS 2005e). Today, wolves live in areas with higher road and human densities than previously believed to be suitable for wolf survival. Wolves continue to disperse to areas in west-central and east-central Minnesota (just north of Minneapolis/St. Paul), North and South Dakota, and Wisconsin (FWS 2005e). As gray wolf populations recover, it is likely that they will be within the vicinity of transmission corridors of interest to the license renewal of Monticello. However, gray wolves have not been sighted in the Monticello area to date.

The MNDNR has determined that the peregrine falcon (*Falco peregrinus*), loggerhead shrike (*Lanius ludovicianus*), and trumpeter swan (*Cygnus buccinator*) are known to occur within the vicinity of Monticello and associated transmission line corridors (MNDR 2004c). All of these species are listed as threatened by the State of Minnesota. With the installation of a nest box on the Monticello Off Gas Stack in 1992, peregrine falcons have been breeding successfully at the site since 1995 (NMC 2005a). The loggerhead shrike, a grassland and open-land species, is known to occur on site and in the vicinity of Monticello. It has been documented in several areas along the transmission corridors in Anoka and Sherburne counties (NMC 2005a).

Trumpeter swans are increasing in numbers on the Mississippi River, and wintering swans readily use open water associated with warm water discharged to the river and available food (NMC 2005a).

One State-listed threatened reptile, the Blanding's turtle (*Emydoidea blandingii*), is documented by MNDNR as occurring in the vicinity of the transmission corridors in Anoka and Sherburne counties. In Sherburne County, the transmission corridor passes through land classified by MNDNR as "known concentration areas" of Blanding's turtles. There are fifteen known areas throughout Minnesota (Hoffman 2004).

A State-listed endangered butterfly, the Uncas skipper (*Hesperia uncas*), is documented by MNDNR as occurring in the vicinity of the transmission corridor in Sherburne County (Hoffmann 2004). Uncas skippers are associated with xeric prairies and open woodlands, which are declining due to fire suppression and natural forestation (Hoff 2000).

The tall nut-rush (*Scleria triglomerata*), a State-listed endangered species, occurs in the vicinity of the transmission corridor that passes through Bunker Hills Regional Park. Tall nut-rush is associated with dry or moist sandy ground in prairies and in the borders of marshes (Hoffmann 2004).

2.2.7 Radiological Impacts

Monticello conducts an annual REMP in and around the Monticello site and publishes an Annual Radiological Environmental Operating Report (NMC 2005d). Through this program, radiological impacts to employees, the public, and the environment are monitored, documented, and compared to the appropriate standards. The objectives of the REMP are the following:

Provide representative measurements of radiation levels and radioactive materials in the exposure pathways and of the radionuclides that have the highest potential for radiation exposures to members of the public; and

- Supplement the radiological effluent monitoring program by verifying that the measurable concentrations of radioactive materials and levels of radiation are not higher than expected on the basis of effluent measurements and the modeling of the environmental exposure pathways.

Radiological releases are summarized in two Monticello reports: the *Annual Radiological Environmental Operating Report* (NMC 2005d) and the *Radioactive Effluent Release Report* (NMC 2005e). The limits for all radiological releases are specified in the Monticello ODCM (NMC 2004b), and these limits are used to meet Federal standards and requirements. The REMP includes monitoring of the waterborne environment (ground, water, and shoreline sediment); airborne environment (airborne radioiodine, gross beta, and gamma); ingestion pathways (milk, fish and invertebrates, and food products); and direct radiation. The REMP

found that there were no indications of radiological effects of Monticello on the environment (NMC 2005d).

A review of historical data on releases from Monticello and the resultant dose calculations revealed that the calculated doses to maximally exposed individuals in the vicinity of Monticello were a small fraction of the limits specified in the Monticello ODCM (NMC 2004b) to meet 10 CFR Part 50, Appendix I design objectives, 10 CFR Part 20 dose limits, and EPA radiation standards in 40 CFR Part 190. For 2004, dose estimates were calculated based on actual liquid and gaseous effluent release data and conservative models to simulate the transport mechanisms. The results are described in the 2004 *Radioactive Effluent Release Report* (NMC 2005e). A breakdown of the calculated maximum dose to an individual located at the Monticello boundary from liquid and gaseous effluents released during 2004 is summarized as follows:

- The maximum whole-body dose to offsite member of the general public from liquid effluents was 1.94×10^{-10} mrem, well below the 3 mrem dose design objective in 10 CFR Part 50, Appendix I.

- The maximum whole-body dose to the likely most exposed member of the general public from gaseous effluents was 0.022 mrem, well below the 5 mrem dose design objective in 10 CFR Part 50, Appendix I.

The applicant does not anticipate any significant changes to the radioactive effluent releases or exposures from Monticello operations during the renewal period and, therefore, the impacts to the environment are not expected to change.

2.2.8 Socioeconomic Factors

2.2.8.1 Housing

Approximately 414 permanent employees and 105 contract and matrixed employees work at Monticello (NMC 2005a). Approximately 41 percent of these employees live in Wright County, 32 percent live in Sherburne County, 7.5 percent live in Hennepin County, and 7.5 percent live in Stearns County. The remaining employees (approximately 12 percent) live in various other locations (NMC 2005a). Given the predominance of NMC and NSP employees living in Wright County and Sherburne County, as well as the absence of the likelihood of significant socioeconomic effects in other locations, the focus of the analysis undertaken in this supplemental environmental impact statement (SEIS) are on these counties.

NMC refuels Monticello on a nominal 22- to 24-month cycle. During refueling outages, site employment increases by as many as 600 temporary workers for 30 to 40 days. Many of these workers are assumed to be temporarily located in the same geographic areas as the permanent staff.

Table 2-6 provides the number of housing unit vacancies for Wright and Sherburne counties for 1990 and 2000, the latest year for which information is available.

Table 2-6. Housing Units and Housing Units Vacant (Available) by County During 1990 and 2000

	1990	2000	Approximate Percentage Change
WRIGHT COUNTY			
Housing Units	26353	34355	30
Occupied Units	23013	31465	37
Vacant Units	3340	2890	–14
SHERBURNE COUNTY			
Housing Units	14964	22827	53
Occupied Units	13643	21581	58
Vacant Units	1321	1246	–6

Sources: USCB 1990, 2000b

2.2.8.2 Public Services

- **Water Supply**

This discussion of public water systems focuses on Wright and Sherburne counties because the majority of Monticello employees reside in these counties (NMC 2005a). Local municipalities provide public potable water service to residents who do not have individual onsite wells. These providers are subject to regulation under the Federal Safe Drinking Water Act, as implemented by the State of Minnesota Department of Health.

- **Description of Site and Environment**

Most water systems in the two-county area are operating below maximum capacity. Portions of both Wright and Sherburne counties are experiencing significant population growth, and several municipal water systems (Elk River, Joint Powers Water Board, and Otsego) are responding by increasing capacity with additional wells (EPA 2005).

Table 2-7 provides the details of Wright and Sherburne counties' respective water suppliers and capacities.

Table 2-7. Major Public Water Supply Systems in Wright and Sherburne Counties

Water System	Maximum Daily Capacity (ft^3/s)	Average Daily Capacity (ft^3/s)
	WRIGHT COUNTY	
Annandale	2.67	0.39
Buffalo	8.47	1.86
Cokato	2.23	0.53
Delano	3.34	0.62
Howard Lake	1.34	0.16
Joint Powers Board System	13.14	2.74
Maple Lake	0.67	0.26
Monticello	12.13	1.72
Montrose	2.45	0.23
Otsego	8.91	0.48
Rockford	5.46	0.62
	SHERBURNE COUNTY	
Becker	1.86	0.39
Big Lake	8.91	0.81
Elk River	12.25	5.73
Zimmerman	1.11	0.6

Source: NMC 2005a

- **Education**

In 2002, 19,991 students attended Wright County mainstream public schools and 15,156 students attended Sherburne County mainstream public schools (NCES 2005). Although the region's two school districts do not keep track of the number of Monticello employees' children attending district schools, it is likely that they are served by these schools because a majority of these employees live in Wright and Sherburne counties.

- **Transportation**

Road access to Monticello is south of the power block via Wright County Road 75, a two-lane paved road that runs roughly parallel to Interstate 94 in the vicinity of the site. Interstate 94 runs northwest from Minneapolis and passes within a mile southwest of the site. Access points to the Interstate are approximately 4 mi to the southeast and 6 mi to the northwest of the site, at the State Highway 25 intersection in Monticello and the Wright County Road 9 intersection, respectively. Access to Sherburne County is via the State Highway 25 bridge in the City of Monticello, approximately 3.5 mi to the south, and the State Highway 24 bridge at Clearwater, approximately 11 mi to the north. The Minnesota Department of Transportation (MDOT) does not normally calculate and keep up-to-date Level of Service (LOS) determinations for either state or county roadways; however, LOS information based on threshold values developed by MDOT for use in District Long Range Transportation Plans was available for State Highways 24 and 25 and Interstate 94 in Wright County. LOS determinations were made for current traffic volumes and with the addition of 60 additional vehicles assumed for license renewal. Results reveal that these roadways could accommodate the demand represented by the NMC bounding estimate for additional employees during the renewal term without a noticeable effect on level of service. MDOT long-term future plans (10 to 20 year time frame) included adding capacity to I-94 in the area and constructing a new river crossing that would improve conditions on Highway 24.

Table 2-8 lists roadways in the vicinity of Monticello and the average number of vehicles per day, as determined by MDOT (2002).

Table 2-8. Traffic Counts for Roads in the Vicinity of Monticello

Roadway and Location	Annual Average Daily Traffic
WRIGHT COUNTY	
State Highway 25 from bridge south to I-94	22600
State Highway 25 from I-94 south 6.6 mi	14200
I-94 east of Highway 24	39000
I-94 adjacent to the Monticello site	4800
I-94 in the City of Monticello	45400
State Highway 24 from I-94 south	5500
Wright County Road 8 north of I-94	1700
Wright County Road 8 south of I-94	1500
Wright County Road 75 south of State Highway 24	1850
Wright County Road 75 in vicinity of Enfield	1050

Table 2-8. (contd)

Roadway and Location	Annual Average Daily Traffic
SHERBURNE COUNTY	
State Highway 24 bridge to Wright County Road 52	15500
State Highway 24 from Wright County Road 52 to State Highway 10	12800
Highway 25 bridge	31300
Highway 25 north of bridge 0.5 mi	16200
Source: MDOT 2002	

2.2.8.3 Offsite Land Use

In order to accommodate and regulate growth and development, Wright and Sherburne counties have developed county-specific comprehensive growth management plans which encourage growth in areas that can be served by existing infrastructure, while preserving open space and environmentally sensitive areas. Sherburne County's plan was adopted in December 1992 and updated in 2004. Wright County's plan was adopted in May 1988. Land use planning and zoning regulations are primarily developed by the cities and towns within Wright and Sherburne counties. Therefore, land use standards may vary greatly in different regions within the counties. Neither county implements growth control measures that limit residential housing development. As shown in Tables 2-9 and 2-10, land is available for new housing developments in both Wright and Sherburne counties.

Table 2-9. Land Use in Wright County, 1980s

Land Use	Acres	Percent of Total
Cultivated fields	242280	52
Residential (urban or rural)	73890	16
Forest	63740	14
Water bodies	29600	6
Pasture and open land	28360	6
Marsh/wetland	17170	4
Urban and misc.	7680	2
Total	462720	100
Source: Wright County 1988		

Table 2-10. Land Use in Sherburne County, 1991

Land Use	Acres	Percent of Total
Residential	14440	5
Commercial/industrial	1240	0.5
Incorporated areas	39990	13.5
Agriculture	73700	26
Open lands designated for environmental protection and not available for development	34100	12
Open lands available for development	122530	43
Total	286000	100

Source: Sherburne County 1992

Thirteen of the sixteen cities in Wright County have developed comprehensive land use plans and guide growth and development in their communities through zoning subdividison ordinances. The three cities that do not have active planning programs are the smallest in the county (MDEED 2005a). Residential growth has been strongest in the northeastern cities, and the United States Census Bureau (USCB) estimates show that Wright County was the 60th fastest growing county in the nation for the period of 2000 to 2003 (USCB 2004). Agriculture is the predominant land use in the county, accounting for 52 percent of total acreage (Wright County 1988).

Wetlands are an important natural resource in Wright County and development of associated flood prone areas is restricted. Preservation of farmland is a major concern and goal of planning efforts, as Wright County contains approximately 337,240 ac of farmland that the State of Minnesota classifies as either prime or of statewide importance, based on soil quality, growing season, and moisture supply characteristics (Wright County 1988).

Sherburne County encompasses less land area than Wright County. Four of the six cities in Sherburne County have developed comprehensive land use plans. The two that do not have active planning programs are the smallest in the county (MDEED 2005b). Residential growth has been the strongest in the southeastern cities and eastern townships, and the USCB estimates show that Sherburne County is the 30th fastest growing county in the nation for the period of 2000 to 2003 (USCB 2004). Open land is the county's largest land use category, accounting for 43 percent of the county's total land area (Sherburne County 1992).

Wetlands are also an important natural resource in Sherburne County, and development is restricted by county, State and Federal regulations. Only a small percentage of Sherburne County is characterized by the State as prime farmlands or of statewide importance; however,

preservation of farmland and/or the rural character of the county is a major concern and goal of planning efforts in Sherburne County (Sherburne County 1992).

Sherco, a coal-fired plant also owned by Xcel Energy, is the closest industrial facility on the Mississippi river. Over 4500 ac comprise the Sherco site, the majority of which are leased for agricultural purposes.

Numerous public recreational and natural areas are located within 50 mi of the Monticello site. Federal properties include 35 ac owned by the National Park Service in the Mississippi National River and Recreation Area, as well as three Federal wildlife refuges. Three State parks, three State forests, eighteen State Scientific and Natural Areas, and numerous State wildlife management areas are also located within a 50-mi radius of the Monticello site (NMC 2005a).

2.2.8.4 Visual Aesthetics and Noise

Monticello is situated on the north and south banks of the Mississippi River in Wright and Sherburne counties. The local terrain is level to gently undulating. The area around Monticello is largely small residential communities, farmland and forest. There are two 9-cell cooling towers and one 328-foot-high off-gas stack on the site. The Monticello site is visible from the highway along its border. The off-gas stack is visible from the local community. The majority of the physical plant is not visible from the local communities. Noise has not been considered a problem due to the plant's distance from other communities.

2.2.8.5 Demography

Census data from 2000 found at the USCB website and geographic information system software (ArcView) were used to determine demographic characteristics in the Monticello vicinity. NRC guidance calls for the use of the most recent USCB decennial census data, which, in the case of publication of the NMC ER (NMC 2005a), was the 2000 Census. Population was estimated from the Monticello site out to 50 mi.

As derived from 2000 USCB information, approximately 166,860 people live within 20 mi of Monticello. Applying the GEIS sparseness measures, Monticello has a population density of 133 persons/mi^2 within 20 mi of the plant, and therefore falls into Category 4 of NRC's GEIS sparseness classification. The City of Buffalo is the largest city in Wright County and has a population of 10,097 persons (USCB 2000a). As estimated from 2000 USCB information, approximately 2,740,995 people live within 50 mi of Monticello. This equates to a population density of 349 persons/mi^2 within 50 mi, and falls into Category 4 of NRC's GEIS proximity classification.

According to the GEIS sparseness and proximity matrix, the ranking (sparseness Category 4 and proximity Category 4), indicates that Monticello is located in a high-population area. All or parts of 21 counties are located within 50 mi of the plant.

The Minneapolis-St. Paul-Bloomington, Minnesota-Wisconsin Metropolitan Statistical Area (MSA), which lies partially within a 50-mi radius of the plant, includes eleven Minnesota counties: Anoka, Carver, Chisago, Dakota, Hennepin, Isanti, Ramsey, Scott, Sherburne, Washington, and Wright. This MSA also includes two Wisconsin counties: Pierce and St. Croix. It is the 16th most populated MSA, with a current total population of approximately 2,968,806 (USCB 2000a). The St. Cloud, Minnesota MSA is entirely within Monticello's 50-mi radius and includes both Benton and Stearns counties. It is the 22nd most populated MSA, with a current total population of approximately 167,392 (USCB 2000a). From 1970 to 2000, Minnesota's average annual population growth rate was 0.9 percent, while the average annual population growth rates of Wright and Sherburne Counties were 2.8 percent and 4.3 percent, respectively (USCB 2000a).

In 2000, Minnesota reported a population count of 4.92 million people (USCB 2000a), or 1.75 percent of the U.S. population, ranking 21st in population among the 50 states and the District of Columbia. By the year 2030, Minnesota is projected to have 6.27 million residents and remain the 21st most populous state (USCB 2000a). Between the years 2000 and 2030, Wright and Sherburne counties are projected to grow at average annual rates of 1.8 percent and 2.97 percent, respectively (Sherburne County 2004).

Table 2-11 shows estimated populations and annual growth rates (1980 to 2040) for Wright and Sherburne counties, Minnesota, the counties with the greatest potential to be socioeconomically affected by license renewal activities at Monticello.

Table 2-11. Estimated Populations and Average Annual Growth Rates in Wright and Sherburne Counties from 1970 to 2040

	Wright County		Sherburne County	
Year	Population	Percent[a]	Population	Percent[a]
1970	38933	---	18344	---
1980	58681	4.19	29908	5.01
1990	68710	1.59	41945	3.44
2000	89986	2.73	64417	4.38
2010	109700	2	86320	2.97
2020	126420	1.43	105620	2.04
2030	139020	0.95	121920	1.45
2040	152876	0.95	140736	1.45

Sources: Years 1970 through 1990, USCB 1990; Year 2000, USCB 2000a; Years 2010 through 2030, MPSDC 2002; Year 2040 is a projection using previous decade's rate of growth.

[a] Annual percent growth rate calculated using the equation $N[t] = N[o] (1+r)t$ where N is population, t is time in years, and r is the annual growth rate expressed as a decimal.

2.2.8.6 Economy

The economy within a 50-mi radius of Monticello is dominated by the cities of St. Paul and Minneapolis. The Minneapolis/St. Paul metropolitan area has an economic employment profile led by services (29.6 percent), manufacturing (16.4 percent), trade (23.9 percent), government (11.6 percent), construction (4.2 percent), transportation and public utilities (5.5 percent), agriculture (1 percent), and finance, insurance and real estate (7.8 percent).

The annualized unemployment rate for the state of Minnesota in June 2005 was 3.9 percent. In June 2005, Wright County had an unemployment rate of 3.5 percent and Sherburne County had an unemployment rate of 3.8 percent (MDEED 2005c). The major employment facilities within 10 mi of Monticello are listed in Table 2-12. The estimated per capita household income in Minnesota in 2000 was $23,198. Wright and Sherburne counties had estimated per capita household incomes of $21,844 and $21,322, respectively (USCB 2000b).

In 2002 there were over 251,832 ac of farmland in Wright County, with an estimated market value of $92,839,000. Within Wright County, major crops consisted of corn (8,573,296 bushels); wheat (90,974 bushels); barley (24,578 bushels); oats (67,850 bushels); soybeans (2,249,289 bushels); and hay (90,307 tons, dry). A total of 178,451 ac were planted, with an average farm size of 171 ac (Cornell 2004).

Table 2-12. Major Employment Facilities Within 10 mi of the Monticello Site

Employer	Number of Employees
Outlet Mall at Albertville	800
Progressive Contractors, Inc.	540
Buffalo Public Schools	514
Wright County Government	450
Monticello Public Schools	450
Monticello-Big Lake Hospital	432
Xcel Energy	792
Wal-Mart	890
Guardian Angels Care Center	372
Great River Energy	316

Source: MTED 2004, NMC 2005a

In 1997 there were over 105,042 ac of farmland in Sherburne County, with an estimated market value of $42,760,000. Major crops consisted of corn (3,106,412 bushels); wheat (6,477 bushels); oats (22,423 bushels); sunflowers (38,800 pounds); soybeans (505,869 bushels); and

hay (19,276 tons, dry). A total of 66,029 ac were planted in 1997, with an average farm size of 205 ac (Cornell 2004).

Monticello paid between $7.95 million and $12.22 million in property taxes each year between 1998 and 2002, which accounted for approximately 11 percent of the property taxes collected over this period (see Table 2-13).

Table 2-13. Property Taxes Paid from 1998 to 2002; Monticello Contribution to County Property Tax Revenues

Year	Total Revenues ($)	Property Tax Paid by Monticello ($)	Percent of Total Property Taxes
		WRIGHT COUNTY[a]	
1998	46199186	3201300	6.9
1999	48271892	2915700	6
2000	51180648	2834800	5.5
2001	56286501	2692600	4.8
2002	59680999	2019300	3.4
		CITY OF MONTICELLO[b]	
1998	9395052	2803500	29.8
1999	9639772	3222200	33.4
2000	12320300	3166500	25.7
2001	12463189	3145300	25.2
2002	13782998	3384700	24.6
		SCHOOL DISTRICT 882[b]	
1998	N/A	6222300	N/A
1999	28056186	5725500	20.4
2000	30032343	5425700	18.1
2001	33301451	5445300	16.4
2002	35555509	1856200	5.2
		STATE GENERAL TAX[b]	
2002	12211949000	691600	< 1

Source: [a]Havala, Robert, Wright County Auditor-Treasurer. Personal communication, 2005.
[b]Wolfsteller, Rich, City of Monticello. Personal communication, 2005.

2.2.9 Historic and Archaeological Resources

This section discusses the cultural background and the known historic and archaeological resources at the Monticello site and surrounding area. Information was obtained from review of previous work conducted at the facility, consultations with the Minnesota State Historic Preservation Office (MNSHPO), and reports of recent cultural resource work conducted in Wright County.

2.2.9.1 Cultural Background

The basic prehistoric cultural framework for central Minnesota is broadly divided into three periods based upon patterns documented in the archaeological record (Minnesota State Museum 2005). The earliest time period when people were known to have been in the region is referred to as the Paleoindian Period (10,000 B.C. to 6000 B.C.). The economy is thought to have centered on big game hunting. Finely made projectile points such as Clovis and Folsom are characteristic of this period.

During the Archaic Period (6000 B.C. to 500 B.C.), settlement in the general area increased significantly. The economy also changed, as Archaic peoples lived as semi-nomadic hunters and gatherers, exploiting a much greater range of local resources than people had previously. The diversity of tools used similarly increased.

The final prehistoric period is referred to as the Woodland Period (500 B.C. to A.D.1750), which is marked by several changes in prehistoric life. The people made extensive use of burial mounds during this time, some complex and containing many grave goods. Earthenware pottery is also characteristic of the period. Evidence also reveals an increase in plant cultivation and a more sedentary way of life compared to earlier periods.

In the mid-17th century, when European explorers and fur traders began arriving in the region, the area was mostly occupied by Dakota Indians. The French initially claimed the land, sold it to Spain in 1762, repurchased it in 1800, and sold it to the United States in 1803 as part of the Louisiana Purchase. In the mid-17th century, people of Ojibwe tribal descent began moving westward into the area, in some cases causing conflict with the resident Dakota tribes. The Minnesota Territory formed in 1849, Indian Treaties were agreed to in 1850, and statehood was achieved in 1858 (Blegan 1975; Folwell 1956).

Settlers, mostly of German and Swedish descent, began arriving in present-day Wright County in the 1850s to farm. Settlement increased following the Civil War, stimulated by the arrival of the railroad. Farming continued to dominate the local economy into the modern era (Farnham 1976).

2.2.9.2 Historic and Archaeological Resources at the Monticello Site

An archaeological records and literature search was conducted at the MNSHPO to identify important resources that may be located in the area of potential effect. The area of potential effect is defined by the NRC as the plant and its immediate environs. The plant is located on the Mississippi River in an area typically considered to have high potential for archaeological sites, and the area is known in Minnesota's early Indian and fur trade history.

The Final Environmental Statement (FES) for Monticello identified several properties within a 10-mi radius listed on the National Register of Historic Places, but none within the proposed plant boundaries (AEC 1972; NSP 1971). The MNSHPO determined that there were no known archaeological or architectural sites known in the immediate vicinity of the plant (Fridlay 1971).

Since the original FES was published, additional cultural resource work in the area has confirmed the presence of cultural and historic resources in the vicinity of Monticello. No resources have been identified within the plant boundaries, however, and none are anticipated because of the disturbance created by the construction of the plant, as documented by aerial photographs (Bloomberg 2005). Based on the absence of input from tribes with current or historical ties to the region, no traditional cultural properties are believed to be located within the area of potential effect. A review of plat maps from 1894, 1901, 1915, and 1931 housed at the Minnesota State Historical Museum Library indicated that parts of the Monticello site were owned as early as 1894. By 1915, the parcels had been purchased by Mississippi River Electric Power Co., which planned to construct a dam at this location.

2.2.10 Related Federal Project Activities and Consultations

The staff reviewed the possibility that activities of other Federal agencies might impact the renewal of the OL for Monticello Nuclear Generating Plant. Any such activities could result in cumulative environmental impacts and the possible need for the Federal agency to become a cooperating agency for preparation of the SEIS.

The Mississippi National River and Recreation Area is located approximately 20 mi from the Monticello site. The park's boundaries enclose approximately 54,000 ac and 72 mi of river that extend in a narrow corridor along the river from Dayton to Hastings, Minnesota. The National Park Service owns 35 ac (NPS 2005).

Sherburne National Wildlife Refuge is located approximately 9 mi to the northeast of the Monticello site. This refuge is 30,700 ac and its primary mission is to represent a diverse biological community characteristic of the transition zone between tall-grass prairie and forest. It also provides resting, nesting and feeding habitat for waterfowl and other migratory birds, and habitat for resident wildlife (FWS 2005b).

The Minnesota Valley National Wildlife Refuge is located approximately 41 mi from the Monticello site. The refuge comprises 14,000 ac stretching for 34 mi from Fort Snelling State Park to Jordan, Minnesota. The Minnesota Valley National Wildlife Refuge also manages fourteen county Wetland Management Districts (WMDs). This refuge assists in restoring wetland and prairie habitats, and is a well-known area for bird watching (FWS 2005d).

Crane Meadows National Wildlife Refuge was established in 1992 to preserve a large, natural wetland complex. The 1825-ac refuge is located approximately 58 mi from the Monticello site, and is an important stop for many migrating bird species. It harbors one of the largest nesting populations of greater sandhill cranes in Minnesota. The refuge also serves as the base for the Federal private lands program in Morrison County, which focuses on restoring drained wetlands through voluntary agreements with landowners (FWS 2005f).

The NRC is required under Section 102(2)(c) of the National Environmental Policy Act of 1969 to consult with and obtain the comments of any Federal agency that has jurisdiction by law or special expertise with respect to any environmental impact involved. The NRC consulted with the FWS. Consultation correspondence is included in Appendix E.

2.3 References

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10 CFR Part 50, Appendix I. Code of Federal Regulations, Title 10, *Energy*, Part 50, Appendix I, "Numerical Guides for Design Objectives and Limiting Conditions for Operation to Meet the Criterion 'As Low as is Reasonably Achievable' for Radioactive Materials in Light-Water-Cooled Nuclear Power Reactor Effluents."

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

10 CFR Part 54. Code of Federal Regulations, Title 10, *Energy*, Part 54, "Requirements for Renewal of Operating Licenses for Nuclear Power Plants."

10 CFR Part 61. Code of Federal Regulations, Title 10, *Energy*, Part 61, "Licensing Requirements for Land Disposal of Radioactive Waste."

40 CFR Part 190. Code of Federal Regulations, Title 40, *Protection of Environment*, Part 190, "Environmental Radiation Protection Standards for Nuclear Power Operations."

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3.0 Environmental Impacts of Refurbishment

Environmental issues associated with refurbishment activities are discussed in the *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS), NUREG-1437, Volumes 1 and 2 (NRC 1996, 1999).[a] The GEIS includes a determination of whether the analysis of the environmental issues could be applied to all plants and whether additional mitigation measures would be warranted. Issues are then assigned a Category 1 or a Category 2 designation. As set forth in the GEIS, Category 1 issues are those that meet all of the following criteria:

(1) The environmental impacts associated with the issue have been determined to apply either to all plants or, for some issues, to plants having a specific type of cooling system or other specified plant or site characteristics.

(2) A single significance level (i.e., SMALL, MODERATE, or LARGE) has been assigned to the impacts (except for collective offsite radiological impacts from the fuel cycle and from high-level waste and spent fuel disposal).

(3) Mitigation of adverse impacts associated with the issue has been considered in the analysis, and it has been determined that additional plant-specific mitigation measures are likely not to be sufficiently beneficial to warrant implementation.

For issues that meet the three Category 1 criteria, no additional plant-specific analysis is required in this supplemental environmental impact statement (SEIS) unless new and significant information is identified.

Category 2 issues are those that do not meet one or more of the criteria for Category 1 and, therefore, additional plant-specific review of these issues is required.

License renewal actions may require refurbishment activities for the extended plant life. These actions may have an impact on the environment that requires evaluation, depending on the type of action and the plant-specific design. Environmental issues associated with refurbishment that were determined to be Category 1 issues are listed in Table 3-1.

Environmental issues related to refurbishment considered in the GEIS for which these conclusions could not be reached for all plants, or for specific classes of plants, are Category 2 issues. These are listed in Table 3-2.

Category 1 and Category 2 issues related to refurbishment that are not applicable to Monticello because they are related to plant design features or site characteristics not found at Monticello are listed in Appendix F.

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[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.

Table 3-1. Category 1 Issues for Refurbishment Evaluation

ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1	GEIS Sections
SURFACE-WATER QUALITY, HYDROLOGY, AND USE (FOR ALL PLANTS)	
Impacts of refurbishment on surface-water quality	3.4.1
Impacts of refurbishment on surface-water use	3.4.1
AQUATIC ECOLOGY (FOR ALL PLANTS)	
Refurbishment	3.5
GROUND-WATER USE AND QUALITY	
Impacts of refurbishment on ground-water use and quality	3.4.2
LAND USE	
Onsite land use	3.2
HUMAN HEALTH	
Radiation exposures to the public during refurbishment	3.8.1
Occupational radiation exposures during refurbishment	3.8.2
SOCIOECONOMICS	
Public services: public safety social services; and tourism and recreation	3.7.4; 3.7.4.3; 3.7.4.4; 3.7.4.6
Aesthetic impacts (refurbishment)	3.7.8

The potential environmental effects of refurbishment actions would be identified, and the analysis would be summarized within this section, if such actions were planned. NMC indicated that it has performed an evaluation of structures and components pursuant to 10 CFR 54.21 to identify activities that are necessary to continue operation of Monticello during the requested 20-year period of extended operation. These activities include replacement of certain components as well as new inspection activities and are described in the Environmental Report (ER) (NMC 2005).

However, NMC stated that the replacement of these components and the additional inspection activities are within the bounds of normal plant component replacement and inspections; therefore, they are not expected to affect the environment outside the bounds of plant operations as evaluated in the final environmental statement (AEC 1972). In addition, NMC's evaluation of structures and components as required by 10 CFR 54.21 did not identify any major plant refurbishment activities or modifications necessary to support the continued operation of Monticello beyond the end of the existing operating licenses. Therefore, refurbishment is not considered in this SEIS.

Table 3-2. Category 2 Issues for Refurbishment Evaluation

ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1	GEIS Sections	10 CFR 51.53(c)(3)(ii) Subparagraph
TERRESTRIAL RESOURCES		
Refurbishment impacts	3.6	E
THREATENED OR ENDANGERED SPECIES (FOR ALL PLANTS)		
Threatened or endangered species	3.9	E
AIR QUALITY		
Air quality during refurbishment (nonattainment and maintenance areas)	3.3	F
SOCIOECONOMICS		
Housing impacts	3.7.2	I
Public services: public utilities	3.7.4.5	I
Public services: education (refurbishment)	3.7.4.1	I
Offsite land use (refurbishment)	3.7.5	I
Public services: transportation	3.7.4.2	J
Historic and archeological resources	3.7.7	K
ENVIRONMENTAL JUSTICE		
Environmental justice	Not addressed[a]	Not addressed[a]

[a] Guidance related to environmental justice was not in place at the time the GEIS and the associated revision to 10 CFR Part 51 were prepared. If an applicant plans to undertake refurbishment activities for license renewal, environmental justice must be addressed in the licensee's environmental report and the staff's environmental impact statement.

3.1 References

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

10 CFR Part 54. Code of Federal Regulations, Title 10, *Energy*, Part 54, "Requirements for Renewal of Operating Licenses for Nuclear Power Plants."

Nuclear Management Company (NMC). 2005. *Applicant's Environmental Report—Operating License Renewal Stage, Monticello Nuclear Generating Plant.* Docket No. 50-263, License No. DPR-22. Monticello, Minnesota.

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4.0 Environmental Impacts of Operation

Environmental issues associated with operation of a nuclear power plant during the renewal term are discussed in the *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS), NUREG-1437, Volumes 1 and 2 (NRC 1996, 1999).[a] The GEIS includes a determination of whether the analysis of the environmental issues could be applied to all plants and whether additional mitigation measures would be warranted. Issues are then assigned a Category 1 or a Category 2 designation. As set forth in the GEIS, Category 1 issues are those that meet all of the following criteria:

(1) The environmental impacts associated with the issue have been determined to apply either to all plants or, for some issues, to plants having a specific type of cooling system or other specified plant or site characteristics.

(2) A single significance level (i.e., SMALL, MODERATE, or LARGE) has been assigned to the impacts (except for collective offsite radiological impacts from the fuel cycle and from high-level waste and spent fuel disposal).

(3) Mitigation of adverse impacts associated with the issue has been considered in the analysis, and it has been determined that additional plant-specific mitigation measures are likely not to be sufficiently beneficial to warrant implementation.

For issues that meet the three Category 1 criteria, no additional plant-specific analysis is required unless new and significant information is identified.

Category 2 issues are those that do not meet one or more of the criteria for Category 1, and therefore, additional plant-specific review of these issues is required.

This chapter addresses the issues related to operation during the renewal term that are listed in Table B-1 of Title 10 of the *Code of Federal Regulations* (CFR) Part 51, Subpart A, Appendix B and are applicable to the Monticello Nuclear Generating Plant (Monticello). Section 4.1 addresses issues applicable to the Monticello cooling system. Section 4.2 addresses issues related to transmission lines and onsite land use. Section 4.3 addresses the radiological impacts of normal operation, and Section 4.4 addresses issues related to the socioeconomic impacts of normal operation during the renewal term. Section 4.5 addresses issues related to groundwater use and quality, while Section 4.6 discusses the impacts of renewal-term operations on threatened and endangered species. Section 4.7 addresses potential new information that was raised during the scoping period, and Section 4.8 discusses cumulative impacts. The results of the evaluation of environmental issues related to operation during the renewal term are summarized in Section 4.9. Finally, Section 4.10 lists the references for Chapter 4. Category 1 and Category 2 issues that are not applicable to Monticello because

[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.

they are related to plant design features or site characteristics not found on the Monticello site are listed in Appendix F.

4.1 Cooling System

Category 1 issues in Table B-1 of 10 CFR Part 51, Subpart A, Appendix B, that are applicable to the Monticello cooling system operation during the renewal term are listed in Table 4-1. Nuclear Management Company (NMC) stated in its Environmental Report (ER) (NMC 2005a) that it is not aware of any new and significant information associated with the renewal of the Monticello operating license (OL) that would warrant additional, plant-specific analysis of the remaining applicable Category 1 issues. The staff has not identified any new and significant information during its independent review of the NMC ER, the staff's site visit, the scoping process, its evaluation of other available information, or public comments on the draft Supplemental Environmental Impact Statement (SEIS). Therefore, the staff concludes that there are no impacts related to these issues beyond those discussed in the GEIS. For all of these issues, the staff concluded in the GEIS that the impacts are SMALL, and additional plant-specific mitigation measures are not likely to be sufficiently beneficial to be warranted.

A brief description of the staff's review and the GEIS conclusions, as codified in Table B-1, for each of these issues follows:

- Altered current patterns at intake and discharge structures. Based on information in the GEIS, the Commission found that

  > Altered current patterns have not been found to be a problem at operating nuclear power plants and are not expected to be a problem during the license renewal term.

The staff has not identified any new and significant information during the staff's independent review of the NMC ER, the scoping process, the staff's site visit, its evaluation of other available information, or public comments on the draft SEIS. Therefore, the staff concludes that there are no impacts of altered current patterns at intake and discharge structures during the renewal term beyond those discussed in the GEIS.

- Temperature effects on sediment transport capacity. Based on information in the GEIS, the Commission found that

  > These effects have not been found to be a problem at operating nuclear power plants and are not expected to be a problem during the license renewal term.

Table 4-1. Category 1 Issues Applicable to the Operation of the Monticello Cooling System During the Renewal Term

ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1	GEIS Sections
SURFACE WATER QUALITY, HYDROLOGY, AND USE (FOR ALL PLANTS)	
Altered current patterns at intake and discharge structures	4.2.1.2.1
Temperature effects on sediment transport capacity	4.2.1.2.3
Scouring caused by discharged cooling water	4.2.1.2.3
Eutrophication	4.2.1.2.3
Discharge of chlorine or other biocides	4.2.1.2.4
Discharge of sanitary wastes and minor chemical spills	4.2.1.2.4
Discharge of other metals in wastewater	4.2.1.2.4
Water use conflicts (plants with once-through cooling systems)	4.2.1.3
AQUATIC ECOLOGY (FOR ALL PLANTS)	
Accumulation of contaminants in sediments or biota	4.2.1.2.4
Entrainment of phytoplankton and zooplankton	4.2.2.1.1
Cold shock	4.2.2.1.5
Thermal plume barrier to migrating fish	4.2.2.1.6
Distribution of aquatic organisms	4.2.2.1.6
Premature emergence of aquatic insects	4.2.2.1.7
Gas supersaturation (gas bubble disease)	4.2.2.1.8
Low dissolved oxygen in the discharge	4.2.2.1.9
ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1	**GEIS Sections**
Losses from predation, parasitism, and disease among organisms exposed to sublethal stresses	4.2.2.1.10
Stimulation of nuisance organisms	4.2.2.1.11
AQUATIC ECOLOGY (FOR PLANTS WITH COOLING TOWER-BASED HEAT DISSIPATION SYSTEMS)	
Entrainment of fish and shellfish in early life stages	4.3.3
Impingement of fish and shellfish	4.3.3
Heat shock	4.3.3
TERRESTRIAL RESOURCES	
Cooling tower impacts on crops and ornamental vegetation	4.3.4
Cooling tower impacts on native plants	4.3.5.1
Bird collisions with cooling towers	4.3.5.2
HUMAN HEALTH	
Microbiological organisms (occupational health)	4.3.6
Noise	4.3.7

The staff has not identified any new and significant information during the staff's independent review of the NMC ER, the scoping process, the staff's site visit, its evaluation of other available information, or public comments on the draft SEIS. Therefore, the staff concludes that there are no impacts of temperature effects on sediment transport capacity during the renewal term beyond those discussed in the GEIS.

- Scouring caused by discharged cooling water. Based on information in the GEIS, the Commission found that

  > Scouring has not been found to be a problem at most operating nuclear power plants and has caused only localized effects at a few plants. It is not expected to be a problem during the license renewal term.

The staff has not identified any new and significant information during the staff's independent review of the NMC ER, the scoping process, the staff's site visit, its evaluation of other available information, or public comments on the draft SEIS. Therefore, the staff concludes that there are no impacts of scouring caused by discharged cooling water during the renewal term beyond those discussed in the GEIS.

- Eutrophication. Based on information in the GEIS, the Commission found that

  > Eutrophication has not been found to be a problem at operating nuclear power plants and is not expected to be a problem during the license renewal term.

The staff has not identified any new and significant information during the staff's independent review of the NMC ER, the scoping process, the staff's site visit, its evaluation of other available information, including plant monitoring data and technical reports, or public comments on the draft SEIS. Therefore, the staff concludes that there are no impacts at intake and discharge structures during the renewal term beyond those discussed in the GEIS.

- Discharge of chlorine or other biocides. Based on information in the GEIS, the Commission found that

  > Effects are not a concern among regulatory and resource agencies, and are not expected to be a problem during the license renewal term.

The staff has not identified any new and significant information during the staff's independent review of the NMC ER, the scoping process, the staff's site visit, its evaluation of other available information, including the National Pollutant Discharge Elimination System (NPDES) permit for Monticello, or public comments on the draft SEIS. Therefore, the staff concludes that there are no impacts of discharge of chlorine or other biocides during the renewal term beyond those discussed in the GEIS.

- Discharge of sanitary wastes and minor chemical spills. Based on information in the GEIS, the Commission found that

  > Effects are readily controlled through NPDES permit and periodic modifications, if needed, and are not expected to be a problem during the license renewal term.

The staff has not identified any new and significant information during the staff's independent review of the NMC ER, the scoping process, the staff's site visit, its evaluation of other available information, including the NPDES permit for Monticello and the Sanitary Sewer Wastewater Discharge Agreement, or public comments on the draft SEIS. Therefore, the staff concludes that there are no impacts of discharges of sanitary wastes and minor chemical spills during the renewal term beyond those discussed in the GEIS.

- Discharge of other metals in wastewater. Based on information in the GEIS, the Commission found that

  > These discharges have not been found to be a problem at operating nuclear power plants with cooling-tower-based heat dissipation systems and have been satisfactorily mitigated at other plants. They are not expected to be a problem during the license renewal term.

The staff has not identified any new and significant information during the staff's independent review of the NMC ER, the scoping process, the staff's site visit, its evaluation of other available information, including the NPDES permit for Monticello, or public comments on the draft SEIS. Therefore, the staff concludes that there are no impacts of discharges of other metals in wastewater during the renewal term beyond those discussed in the GEIS.

- Water use conflicts (plants with once-through cooling systems). Based on information in the GEIS, the Commission found that

  > These conflicts have not been found to be a problem at operating nuclear power plants with once-through heat dissipation systems.

The staff has not identified any new and significant information during the staff's independent review of the NMC ER, the scoping process, the staff's site visit, its evaluation of other available information, including the NPDES permit and the Surface Water Appropriations Permit, or public comments on the draft SEIS. Therefore, the staff concludes that there are no impacts of water-use conflicts for plants with once-through cooling systems during the renewal term beyond those discussed in the GEIS.

- Accumulation of contaminants in sediments or biota. Based on information in the GEIS, the Commission found that

> Accumulation of contaminants has been a concern at a few nuclear power plants but has been satisfactorily mitigated by replacing copper alloy condenser tubes with those of another metal. It is not expected to be a problem during the license renewal term.

The staff has not identified any new and significant information during its independent review of the NMC ER, the staff's site visit, the scoping process, its evaluation of available information, or public comments on the draft SEIS. Therefore, the staff concludes that there are no impacts of accumulation of contaminants in sediments or biota during the renewal term beyond those discussed in the GEIS.

- Entrainment of phytoplankton and zooplankton. Based on information in the GEIS, the Commission found that

> Entrainment of phytoplankton and zooplankton has not been found to be a problem at operating nuclear power plants and is not expected to be a problem during the license renewal term.

The staff has not identified any new and significant information during its independent review of the NMC ER, the staff's site visit, the scoping process, its evaluation of other available information, or public comments on the draft SEIS. Therefore, the staff concludes that there are no impacts of entrainment of phytoplankton and zooplankton during the renewal term beyond those discussed in the GEIS.

- Cold shock. Based on information in the GEIS, the Commission found that

> Cold shock has been satisfactorily mitigated at operating nuclear plants with once-through cooling systems, has not endangered fish populations or been found to be a problem at operating nuclear power plants with cooling towers or cooling ponds, and is not expected to be a problem during the license renewal term.

The staff has not identified any new and significant information during its independent review of the NMC ER, the staff's site visit, the scoping process, its evaluation of other available information, or public comments on the draft SEIS. Therefore, the staff concludes that there are no impacts of cold shock during the renewal term beyond those discussed in the GEIS.

- Thermal plume barrier to migrating fish. Based on information in the GEIS, the Commission found that

> Thermal plumes have not been found to be a problem at operating nuclear power plants and are not expected to be a problem during the license renewal term.

The staff has not identified any new and significant information during its independent review of the NMC ER, the staff's site visit, the scoping process, its evaluation of other available information, or public comments on the draft SEIS. Therefore, the staff concludes that there are no impacts of thermal plume barriers to migrating fish during the renewal term beyond those discussed in the GEIS.

- Distribution of aquatic organisms. Based on information in the GEIS, the Commission found that

  > Thermal discharge may have localized effects but is not expected to effect the larger geographical distribution of aquatic organisms.

The staff has not identified any new and significant information during its independent review of the NMC ER, the staff's site visit, the scoping process, its evaluation of other available information, or public comments on the draft SEIS. Therefore, the staff concludes that there are no impacts on distribution of aquatic organisms during the renewal term beyond those discussed in the GEIS.

- Premature emergence of aquatic insects. Based on information in the GEIS, the Commission found that

  > Premature emergence has been found to be a localized effect at some operating nuclear power plants but has not been a problem and is not expected to be a problem during the license renewal term.

The staff has not identified any new and significant information during its independent review of the NMC ER, the staff's site visit, the scoping process, its evaluation of other available information, or public comments on the draft SEIS. Therefore, the staff concludes that there are no impacts of premature emergence of aquatic insects during the renewal term beyond those discussed in the GEIS.

- Gas supersaturation (gas bubble disease). Based on information in the GEIS, the Commission found that

  > Gas supersaturation was a concern at a small number of operating nuclear power plants with once-through cooling systems but has been satisfactorily mitigated. It has not been found to be a problem at operating nuclear power plants with cooling towers or cooling ponds and is not expected to be a problem during the license renewal term.

The staff has not identified any new and significant information during its independent review of the NMC ER, the staff's site visit, the scoping process, its evaluation of other available information, or public comments on the draft SEIS. Therefore, the staff concludes that there

are no impacts of gas supersaturation during the renewal term beyond those discussed in the GEIS.

- Low dissolved oxygen in the discharge. Based on information in the GEIS, the Commission found that

  > Low dissolved oxygen has been a concern at one nuclear power plant with a once-through cooling system but has been effectively mitigated. It has not been found to be a problem at operating nuclear power plants with cooling towers or cooling ponds and is not expected to be a problem during the license renewal term.

The staff has not identified any new and significant information during its independent review of the NMC ER, the staff's site visit, the scoping process, its evaluation of other available information, or public comments on the draft SEIS. Therefore, the staff concludes that there are no impacts of low dissolved oxygen during the renewal term beyond those discussed in the GEIS.

- Losses from predation, parasitism, and disease among organisms exposed to sublethal stresses. Based on information in the GEIS, the Commission found that

  > These types of losses have not been found to be a problem at operating nuclear power plants and are not expected to be a problem during the license renewal term.

The staff has not identified any new and significant information during its independent review of the NMC ER, the staff's site visit, the scoping process, its evaluation of other available information, or public comments on the draft SEIS. Therefore, the staff concludes that there are no impacts of losses from predation, parasitism, and disease among organisms exposed to sublethal stresses during the renewal term beyond those discussed in the GEIS.

- Stimulation of nuisance organisms. Based on information in the GEIS, the Commission found that

  > Stimulation of nuisance organisms has been satisfactorily mitigated at the single nuclear power plant with a once-through cooling system where previously it was a problem. It has not been found to be a problem at operating nuclear power plants with cooling towers or cooling ponds and is not expected to be a problem during the license renewal term.

The staff has not identified any new and significant information during its independent review of the NMC ER, the staff's site visit, the scoping process, its evaluation of other available information, or public comments on the draft SEIS. Therefore, the staff concludes that there

are no impacts of stimulation of nuisance organisms during the renewal term beyond those discussed in the GEIS.

- Entrainment of fish and shellfish in early life stages (cooling tower based systems). Based on information in the GEIS, the Commission found that

  > Entrainment of fish has not been found to be a problem at operating nuclear power plants with this type of cooling system and is not expected to be a problem during the license renewal term.

The staff has not identified any new and significant information during its independent review of the NMC ER, the staff's site visit, the scoping process, its evaluation of other available information, or public comments on the draft SEIS. Therefore, the staff concludes that there are no impacts of entrainment of fish and shellfish in early life stages for cooling tower based systems during the renewal term beyond those discussed in the GEIS.

- Impingement of fish and shellfish (cooling tower based systems). Based on information in the GEIS, the Commission found that

  > The impingement has not been found to be a problem at operating nuclear power plants with this type of cooling system and is not expected to be a problem during the license renewal term.

The staff has not identified any new and significant information during its independent review of the NMC ER, the staff's site visit, the scoping process, its evaluation of other available information, or public comments on the draft SEIS. Therefore, the staff concludes that there are no impacts of impingement of fish and shellfish for cooling tower based systems during the renewal term beyond those discussed in the GEIS.

- Heat shock (cooling tower based systems). Based on information in the GEIS, the Commission found that

  > Heat shock has not been found to be a problem at operating nuclear power plants with this type of cooling system and is not expected to be a problem during the license renewal term.

The staff has not identified any new and significant information during its independent review of the NMC ER, the staff's site visit, the scoping process, its evaluation of other available information, or public comments on the draft SEIS. Therefore, the staff concludes that there are no impacts of heat shock for cooling tower based systems during the renewal term beyond those discussed in the GEIS.

- Cooling tower impacts on crops and ornamental vegetation. Based on information in the GEIS, the Commission found that

> Impacts from salt drift, icing, fogging, or increased humidity associated with cooling tower operation have not been found to be a problem at operating nuclear power plants and are not expected to be a problem during the license renewal term.

The staff has not identified any new and significant information during its independent review of the NMC ER, the staff's site visit, the scoping process, its evaluation, or public comments on the draft SEIS. Therefore, the staff concludes that there are no cooling tower impacts on crops and ornamental vegetation during the renewal term beyond those discussed in the GEIS.

- Cooling tower impacts on native plants. Based on information in the GEIS, the Commission found that

  > Impacts from salt drift, icing, fogging, or increased humidity associated with cooling tower operation have not been found to be a problem at operating nuclear power plants and are not expected to be a problem during the license renewal term.

The staff has not identified any new and significant information during its independent review of the NMC ER, the staff's site visit, the scoping process, its evaluation of other available information, or public comments on the draft SEIS. Therefore, the staff concludes that there are no cooling tower impacts on native vegetation during the renewal term beyond those discussed in the GEIS:

- Bird collisions with cooling towers. Based on information in the GEIS, the Commission found that

  > These collisions have not been found to be a problem at operating nuclear power plants and are not expected to be a problem during the license renewal term.

The staff has not identified any new and significant information during its independent review of the NMC ER, the staff's site visit, the scoping process, its evaluation of other available information, or public comments on the draft SEIS. Therefore, the staff concludes that there are no impacts of bird collisions with cooling towers during the renewal term beyond those discussed in the GEIS.

- Microbiological organisms (occupational health). Based on information in the GEIS, the Commission found that

  > Occupational health impacts are expected to be controlled by continued application of accepted industrial hygiene practices to minimize worker exposures.

The staff has not identified any new and significant information during its independent review of the NMC ER, the staff's site visit, the scoping process, its evaluation of other available

information, or public comments on the draft SEIS. Therefore, the staff concludes that there are no impacts of microbiological organisms during the renewal term beyond those discussed in the GEIS.

- Noise. Based on information in the GEIS, the Commission found that

  > Noise has not been found to be a problem at operating plants and is not expected to be a problem at any plant during the license renewal term.

The staff has not identified any new and significant information during its independent review of the NMC ER, the staff's site visit, the scoping process, its evaluation of other available information, or public comments on the draft SEIS. Therefore, the staff concludes that there are no impacts of noise during the renewal term beyond those discussed in the GEIS.

The Category 2 issues related to cooling system operation during the renewal term that are applicable to Monticello are discussed in the sections that follow, and are listed in Table 4-2.

Table 4-2. Category 2 Issues Applicable to the Operation of the Monticello Cooling System During the Renewal Term

ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1	GEIS Section	10 CFR 51.53(c)(3)(ii) Subparagraph	SEIS Section
SURFACE WATER QUALITY, HYDROLOGY, AND USE (FOR ALL PLANTS)			
Water use conflicts (plants with cooling ponds or cooling towers using makeup water from a small river with a low flow)	4.3.2.1; 4.4.2.1	A	4.1.1
AQUATIC ECOLOGY (FOR PLANTS WITH ONCE THROUGH AND COOLING POND HEAT-DISSIPATION SYSTEMS)			
Entrainment of fish and shellfish in early life stages	4.2.2.1.2	B	4.1.2
Impingement of fish and shellfish	4.2.2.1.3	B	4.1.3
Heat shock	4.2.2.1.4	B	4.1.4
HUMAN HEALTH			
Microbiological organisms (public health) (plants using lakes or canals, or cooling towers or cooling ponds that discharge to a small river)	4.3.6	G	4.1.5

4.1.1 Water Use Conflicts (Plants with Cooling Ponds or Cooling Towers Using Makeup Water from a Small River with a Low Flow)

Water use conflicts for plants with cooling ponds or towers using makeup water from small river with low flow is a Category 2 issue, requiring a site-specific assessment before license renewal. Monticello utilizes cooling towers and withdraws make-up water from the Mississippi River which has annual flow rate of less than the 3.15×10^{12} cubic ft per year threshold value in 10 CFR 51.53(c)(3)(ii)(A).

The impact of consumptive loss on the downstream riparian communities is associated with the small difference it can cause in the river surface elevation. Section 2.2.2 describes Monticello surface water withdrawal from the Mississippi River, which is regulated by the Minnesota Pollution Control Agency (MPCA) NPDES permit and by the Minnesota Department of Natural Resources (MNDNR) Surface Water Appropriations Permit. During normal conditions, river flows in the Mississippi River exceed 860 cfs and cooling of circulating water meets NPDES permit limits. Under these conditions, the NPDES permit allows Monticello to withdraw a maximum of 645 cfs and Monticello operates in a once-through mode. When water temperatures approach NPDES permit limits, Monticello operates in helper cycle (see Section 2.2.2) and some of the cooling water is passed through the cooling towers before discharging into the discharge canal. United States Geological Survey (USGS) gage station data is available approximately 26 mi upstream from Monticello since 1988 (Station 05270700, Mississippi River at St. Cloud). This gage station represents a conservative estimate of flow at Monticello because this does not take into account additional flow inputs between the USGS gage station and Monticello. Furthermore, review of the MNDNR online database of water allocation permits indicate there are no significant surface water withdrawals between the measuring station and the intake at Monticello (MNDNR 2005a). From September 1988 through September 2004, the maximum and minimum daily flows at the upstream USGS gage station were 45,100 cfs and 1010 cfs, occurring on April 9, 1997, and August 24, 1989, respectively (USGS 2005). A separate flow analysis was conducted by NMC in the ER using data from USGS gage stations both upstream and downstream of Monticello. In this analysis, the flow at Monticello was estimated based on its drainage area relative to the drainage areas of the USGS gage stations. This analysis estimated the lowest daily river flow at 586 cfs (NMC 2005a). If the Mississippi River is between 240 and 860 cfs, NMC is only allowed to withdraw 75 percent of the river flow (see Section 2.2.2). At a river flow of 586 cfs, NMC is allowed to withdraw 440 cfs. Under these conditions, and with an assumed evaporative loss of water from the cooling towers of 18 cfs (AEC 1972), the consumptive loss due to evaporation from the cooling towers represents four percent of the river flow, which is not considered significant.

The staff independently reviewed the NMC ER, visited the site, and reviewed the Monticello NPDES permit, the Surface Water Appropriations permit, and other reports. Based on this information, the staff concludes that the potential impacts of water use conflicts are SMALL. During the course of this evaluation, staff considered mitigation measures for continued operation of Monticello. Based on this evaluation, the staff expects that the existing State

restrictions on water withdrawal during low-flow conditions in the Mississippi River are appropriate and no additional mitigation measures are warranted.

4.1.2 Entrainment of Fish and Shellfish in Early Life Stages

For plants with a once-through cooling system, entrainment of fish and shellfish in early life stages into cooling water systems associated with nuclear power plants is considered a Category 2 issue, requiring a site-specific assessment before license renewal. To perform this evaluation, the staff reviewed the applicant's ER (NMC 2005a) and related documents (including the Clean Water Act (CWA) Section 316(b) Demonstration [Amish et al. 1978]); visited the Monticello site; and reviewed the applicant's State of Minnesota NPDES Permit No. 0000868, issued on August 22, 2002, and in force until July 31, 2007 (MPCA 2002).

Section 316(b) of the CWA requires that the location, design, construction, and capacity of cooling water intake structures reflect the best technology available for minimizing adverse environmental impacts. Entrainment of fish and shellfish into the cooling water system is a potential adverse environmental impact that can be minimized by use of the best available technology.

On July 9, 2004, the U.S. Environmental Protection Agency (EPA) published a final rule in the *Federal Register* (EPA 2004) addressing cooling water intake structures at existing power plants, such as Monticello, whose flow levels exceed a minimum threshold value of 50 million gpd. The rule is Phase II in the EPA's development of CWA 316(b) regulations that establish national requirements applicable to the location, design, construction, and capacity of cooling water intake structures at existing facilities that exceed the threshold value for water withdrawals. The national requirements, which are implemented through NPDES permits, minimize the adverse environmental impacts associated with the continued use of the intake systems. Licensees are required to demonstrate compliance with the Phase II performance standards at the time of renewal of their NPDES permit. Licensees may be required as part of the NPDES renewal to alter the intake structure, redesign the cooling system, modify station operation, or take other mitigative measures as a result of this regulation. The new performance standards are designed to significantly reduce entrainment losses due to water withdrawals associated with cooling water intake structures used for power production. Any site-specific mitigation would result in less impact from entrainment during the license renewal period.

Condenser cooling water is withdrawn from the Mississippi River through an approach channel angled at 81° to the shoreline (Amish et al. 1978; NMC 2005a). Water enters the intake over a concrete sill equipped with a 12.5-ft wide stop log section in the center of the sill. After passing over the sill, the water passes through a bar rack. The water is then diverted into two separate streams that each pass through paired traveling screens with 3/8-in. mesh (NMC 2005a). The Mississippi River is also used for service water cooling, screen wash, and fire protection (MPCA 2002).

Under the current Surface Water Appropriations Permit, Monticello is allowed to withdraw a maximum of 645 cfs for once-through or helper-cycle mode cooling and plant process water from the Mississippi River. Special operating conditions are required when the river flow is less than 860 cfs. For example, plant water intake may not exceed 75 percent of river flow when the river flow is less than 860 cfs but greater than 240 cfs (NMC 2005a). When river flow is less than 240 cfs, there are further restrictions, including use of a closed-cycle mode of operation (NMC 2005a). Withdrawn water is returned to the river except for that amount evaporated in the discharge canal and cooling towers. During 2002, the mean river flow was 6351 cfs while mean intake flow was approximately 529 cfs; similar means for 2003 were 4572 cfs and 491.9 cfs, respectively (Xcel Energy 2004).

The cooling water flow path for open-cycle or once-through cooling includes (1) the Mississippi River, (2) the intake, (3) the condenser, (4) the discharge structure, (5) the discharge canal, (6) the discharge weir, and (7) the Mississippi River. From the discharge canal, the cooling water returns to the river at a point approximately 1500 ft downstream from the intake. For the other modes of operation (see Table 2-2), all, part, or none of the cooled water from the cooling towers can be sent back to the circulating water pump intake (Afzal et al. 1975). Approximately 5 to 6 percent of total cooling water flow needs to be replaced with makeup water from the Mississippi River during closed-cycle operation (NMC 2005a). Makeup water is supplied by two 31 cfs pumps that replace water lost by cooling tower evaporation, drift, and blowdown (Afzal et al. 1975).

Entrainment samples were collected at Monticello from September 12, 1973, to August 18, 1974, by Knutson et al. (1976). During that period, river flow used for cooling ranged from 1.6 to 19.4 percent of river flow with a mean of 10.1 percent (Knutson et al. 1976). Entrainment rates for young-of-the-year fish were estimated at 9.2/hr from September 12, 1973, to March 13, 1974; 5986/hr from May 22, 1974, to June 28, 1974; and 35/hr from June 28 to August 18, 1974. The entrainment rate was estimated to be 1617/hr or 38,805/day for all fishes. The maximum estimated entrainment rate was 22,635/hr on June 12, 1974. Approximately 98 percent of all entrainment occurred between May 22 and June 28, 1974 (Knutson et al. 1976).

Entrainment losses consisted of twenty-three fish species or species groups (Knutson et al. 1976). Catostomid (sucker) fry comprised 96.5 percent of the entrainment. Black crappie *(Pomoxis nigromaculatus)* comprised 1.3 percent, walleye (*Sander vitreus*) comprised 0.5 percent, and cyprinids (minnows) comprised 0.8 percent of total fish entrained (Knutson et al. 1976). Entrainment of young-of-the-year shorthead redhorse (*Moxostoma macrolepidotum*), silver redhorse *(M. anisurum)*, and white sucker (*Catostomus commersoni*) during April to August 1974 was estimated at 7.8 million individuals; while only a combined 8400 black crappie, walleye, and smallmouth bass (*Micropterus dolomieu*) were entrained (Knutson et al. 1976). Since regular fish surveys have been initiated at Monticello before the plant started operation, suckers have been the predominant species collected in electroshocking samples (Xcel Energy 2004). Thus, entrainment has not apparently had an impact on sucker species production.

In addition to elevated temperatures, entrained organisms are exposed to biocides and mechanical stresses. Experimental studies using fathead minnow (*Pimephales promelas*) fry demonstrated that up to 11.8 percent survived temperature elevations of 25.6 to 41.6° F; while 8.5 to 42.4 percent showed signs of mechanical damage from passing through the condensers. The incidence of external injuries for fish that were alive at recapture was only approximately 2 percent (Knutson et al. 1976). However, survival was found to be very low (0.0 to 1.6 percent) when ambient river temperatures were 55.0° F or higher or when the change in temperature was 59.4° F (Knutson et al. 1976). Overall, it was concluded that sublethal thermal and mechanical effects would result in long-term survival of less than 10 percent of entrained fishes (Knutson et al. 1976).

Entrainment monitoring was also conducted at Monticello between April 23 and September 4, 1976, for the CWA 316(b) Demonstration. This sampling period encompassed a low-flow year in the Mississippi River. Therefore, Monticello withdrew a relatively high percentage of river water, and consequently, entrainable organisms (Amish et al. 1978). During the year, an average of 19.3 percent of the Mississippi River flow passed though the plant, ranging from a high of 36 percent in August 1976 to a low of 7 percent in April 1976 (Amish et al. 1978).

In the 1976 study, 2.83 million young-of-the-year fish and 1.08 million fish eggs were estimated to have been entrained at Monticello. The predominant species entrained as larvae were 879,000 logperch (*Percina caprodes*) (31.8 percent); 633,000 shorthead redhorse (22.4 percent); 388,000 unidentifiable darters (13.7 percent); and 308,000 unidentifiable minnows (10.9 percent). The eggs were not identified to species (Amish et al. 1978). The maximum number of equivalent adult fish estimated to have been lost due to this entrainment was 250,124 fishes, including 218,000 logperch, 9230 shorthead redhorse, 1410 darters, and 13,600 minnows (Amish et al. 1978).

Generally, buoyant eggs are the only ones capable of being entrained at Monticello. Most fish species in the area of Monticello have adhesive eggs. Therefore, it was assumed that free-floating eggs were either diseased or accidentally removed from the riverbed by current and scouring action. These eggs would have had a naturally low potential for survival (Knutson et al. 1976).

To interpret the impacts of entrainment on fish community species populations and structure, entrainment losses must be compared to the distribution, abundance, and life cycles of the species that occur near Monticello. The ultimate impact of entrainment losses must be evaluated in terms of a system's resiliency (i.e., environmental stability, productivity, population compensation, and ecological and economic importance of the individual species) (Noguchi et al. 1985). The fish community has been persistent and stable since the plant became operational; and species composition has been similar between locations upstream and downstream of the Monticello site (Xcel Energy 2004). Based on the CWA 316(b) Demonstration (Amish et al. 1978), the Minnesota Pollution Control Agency concluded that entrainment at Monticello does not pose a substantial detrimental effect on the fish population

(MPCA 1979). Under conditions of the current State of Minnesota NPDES permit, the location and operation of the intake will continue to have minimal environmental impact.

During the course of the SEIS preparation, the staff considered mitigation measures for the continued operation of Monticello. Based on the assessment conducted, the staff expects that the measures in place at Monticello (e.g., the intake structure is situated in a location devoid of unique spawning habitat and the capability of the plant to operate in a partial recirculation or closed-cycle mode) provide mitigation for impacts related to entrainment. The staff concludes that the potential impacts of entrainment of fish and shellfish in the early life stages into the cooling water intake system are SMALL, and further mitigation measures would not be warranted.

4.1.3 Impingement of Fish and Shellfish

For plants with once-through cooling systems, impingement of fish and shellfish on debris screens of cooling water system intakes is considered a Category 2 issue, requiring a site-specific assessment before license renewal. To perform this evaluation, the staff reviewed the applicant's ER (NMC 2005a) and related documents [including the CWA 316(b) Demonstration (Amish et al. 1978)]; visited the Monticello site; and reviewed the applicant's State of Minnesota NPDES Permit No. 0000868, issued on August 22, 2002, and in force until July 31, 2007 (MPCA 2002).

Condenser cooling water is withdrawn from the Mississippi River through an approach channel angled at 81° to the shoreline (Amish et al. 1978). Water enters the intake over a concrete sill equipped with a 12.5 ft wide stop log section in the center of the sill. After passing over the sill, the water passes through a bar rack. The water is then diverted into two separate streams that each pass through paired traveling screens with 3/8-in. mesh (NMC 2005a). The Mississippi River is also used for service water cooling, screen wash, and fire protection (MPCA 2002). The traveling screens at Monticello are normally rotated and rinsed every 12 hours, but run continuously when the river temperature is higher than 50°F. The screen rinse sluiceway was installed in 1973 to decrease mortality of impinged fish. During periods of continuous screen washing, the sluiceway produces up to 95 percent survival of impinged fish (Amish et al. 1978).

Monticello may withdraw a maximum of 645 cfs for once-through or helper-cycle mode cooling and plant process water from the Mississippi River. Special operating conditions are required when the river flow is less than 860 cfs. For example, plant water intake may not exceed 75 percent of river flow when the river flow is less than 860 cfs but greater than 240 cfs (NMC 2005a). When river flow is less than 240 cfs, there are further restrictions, including use of a closed-cycle mode of operation (NMC 2005a). Withdrawn water is returned to the river except for that amount evaporated in the discharge canal and cooling towers. During 2002, the mean river flow was 6351 cfs, while mean intake flow was approximately 529 cfs; similar means for 2003 were 4572 cfs and 491.9 cfs, respectively (Xcel Energy 2004).

Section 316(b) of the CWA requires that the location, design, construction, and capacity of cooling water intake structures reflect the best technology available for minimizing adverse environmental impacts. Impingement of fish and shellfish on the traveling screens of the cooling water intake system is a potential adverse environmental impact that can be minimized by use of the best available technology.

On July 9, 2004, the EPA published a final rule in the *Federal Register* (EPA 2004) addressing cooling water intake structures at existing power plants such as Monticello, whose flow levels exceed a minimum threshold value of 50 million gpd. The rule is Phase II in the EPA's development of CWA 316(b) regulations that establish national requirements applicable to the location, design, construction, and capacity of cooling water intake structures at existing facilities that exceed the threshold value for water withdrawals. The national requirements, which are implemented through NPDES permits, minimize the adverse environmental impacts associated with the continued use of the intake systems. Licensees are required to demonstrate compliance with the Phase II performance standards at the time of renewal of their NPDES permit. Licensees may be required as part of the NPDES renewal to alter the intake structure, redesign the cooling system, modify station operation, or take other mitigative measures as a result of this regulation. The new performance standards are designed to significantly reduce impingement losses due to plant operation. Any site-specific mitigation would result in less impact due to continued plant operation.

Impingement studies at Monticello were conducted from 1972 to 1975, and were summarized by Amish et al. (1978):

- Between June and September 1972, an estimated 2952 fish were impinged; 65 percent were black bullheads (*Ameiurus melas*) and nearly 26 percent were black crappies. Impinged smallmouth bass, northern pike (*Esox lucius*), and common carp (*Cyprinus carpio*) were mostly young-of-the-year.

- Between July and December 1973, an estimated 18,030 fish were impinged; 75 percent were bluegills (*Lepomis macrochirus*) and 8 percent were black crappies. Young-of-the-year (including all of the bluegills) made up 94 percent of the impinged fish.

- During 1974, an estimated 16,343 fish (52 percent being young-of-the-year) were impinged. Among these, 28 percent were black crappies and 35 percent were black bullheads. Smallmouth bass and white sucker each comprised 4 percent of the impinged fish. Highest impingement occurred in late summer and fall when young-of-the-year had attained an impingeable size.

- During 1975, an estimated 34,157 fish were impinged; 73 percent were black bullheads. Common carp and black crappies together comprised 9 percent of the impinged fish. During the year-long study, only 20 percent of the impinged fish were young-of-the-year. However, Monticello was shut down in the fall of 1975 when young-of-the-year impingement primarily occurs.

Additional impingement studies were conducted at Monticello between April 16, 1976, and April 8, 1977, as part of the CWA 316(b) Demonstration (Amish et al. 1978). An estimated 39,767 fish were impinged. The predominant fish impinged were 15,295 shorthead redhorse (38.5 percent), 7385 silver redhorse (18.6 percent); 3381 logperch (8.5 percent); 2506 common carp (6.3 percent); 2254 black crappie (5.7 percent); 2121 white sucker (5.3 percent); and 1799 black bullhead (4.5 percent) (Amish et al. 1978). The maximum number of equivalent adult fish estimated to have been lost due to this impingement was 10,838, including: 1820 shorthead redhorse; 635 silver redhorse; 3381 logperch; 215 common carp; 230 black crappie; 252 white sucker; and 1799 black bullhead (Amish et al. 1978).

Based on the CWA 316(b) Demonstration (Amish et al. 1978), the Minnesota Pollution Control Agency concluded that impingement at Monticello does not pose a substantial detrimental effect on the fish population (MPCA 1979). The Mississippi River fish community has been persistent and stable since the plant became operational, and species composition has been similar between locations upstream and downstream of the Monticello site (Xcel Energy 2004). Under the current State of Minnesota NPDES permit, the location and operation of the intake will continue to have minimal environmental impact.

During the course of the SEIS preparation, the staff considered mitigation measures for the continued operation of Monticello. Based on the assessment conducted, the staff expects that the measures in place at Monticello (e.g., the intake structure located in an area where fish congregation does not occur and that is devoid of unique spawning habitat, and a screen wash system that returns impinged fish to the river) provide mitigation for impacts related to impingement. Based on the results of past impingement studies and the operating history of Monticello's intake structure, the staff concludes that the potential impacts of impingement of fish and shellfish are SMALL, and further mitigation measures would not be warranted.

4.1.4 Heat Shock

For plants with once-through cooling systems, the impacts of heat shock are listed as a Category 2 issue and require plant-specific evaluation before license renewal. The NRC made impacts on fish and shellfish resources resulting from heat shock a Category 2 issue because of continuing concerns about thermal discharge impacts and the possible need to modify thermal discharges in the future in response to changing environmental conditions (NRC 1996). Information to be considered includes (1) the type of cooling system (whether once-through or cooling pond) and (2) evidence of a CWA Section 316(a) variance or equivalent State documentation. Heat shock can be defined as thermal stress caused by exposure to a sudden elevation of water temperature that adversely affects the metabolism and behavior of fish and can lead to death. Heat shock is most likely to occur when an offline unit returns to service. To perform this evaluation, the staff reviewed the applicant's ER (NMC 2005a) and related documents (including the CWA 316(a) Demonstration [Afzal et al. 1975]); visited the Monticello site; and reviewed the applicant's State of Minnesota NPDES Permit No. 0000868, issued on August 22, 2002, and in force until July 31, 2007 (MPCA 2002).

Monticello has a once-through heat dissipation system. However, due to a potential combination of low flows and high ambient water temperatures, Monticello has two cooling towers that can be used to meet thermal discharge standards through helper cycle mode or by complete or partial recirculation of the cooling water (NMC 2005a). The Surface Water Appropriations Permit requires that the cooling towers must be operated in partial recirculation mode when the river flow is between 240 and 860 cfs, or closed-cycle mode when the river flow is less than 240 cfs, and in accordance with allowable thermal discharge limits set forth by the MPCA in the NPDES Permit. NPDES Permit stipulations specify that the maximum daily average temperature at the end of the discharge canal cannot exceed the following limiting temperatures: 95°F from April through October; 85°F in November and March; and 80°F from December through February (MPCA 2002). However, discharge temperatures in excess of these limits is allowed, on a limited basis, when the plant is required to operate in a partial recirculation or closed-cycle mode to meet the Surface Water Appropriations Permit limitation (NMC 2005a). When reduced river flows and/or elevated ambient river temperatures limit the ability for Monticello to meet thermal discharge limits, plant procedures require a reduction in power output to maintain compliance with the State of Minnesota NPDES permit (NMC 2005a).

The cooling towers are normally used when the ambient river temperature reaches 68°F or when the discharge canal temperature approaches permitted temperature limits (NMC 2005a). In partial recirculation mode, a portion of the cooled water from the cooling towers is recirculated to the intake, while the remainder is discharged to the river. When river flow is less than 860 cfs, a maximum of 75 percent of river flow at the intake may be withdrawn. Partial recirculation may used to comply with this restriction (NMC 2005a). During extreme low flow conditions, Monticello can operate as a closed system. During this operational mode, the makeup requirement is only 54 cfs (NMC 2005a). Occasionally, one cooling tower may be used during winter to provide a flow path for heated water to the intake structure when suspended ice is present in the river (NMC 2005a).

Monticello has operated in a once-through or helper mode approximately 98 percent of the time (NMC 2005). The remainder of the time Monticello has operated in a partial recirculation or closed-cycle mode.

In 2002, the mean ambient river temperature was 49.7°F while the discharge canal temperature was 77.9°F. In 2003, these temperatures were 50.9°F and 78.2°F, respectively (Xcel Energy 2004). In winter, when ambient river temperatures were near freezing (32°F), the discharge temperatures generally ranged between 70 and 75°F; whereas in summer when ambient river temperatures range from approximately 70 to 80°F, the discharge temperatures ranged from approximately 84 to 91°F (NSP 2004). The main body of the thermal plume is generally confined to the south bank of the river; and 30 to 70 percent of the river was unaffected by the thermal plume (NMC 2005a). The 9°F plume is considered the immediate discharge zone, while the 3°F plume is considered the intermediate discharge zone (Afzal et al. 1975). During approximately 70 percent of the period from June through September, the 9°F isotherm extended less than half the river width and less than 700 ft downstream of the discharge. The

intermediate discharge zone extended across the entire river at spots and extended at least 3.5 mi downstream (Afzal et al. 1975).

Afzal et al. (1975) noted that some fish remained in the discharge canal (during the early years of operation before the weir was installed) when temperatures were 91 to 95°F, but avoided the canal when temperatures reached 104°F. In 1980, an overflow weir that closely approximates the preconstruction shoreline of the Mississippi River was added to the discharge canal. Under normal conditions the weir effectively prevents movement of fish from the river into the discharge canal. Fish species that frequent the area immediately downstream of the weir included smallmouth bass, black crappie, walleye, northern pike, common carp, shorthead redhorse, silver redhorse, and white sucker. The fish population inhabiting the discharge canal in the fall and winter of 1974-1975 was estimated at 147 black bullhead, 354 rock bass (*Ambloplites rupestris*), 22 black crappie, and 216 bluegill (Afzal et al. 1975). These observations were made before the channel catfish (*Ictalurus punctatus*) first appeared in the Monticello area.

Spawning areas for shorthead redhorse, silver redhorse, white sucker, and black crappie were identified from both sides of the Mississippi River and from areas both upstream and downstream of Monticello (Afzal et al. 1975). Thus, thermal effects would not be expected to have a significant impact on local fish production. The fish community has been persistent and stable since the plant became operational, and species composition has been similar between locations upstream and downstream of the discharge (Xcel Energy 2004).

The Monticello thermal discharge to the Mississippi River does not entrap fish in an area of elevated temperatures. Thus, acute thermal impacts (e.g., death or immediate disability) are unlikely. Generally, the maximum plume temperature differential would be within the tolerance range of most warmwater species (Talmadge and Opreska 1981). Furthermore, the thermal plume in the Mississippi River encompassed by the 3°F isotherm is sufficiently large that fish would rarely be exposed to abrupt temperature differentials that would be high enough to be potentially harmful. Also, no currents or physical deterrents are present that would force fish to remain in areas of potentially harmful water temperatures.

There have been periods of non-compliance with the NPDES permit; however, there have been no indications of adverse impacts to the aquatic biota within the area of influence from the Monticello discharge (Afzal et al. 1975). Based on the results of the CWA 316(a) Demonstration, the Minnesota Pollution Control Agency concluded that the thermal discharges from Monticello do not pose a substantial detrimental effect on the fish and benthic macroinvertebrate communities (MPCA 1979).

The staff has reviewed the available information, including that provided by the applicant, the staff's site visit, the NPDES permit, the CWA 316(a) demonstration, and other public sources. During the course of this SEIS preparation, the staff considered mitigation measures for the continued operation of Monticello during the license renewal period. Based on the staff's assessment of measures in place at Monticello (e.g., the discharge is located in an area where

fish congregation does not occur and that is devoid of unique spawning habitat, the installation of the discharge canal fish weir that limits fish movement into the discharge canal, and the capability of the plant to operate in a partial recirculation or closed-cycle mode) further mitigation measures are not warranted. It is the staff's conclusion that potential impacts to fish and shellfish due to heat shock during the renewal term are SMALL, and further mitigation measures would not be warranted.

4.1.5 Microbiological Organisms (Public Health)

The effects of microbiological organisms on human health are listed as a Category 2 issue and require plant-specific evaluation before license renewal for those plants with closed-cycle cooling on a small river. The average annual flow of Mississippi River discharge in the vicinity of the Monticello site is approximately 2.3×10^{11} cubic ft per year (NMC 2005a), which is less than the 3.15×10^{12} cubic ft per year threshold value in 10 CFR 51.53(c)(3)(ii)(G) for thermal discharge to a small river. Hence, the staff considers this a small river and the effects of its discharge on microbiological organisms must be addressed for Monticello.

Thermophilic bacteria generally occur at temperatures of 77 to 176°F, with maximum growth occurring between 122 and 140°F. Bacteria pathogenic to humans typically have optimum temperatures of approximately 99ºF (Joklik and Willett 1976). Populations of the pathogenic amoeba *Naegleria fowleri* can be enhanced in thermally altered water bodies at temperatures ranging from 95 to 106°F or higher, but this organism is rarely found in water cooler than 95°F based on studies reviewed and coordinated by Tyndall et al. (1989).

The Mississippi River in the vicinity of the plant is a broad turbulent stream with a boulder substrate. Recreational uses including boating, fishing, and canoeing are frequent in the vicinity of the plant. NMC employees also perform sampling in the river. All of these activities create the potential for human exposure. The ambient temperatures of the Mississippi River near the Monticello site vary from freezing (approximately 32°F) in the winter to 83°F in the summer (AEC 1972). Therefore, ambient river conditions are not likely to support the proliferation of pathogenic organisms of concern.

The Monticello site discharge monitoring data collected from 1999 through 2001 for the months of June through September were reviewed. During those months the monthly average water temperature within the discharge canal ranged from 86 to 91°F. Additionally, the plant's NPDES permit limits the maximum daily average temperature at the end of the discharge canal to 95°F, the temperature specified for the warmer months of the year (April through October). Based on monthly average water temperatures within the discharge canal and maximum discharge temperatures at the end of the discharge canal, coupled with the dilution provided by the Mississippi River, thermophilic microorganisms are not expected to cause any appreciable public health risk (NMC 2005a).

The staff independently reviewed the NMC ER, visited the Monticello site, and reviewed the applicant's State of Minnesota NPDES permit. Based on the evaluation presented above, thermophilic microbiological organisms are not likely to occur as a result from Monticello discharges to the Mississippi River. The staff concludes that impacts on public health from thermophilic microbiological organisms from continued operation of Monticello in the license renewal period are SMALL, and further mitigation would not be warranted.

4.2 Transmission Lines

The Final Environmental Statement (FES) for the Monticello site (AEC 1972) describes two transmission lines that connect Monticello substation with the transmission system. These transmission corridors cover approximately 1441 ac over a total corridor length of approximately 80 mi. There are five additional transmission lines emanating from the Monticello substation; however, they are not part of this review. The Xcel Energy program for conductor and tower maintenance includes monthly fixed-wing aerial patrols for the 345-kV lines and annual helicopter patrols on all lines in the system. These patrols include surveillance for system anomalies and land use changes that could impact design assumptions. The objective of Xcel Energy's transmission line vegetation management program is to keep the corridors clear of trees, bushes, and other tall-growing vegetation that could come into close proximity with the conductors and cause line outages. They achieve this objective by selectively removing tall-growing trees and brush from the transmission corridors while encouraging the growth of lower-growing trees, shrubs, and grasses. Herbicides are used occasionally, primarily applied to individual trees or shrubs to prevent re-sprouting (Xcel Energy 2005).

Category 1 issues in 10 CFR Part 51, Subpart A, Appendix B, Table B-1 that are applicable to transmission lines from the Monticello Site are listed in Table 4-3. NMC stated in its ER that it is not aware of any new and significant information associated with the renewal of the Monticello site. The staff has not identified any new and significant information during its independent review of the NMC ER, the staff's site visit, the scoping process, its evaluation of other available information, or public comments on the draft SEIS. Therefore, the staff concludes that there are no impacts related to these issues beyond those discussed in the GEIS. For all of those issues, the staff concluded in the GEIS that the impacts are SMALL, and additional plant-specific mitigation measures are not likely to be sufficiently beneficial to be warranted.

A brief description of the staff's review and the GEIS conclusions, as codified in Table B-1, for each of these issues follows:

- Power line right-of-way management (cutting and herbicide application). Based on information in the GEIS, the Commission found that

  > The impacts of right-of-way maintenance on wildlife are expected to be of small significance at all sites.

Table 4-3. Category 1 Issues Applicable to the Monticello Transmission Lines During the Renewal Term

ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1	GEIS Sections
TERRESTRIAL RESOURCES	
Power line right-of-way management (cutting and herbicide application)	4.5.6.1
Bird collisions with power lines	4.5.6.2
Impacts of electromagnetic fields on flora and fauna (plants, agricultural crops, honeybees, wildlife, livestock)	4.5.6.3
Flood plains and wetlands on power line right-of-way	4.5.7
AIR QUALITY	
Air quality effects of transmission lines	4.5.2
LAND USE	
Onsite land use	4.5.3
Power line right-of-way	4.5.3

The staff has not identified any new and significant information during its independent review of the NMC ER, the staff's site visit, the scoping process, consultation with the U.S. Fish and Wildlife Service (FWS), its evaluation of other information, or public comments on the draft SEIS. Therefore, the staff concludes that there are no impacts of power line right-of-way maintenance during the renewal term beyond those discussed in the GEIS.

- Bird collisions with power lines. Based on information in the GEIS, the Commission found that

  > Impacts are expected to be of small significance at all sites.

The staff has not identified any new and significant information during its independent review of the NMC ER, the staff's site visit, the scoping process, consultation with the FWS, its evaluation of other information, or public comments on the draft SEIS. Therefore, the staff concludes that there are no impacts of bird collisions with power lines during the renewal term beyond those discussed in the GEIS.

- Impacts of electromagnetic fields on flora and fauna (plants, agricultural crops, honeybees, wildlife, livestock). Based on information in the GEIS, the Commission found that

  > No significant impacts of electromagnetic fields on terrestrial flora and fauna have been identified. Such effects are not expected to be a problem during the license renewal term.

The staff has not identified any new and significant information during its independent review of the NMC ER, the staff's site visit, the scoping process, consultation with the FWS, its evaluation

of other information, or public comments on the draft SEIS. Therefore, the staff concludes that there are no impacts of electromagnetic fields on flora and fauna during the renewal term beyond those discussed in the GEIS.

- Flood plains and wetlands on power line right-of-way. Based on information in the GEIS, the Commission found that

> Periodic vegetation control is necessary in forested wetlands underneath power lines and can be achieved with minimal damage to the wetland. No significant impact is expected at any nuclear power plant during the license renewal term.

The staff has not identified any new and significant information during its independent review of the NMC ER, the staff's site visit, the scoping process, consultation with the FWS, its evaluation of other information, or public comments on the draft SEIS. Therefore, the staff concludes that there are no impacts of power line rights-of-way on flood plains and wetlands during the renewal term beyond those discussed in the GEIS.

Air quality effects of transmission lines. Based on information in the GEIS, the Commission found that

> Production of ozone and oxides of nitrogen is insignificant and does not contribute measurably to ambient levels of these gases.

The staff has not identified any new and significant information during its independent review of the NMC ER, the staff's site visit, the scoping process, public comments, its evaluation of other information, or public comments on the draft SEIS. Therefore, the staff concludes that there are no air quality impacts of transmission lines during the renewal term beyond those discussed in the GEIS.

- Onsite land use. Based on the information in the GEIS, the Commission found that

> Projected onsite land use changes required during ... the renewal period would be a small fraction of any nuclear power plant site and would involve land that is controlled by the applicant.

The staff has not identified any new and significant information during its independent review of the NMC ER, the staff's site visit, the scoping process, consultation with the FWS, its evaluation of other information, or public comments on the draft SEIS. Therefore, the staff concludes that there are no onsite land use impacts during the renewal term beyond those discussed in the GEIS.

- Power line right-of-way. Based on information in the GEIS, the Commission found that

> Ongoing use of power line rights of ways would continue with no change in restrictions. The effects of these restrictions are of small significance.

The staff has not identified any new and significant information during its independent review of the NMC ER, the staff's site visit, the scoping process, consultation with the FWS, its evaluation of other information, or public comments on the draft SEIS. Therefore, the staff concludes that there are no impacts of power lines on land use during the renewal term beyond those discussed in the GEIS.

There is one Category 2 issue related to transmission lines, and another issue related to transmission lines is also evaluated. These issues are listed in Table 4-4 and are discussed in Sections 4.2.1 and 4.2.2.

Table 4-4. Category 2 and Uncategorized Issues Applicable to the Monticello Transmission Lines During the Renewal Term

ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1	GEIS Section	10 CFR 51.53(c)(3)(ii) Subparagraph	SEIS Section
HUMAN HEALTH			
Electromagnetic fields, acute effects (electric shock)	4.5.4.1	H	4.2.1
Electromagnetic fields, chronic effects	4.5.4.2	N/A	4.2.2

4.2.1 Electromagnetic Fields—Acute Effects

Based on the GEIS, the Commission found that electric shock resulting from direct access to energized conductors or from induced charges in metallic structures has not been found to be a problem at most operating plants and generally is not expected to be a problem during the license renewal term. However, site-specific review is required to determine the significance of the electric shock potential along the portions of the transmission lines that are within the scope of this SEIS.

In the GEIS (NRC 1996), the staff found that without a review of the conformance of each nuclear plant transmission line with National Electrical Safety Code (NESC) criteria (NESC 2001), it was not possible to determine the significance of the electric shock potential. Evaluation of individual plant transmission lines is necessary because the issue of electric shock safety was not addressed in the licensing process for some nuclear power plants. For other nuclear power plants, land use in the vicinity of transmission lines may have changed, or power distribution companies may have chosen to upgrade line voltage. To comply with 10 CFR 51.53(c)(3)(ii)(H), the applicant must provide an assessment of the potential shock

hazard if the transmission lines that were constructed for the specific purpose of connecting the plant to the transmission system do not meet the recommendations of the NESC for preventing electric shock from induced currents.

Two 345-kV transmission lines (Monticello to Coon Creek and Monticello to Parkers Lake circuits) were originally constructed to connect Monticello to the transmission system. However, changes to the 345-kV transmission system and to these lines have fully integrated Monticello Substation into the 345-kV transmission system. Based on these considerations, Monticello Substation now constitutes the transmission interconnection for Monticello.

All lines emanating from Monticello Substation were designed, constructed, and are operated in compliance with the applicable sections of the NESC, including the most recent edition. These lines meet the requirements in effect since the 1990 edition of the Code for lines exceeding 98 kV alternating current to ground, which limits "the steady state current due to electrostatic effects to 5 mA if the largest anticipated truck, vehicle or equipment under the line were short-circuited to ground." This current is induced in vehicles by the transmission line electric field and is proportional to the voltage of the line and inversely proportional to the distance from the line. The Electric Power Research Institute (EPRI) has performed measurements on objects beneath lines to determine the level of electric field that will induce current in various objects. Results indicate that an electric field of 7.8 kV per meter at 1 meter above ground is required to induce a 5 mA current through a large tractor-trailer (EPRI 1987).

The 345-kV lines associated with Monticello Substation produce a maximum electric field at 1 meter above ground of 6.0 kV per meter. The unloaded sag at 120°F is limited by the NESC to a minimum distance to ground of 30 ft in order to meet the minimum clearance required for operation at 212°F, the highest operating temperature. For a large vehicle, the electric field values indicated above could potentially generate an induced current of 3.84 mA, which is below the NESC code criteria of 5 mA (NMC 2005a).

Transmission line compliance with the provisions of the NESC code discussed above is verified by periodic air patrols (monthly), which monitor construction activities beneath and near the lines that could alter corridor terrain and clearances. Based on these considerations, NMC concluded that the Monticello 345-kV transmission lines meet the NESC recommendations for preventing shock from induced currents and further assessment of the impact of the proposed action on the potential shock hazard is not required (NMC 2005a). NMC's assessment under 10 CFR Part 51 concludes that electric shock is of small significance for Monticello transmission lines. Due to the small significance of the issue, mitigation measures, such as the installation of warning signs at roadway crossings or increasing wire clearance, are not warranted.

The staff has reviewed the available information, including that provided by the applicant, the staff's site visit, the scoping process, and other public sources. Using this information, the staff evaluated the potential impacts for electric shock resulting from operation of Monticello and associated transmission lines. It is the staff's conclusion that the potential impacts for electric shock during the renewal term are SMALL.

4.2.2 Electromagnetic Fields—Chronic Effects

In the GEIS, the chronic effects of 60-Hz electromagnetic fields from power lines were not designated as either Category 1 or Category 2, and will not be until a scientific consensus is reached on the health implications of these fields.

The potential for chronic effects from these fields continues to be studied and is not known at this time. The National Institute of Environmental Health Sciences (NIEHS) directs related research through the U.S. Department of Energy. A recent report (NIEHS 1999) contains the following conclusion:

> The NIEHS concludes that ELF-EMF (extremely low frequency-electromagnetic field) exposure cannot be recognized as entirely safe because of weak scientific evidence that exposure may pose a leukemia hazard. In our opinion, this finding is insufficient to warrant aggressive regulatory concern. However, because virtually everyone in the United States uses electricity and therefore is routinely exposed to ELF-EMF, passive regulatory action is warranted such as a continued emphasis on educating both the public and the regulated community on means aimed at reducing exposures. The NIEHS does not believe that other cancers or non-cancer health outcomes provide sufficient evidence of a risk to currently warrant concern.

This statement is not sufficient to cause the staff to change its position with respect to the chronic effects of electromagnetic fields. Footnote 5 to Table B-1 states: "If, in the future, the Commission finds that, contrary to current indications, a consensus has been reached by appropriate Federal health agencies that there are adverse health effects from electromagnetic fields, the Commission will require applicants to submit plant-specific reviews of these health effects as part of their license renewal applications. Until such time, applicants for license renewal are not required to submit information on this issue." The staff considers the GEIS finding of "uncertain" still appropriate and will continue to follow developments on this issue.

4.3 Radiological Impacts of Normal Operations

Category 1 issues in 10 CFR Part 51, Subpart A, Appendix B, Table B-1 that are applicable to Monticello in regard to radiological impacts are listed in Table 4-5. NMC stated in its ER (NMC 2005a) that it is not aware of any new and significant information associated with the renewal of the Monticello OL. The staff has not identified any new and significant information during its independent review of the NMC ER, the staff's site visit, the scoping process, its evaluation of other available information, or public comments on the draft SEIS. Therefore, the staff concludes that there are no impacts related to these issues beyond those discussed in the GEIS. For these issues, the staff concluded in the GEIS that the impacts are SMALL, and additional plant-specific mitigation measures are not likely to be sufficiently beneficial to be warranted.

Table 4-5. Category 1 Issues Applicable to Radiological Impacts of Normal Operations During the Renewal Term

ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1	GEIS Sections
HUMAN HEALTH	
Radiation exposures to public (license renewal term)	4.6.2
Occupational radiation exposures (license renewal term)	4.6.3

A brief description of the staff's review and the GEIS conclusions, as codified in Table B-1, for each of these issues follows:

- Radiation exposures to public (license renewal term). Based on information in the GEIS, the Commission found that

  Radiation doses to the public will continue at current levels associated with normal operations.

The staff has not identified any new and significant information during its independent review of the NMC ER, the staff's site visit, the scoping process, its evaluation of other available information, or public comments on the draft SEIS. Therefore, the staff concludes that there are no impacts of radiation exposures to the public during the renewal term beyond those discussed in the GEIS.

- Occupational radiation exposures (license renewal term). Based on information in the GEIS, the Commission found that

  Projected maximum occupational doses during the license renewal term are within the range of doses experienced during normal operations and normal maintenance outages, and would be well below regulatory limits.

The staff has not identified any new and significant information during its independent review of the NMC ER, the staff's site visit, the scoping process, its evaluation of other available information, or public comments on the draft SEIS. Therefore, the staff concludes that there are no impacts of occupational radiation exposures during the renewal term beyond those discussed in the GEIS.

There are no Category 2 issues related to radiological impacts of routine operations.

4.4 Socioeconomic Impacts of Plant Operations During the License Renewal Term

Category 1 issues in 10 CFR Part 51, Subpart A, Appendix B, Table B-1 that are applicable to socioeconomic impacts during the renewal term are listed in Table 4-6. NMC stated in its ER (NMC 2005a) that it is not aware of any new and significant information associated with the renewal of Monticello. The staff has not identified any new and significant information during its independent review of the NMC ER, the staff's site visit, the scoping process, its evaluation of other available information, or public comments on the draft SEIS. Therefore, the staff concludes that there are no impacts related to these issues beyond those discussed in the GEIS (NRC 1996). For all of those issues, the GEIS concluded that the impacts are SMALL, and plant-specific mitigation measures are not likely to be sufficiently beneficial to be warranted.

Table 4-6. Category 1 Issues Applicable to Socioeconomics During the Renewal Term

ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1	GEIS Sections
SOCIOECONOMICS	
Public services: public safety, social services, and tourism and recreation	4.73; 4.7.3.3 4.7.3.4; 4.7.3.6
Public services: education (license renewal term)	4.7.3.1
Aesthetic impacts (license renewal term)	4.7.6
Aesthetic impacts of transmission lines (license renewal term)	4.5.8

A brief description of the staff's review and the GEIS conclusions, as codified in Table B-1, for each of these issues follows:

- Public services: public safety, social services, and tourism and recreation. Based on information in the GEIS, the Commission found that

  > Impacts to public safety, social services, and tourism and recreation are expected to be of small significance at all sites.

The staff has not identified any new and significant information during its independent review of the NMC ER, the staff's site visit, the scoping process, its evaluation of other available information, or public comments on the draft SEIS. Therefore, the staff concludes that there are no impacts on public safety, social services, and tourism and recreation during the renewal term beyond those discussed in the GEIS.

- Public services: education (license renewal term). Based on information in the GEIS, the Commission found that

  Only impacts of small significance are expected.

The staff has not identified any new and significant information during its independent review of the NMC ER, the staff's site visit, the scoping process, its evaluation of other available information, or public comments on the draft SEIS. Therefore, the staff concludes that there are no impacts on education during the renewal term beyond those discussed in the GEIS.

- Aesthetic impacts (license renewal term). Based on information in the GEIS, the Commission found that

  No significant impacts are expected during the license renewal term.

The staff has not identified any new and significant information during its independent review of the NMC ER, the staff's site visit, the scoping process, its evaluation of other available information, or public comments on the draft SEIS. Therefore, the staff concludes that there are no aesthetic impacts during the renewal term beyond those discussed in the GEIS.

- Aesthetic impacts of transmission lines (license renewal term). Based on information in the GEIS, the Commission found that

  No significant impacts are expected during the license renewal term.

The staff has not identified any new and significant information during its independent review of the NMC ER, the staff's site visit, the scoping process, its evaluation of other available information, or public comments on the draft SEIS. Therefore, the staff concludes that there are no aesthetic impacts during the renewal term beyond those discussed in the GEIS.

Table 4-7 lists the Category 2 socioeconomic issues, which require plant-specific analysis, and environmental justice, which was not addressed in the GEIS.

4.4.1 Housing Impacts During Operations

In determining housing impacts, the applicant chose to follow Appendix C of the GEIS (NRC 1996), which presents a population characterization method that is based on two factors, "sparseness" and "proximity" (GEIS Section C.1.4 [NRC 1996]). Sparseness measures population density within 20 mi of the site, and proximity measures population density and city size within 50 mi. Each factor has categories of density and size (GEIS Table C.1 [NRC 1996]), and a matrix is used to rank the population category as low, medium, or high (GEIS Figure C.1 [NRC 1996]).

According to the U.S. Census Bureau (USCB) 2000 information, the population living within 20 mi of the Monticello site was estimated to be approximately 166,860. This translates to

approximately 133 persons/mi^2 living on the land area present within a 20-mi radius of Monticello.

Table 4-7. Environmental Justice and GEIS Category 2 Issues Applicable to Socioeconomics During the Renewal Term

ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1	GEIS Section	10 CFR 51.53(c)(3)(ii) Subparagraph	SEIS Section
	SOCIOECONOMICS		
Housing impacts	4.7.1	I	4.4.1
Public services: public utilities	4.7.3.5	I	4.4.2
Offsite land use (license renewal term)	4.7.4	I	4.4.3
Public services: public transportation	4.7.3.2	J	4.4.4
Historic and archeological resources	4.7.7	K	4.4.5
Environmental justice	Not addressed[a]	Not addressed[a]	4.4.6

[a] Guidance related to environmental justice was not in place at the time the GEIS and the associated revision to 10 CFR Part 51 were prepared. Therefore, environmental justice must be addressed in the staff's environmental impact statement.

This concentration falls into GEIS sparseness Category 4. As estimated from 2000 USCB information, approximately 2,740,995 people live within 50 mi of Monticello. This equates to a population density of 349 persons/mi^2 within 50 mi. According to the GEIS proximity measures (NRC 1996), Monticello is therefore classified as Category 4. Applying the GEIS sparseness and proximity matrix (sparseness Category 4 and proximity Category 4) results in the conclusion that Monticello is located in a high-population area.

SMALL impacts result when no discernible change in housing occurs, changes in rental rates and housing values are similar to those occurring statewide, and no housing construction or conversion is required to meet new demand (NRC 1996). The GEIS assumes that no more than a total additional staff of 60 permanent workers might be needed during the license renewal period to perform routine maintenance and other activities. The number of vacant housing units in Wright County and Sherburne County are 8.4 percent or 2890 housing units and 5.5 percent or 1246 housing units, respectively (USCB 2000). Therefore, the addition of 60 workers and 74 indirect jobs generated by those additional employees (NMC 2005a) could be comfortably absorbed without significant impact to the housing market during the license renewal period.

Monticello is not projecting new employment due to license renewal activities. As a result, NMC indicated that the impacts would be SMALL and mitigation measures would not be necessary (NMC 2005a). The staff reviewed the available information relative to housing impacts and NMC conclusions. Based on this review, the staff concludes that the impact on housing during

the license renewal period would be SMALL, and additional mitigation measures are not warranted.

4.4.2 Public Services: Public Utility Impacts During Operations

Impacts on public utility services are considered SMALL if there is little or no change in the ability of the system to respond to the level of demand, and thus there is no need to add capital facilities. Impacts are considered MODERATE if overtaxing of service capabilities occurs during periods of peak demand. Impacts are considered LARGE if existing levels of service (e.g., water or sewer services) are substantially degraded and additional capacity is needed to meet ongoing demands for services. The GEIS indicates that, in the absence of new and significant information to the contrary, the only impacts on public utilities that could be significant are impacts on public water supplies (NRC 1996).

Analysis of impacts on the public water supply system considered plant demand and plant-related population growth. Section 2.2.2 describes the Monticello permitted withdraw rate and actual use of water. There are no plans for refurbishment at Monticello, so plant demand would not change (NMC 2005a).

In the bounding analysis, Monticello assumed 60 new employees and 74 indirect jobs created by the new employees due to license renewal activity. Most area water capacities are below maximum withdraw capacities (see Table 2-7). The additional direct and indirect employees would use less than 1 percent of the current usage from these facilities. The staff finds that the impact of increased water use on area water systems is SMALL, and that no further mitigation measures are warranted.

4.4.3 Offsite Land Use During Operations

Offsite land use during the license renewal term is a Category 2 issue (10 CFR Part 51, Subpart A, Appendix B, Table B-1). Table B-1 of 10 CFR Part 51 Subpart A, Appendix B notes that "significant changes in land use may be associated with population and tax revenue changes resulting from license renewal."

Section 4.7.4 of the GEIS defines the magnitude of land use changes as a result of plant operation during the license renewal term as follows:

SMALL—Little new development and minimal changes to an area's land use pattern.

MODERATE—Considerable new development and some changes to the land use pattern.

LARGE—Large-scale new development and major changes in the land use pattern.

Tax revenue can affect land use because it enables local jurisdictions to be able to provide the public services (e.g., transportation and utilities) necessary to support development. Section 4.7.4.1 of the GEIS states that the assessment of tax-driven land use impacts during the license renewal term should consider (1) the size of the plant's payments relative to the community's total revenues, (2) the nature of the community's existing land use pattern, and (3) the extent to which the community already has public services in place to support and guide development. If the plant's tax payments are projected to be small relative to the community's total revenue, tax-driven land use changes during the plant's license renewal term would be SMALL, especially where the community has pre-established patterns of development and has provided adequate public services to support and guide development. Section 4.7.2.1 of the GEIS states that if tax payments by the plant owner are less than 10 percent of the taxing jurisdictions revenue, the significance level would be SMALL. If the plant's tax payments are projected to be medium to large relative to the community's total revenue, new tax-driven land use changes would be MODERATE. If the plant's tax payments are projected to be a dominant source of the community's total revenue, new tax-driven land use changes would be LARGE. This would be especially true where the community has no pre-established pattern of development or has not provided adequate public services to support and guide development.

Northern States Power Company (NSP) is assessed annual property taxes for the Monticello site by Wright County, the City of Monticello, School District 882, and the Monticello-Big Lake Hospital District. NSP is also assessed the State General Tax. Property taxes are paid directly to Wright County, which in turn distributes the money to the aforementioned taxing jurisdictions. Property taxes fund local government services such as highway maintenance, education, public health, public safety, public libraries, and various other social services (NMC 2005a).

From 1994 to 2001, NSP's largest annual property tax contributions for Monticello went to School District 882. Payments during the period from 1998 to 2002 decreased by 70.2 percent as a result of the passage of a tax bill by the State in 2001 which replaced the State Assessed School Levy with the State General Tax. Assessments under the State General Tax are paid into the State General Fund and redistributed by a State-determined formula to school districts statewide in part based on student numbers. The State Assessed School Levy had been included in School District 882 payments prior to year 2002. Contributions to School District 882 accounted for 20.4 percent of the school district's total revenues and 18.5 percent of the total operating budget in 1999. By 2002, payments for Monticello represented a much smaller percentage of both the school district's total revenues and total operating budget, 5.2 percent and 5.5 percent, respectively (NMC 2005a).

Annual property tax payments to Wright County decreased from approximately 3.2 to 2.0 million dollars from 1998 to 2002, a 36.9 percent decrease. These contributions represented 6.9 to 3.4 percent of the county's total annual revenues during the period.

Annual payments to the hospital district decreased 30 percent during the period from 1998 to 2003. These payments represented an increasingly smaller percentage of total revenues from 1998 to 2002, 1.4 to 0.5 percent. When viewed in relation to total Wright County property tax

dollars received by the hospital district, NSP's tax payment for Monticello represented between 27.9 percent and 21.3 percent of the total tax levy during the period.

Annual NSP payments to the City of Monticello increased from approximately 2.8 to 3.4 million dollars from 1998 to 2002, a 20.9 percent increase, but represented a smaller percentage of the city's total revenues than in previous years, decreasing from 29.8 to 24.6 percent between 1998 to 2002. In addition, these annual payments represented a slightly increasing percentage (11.7 to 12.8) of the total operating budget for the City of Monticello during the same period (NMC 2005a).

NSP projects that future tax payments will gradually increase due to increased levies by the aforementioned taxing jurisdictions. NSP's tax liability for Monticello could also be influenced by changes at higher levels of government. The Minnesota Department of Revenue is currently reviewing the rules determining the way electric utilities are valued. These reviews may result in a reduction of NSP's apportionable value regarding its Monticello property, thereby potentially lowering future tax payments for NSP. However, state lawmakers have discussed reducing some of the exemptions currently available to NSP, resulting in potentially higher future tax liabilities for Monticello (NMC 2005a).

Because (1) Monticello does not propose to employ additional personnel during the license renewal period, and (2) Monticello does not anticipate major refurbishment or construction during this period, and therefore, does not anticipate any increase in the assessed value of Monticello during the license renewal period, the staff concludes that the net impact of plant-related population changes is likely to be SMALL. However, if the operating license for Monticello was not renewed and the plant was decommissioned, the impacts to the tax base for Wright County, the City of Monticello, School District 882, and the Monticello-Big Lake Hospital District could be significant. Therefore, the staff concludes that the net impact of tax-related land use impacts of not renewing the operating license for Monticello are MODERATE.

4.4.4 Public Services: Transportation Impacts During Operations

Table B-1, 10 CFR Part 51 states: "Transportation impacts (level of service) of highway traffic generated during the term of the renewed license are generally expected to be of small significance. However, the increase in traffic associated with additional workers and the local road and traffic control conditions may lead to impacts of moderate or large significance at some sites." All applicants are required by 10 CFR 51.53(c)(3)(ii)(J) to assess the impacts of highway traffic generated by the proposed project on the level of service of local highways during the term of the renewed license.

Expected population growth in the area around Monticello is not due to changes in employment at Monticello, but due to the migration away from the Minneapolis/St. Paul area and the successful recruitment of outlet malls and retail. Current employment associated with Monticello is approximately 414 permanent employees and 105 contract and matrixed employees (NMC 2005a). Monticello refuels on a nominal 22- to 24-month cycle. During

refueling outages, site employment increases by as many as 600 temporary workers for 30 to 40 days. During surveillance, monitoring, inspections, testing, trending, and recordkeeping (SMITTR), Monticello believes that these tasks can be performed within this schedule and employment level. NRC uses 60 workers as a conservative estimate of additional permanent workers needed per unit for license renewal SMITTR activities. GEIS Section C.3.1.2 was written using this approach in order to "...provide a realistic upper bound to potential population-driven impacts...." (NRC 1996). NMC submitted its opinion on the effects of an additional 60 workers and concluded that there would be no significant transportation impacts during operations.

This additional analysis did not change the staff's conclusions related to impacts on transportation service.

The staff reviewed Monticello's assumptions and resulting conclusions. Based on its independent review, the staff concludes that any impact of Monticello employees on transportation service degradation is SMALL and no further mitigation measures are warranted.

4.4.5 Historic and Archaeological Resources

The National Historic Preservation Act (NHPA) requires that Federal agencies take into account the impacts of their undertakings on historic properties. The historic preservation review process mandated by Section 106 of the NHPA is outlined in regulations issued by the Advisory Council on Historic Preservation at 36 CFR Part 800. Renewal of an OL is an undertaking that could potentially affect historic properties. Therefore, according to the NHPA, the NRC is to make a reasonable effort to identify historic properties in the areas of potential effect. If no historic properties are present or affected, the NRC is required to notify the State Historic Preservation Officer (SHPO) before proceeding. If it is determined that historic properties are present, the NRC is required to assess and resolve possible adverse effects of the undertaking.

In accordance with 36 CFR Part 800.8(c), the NRC informed the Advisory Council on Historic Preservation, the Minnesota State Historic Preservation Office (MNSHPO), and tribes with current and historical ties to the region that the Section 106 process is being integrated with the NEPA process and "the SEIS will include analyses of potential impacts to historic and cultural resources" (NRC 2005b,c). The NRC then conducted an archaeological records and literature search at the MNSHPO in June 2005 to identify important resources that may be located in the area of potential effect.

Based on the site records search, the input from MNSHPO (Bloomberg 2005), and absence of input from tribes concerning traditional properties in the vicinity, the NRC has determined that no historic properties will be affected by this undertaking. Further, due to the extensive disturbance resulting from the original plant construction, no impacts to historic properties are anticipated during operation. According to plant procedures that are in place, ground-disturbing activities will be reviewed by the Environmental Coordinator, and, in the unlikely event that resources are discovered within the area of potential effect during the course of operations, the

MNSHPO will be notified and consulted in developing any response needed to address the discovery. In April 2006, MN SHPO concurred with these findings following a review of the draft SEIS (Bloomberg 2006).

Due to the extensive disturbance present in the area of potential effect, and the lack of substantial land-altering aspects of this license renewal, it is the staff's conclusion that the potential impacts to historic and archaeological resources are expected to be SMALL and mitigation is not warranted.

4.4.6 Environmental Justice

Environmental justice refers to a Federal policy that Federal agencies identify and address, as appropriate, disproportionately high and adverse human health or environmental effects of its action on minority[a] or low-income populations. The memorandum accompanying Executive Order 12898 directs Federal executive agencies to consider environmental justice under the National Environmental Policy Act of 1969 (NEPA). The Council on Environmental Quality (CEQ) has provided guidance for addressing environmental justice. Although the Executive Order is not mandatory for independent agencies, the NRC has voluntarily committed to undertake environmental justice reviews. Specific guidance is provided in NRC Office of Nuclear Reactor Regulation Office Instruction LIC-203, *Procedural Guidance for Preparing Environmental Assessments and Considering Environmental Issues Rev. 1* (NRC 2004a). In 2004, the Commission issued a Final Policy Statement on the *Treatment of Environmental Justice Matters in NRC Regulatory and Licensing Actions* (NRC 2004b).

The scope of the review as defined in NRC guidance (NRC 2004a) includes identification of impacts on minority and low-income populations, the location and significance of any environmental impacts during operations on populations that are particularly sensitive, and information pertaining to mitigation. It also includes evaluation of whether these impacts are likely to be disproportionately high and adverse.

The staff looks for minority and low-income populations within the 50-mi radius of the site. For the staff's review, a minority population exists in a census block group[b] if the percentage of each minority and aggregated minority category within the census block group exceeds the

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[a] The NRC guidance for performing environmental justice reviews defines "minority" as American Indian or Alaskan Native; Asian, Native Hawaiian, or other Pacific Islander; or Black races; or Hispanic ethnicity. "Other" races and multiracial individuals may be considered a separate minority category (NRC 2004a).

[b] A census block group is a combination of census blocks, which are statistical subdivisions of a census tract. A census block is the smallest geographical entity for which the USCB collects and tabulates decennial census information. A census tract is a small, relatively permanent statistical subdivision of counties delineated by local committees of census data users in accordance with USCB guidelines for the purpose of collecting and presenting decennial census data. Census block groups are subsets of census tracts.

corresponding percentage of minorities in the state of which it is a part by 20 percentage points, or the corresponding percentage of minorities within the census block group is at least 50 percent. A low-income population exists if the percentage of low-income population within a census block group exceeds the corresponding percentage of low-income population in the state of which it is a part by 20 percent, or if the corresponding percentage of low-income population within a census block group is at least 50 percent.

For the NMC review, the staff examined the geographical distribution of minority and low-income populations within 50 mi of the site, employing the 2000 census for low-income and minority populations. NMC conducted its analysis for minority and low-income populations using the convention of including a census tract or block group if any part of its area lay within 50 mi of Monticello. The 50-mi radius includes 2166 census block groups. NMC used USCB 2000 census data to determine the minority and low-income characteristics on a block-group level. NMC included in its analysis census block groups that were 50 percent or more within the 50-mi radius of Monticello. The criterion of more than 20 percentage points was used to determine whether a census tract or block group should be counted as containing a minority or low-income population. Figures 4-1 and 4-2 show the distribution of census blocks for the minority and low-income populations, respectively.

Based on the NRC criterion, the staff determined that Black minority populations exist in 149 block groups. American Indian or Native American minority populations exist in 3 census block groups. Asian minority populations exist in 46 census block groups. Hispanic or Latino minority populations exist in 52 census block groups. "Other" minority populations exist in 11 census block groups. Figure 4-1 shows the location of census block groups with minority populations. By the NRC criteria, 91 census blocks contained areas of low-income populations, as shown in Figure 4-2.

With the locations of minority and low-income populations identified, the staff evaluated whether any of the environmental impacts of the proposed action could affect these populations in a disproportionately high or adverse manner. Based on staff guidance (NRC 2004a), air, land and water resources within 50 mi of the Monticello site were examined. Within that area, a few potential environmental impacts could affect human populations; all of these were considered SMALL for the general population.

The pathways through which the environmental impacts associated with Monticello license renewal can affect human populations are discussed in each associated section. The staff evaluated whether minority or low-income populations could be disproportionately affected by these impacts. The staff found that a specific ethnic group, the Hmong, identified within the Asian minority population, depends on fishing and consuming fish from local rivers at a disproportionately higher level than other populations. However, the staff did not identify any significant effects from the plant on local fish. In addition, the staff did not identify any location-dependent disproportionate impacts affecting these minority and low-income populations. The staff concludes that offsite impacts from Monticello to minority and low-income populations are SMALL, and no mitigation actions are warranted.

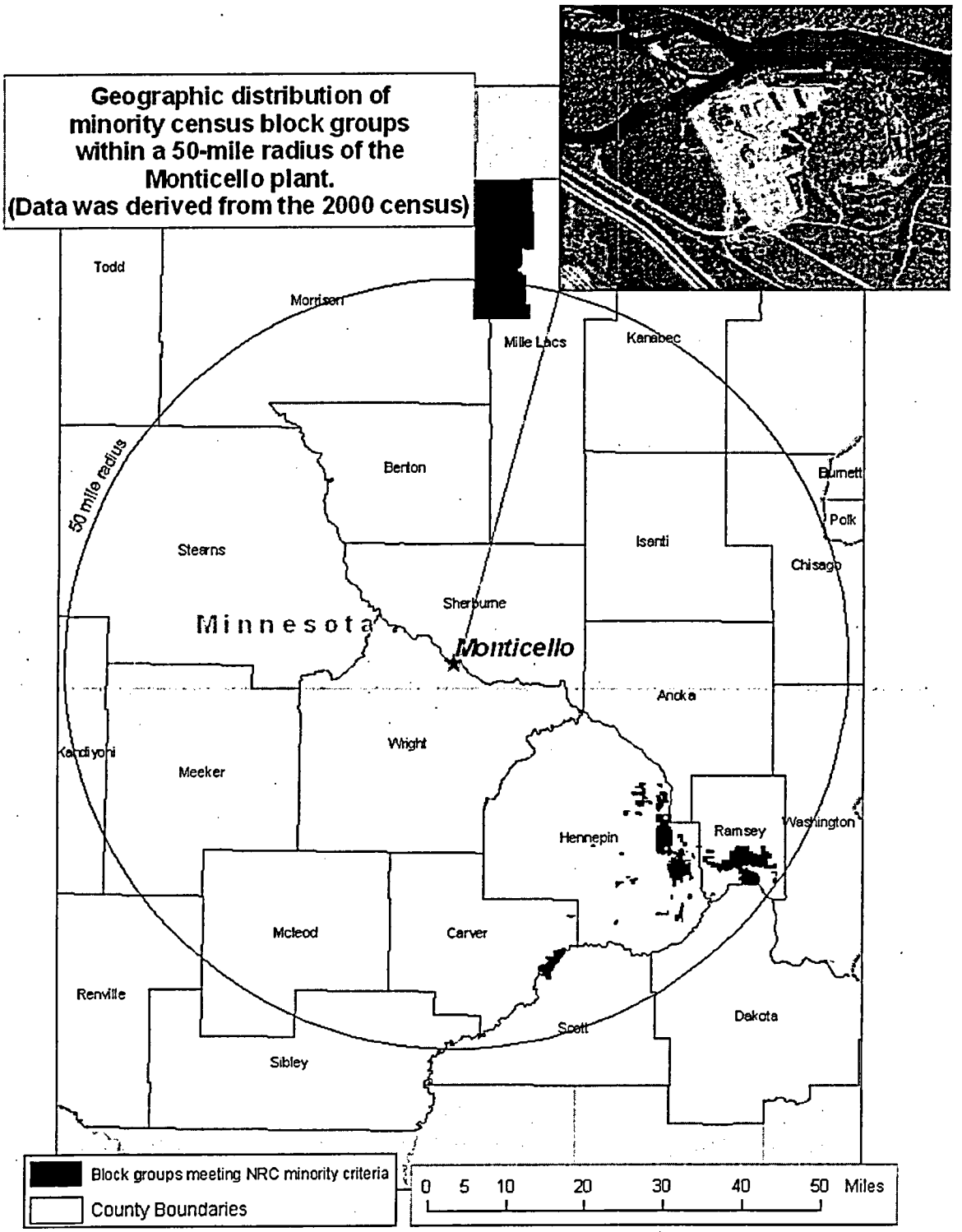

Figure 4-1. Geographic Distribution of Minority Populations (Shown in Shaded Areas) Within 50 mi of Monticello Based on Census Block Group Data

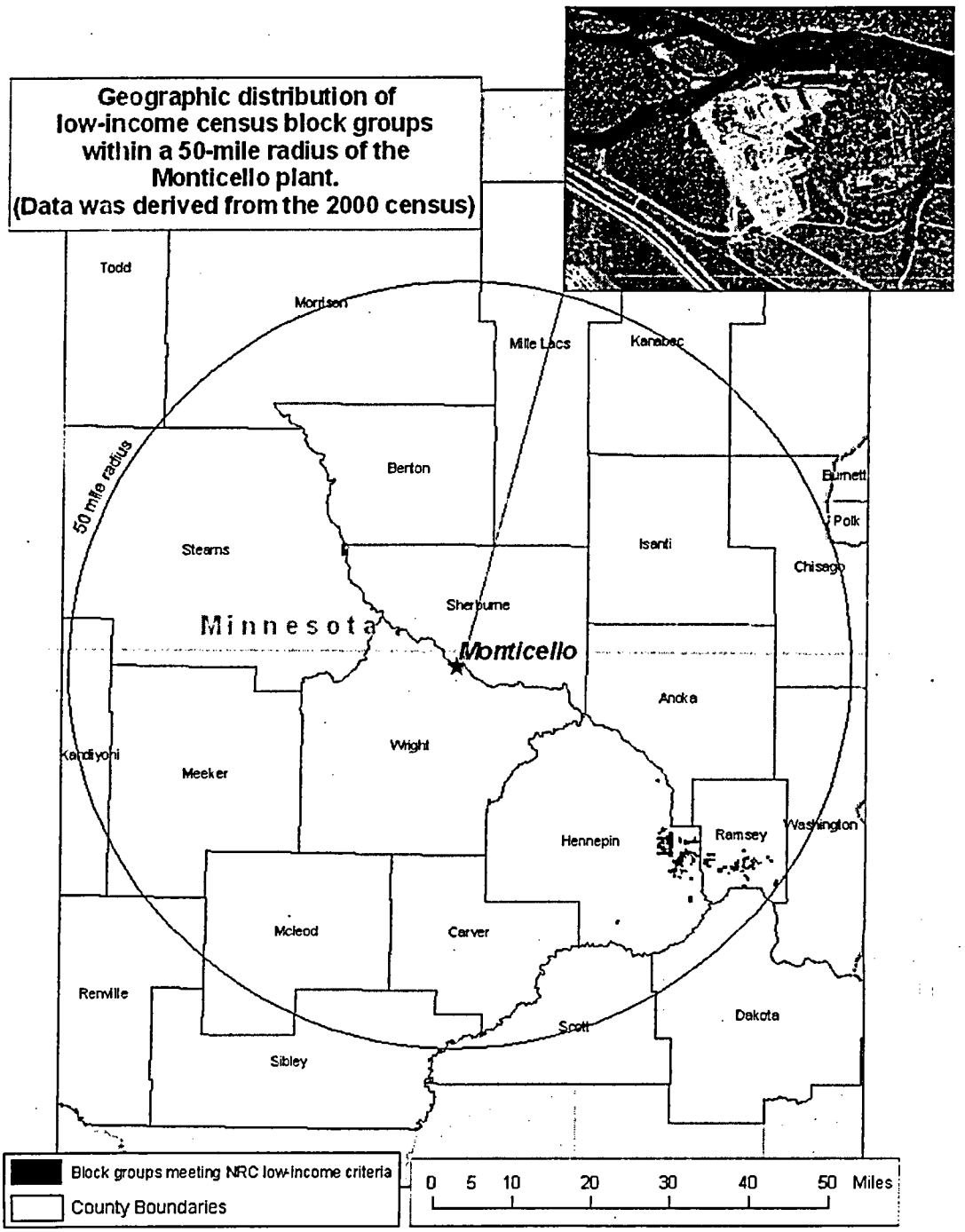

Figure 4-2. Geographic Distribution of Low-Income Populations (Shown in Shaded Areas) Within 50 mi of Monticello Based on Census Block Group Data

4.5 Groundwater Use and Quality

The Category 1 issue in 10 CFR Part 51, Subpart A, Appendix B, Table B-1 that is applicable to Monticello groundwater use and quality is listed in Table 4-8. NMC stated in its ER that it is not aware of any new and significant information associated with the renewal of the Monticello OL (NMC 2005a). The staff has not identified any new and significant information during its independent review of the NMC ER, the staff's site visit, the scoping process, its evaluation of other available information, or public comments on the draft SEIS (NMC 2005a). Therefore, the staff concludes that there are no impacts related to this issue beyond that discussed in the GEIS. For this issue, the GEIS concluded that the impacts are SMALL, and additional plant-specific mitigation measures are not likely to be sufficiently beneficial to be warranted.

A brief description of the staff's review and the GEIS conclusions, as codified in Table B-1, 10 CFR Part 51, Subpart A, Appendix B, Table B-1, follows.

Table 4-8. Category 1 Issue Applicable to Groundwater Use and Quality During the Renewal Term

ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1	GEIS Section
GROUND-WATER USE AND QUALITY	
Ground-water use conflicts (potable and service water; plants that use < 100 gpm)	4.8.1.1

- Ground-water use conflicts (potable and service water; plants that use < 100 gpm). Based on information in the GEIS, the Commission found that

  > Plants using less than 100 gpm are not expected to cause any ground-water use conflicts.

As discussed in Section 2.2.2, Monticello groundwater use is less than 100 gpm. The staff has not identified any new and significant information during its independent review of the NMC ER, the staff's site visit, the scoping process, its evaluation of other available information, or public comments on the draft SEIS. Therefore, the staff concludes that there are no groundwater use conflicts during the renewal term beyond those discussed in the GEIS.

The Category 2 issue related to groundwater use and quality during the renewal term that is applicable to the Monticello site is discussed in the section that follows. This issue, which requires plant-specific analysis, is listed in Table 4-9.

Table 4-9. Category 2 Issue Applicable to Groundwater Use and Quality During the Renewal Term

ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1	GEIS Section	10 CFR 51.53(c)(3)(ii) Subparagraph	SEIS Section
GROUND-WATER USE AND QUALITY			
Ground-water use conflicts (plants using cooling towers withdrawing make-up water from a small river)	4.8.1.3; 4.4.2.1	A	4.5.1

4.5.1 Groundwater Use Conflicts (Make-Up From a Small River)

Groundwater use conflicts for plants that have cooling towers withdrawing makeup water from a small river is a Category 2 issue, requiring a site-specific assessment before license renewal. Surface-water withdrawals from small water bodies during low-flow conditions may result in groundwater use conflicts with nearby groundwater users.

Groundwater use at Monticello is regulated by a Water Appropriations Permit with MNDNR. The permit required NMC to measure groundwater elevations during 1967 to 1994, which showed that the groundwater level is higher than river elevations (NMC 2005a). The impact of consumptive loss on nearby groundwater users is associated with the difference it could potentially cause in aquifer recharge, especially if other new groundwater or upstream surface water users begin withdrawals. However, since groundwater flows towards the Mississippi River, groundwater withdrawals would not be impacted by changes in river flow.

The staff reviewed available information relative to potential groundwater-use conflicts due to consumptive loss of aquifer recharge. Based on this review, the staff concludes that the potential impacts are SMALL, and additional mitigation is not warranted.

4.6 Threatened or Endangered Species

Federally threatened or endangered species are listed as a Category 2 issue in 10 CFR Part 51, Subpart A, Appendix B, Table B-1. This issue is listed in Table 4-10.

This issue requires consultation with appropriate agencies to determine whether threatened or endangered species are present and whether they would be adversely affected by continued operation of the nuclear plant during the license renewal term. The presence of threatened or endangered species in the vicinity of the Monticello site is discussed in Sections 2.2.5 and 2.2.6. On June 3, 2005, the staff contacted the FWS to request information on threatened and endangered species and the impacts of license renewal (NRC 2005a). In response, on July 13, 2005, the FWS provided additional information regarding Federally listed species that have been observed or may occur in the four-county area (Wright, Sherburne, Hennepin, and Anoka counties) that includes the Monticello site and its associated transmission lines, as well

as concerns that the FWS has regarding those species (FWS 2005). The staff has prepared a biological assessment (BA) documenting its review of Federally listed threatened or endangered species at the Monticello site and associated transmission lines and submitted it to the FWS for concurrence (NRC 2005d).

Table 4-10. Category 2 Issue Applicable to Threatened or Endangered Species in the Vicinity of Monticello During the License Renewal Term

ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1	GEIS Section	10 CFR 51.53(c)(3)(ii) Subparagraph	SEIS Section
THREATENED OR ENDANGERED SPECIES (FOR ALL PLANTS)			
Threatened or endangered species	4.1	E	4.6

4.6.1 Aquatic Species

The Higgins' eye pearlymussel (*Lampsilis higginsii*) is the only Federally listed (endangered) aquatic species reported from the four-county area that includes the Monticello site and its associated transmission lines (FWS 2005). As discussed in Section 2.2.5, the closest Essential Habitat Areas for the Higgins' eye pearlymussel occur in the St. Croix River (RM 811), which flows into the Mississippi River approximately 89 mi downstream from Monticello (RM 900). Also, the Higgins' eye pearlymussel is not known to occur further upstream than Pool 2 (RM 848 to RM 815) of the Mississippi River, which is mostly located downstream from the Twin Cities area (Kelner and Davis 2002; Hornbach 2004). Therefore, potential impacts from the operation of Monticello are too far removed to adversely affect the species. The Monticello cooling-water intake and discharge are closely monitored under the NPDES program. NPDES permit limits are reviewed on a regular basis by the Minnesota Pollution Control Agency to ensure the protection of aquatic biota, including fish species that can serve as hosts for the glochidia of the Higgins' eye pearlymussel.

There are no plans to conduct refurbishment or construction activities at Monticello. Therefore, the staff has concluded that continued operation of the plant during the license renewal term will have no effect on the Higgins' eye pearlymussel. Thus, it is the staff's finding, as documented in its BA (see Appendix E), that the impacts on threatened or endangered aquatic species from an additional 20 years of operation of Monticello would be SMALL, and additional mitigation is not warranted.

4.6.2 Terrestrial Species

There are two Federally listed threatened or endangered terrestrial species that have the potential to occur on or in the vicinity of the Monticello site and its associated transmission lines. These two species are discussed in Section 2.2.6. One Federally threatened species, the bald

eagle, is known to occur on the Monticello site and on one of its associated transmission corridors. The gray wolf, also a Federally threatened species, occurs in the northern portions of Minnesota and has recovered significantly, compared with its numbers in past decades. Continued recovery and dispersal of this species into central and southern portions of Minnesota is probable.

Two active bald eagle nests occur in the vicinity of the Monticello site. One nest is located on Beaver Island in the Mississippi River north-northwest of the Monticello power block; the second nest is located in a transmission tower along the Monticello-Coon Creek 345 kV line. Public access to both nest sites is limited. The nest located on Beaver island is approximately 1000 ft from the Monticello power block in which the majority of site activity occurs and would not be affected by routine site operation or maintenance activities. The nest located in the transmission tower is in a remote area and Xcel Energy has restricted right-of-way maintenance activities in the vicinity of the nest (NMC 2005b).

NMC has not identified any additional construction or refurbishment activities that would result in greater land disturbance during the license renewal period (NMC 2005a). Furthermore, Xcel Energy has in place a program to install flight diverters on its transmission lines to reduce the potential for avian collisions and has entered into a memorandum of understanding (MOU) with the FWS to develop and implement an Avian Protection Plan (Xcel Energy et al. 2002). Electrocutions in the U.S. of large raptors almost always occur on comparatively low voltage distribution lines, not transmission lines. NMC and Xcel Energy are not aware of any adverse impacts to threatened or endangered species that have resulted from the operation of the Monticello plant during its 30-year operating history (NMC 2005a). Therefore the staff concludes that operations and maintenance activities on the Monticello site or its associated transmission line corridors are not likely to adversely affect the bald eagle.

The gray wolf currently does not occur on the Monticello site or associated transmission line corridors. Operations and maintenance activities at Monticello and its associated transmission corridors will have no effect on the gray wolf.

Based on this information, as documented in its BA (NRC 2005d), the staff concludes that the potential impacts on threatened or endangered terrestrial species from an additional 20 years of operation of Monticello on terrestrial threatened and endangered species would be SMALL, and additional mitigation is not warranted.

4.7 Evaluation of Potential New and Significant Information on Impacts of Operations During the Renewal Term

The staff has not identified new and significant information on environmental issues listed in 10 CFR Part 51, Subpart A, Appendix B, Table B-1, related to operation during the renewal term. The staff also determined that information provided during the public comment period did

not identify any new issue that requires site-specific assessment. The staff reviewed the discussion of environmental impacts associated with operation during the renewal term in the GEIS and has conducted its own independent review, including public scoping meetings, to identify issues with new and significant information. Processes for identification and evaluation of new information are described in Section 1.2.2.

4.8 Cumulative Impacts

The staff considered potential cumulative impacts of operations of Monticello during the renewal term. For the purposes of this analysis, past actions are those related to the resources at the time of the plant licensing and construction, present actions are those related to the resources at the time of current operation of the power plant, and future actions are considered to be those that are reasonably foreseeable through the end of the current license term, as well as during the 20-year license renewal term. Therefore, the analysis considers potential impacts through the end of the current license term as well as the 20-year renewal license term. The geographical area over which past, present, and future actions would occur is dependent on the type of action considered and is described below for each impact area.

The impacts of the proposed action, as described in Section 4, are combined with other past, present, and reasonably foreseeable future actions at Monticello regardless of what agency (Federal or non-Federal) or person undertakes such other actions. These combined impacts are defined as "cumulative" in 40 CFR 1508.7 and include individually minor but collectively significant actions taking place over a period of time. It is possible that an impact that may be SMALL by itself could result in a MODERATE or LARGE impact when considered in combination with the impacts of other actions on the affected resource. Likewise, if a resource is regionally declining or imperiled, even a SMALL individual impact could be important if it contributes to or accelerates the overall resource decline.

4.8.1 Cumulative Impacts Resulting from Operation of the Plant Cooling System

For the purposes of this analysis, the geographic area considered for cumulative impacts resulting from operation of the Monticello cooling system is primarily the upper portion of the Mississippi River, particularly that area bounded by St. Cloud upstream of the plant (RM 900) and St. Anthony Falls Lock and Dam (RM 854) downstream of the plant. As discussed in Section 4.1, the staff found no new and significant information that would indicate that the conclusion regarding any of the cooling system-related Category 1 issues related to Monticello is inconsistent with the conclusions in the GEIS (NRC 1996). Additionally, the staff determined that none of the cooling system-related Category 2 issues would have greater than a SMALL impact on local water quality and aquatic resources.

The cumulative impacts of past actions have resulted in the existing water quality and aquatic resource conditions near Monticello. The major changes and modifications within the upstream reach of the Mississippi River that have had the greatest impacts on aquatic resources include

physical and chemical stresses and introduction of nonnative species. The physical and chemical stresses include urban, industrial, and agricultural contaminants (e.g., nutrients, toxic chemicals, sediments); stream modification; water diversions; land-use changes (e.g., residential, recreational, agricultural and industrial development); dredging; shoreline modifications; wetland elimination and modification; dams and impoundments; impingement and entrainment in water-intake structures; thermal loading from cooling water; and major degradative incidents or catastrophes (Weitzell et al. 2003; Genet and Chirhart 2004). These in turn can affect fish, benthic macroinvertebrates, and plankton populations; cause a loss of habitat; cause deformities or tumors in fish and other biota; and contaminate fish, which leads to restrictions on human consumption.

Industrial, municipal, agricultural, and power plant usage of the Mississippi River occurs between St. Cloud and the Twin Cities (NMC 2005a). While pollution from domestic sewage has been reduced since passage of the Federal Water Pollution Control Act of 1972 (CWA), the Mississippi River still receives contaminants from agricultural, industrial, municipal, and residential sources (Fremling and Drazkowski 2000). The Monticello intake area requires dredging every six to eight years to prevent excess sand and silt from being drawn into the plant circulating water system (Amish et al. 1978). This causes a temporary, localized stress to aquatic biota within the immediate area near the Monticello plant.

The river water supply is adequate to meet the needs of the facility for cooling purposes under all conditions. The staff, while preparing this assessment, assumed that other industrial, commercial, or public installations could be located in the general vicinity of the Monticello site prior to the end of Monticello operations. Any discharge of water by such facilities into the Mississippi River would be regulated by the MPCA. The discharge limits are set considering the overall or cumulative impact of all of the other regulated activities in the area. Compliance with the CWA and its NPDES permit minimizes Monticello's cumulative impacts on aquatic resources. Continued operation of Monticello would require renewed discharge permits from the MPCA, which would address changing requirements so that cumulative water quality objectives would be served.

Future contributions to cumulative impacts to aquatic resources within the Mississippi River would generally occur from those actions that currently cause impacts (e.g., human habitation, urban and industrial development, agriculture, recreational fisheries, and spread of nonnative species). The quality of the aquatic resources within the Upper Mississippi River will continue to decline unless inputs of sediments, nutrients, and toxic substances are reduced or eliminated (Fremling and Drazkowski 2000).

The potential exists for the expansion of nonnative species that have already begun to occur in the Upper Mississippi River, and for additional nonnative species to become established within the river. Four species of Asian carp are established within the Upper Mississippi River. As mentioned, the common carp (*Cyprinus carpio*) is a prominent species within the Monticello area, while the grass carp (*Ctenopharyngodon idella*), silver carp *(Hypophthalmichthys molotrix*), and bighead carp (*H. nobilis*) have become established within the Upper Mississippi

River (but not within Minnesota) during the past two decades (Chick 2002). These species can impact native species by destroying habitat, reducing water quality, and by consuming aquatic vegetation (grass carp) or planktonic organisms (silver and bighead carp) (USGS 2004). The silver and bighead carp have the potential to adversely affect every species of fish within the Upper Mississippi River (Chick 2002). These three carp species are moving towards Minnesota. The closest known populations are in the Iowa waters of the Mississippi River (MNDNR 2005b).

The Higgins' eye pearlymussel is the only Federally listed aquatic species that is reported from the Mississippi River in the four-county area being considered for cumulative impacts. As mentioned in Section 2.2.5, past actions that have adversely affected this species have included siltation; impoundments; in-stream habitat disturbance; contaminants; pearl button and cultured pearl industries; and introduced species, particularly the zebra mussel *(Dreissena polymorpha)* (Hornbach 2004).

As discussed in Section 4.6.1, existing Higgins' eye pearlymussel populations are too far removed from Monticello for plant operations to contribute to the cumulative impacts that are affecting this species. Additionally, entrainment, impingement, thermal discharges, and infrequent cold shock events have only a minimal localized impact on fish species that are suitable hosts for the glochidia of the Higgins' eye pearlymussel.

The staff concludes that the potential cumulative impacts of the Monticello cooling system operations, including entrainment and impingement of fish and shellfish, heat shock, or any of the cooling system-related Category 1 issues (including cold shock) contributed by the continued operation of the facility will be SMALL and that no further mitigation measures are warranted.

4.8.2 Cumulative Impacts Resulting from Continued Operation of the Transmission Lines

Continued operation of the electrical transmission facilities associated with renewal of the operating license for Monticello was evaluated to determine if there is the potential for interactions with other past, present, and future actions that could result in adverse cumulative impacts to terrestrial resources (e.g., wildlife populations, the size and distribution of habitat areas), wetlands, floodplains, or aquatic resources. For the purposes of this analysis, the geographic area that encompasses the past, present, and foreseeable future actions that could contribute to adverse cumulative impacts includes those Minnesota counties that contain the transmission lines associated with the Monticello site (Wright, Hennepin, Sherburne, and Anoka counties). The staff is unaware of any planned activities within the area of consideration that could potentially produce additional impacts in association with the continued operation of the transmission lines. The presence of transmission lines generally precludes further activities that could affect the environment.

Therefore, the staff has determined that the cumulative impacts of the continued operation of the Monticello transmission lines are SMALL, and that no additional mitigation would be warranted.

4.8.3 Cumulative Radiological Impacts

The radiological dose limits for protection of the public and workers have been developed by the EPA and NRC to address the cumulative impact of acute and long-term exposure to radiation and radioactive material. These dose limits are codified in 40 CFR Part 190 and 10 CFR Part 20. For the purpose of this analysis, the area within a 50-mi radius of the Monticello site was included. The radiological environmental monitoring program (REMP) conducted by NMC in the vicinity of the Monticello site measures radiation and radioactive materials from all sources, including Monticello; therefore, the monitoring program measures cumulative radiological impacts. There are no other nuclear power plants within a 50-mi radius of Monticello. Monitoring results for the 5-year period from 1999 to 2004 were reviewed as part of the cumulative impacts assessment. Additionally, in Sections 2.2.7 and 4.3, the staff concluded that impacts of radiation exposure to the public and workers (occupational) from operation of Monticello during the renewal term are SMALL. The NRC and the State of Minnesota would regulate any future actions in the vicinity of the Monticello site that could contribute to cumulative radiological impacts.

Therefore, the staff concludes that cumulative radiological impacts of continued operations of Monticello are SMALL, and that no further mitigation measures are warranted.

4.8.4 Cumulative Socioeconomic Impacts

The continued operation of Monticello is not likely to result in significant cumulative impacts for any of the socioeconomic impact measures assessed in Section 4.4 of this SEIS (public services, housing, and offsite land use). This is because operating expenditures, staffing levels, and local tax payments during renewal would be similar to those during the current license period. Similarly, the proposed action is not likely to result in significant cumulative impacts on historic and archaeological resources.

When combined with the impact of other potential activities likely in the area surrounding the plant, socioeconomic impacts resulting from Monticello license renewal would not produce an incremental change in any of the impact measures used. The staff therefore determined that the impacts on employment, personal income, housing, local public services, utilities, and education occurring in the local socioeconomic environment as a result of license renewal activities, in addition to the impacts of other potential economic activity in the area, would be SMALL. The staff determined that the impact on offsite land use would be SMALL because no refurbishment activities are planned at Monticello, and no new incremental changes to plant-related tax payments are expected that could influence land use by fostering considerable growth. The impacts of license renewal on transportation and environmental justice would also

be SMALL. There are no reasonably foreseeable scenarios that would alter these conclusions in regard to cumulative impacts.

Although no archaeological or architectural surveys have been conducted to date at the Monticello site, and the potential exists for significant cultural resources to be present within the site boundaries, it does not appear that the proposed license renewal will adversely affect these resources. The applicant has indicated that no refurbishment or replacement activities, including additional land-disturbing activities, at the plant site (or along existing transmission corridors) are planned for the license renewal period. Therefore, continued operation of Monticello would likely protect any cultural resources present within the Monticello site boundary by protecting those lands from development and providing secured access. On the basis of the staff's analysis of cultural resources, the contribution to a cumulative impact on cultural resources by continued operation of Monticello during the license renewal period is considered SMALL.

4.8.5 Cumulative Impacts on Groundwater Use and Quality

Monticello's groundwater appropriations permit for two wells limits groundwater withdrawal to a maximum of 200 gpm for both wells. From 1998 to 2000, actual usage averaged 30 gpm. Three other wells have an annual usage of under 1.9 gpm and do not require appropriation permits. The current impact of Monticello on the alluvial aquifer due to plant operations and current groundwater withdrawals is small, as discussed in Section 4.5. There are no known or planned projects requiring withdrawal of groundwater, either at the plant or within its vicinity, that would potentially cause an adverse impact on groundwater if implemented in addition to the Monticello unit license renewal. On the basis of this analysis, the staff concludes that the cumulative impact to groundwater resources during the license renewal period would be SMALL and that additional mitigation would not be warranted.

4.8.6 Cumulative Impacts on Threatened or Endangered Species

The geographic area considered in the analysis of potential cumulative impacts to threatened or endangered species includes the counties of Wright, Sherburne, Minnesota. The Monticello site and its associated transmission line rights-of-way that are within scope of the license renewal review are found within these two counties. As discussed in sections 2.2.5 and 2.2.6, there are three Federally listed species that potentially could inhabit Wright and Sherburne counties. No Federally designated candidate species, nor critical habitat for any threatened or endangered species are known to occur within the geographic area of consideration.

The staff's findings on the three Federally protected species are presented in the December 22, 2005 (NRC 2005d) BA (Appendix E) and in Section 4.6 of this SEIS. The staff concluded in the BA and Section 4.6 that continued operation of Monticello, and the continued use of the existing transmission lines within the scope of this review, will have no effect on the Higgins' eye pearlymussel and grey wolf and is not likely to adversely affect the bald eagle. Therefore, the staff determined that since there is currently no adverse impact to these species

and there is little or no likelihood of any impact during the renewal period the contributions to cumulative impacts to Federally listed threatened or endangered species due to continued operation of Monticello and its transmission lines is SMALL and no mitigation is warranted.

4.8.7 Conclusions Regarding Cumulative Impacts

The staff considered the potential impacts resulting from operation of Monticello during the license renewal term and other past, present, and future actions in the vicinity of Monticello. For each impact area, the staff has determined that the potential cumulative impacts resulting from Monticello operation during the license renewal term are SMALL, and mitigation is not warranted.

4.9 Summary of Impacts of Operations During the Renewal Term

Neither NMC nor the staff is aware of information that is both new and significant related to any of the applicable Category 1 issues associated with the Monticello operations during the renewal term. Consequently, the staff concludes that the environmental impacts associated with these issues are bounded by the impacts described in the GEIS. For each of these issues, the GEIS concluded that the impacts would be SMALL and that additional plant-specific mitigation measures are not likely to be sufficiently beneficial to warrant implementation.

Plant-specific environmental evaluations were conducted for 13 Category 2 issues applicable to Monticello operations during the renewal term, and for environmental justice and chronic effects of electromagnetic fields. For 13 issues and environmental justice, the staff concluded that the potential environmental impact of renewal term operations of Monticello would be of SMALL significance in the context of the standards set forth in the GEIS, and that additional mitigation would not be warranted. In addition, the staff determined that a consensus has not been reached by appropriate Federal health agencies regarding chronic adverse effects from electromagnetic fields. Therefore, the staff did not conduct an evaluation of this issue.

Cumulative impacts of past, present, and reasonably forseeable future actions were considered, regardless of what agency (Federal or non-Federal) or person undertakes such other actions. For purposes of this analysis, where Monticello license renewal impacts are deemed to be SMALL, the staff concluded that these impacts would not result in significant cumulative impacts on potentially affected resources.

4.10 References

10 CFR Part 20. Code of Federal Regulations, Title 10, *Energy*, Part 20, "Standards for Protection Against Radiation."

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

36 CFR Part 800. Code of Federal Regulations, Title 36, *Parks, Forests, and Public Property*, Part 800, "Advisory Council on Historic Preservation."

40 CFR Part 190. Code of Federal Regulations, Title 40, *Protection of Environment*, Part 190, "Environmental Radiation Protection Standards for Nuclear Power Operations."

40 CFR Part 1508. Code of Federal Regulations, Title 40, *Protection of Environment*, Part 1508, "Terminology and Index."

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5.0 Environmental Impacts of Postulated Accidents

Environmental issues associated with postulated accidents are discussed in the *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS), NUREG-1437, Volumes 1 and 2 (NRC 1996, 1999).[a] The GEIS includes a determination of whether the analysis of the environmental issue could be applied to all plants and whether additional mitigation measures would be warranted. Issues are then assigned a Category 1 or a Category 2 designation. As set forth in the GEIS, Category 1 issues are those that meet all of the following criteria:

(1) The environmental impacts associated with the issue have been determined to apply either to all plants or, for some issues, to plants having a specific type of cooling system or other specified plant or site characteristics.

(2) Single significance level (i.e., SMALL, MODERATE, or LARGE) has been assigned to the impacts (except for collective offsite radiological impacts from the fuel cycle and from high-level waste and spent fuel disposal).

(3) Mitigation of adverse impacts associated with the issue has been considered in the analysis, and it has been determined that additional plant-specific mitigation measures are likely not to be sufficiently beneficial to warrant implementation.

For issues that meet the three Category 1 criteria, no additional plant-specific analysis is required unless new and significant information is identified.

Category 2 issues are those that do not meet one or more of the criteria for Category 1, and therefore, additional plant-specific review of these issues is required.

This chapter describes the environmental impacts from postulated accidents that might occur during the license renewal term.

5.1 Postulated Plant Accidents

Two classes of accidents are evaluated in the GEIS. These are design-basis accidents (DBAs) and severe accidents, as discussed below.

5.1.1 Design-Basis Accidents

In order to receive NRC approval to operate a nuclear power facility, an applicant for an initial operating license must submit a safety analysis report (SAR) as part of its application. The

[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.

Environmental Impacts of Postulated Accidents

SAR presents the design criteria and design information for the proposed reactor and comprehensive data on the proposed site. The SAR also discusses various hypothetical accident situations and the safety features that are provided to prevent and mitigate accidents. The NRC staff reviews the application to determine whether the plant design meets the Commission's regulations and requirements and includes, in part, the nuclear plant design and its anticipated response to an accident.

DBAs are those accidents that both the licensee and the NRC staff evaluate to ensure that the plant can withstand normal and abnormal transients, and a broad spectrum of postulated accidents, without undue hazard to the health and safety of the public. A number of these postulated accidents are not expected to occur during the life of the plant, but are evaluated to establish the design basis for the preventive and mitigative safety systems of the facility. The acceptance criteria for DBAs are described in Title 10 of the *Code of Federal Regulations* (CFR) Part 50 and 10 CFR Part 100.

The environmental impacts of DBAs are evaluated during the initial licensing process, and the ability of the plant to withstand these accidents is demonstrated to be acceptable before issuance of the operating license (OL). The results of these evaluations are found in license documentation such as the applicant's final safety analysis report (FSAR), the staff's safety evaluation report (SER), the final environmental statement (FES), and Section 5.1 of this supplemental environmental impact statement (SEIS). A licensee is required to maintain the acceptable design and performance criteria throughout the life of the plant, including any extended-life operation. The consequences for these events are evaluated for the hypothetical maximum exposed individual; as such, changes in the plant environment will not affect these evaluations. Because of the requirements that continuous acceptability of the consequences and aging management programs be in effect for license renewal, the environmental impacts as calculated for DBAs should not differ significantly from initial licensing assessments over the life of the plant, including the license renewal period. Accordingly, the design of the plant relative to DBAs during the extended period is considered to remain acceptable and the environmental impacts of those accidents were not examined further in the GEIS.

The Commission has determined that the environmental impacts of DBAs are of SMALL significance for all plants because the plants were designed to successfully withstand these accidents. Therefore, for the purposes of license renewal, DBAs are designated as a Category 1 issue in 10 CFR Part 51, Subpart A, Appendix B, Table B-1. The early resolution of the DBAs makes them a part of the current licensing basis of the plant; the current licensing basis of the plant is to be maintained by the licensee under its current license and, therefore, under the provisions of 10 CFR 54.30, is not subject to review under license renewal. This issue, applicable to Monticello, is listed in Table 5-1.

Table 5-1. Category 1 Issue Applicable to Postulated Accidents During the Renewal Term

ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1	GEIS Sections
POSTULATED ACCIDENTS	
Design basis accidents	5.3.2; 5.5.1

Based on information in the GEIS, the Commission found that:

> The NRC staff has concluded that the environmental impacts of design basis accidents are of small significance for all plants.

Nuclear Management Company (NMC) stated in its Environmental Report (ER) (NMC 2005a) that it is not aware of any new and significant information associated with the renewal of the Monticello OL. The staff has not identified any new and significant information during its independent review of the NMC ER, the staff's site visit, the scoping process, its evaluation of other available information, or public comments on the draft SEIS. Therefore, the staff concludes that there are no impacts related to design basis accidents beyond those discussed in the GEIS.

5.1.2 Severe Accidents

Severe nuclear accidents are those that are more severe than DBAs because they could result in substantial damage to the reactor core, whether or not there are serious offsite consequences. In the GEIS, the staff assessed the impacts of severe accidents during the license renewal period, using the results of existing analyses and site-specific information to conservatively predict the environmental impacts of severe accidents for each plant during the renewal period.

Severe accidents initiated by external phenomena, such as tornadoes, floods, earthquakes, fires, and sabotage have not traditionally been discussed in quantitative terms in FESs and were not specifically considered for the Monticello site in the GEIS (NRC 1996). However, in the GEIS, the NRC staff did evaluate existing impact assessments performed by the NRC and by the industry at 44 nuclear plants in the United States and concluded that the risk from beyond design-basis earthquakes at existing nuclear power plants is SMALL. Additionally, the NRC regulatory requirements under 10 CFR Part 73 provide reasonable assurance that the risk from sabotage is SMALL. Furthermore, the NRC staff concluded that the risks from other external events are adequately addressed by a generic consideration of internally initiated severe accidents.

Environmental Impacts of Postulated Accidents

Based on information in the GEIS, the Commission found that:

> The probability weighted consequences of atmospheric releases, fallout onto open bodies of water, releases to groundwater, and societal and economic impacts from severe accidents are small for all plants. However, alternatives to mitigate severe accidents must be considered for all plants that have not considered such alternatives.

Therefore, the Commission has designated mitigation of severe accidents as a Category 2 issue in 10 CFR Part 51, Subpart A, Appendix B, Table B-1. This issue, applicable to Monticello, is listed in Table 5-2.

Table 5-2. Category 2 Issue Applicable to Postulated Accidents During the Renewal Term

ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1	GEIS Sections	10 CFR 51.53(c)(3)(ii) Subparagraph	SEIS Section
	POSTULATED ACCIDENTS		
Severe accidents	5.3.3; 5.3.3.2; 5.3.3.3; 5.3.3.4; 5.3.3.5; 5.4; 5.5.2	L	5.2

The staff has not identified any new and significant information with regard to the consequences from severe accidents during its independent review of the NMC ER, the staff's site visit, the scoping process, its evaluation of other available information, or public comments on the draft SEIS. Therefore, the staff concludes that there are no impacts of severe accidents beyond those discussed in the GEIS. However, in accordance with 10 CFR 51.53(c)(3)(ii)(L), the staff has reviewed severe accident mitigation alternatives (SAMAs) for Monticello. The results of its review are discussed in Section 5.2.

5.2 Severe Accident Mitigation Alternatives

10 CFR 51.53(c)(3)(ii)(L) requires that license renewal applicants consider alternatives to mitigate severe accidents if the staff has not previously evaluated SAMAs for the applicant's plant in an environmental impact statement (EIS) or related supplement or in an environmental assessment. The purpose of this consideration is to ensure that plant changes (i.e., hardware, procedures, and training) with the potential for improving severe accident safety performance are identified and evaluated. SAMAs have not been previously considered for Monticello; therefore, the remainder of Chapter 5 addresses those alternatives.

5.2.1 Introduction

This section presents a summary of the SAMA evaluation for Monticello conducted by NMC, and described in the ER, and the NRC's review of this evaluation. The details of the review are described in the NRC staff evaluation that was prepared with contract assistance from Information Systems Laboratories, Inc. The entire evaluation for Monticello is presented in Appendix G.

The SAMA evaluation for Monticello was conducted with a four-step approach. In the first step NMC quantified the level of risk associated with potential reactor accidents using the plant-specific probabilistic safety assessment (PSA) and other risk models.

In the second step NMC examined the major risk contributors and identified possible ways (SAMAs) of reducing that risk. Common ways of reducing risk are changes to components, systems, procedures, and training. NMC initially identified 40 potential SAMAs for Monticello. NMC screened out 24 SAMAs from further consideration because they are not applicable at Monticello due to design differences, require extensive changes that would involve implementation costs known to exceed any possible benefit, or exceed the dollar value associated with completely eliminating all internal and external event severe accident risk at Monticello. The remaining 16 SAMAs were subjected to further evaluation. During the second phase of the evaluation, NMC screened out one additional SAMA based on risk insights and other factors, leaving 15 SAMAs.

In the third step NMC estimated the benefits and the costs associated with each of the remaining SAMAs. Estimates were made of how much each SAMA could reduce risk. Those estimates were developed in terms of dollars in accordance with NRC guidance for performing regulatory analyses (NRC 1997a,b). The cost of implementing the proposed SAMAs was also estimated.

Finally, in the fourth step, the costs and benefits of each of the remaining SAMAs were compared to determine whether the SAMA was cost-beneficial, meaning the benefits of the SAMA were greater than the cost (a positive cost-benefit). NMC found seven SAMAs to be potentially cost-beneficial in the baseline analysis, and three additional SAMAs to be potentially cost-beneficial when alternative discount rates and analysis uncertainties are considered (NMC 2005a).

NMC recognized that a combination of low-cost SAMAs can provide much of the risk reduction associated with higher-cost SAMAs, and may act synergistically to yield a combined risk reduction greater than the sum of the benefits for each SAMA if implemented individually. Since the ER was submitted, NMC has implemented six SAMAs, and reassessed the value of the remaining SAMAs. Implementation of the six SAMAs reduces the benefit of the remaining SAMAs such that only one SAMA remains potentially cost-beneficial.

The one potentially cost-beneficial SAMA does not relate to adequately managing the effects of aging during the period of extended operation; therefore, it need not be implemented as part of license renewal pursuant to 10 CFR Part 54. NMC indicates that it plans to further evaluate the potentially cost-beneficial SAMA for possible implementation. NMC's SAMA analyses and the NRC's review are discussed in more detail below.

5.2.2 Estimate of Risk

NMC submitted an assessment of SAMAs for Monticello as part of the ER (NMC 2005a). This assessment was based on a slight modification of the 2003 Level 1 and Level 2 PSA model, a plant-specific offsite consequence analysis performed using the MELCOR Accident Consequence Code System 2 (MACCS2) computer program, and insights from the Monticello Individual Plant Examination (IPE) (NSP 1992) and Individual Plant Examination of External Events (IPEEE) (NSP 1995a,b).

The baseline core damage frequency (CDF) for the purpose of the SAMA evaluation is approximately 4.5×10^{-5} per year. This CDF is based on the risk assessment for internally initiated events. NMC did not include the contribution to risk from external events within the Monticello risk estimates; however, it did account for the potential risk reduction benefits associated with external events by increasing the estimated benefits for internal events by a factor of two. The breakdown of CDF by initiating event is provided in Table 5-3.

Table 5-3. Monticello Core Damage Frequency for Internal Events

Initiating Event	CDF (per year)	% Contribution to CDF
Fire protection system (FPS) line break in turbine building (TB) 931-ft elevation west	3.2×10^{-5}	71
Service water (SW) line break in TB 931-ft elevation west	5.8×10^{-6}	13
SW line break in TB 911-ft elevation	1.8×10^{-6}	4
Loss of offsite power	1.8×10^{-6}	4
SW line break in residual heat removal (RHR) A room	8.9×10^{-7}	2
SW line break in RHR B room	8.9×10^{-7}	2
SW line break in reactor building 896-ft elevation	4.5×10^{-7}	1
Turbine trip	4.5×10^{-7}	1
Loss of feedwater	4.5×10^{-7}	1
Other	4.5×10^{-7}	1
Total CDF (internal events)	**4.5×10^{-5}**	**100**

As shown in Table 5-3, internal flood events initiated by FPS and SW pipe breaks are the dominant contributors to CDF. Loss of offsite power and other transient initiators contribute about 6 percent of the CDF.

In the ER, NMC estimated the dose to the population within 50 mi of the Monticello site to be approximately 38 person-rem per year. The breakdown of the total population dose by containment release mode is summarized in Table 5-4. Containment failures within the late time frame (greater than 6 hours following declaration of a general emergency) and early time frame (less than 6 hours following declaration of a general emergency) provide similar contributions to the population dose risk at Monticello.

Table 5-4. *Breakdown of Population Dose by Containment Release Mode*

Containment Release Mode	Population Dose (person-rem[a] per year)	% Contribution
Late containment failure	20.4	54
Early containment failure	17.6	46
Intact containment	Negligible	Negligible
Total	**38**	**100**

[a] 1 person-rem per year = 0.01 person-Sv per year

The NRC staff has reviewed NMC's data and evaluation methods and concludes that the quality of the risk analyses is adequate to support an assessment of the risk reduction potential for candidate SAMAs. Accordingly, the staff based its assessment of offsite risk on the CDFs and offsite doses reported by NMC.

5.2.3 Potential Plant Improvements

Once the dominant contributors to plant risk were identified, NMC searched for ways to reduce that risk. In identifying and evaluating potential SAMAs, NMC considered insights from the plant-specific PSA, SAMA analyses performed for other operating plants that have submitted license renewal applications, as well as SAMAs that could further reduce the risk of the dominant internal fires. NMC identified 40 potential risk-reducing improvements (SAMAs) to plant components, systems, procedures and training.

Twenty-four SAMAs were removed from further consideration because they are not applicable at Monticello due to design differences, require extensive changes that would involve implementation costs known to exceed any possible benefit, or exceed the dollar value associated with completely eliminating all internal and external event severe accident risk at Monticello. The remaining 16 SAMAs were subjected to further evaluation. During the second phase of the evaluation, NMC screened out one additional SAMA based on risk insights and

other factors. A detailed cost-benefit analysis was performed for each of the 15 remaining SAMAs.

The staff concludes that NMC used a systematic and comprehensive process for identifying potential plant improvements for Monticello, and that the set of potential plant improvements identified by NMC is reasonably comprehensive and, therefore, acceptable.

5.2.4 Evaluation of Risk Reduction and Costs of Improvements

NMC evaluated the risk-reduction potential of the remaining 15 SAMAs. The SAMA evaluations were performed using realistic assumptions with some conservatism.

NMC estimated the costs of implementing the 15 candidate SAMAs through the application of engineering judgement, use of other licensees' estimates for similar improvements, and development of site-specific cost estimates. The cost estimates conservatively did not include the cost of replacement power during extended outages required to implement the modifications, nor did they include contingency costs associated with unforeseen implementation obstacles.

The staff reviewed NMC's bases for calculating the risk reduction for the various plant improvements and concludes that the rationale and assumptions for estimating risk reduction are reasonable and somewhat conservative (i.e., the estimated risk reduction is similar to or somewhat higher than what would actually be realized). Accordingly, the staff based its estimates of averted risk for the various SAMAs on NMC's risk reduction estimates.

The staff reviewed the bases for the applicant's cost estimates. For certain improvements, the staff also compared the cost estimates to estimates developed elsewhere for similar improvements, including estimates developed as part of other licensees' analyses of SAMAs for operating reactors and advanced light-water reactors. The staff found the cost estimates to be consistent with estimates provided in support of other plants' analyses.

The staff concludes that the risk reduction and the cost estimates provided by NMC are sufficient and appropriate for use in the SAMA evaluation.

5.2.5 Cost-Benefit Comparison

The cost-benefit analysis performed by NMC was based primarily on NUREG/BR-0184 (NRC 1997b) and was executed consistent with this guidance. NUREG/BR-0058 has recently been revised to reflect the agency's revised policy on discount rates. Revision 4 of NUREG/BR-0058 states that two sets of estimates should be developed—one at three percent and one at seven percent (NRC 2004). NMC provided both sets of estimates (NMC 2005a).

NMC identified seven potentially cost-beneficial SAMAs in the baseline analysis contained in the ER (using a seven-percent discount rate):

- SAMA 2—enhance DC power availability by providing a direct connection from diesel generator 13, the security diesel, or another source, to the 250-V battery chargers or other required loads.

- SAMA 4—install a direct-drive diesel injection pump as additional high-pressure injection system.

- SAMA 6—install additional fan and louver pair for emergency diesel generator heating, ventilation, and air conditioning.

- SAMA 11—enhance alternate injection reliability by including the residual heat removal service water and fire service water cross-tie valves in the maintenance program.

- SAMA 12—proceduralize the use of a fire pumper truck to pressurize the fire service water system.

- SAMA 16—provide passive overpressure relief by changing the containment vent valves to fail open and improving the strength of the rupture disk.

- SAMA 36—install an interlock to open the door to hot machine shop and change swing direction of door to plant administration building to divert water from turbine building 931-foot elevation east.

When benefits are evaluated using a three-percent discount rate, two additional SAMAs were determined to be potentially cost-beneficial:

- SAMA 39—upgrade the automatic shutdown system (ASDS) panel to include additional system controls for opposite division.

- SAMA 40—add emergency level control sensor and control valve to the hotwell.

NMC performed additional analyses to evaluate the impact of parameter choices and uncertainties on the results of the SAMA assessment (NMC 2005a). If the benefits are increased by a factor of 2.5 to account for uncertainties, one additional SAMA (SAMA 9, dedicated alternate low-pressure injection/drywell spray system) was determined to be potentially cost-beneficial.

NMC recognized that a combination of low-cost SAMAs could provide much of the risk reduction associated with higher-cost SAMAs, and may act synergistically to yield a combined risk reduction greater than the sum of the benefits of each SAMA if implemented individually (NMC 2005a). NMC identified six low-cost SAMAs as a recommended combination of SAMAs which substantially reduces risk at Monticello for a relatively low cost of implementation. These include previously identified SAMAs 2, 11, 12, and 36, and two additional SAMAs not identified as being cost-beneficial:

- SAMA 28—develop a procedure to refill the condensate storage tank with fire service water system.

- SAMA 37—develop guidance to allow local, manual control for reactor core isolation cooling system operation.

Since the ER was submitted, NMC has implemeted the six recommended SAMAs (SAMAs 2, 11, 12, 28, 36, and 37), and has reassessed the value of the remaining SAMAs. Implementation of the six recommended SAMAs reduces the benefit of the remaining SAMAs (including SAMA 9, which was identified as a result of the uncertainty analysis), such that only one SAMA that has not been implemented yet, remains potentially cost-beneficial. SAMA 16 (passive overpressure relief for containment) becomes even more cost-beneficial because the set of SAMAs implemented by NMC shifts the risk to categories influenced by containment venting, which could be mitigated by SAMA 16. NMC stated that the improvement is being pursued to determine if cost-effective modifications can be implemented (NMC 2005b).

The staff concludes that, with the exception of the one potentially cost-beneficial SAMA discussed above, the costs of the SAMAs evaluated would be higher than the associated benefits.

5.2.6 Conclusions

The staff reviewed NMC's analysis and concluded that the methods used and the implementation of those methods were sound. The treatment of SAMA benefits and costs support the general conclusion that the SAMA evaluations performed by NMC are reasonable and sufficient for the license renewal submittal. Although the treatment of SAMAs for external events was somewhat limited by the unavailability of an external event PSA, the likelihood of there being cost-beneficial enhancements in this area was minimized by including several candidate SAMAs related to dominant fire events, and increasing the estimated SAMA benefits for internal events by a factor of two to account for potential benefits in external events.

Based on its review of the SAMA analysis, and on the implementation of the six recommended low-cost SAMAs by NMC, the staff concurs with NMC's identification of areas in which risk can be further reduced in a cost-beneficial manner through the implementation of one potentially cost-beneficial SAMA. Given the potential for cost-beneficial risk reduction, the staff agrees that further evaluation of this SAMA by NMC is warranted. However, this potentially cost-beneficial SAMA does not relate to adequately managing the effects of aging during the period of extended operation. Therefore, it need not be implemented as part of the license renewal pursuant to 10 CFR Part 54.

5.3 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 Regulatory Functions."

10 CFR Part 54. Code of Federal Regulations, Title 10, *Energy*, Part 54, "Requirements for Renewal of Operating Licenses for Nuclear Power Plants."

10 CFR Part 100. Code of Federal Regulations, Title 10, *Energy*, Part 100, "Reactor Site Criteria."

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U.S. Nuclear Regulatory Commission (NRC). 1999. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants, Main Report*, Section 6.3 – Transportation, Table 9.1, Summary of findings on NEPA issues for license renewal of nuclear power plants. NUREG-1437, Volume 1, Addendum 1, Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 2004. *Regulatory Analysis Guidelines of the U.S. Nuclear Regulatory Commission.* NUREG/BR-0058, Rev. 4, Washington, D.C.