NUREG-1437
Supplement 26

Generic Environmental Impact Statement for License Renewal of Nuclear Plants

Supplement 26

Regarding
Monticello Nuclear Generating Plant

Draft Report

U.S. Nuclear Regulatory Commission
Office of Nuclear Reactor Regulation
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Abstract

The U.S. Nuclear Regulatory Commission (NRC) considered the environmental impacts of renewing nuclear power plant operating licenses (OLs) for a 20-year period in its *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS), NUREG-1437, Volumes 1 and 2, and codified the results in 10 CFR Part 51. In the GEIS (and its Addendum 1), the staff identifies 92 environmental issues and reaches generic conclusions related to environmental impacts for 69 of these issues that apply to all plants or to plants with specific design or site characteristics. Additional plant-specific review is required for the remaining 23 issues. These plant-specific reviews are to be included in a supplement to the GEIS.

This draft supplemental environmental impact statement (SEIS) has been prepared in response to an application submitted to the NRC by Nuclear Management Company, LLC (NMC), to renew the OL for the Monticello Nuclear Generating Plant (Monticello) for an additional 20 years under 10 CFR Part 54. This draft SEIS includes the NRC staff's analysis that considers and weighs the environmental impacts of the proposed action, the environmental impacts of alternatives to the proposed action, and mitigation measures available for reducing or avoiding adverse impacts. It also includes the staff's preliminary recommendation regarding the proposed action.

Regarding the 69 issues for which the GEIS reached generic conclusions, neither NMC nor the staff has identified information that is both new and significant for any issue that applies to Monticello. In addition, the staff determined that information provided during the scoping process did not call into question the conclusions in the GEIS. Therefore, the staff concludes that the impacts of renewing the Monticello OL will not be greater than impacts identified for these issues in the GEIS. For each of these issues, the staff's conclusion in the GEIS is that the impact is of SMALL[(a)] significance (except for collective offsite radiological impacts from the fuel cycle and high-level waste and spent fuel, which were not assigned a single significance level).

Regarding the remaining 23 issues, those that apply to Monticello are addressed in this draft SEIS. For each applicable issue (with the exception of chronic effects from electromagnetic fields, for which the impact is “uncertain”), the staff concludes that the significance of the potential environmental impacts of renewal of the OL is SMALL. The staff also concludes that additional mitigation measures are not likely to be sufficiently beneficial as to be warranted. The staff determined that information provided during the scoping process did not identify any new issue that has a significant environmental impact.

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[a] Environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource.

Abstract

The NRC staff's preliminary recommendation is that the Commission determine that the adverse environmental impacts of license renewal for Monticello are not so great that preserving the option of license renewal for energy-planning decisionmakers would be unreasonable. This recommendation is based on (1) the analysis and findings in the GEIS; (2) the Environmental Report submitted by NMC; (3) consultation with Federal, State, and local agencies; (4) the staff's own independent review; and (5) the staff's consideration of public comments received during the scoping process.

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Executive Summary

By letter dated March 16, 2005, Nuclear Management Company, LLC (NMC), submitted an application to the U.S. Nuclear Regulatory Commission (NRC) to renew the operating license (OL) for Monticello Nuclear Generating Plant (Monticello) for an additional 20-year period. If the OL is renewed, State regulatory agencies and NMC 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. If the OL is not renewed, then the plant must be shut down on or before the expiration date of the current OL, which is September 8, 2010.

The NRC has implemented Section 102 of the National Environmental Policy Act (NEPA) (42 USC 4332) in Title 10 of the *Code of Federal Regulations* (CFR) Part 51 (10 CFR Part 51). In 10 CFR 51.20(b)(2), the Commission requires preparation of an environmental impact statement (EIS) or a supplement to an EIS for renewal of a reactor OL. In addition, 10 CFR 51.95(c) states that the EIS prepared at the OL renewal stage will be a supplement to the *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS), NUREG-1437, Volumes 1 and 2.[(a)]

Upon acceptance of the NMC application, the NRC began the environmental review process described in 10 CFR Part 51 by publishing a notice of intent to prepare an EIS and conduct scoping. The staff visited the Monticello site in June 2005 and held public scoping meetings on June 30, 2005, in Monticello, Minnesota. In the preparation of this draft supplemental environmental impact statement (SEIS) for Monticello, the staff reviewed the NMC Environmental Report (ER) and compared it to the GEIS, consulted with other agencies, conducted an independent review of the issues, following the guidance set forth in NUREG-1555, *Standard Review Plans for Environmental Reviews for Nuclear Power Plants, Supplement 1: Operating License Renewal*, and considered the public comments received during the scoping process. The public comments received during the scoping process that were considered to be within the scope of the environmental review are provided in Appendix A, Part 1, of this SEIS.

The staff will hold two public meetings in Monticello, Minnesota, in March 2006 to describe the preliminary results of the NRC environmental review, to answer questions, and to provide members of the public with information to assist them in formulating comments on this SEIS. When the comment period ends, the staff will consider and address all of the comments received. These comments will be addressed in Appendix A, Part 2 of the final SEIS.

This draft SEIS includes the NRC staff's preliminary analysis that considers and weighs the environmental effects of the proposed action, the environmental impacts of alternatives to the proposed action, and mitigation measures for reducing or avoiding adverse effects. It also includes the staff's preliminary recommendation regarding the proposed action.

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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.

The Commission has adopted the following statement of purpose and need for license renewal from the GEIS:

> 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.

The evaluation criterion for the staff's environmental review, as defined in 10 CFR 51.95(c)(4) and the GEIS, is to determine

> ... 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.

Both the statement of purpose and need and the evaluation criterion implicitly acknowledge that there are factors, in addition to license renewal, that will ultimately determine whether an existing nuclear power plant continues to operate beyond the period of the current OL.

NRC regulations [10 CFR 51.95(c)(2)] contain the following statement regarding the content of SEISs prepared at the license renewal stage:

> The supplemental environmental impact statement for license renewal is not required to include discussion of need for power or the economic costs and economic benefits of the proposed action or of alternatives to the proposed action except insofar as such benefits and costs are either essential for a determination regarding the inclusion of an alternative in the range of alternatives considered or relevant to mitigation. In addition, the supplemental environmental impact statement prepared at the license renewal stage need not discuss other issues not related to the environmental effects of the proposed action and the alternatives, or any aspect of the storage of spent fuel for the facility within the scope of the generic determination in § 51.23(a) ["Temporary storage of spent fuel after cessation of reactor operation—generic determination of no significant environmental impact"] and in accordance with § 51.23(b).

The GEIS contains the results of a systematic evaluation of the consequences of renewing an OL and operating a nuclear power plant for an additional 20 years. It evaluates 92 environmental issues using the NRC's three-level standard of significance—SMALL, MODERATE, or LARGE—developed using the Council on Environmental Quality guidelines. The following definitions of the three significance levels are set forth in footnotes to Table B-1 of 10 CFR Part 51, Subpart A, Appendix B:

> SMALL—Environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource.

MODERATE—Environmental effects are sufficient to alter noticeably, but not to destabilize, important attributes of the resource.

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

For 69 of the 92 issues considered in the GEIS, the analysis in the GEIS reached the following conclusions:

(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 not likely to be sufficiently beneficial to warrant implementation.

These 69 issues were identified in the GEIS as Category 1 issues. In the absence of new and significant information, the staff relied on conclusions as amplified by supporting information in the GEIS for issues designated as Category 1 in Table B-1 of 10 CFR Part 51, Subpart A, Appendix B.

Of the 23 issues that do not meet the criteria set forth above, 21 are classified as Category 2 issues requiring analysis in a plant-specific supplement to the GEIS. The remaining two issues, environmental justice and chronic effects of electromagnetic fields, were not categorized. Environmental justice was not evaluated on a generic basis and must be addressed in a plant-specific supplement to the GEIS. Information on the chronic effects of electromagnetic fields was not conclusive at the time the GEIS was prepared.

This draft SEIS documents the staff's consideration of all 92 environmental issues identified in the GEIS. The staff considered the environmental impacts associated with alternatives to license renewal and compared the environmental impacts of license renewal and the alternatives. The alternatives to license renewal that were considered include the no-action alternative (not renewing the OL for Monticello) and alternative methods of power generation. Based on projections made by the U.S. Department of Energy's Energy Information Administration (DOE/EIA), gas- and coal-fired generation appear to be the most likely power-generation alternatives if the power from Monticello is replaced. These alternatives are evaluated assuming that the replacement power generation plant is located at either the Monticello site or some other unspecified alternate location.

NMC and the staff have established independent processes for identifying and evaluating the significance of any new information on the environmental impacts of license renewal. Neither NMC nor the staff has identified information that is both new and significant related to Category 1 issues that would call into question the conclusions in the GEIS. Similarly, neither the scoping process nor the staff has identified any new issue applicable to Monticello that has a significant environmental impact. Therefore, the staff relies upon the conclusions of the GEIS for all of the Category 1 issues that are applicable to Monticello.

NMC's license renewal application presents an analysis of the Category 2 issues plus environmental justice and chronic effects from electromagnetic fields. The staff has reviewed the NMC analysis for each issue and has conducted an independent review of each issue. Three Category 2 issues are not applicable, because they are related to plant design features or site characteristics not found at Monticello. Four Category 2 issues are not discussed in this draft SEIS, because they are specifically related to refurbishment. NMC has stated that its evaluation of structures and components, as required by 10 CFR 54.21, did not identify any major plant refurbishment activities or modifications as necessary to support the continued operation of Monticello for the license renewal period. In addition, any replacement of components or additional inspection activities are within the bounds of normal plant operation, and are not expected to affect the environment outside of the bounds of the plant operations evaluated in the U.S. Atomic Energy Commission's 1972 *Final Environmental Statement Related to Operation of Monticello Plant*.

Fourteen Category 2 issues related to operational impacts and postulated accidents during the renewal term, as well as environmental justice and chronic effects of electromagnetic fields, are discussed in this draft SEIS. Five of the Category 2 issues and environmental justice apply to both refurbishment and to operation during the renewal term and are only discussed in this draft SEIS in relation to operation during the renewal term. For all 14 Category 2 issues and environmental justice, the staff concludes that the potential environmental effects are of SMALL significance in the context of the standards set forth in the GEIS. In addition, the staff determined that appropriate Federal health agencies have not reached a consensus on the existence of chronic adverse effects from electromagnetic fields. Therefore, no further evaluation of this issue is required. For severe accident mitigation alternatives (SAMAs), the staff concludes that a reasonable, comprehensive effort was made to identify and evaluate SAMAs. Based on its review of the SAMAs for Monticello, and the plant improvements already made, the staff concludes that one of the candidate SAMAs is potentially cost-beneficial. However, this SAMA does not relate to adequately managing the effects of aging during the period of extended operation. Therefore, it does not need to be implemented as part of license renewal pursuant to 10 CFR Part 54.

Mitigation measures were considered for each Category 2 issue. Current measures to mitigate the environmental impacts of plant operation were found to be adequate, and no additional mitigation measures were deemed sufficiently beneficial to be warranted.

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.

If the Monticello operating license is not renewed and the unit ceases operation on or before the expiration of the current operating license, then the adverse impacts of likely alternatives will not be smaller than those associated with continued operation of Monticello. The impacts may, in fact, be greater in some areas.

The preliminary recommendation of the NRC staff is that the Commission determine that the adverse environmental impacts of license renewal for Monticello are not so great that preserving the option of license renewal for energy planning decisionmakers would be unreasonable. This recommendation is based on (1) the analysis and findings in the GEIS; (2) the ER submitted by NMC; (3) consultation with other Federal, State, and local agencies; (4) the staff's own independent review; and (5) the staff's consideration of public comments received during the scoping process.

Abbreviations/Acronyms

°	degree
µCi	microcurie(s)
µCi/mL	microcurie(s) per milliliter
µm	micrometer(s) (microns)
ac	acre(s)
AC	alternating current
ACC	averted cleanup and decontamination costs
ADAMS	NRC documents access and management system
AEC	U.S. Atomic Energy Commission
ALARA	as low as reasonably achievable
AOC	present value of averted offsite property damage costs
AOE	present value of averted occupational exposure
AOSC	present value of averted onsite costs
APE	present value of averted public exposure
ASDS	automatic (or alternate) shutdown system
B.C.	before the common era
BTU	British thermal unit(s)
BTU/kWh	British thermal unit(s) per kilowatt-hour
BWR	boiling water reactor
BWROG	boiling water reactor owners group
CAIR	Clean Air Interstate Rule
CDF	core damage frequency
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
cfs	cubic feet per second
Ci	curie(s)
CO	carbon monoxide
CO_2	carbon dioxide
COE	cost of enhancement
CRD	control rod drive
CST	condensate storage tank
CT	combustion turbine
CWA	Clean Water Act
DBA	design-basis accident
dc	direct current

DOE	U.S. Department of Energy
DOI	U.S. Department of the Interior
DOT	U.S. Department of Transportation
DSM	demand-side management
EDG	emergency diesel generator
EIA	Energy Information Administration (of DOE)
EIS	environmental impact statement
ELF-EMF	extremely low frequency electromagnetic field
EPA	U.S. Environmental Protection Agency
EPRI	Electric Power Research Institute
ER	Environmental Report
ESW	emergency service water
F	Fahrenheit
FES	final environmental statement
FIVE	fire-induced vulnerability evaluation
FPS	fire protection system
FR	Federal Register
FSAR	final safety analysis report
FSW	fire service water
ft	foot/feet
ft/s	foot/feet per second
ft^3	cubic foot/feet
ft^3/s	cubic foot/feet per second
FWS	U.S. Fish and Wildlife Service
GEIS	*Generic Environmental Impact Statement for License Renewal of Nuclear Plants*, NUREG-1437
GL	generic letter
gpd	gallons per day
gpm	gallons per minute
GWh	gigawatt-hours
HLW	high-level waste
HPCI	high-pressure coolant injection
hr	hour(s)
HRSG	heat recovery steam generator
Hp	horsepower
Hz	hertz

in.	inch(es)
IPE	individual plant examination
IPEEE	individual plant examination of external events
J	joule(s)
kV	kilovolt(s)
kW	kilowatt(s)
kWh	kilowatt hour(s)
lb	pound
lb/MWh	pound(s) per megawatt-hour
LLW	low-level waste
LOS	level of service
MAAP	modular accident analysis program
mA	milliampere(s)
MACCS2	MELCOR Accident Consequence Code System 2
MAPP	Mid-Continent Area Power Pool
MCBS	Minnesota County Biological Survey
MDC	Minnesota Department of Commerce
MDEED	Minnesota Department of Employment and Economic Development
MDOT	Minnesota Department of Transportation
mi	mile(s)
mi^2	square mile(s)
mL	milliliter(s)
MMACR	modified maximum averted cost-risk
MNDNR	Minnesota Department of Natural Resources
MNSHPO	Minnesota State Historic Preservation Office
MOU	Memorandum of Understanding
mph	miles per hour
MPCA	Minnesota Pollution Control Agency
MPSDC	Minnesota Planning State Demographic Center
MPUC	Minnesota Public Utilities Commission
mrem	millirem(s)
mrem/yr	millirem(s) per year
MSA	metropolitan statistical area
mSv	millisievert(s)
mSv/yr	millisievert(s) per year
MTED	Minnesota Trade and Economic Development
MTHM	metric tons of heavy metal (a conventional unit for high-level nuclear waste)

MTU	metric ton(s) uranium
MW	megawatt(s)
MWd	megawatt-days
MWd/MTU	megawatt-days per metric ton(s) uranium
MW(e)	megawatt(s) electric
MW(t)	megawatt(s) thermal
MWh	megawatt hour(s)
N/A	not applicable
NAAQS	National Ambient Air Quality Standards
NAS	National Academy of Sciences
NEPA	National Environmental Policy Act of 1969
NESC	National Electrical Safety Code
ng/J	nanogram(s) per joule
NHPA	National Historic Preservation Act
NIEHS	National Institute of Environmental Health Sciences
NMC	Nuclear Management Company
NO_2	nitrogen dioxide
NO_x	nitrogen oxide(s)
NPDES	National Pollutant Discharge Elimination System
NPSH	net positive suction head
NRC	U.S. Nuclear Regulatory Commission
NRHP	National Register of Historic Places
NSP	Northern States Power Company
ODCM	Offsite Dose Calculation Manual
OL	operating license
PARS	publically available records
PCB	polychlorinated biphenyl
pCi/L	picocuries per liter
PIO	Public Information Officer
PM_{10}	particulate matter, 10 microns or less in diameter
ppm	parts per million
PRA	probabilistic risk analysis
PSA	probabilistic safety assessment
PSD	prevention of significant deterioration
RAI	request for additional information
RCIC	reactor core isolation cooling
RCRA	Resource Conservation and Recovery Act

RDS	rapid dewatering system
rem	roentgen equivalent man, equal to 0.01 sievert
REMP	radiological environmental monitoring program
RHR	residual heat removal
RM	river mile(s)
ROW	right-of-way
RPC	replacement power costs
SAMA	severe accident mitigation alternative
SAR	safety analysis report
SBO	station blackout
scfm	standard cubic feet per minute
SCR	selective catalytic reduction
SEIS	supplemental environmental impact statement
SER	safety evaluation report
SHPO	State Historic Preservation Officer
SMITTR	surveillance, monitoring, inspections, testing, trending, and record keeping
SO_2	sulfur dioxide
SO_x	sulfur oxide(s)
SRV	safety/relief valve
Sv	sievert(s) (special unit of dose equivalent)
SW	service water
TB	turbine building
TVA	Tennessee Valley Authority
U.S.	United States
USAR	updated safety analysis report
USC	United States Code
USCB	U.S. Census Bureau
USDA	U.S. Department of Agriculture
USGS	U.S. Geological Survey
USI	unresolved safety issue
V	volt(s)
WMD	Wetland Management District
yr	year

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. Use of 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 southern 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

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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.

action to renew the Monticello OL, (3) discuss the purpose and need for the proposed action, 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 draft 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 preliminary recommendation with respect to the proposed license renewal action.

Additional information is included in appendixes. Appendix A contains public comments related to the environmental review for license renewal and staff responses to those 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
- 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, 21 qualified as Category 2 issues, and 2 issues (environmental justice and chronic effects of electromagnetic fields) were not categorized. Environmental justice was not evaluated on a generic basis and must be addressed in a plant-specific supplement to the GEIS. 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 and 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 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 to ensure that 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 draft SEIS sections where the analysis is presented. The draft SEIS sections that discuss 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. Comments that are applicable to this environmental review are 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.

This draft 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.

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

1.3 The Proposed Federal Action

The proposed Federal action is renewal of the OL for Monticello. Monticello is located in southeastern 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.

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. 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 southeastern 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 north 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.

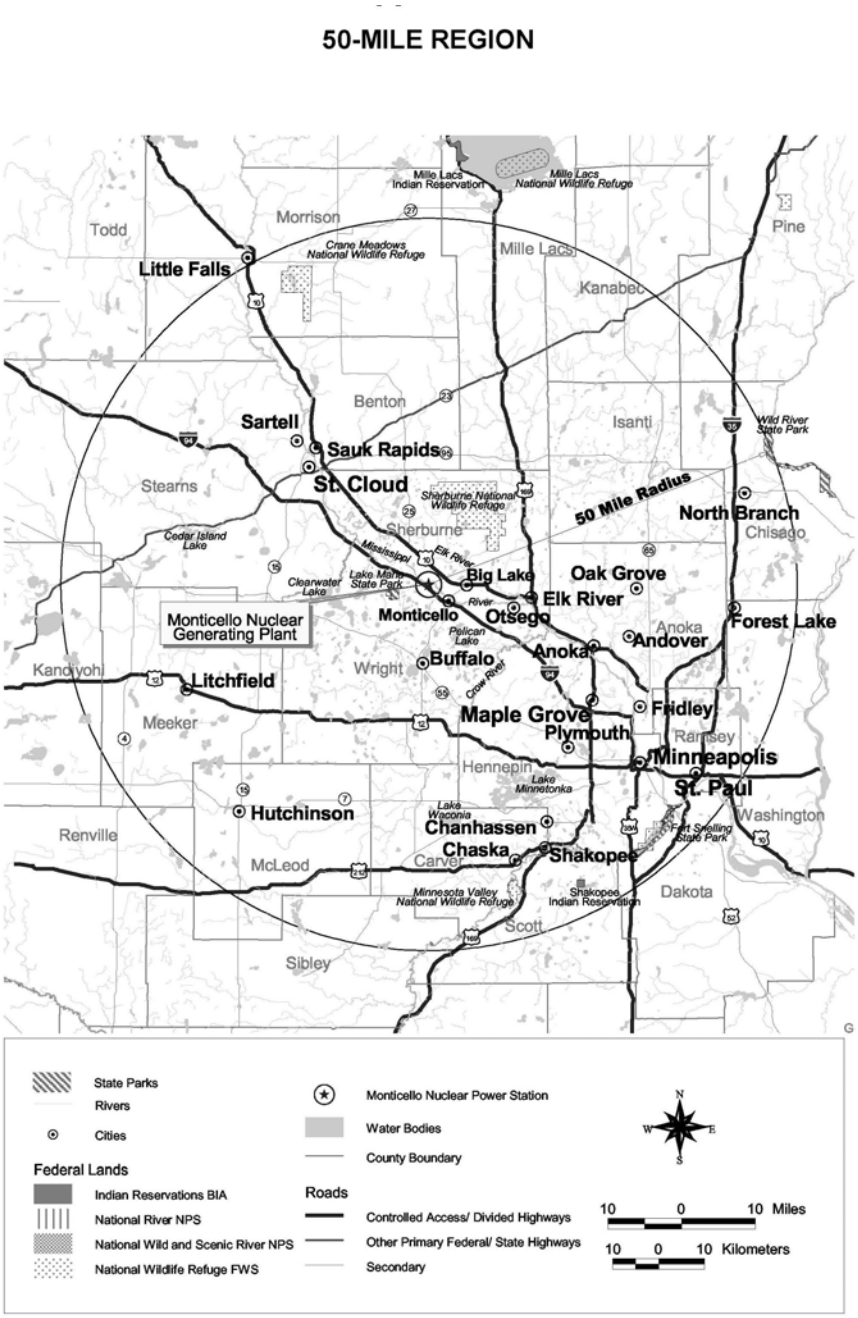

Figure 2-1. Location of Monticello, 50-mi Region

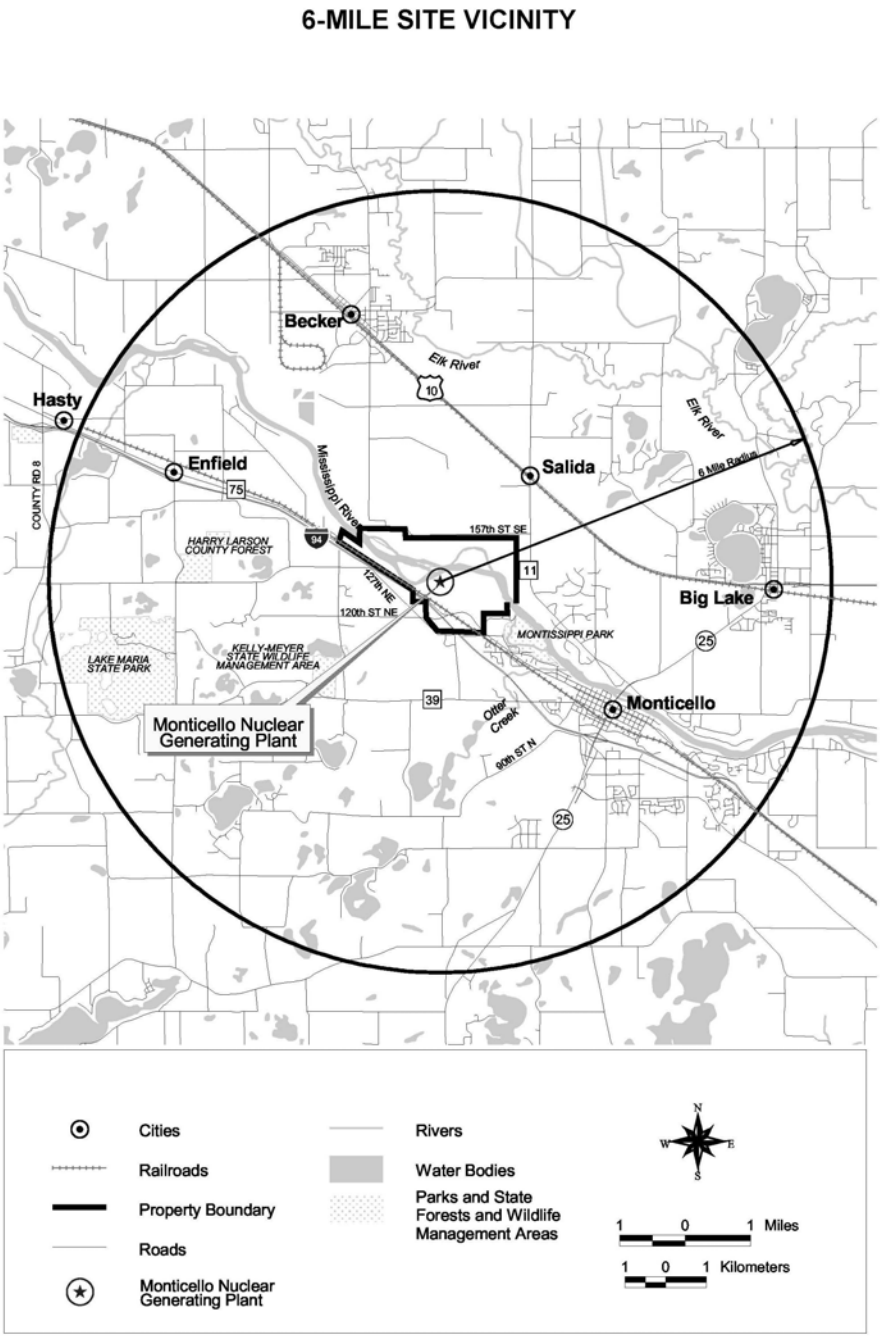

Figure 2-2. Location of Monticello, 6-mi Region

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, and fuel 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. Four 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.

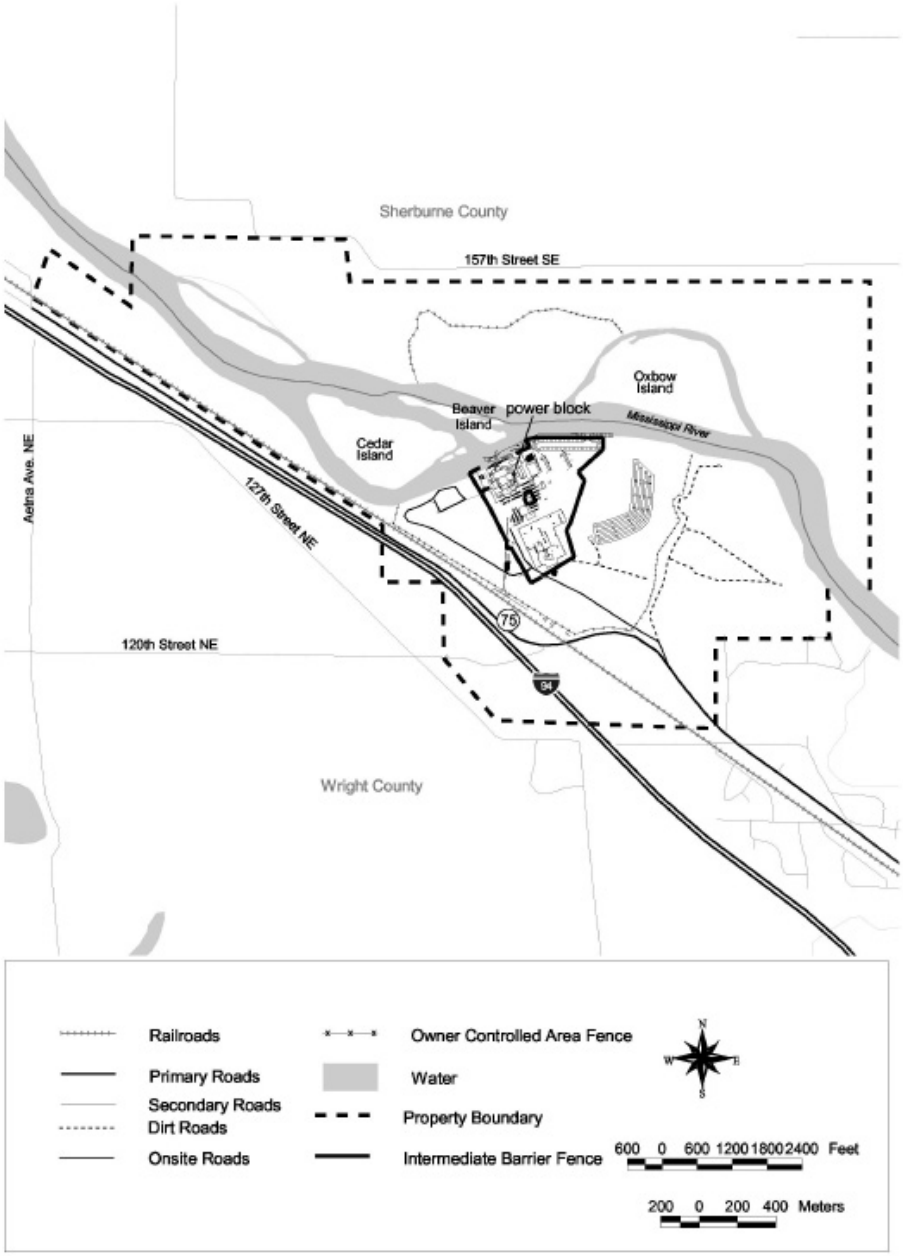

Figure 2-3. Monticello Site Powerblock Area

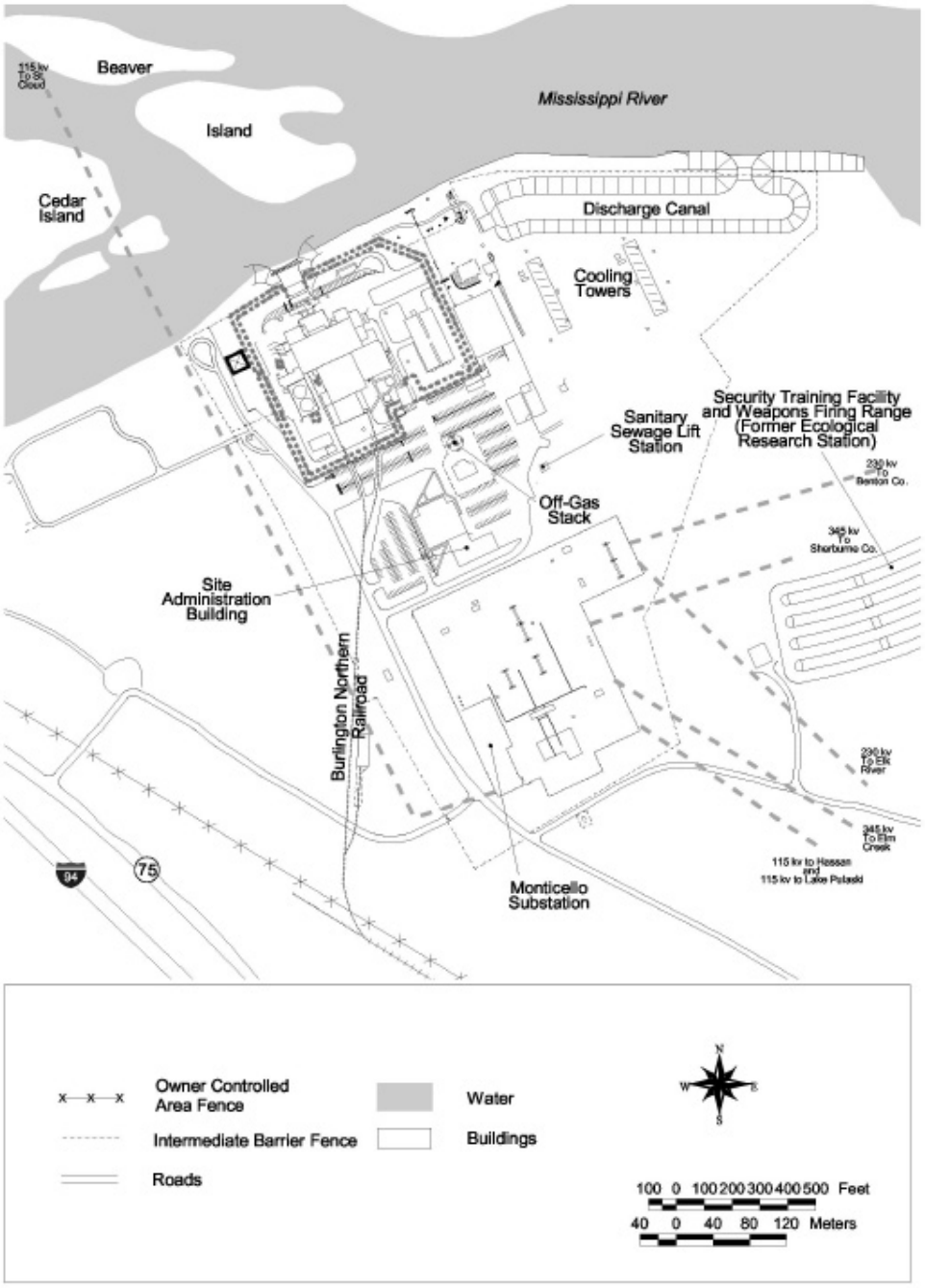

Figure 2-4. Monticello Cooling and Auxiliary Water System

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. Two of 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 if suspended ice is present on the river.

Four 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. The other two wells provide additional domestic water as needed.

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. There are no releases of liquid radioactive wastes to the Mississippi River.

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 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.

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. 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.

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, the total fission and activation gas activity released was 1371 Ci; iodine-131 was 1.5×10^{-3} Ci; particulates were 1.2×10^{-3} Ci; and tritium was 16.2 Ci. 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.

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 24-month interval. 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 Parker 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-Parker Lake line in 1996 (NMC 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).

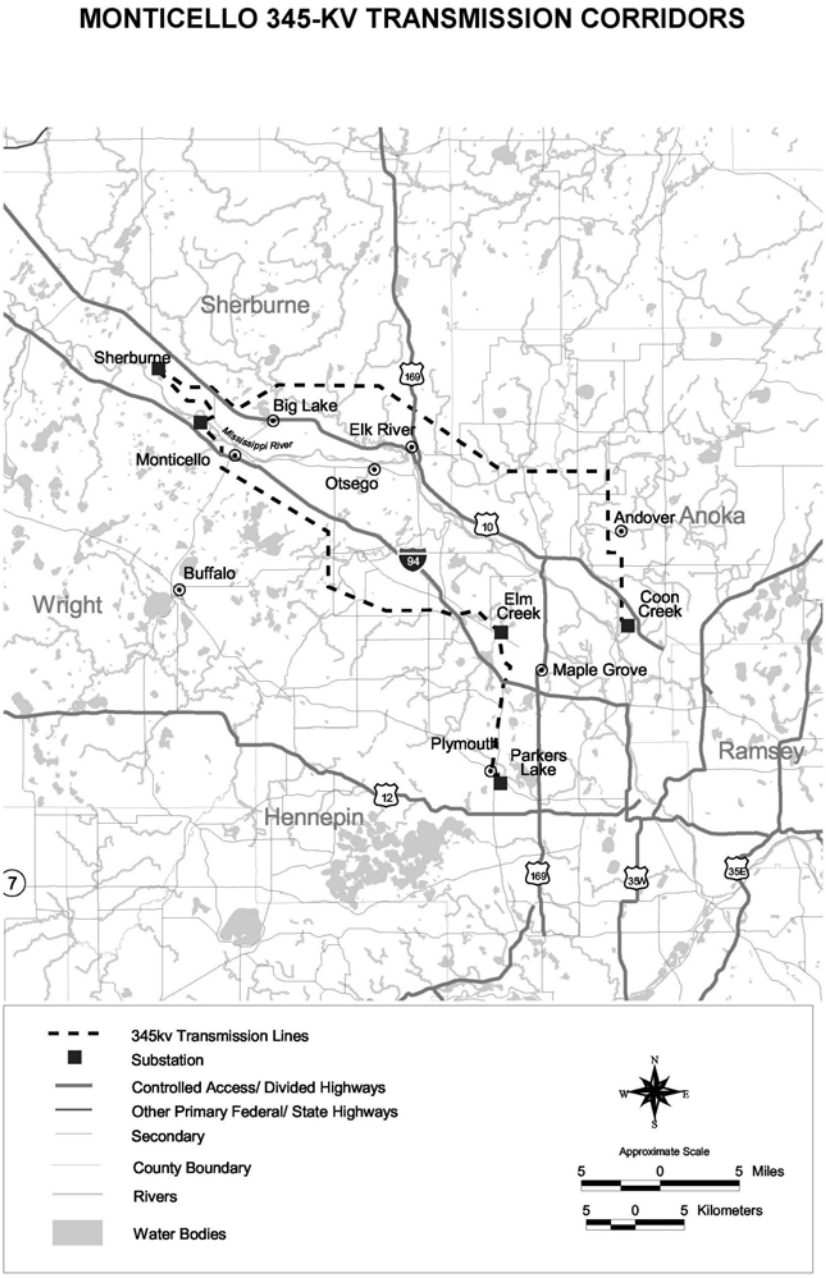

Figure 2-5. Monticello Transmission Lines

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

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.

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.

Table 2-2. (contd)

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.

Four 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. The other two wells, each equipped with a 45-gpm pump, provide additional domestic water to a warehouse and the site administration building. 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.

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.

Description of Site and Environment

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. EO 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 71ºF, 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 fontinglis 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 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). To date, populations of the zebra mussel within the Mississippi River have not been found 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). Similarly, the Asiatic clam *(Corbicula fluminea*), another invasive mollusc species that can cause condenser tube clogging problems, has not been found above the Twin Cities area of the Mississippi River (Siteman 2003).

Few Federally or State-listed aquatic species (see Table 2-3) 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 and Endangered Aquatic Species Potentially Occurring in the Vicinity of Monticello and the Associated Transmission Corridors

		Status[a]	
Scientific Name	**Common Name**	**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).

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

Table 2-4. (contd)

General Location	Communities	Site Biodiversity Significance
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

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

		Status[a]	
Scientific Name	**Common Name**	**Minnesota**	**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 Monticello effects 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 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 limit 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 limit 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 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.

NSP 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. Housing Units and Housing Units Vacant (Available) by County During 1990 and 2000

	1990	2000	Approximate Percentage Change
WRIGHT COUNTY			
Housing Units	26,353	34,355	30
Occupied Units	23,013	31,465	37
Vacant Units	3,340	2,890	–14
SHERBURNE COUNTY			
Housing Units	14,964	22,827	53
Occupied Units	13,643	21,581	58
Vacant Units	1,321	1,246	–6
Sources: USCB 1990, 2000b			

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.

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	0.60

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	22,600
State Highway 25 from I-94 south 6.6 mi	14,200
I-94 east of Highway 24	39,000
I-94 adjacent to the Monticello site	4,800
I-94 in the City of Monticello	45,400
State Highway 24 from I-94 south	5,500
Wright County Road 8 north of I-94	1,700
Wright County Road 8 south of I-94	1,500
Wright County Road 75 south of State Highway 24	1,850
Wright County Road 75 in vicinity of Enfield	1,050

Table 2-8. (contd)

Roadway and Location	Annual Average Daily Traffic
SHERBURNE COUNTY	
State Highway 24 bridge to Wright County Road 52	15,500
State Highway 24 from Wright County Road 52 to State Highway 10	12,800
Highway 25 bridge	31,300
Highway 25 north of bridge 0.5 mi	16,200

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	242,280	52
Residential (urban or rural)	73,890	16
Forest	63,740	14
Water bodies	29,600	6
Pasture and open land	28,360	6
Marsh/wetland	17,170	4
Urban and misc.	7,680	2
Total	462,720	100

Source: Wright County 1988

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

Land Use	Acres	Percent of Total
Residential	14,440	5
Commercial/industrial	1,240	0.5
Incorporated areas	39,990	13.5
Agriculture	73,700	26
Open lands designated for environmental protection and not available for development	34,100	12
Open lands available for development	122,530	43
Total	286,000	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 off-gas stack that is 328 ft high 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	38,933	---	18,344	---
1980	58,681	4.19	29,908	5.01
1990	68,710	1.59	41,945	3.44
2000	89,986	2.73	64,417	4.38
2010	109,700	2.00	86,320	2.97
2020	126,420	1.43	105,620	2.04
2030	139,020	0.95	121,920	1.45
2040	152,876	0.95	140,736	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	

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	46,199,186	3,201,300	6.9
1999	48,271,892	2,915,700	6.0
2000	51,180,648	2,834,800	5.5
2001	56,286,501	2,692,600	4.8
2002	59,680,999	2,019,300	3.4
		CITY OF MONTICELLO[b]	
1998	9,395,052	2,803,500	29.8
1999	9,639,772	3,222,200	33.4
2000	12,320,300	3,166,500	25.7
2001	12,463,189	3,145,300	25.2
2002	13,782,998	3,384,700	24.6
		SCHOOL DISTRICT 882[b]	
1998	N/A	6,222,300	N/A
1999	28,056,186	5,725,500	20.4
2000	30,032,343	5,425,700	18.1
2001	33,301,451	5,445,300	16.4
2002	35,555,509	1,856,200	5.2
		STATE GENERAL TAX[b]	
2002	12,211,949,000	691,600	< 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.

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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.

[(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. The Nuclear Management Company (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 license. Therefore, refurbishment is not considered in this draft 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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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.

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 plant. 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

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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.

Category 2 issues that are not applicable to Monticello because 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). 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, or its evaluation of other available information. 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.

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

Table 4-1. (contd)

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

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, or its evaluation of other available information. 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.

Environmental Impacts of Operation

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, or its evaluation of other available information. 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, or its evaluation of other available information. 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, or its evaluation of other available information, including plant monitoring data and technical reports. 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, or its evaluation of other available information, including the National Pollutant Discharge Elimination System (NPDES) permit for Monticello. 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, or its evaluation of other available information, including the NPDES permit for Monticello and the Sanitary Sewer Wastewater Discharge Agreement. 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, or its evaluation of other available information, including the NPDES permit for Monticello. 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, or its evaluation of other available information, including the NPDES permit and the Surface Water Appropriations Permit. 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, or its evaluation of available information. 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, or its evaluation of other available information. 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, or its evaluation of other available information. 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, or its evaluation of other available

information. 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, or its evaluation of other available information. 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, or its evaluation of other available information. 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, or its evaluation of other available information. 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, or its evaluation of other available information. 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, or its evaluation of other available information. 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, or its evaluation of other available information. 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, or its evaluation of other available information. 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, or its evaluation of other available information. 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, or its evaluation of other available information. 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, or its evaluation of other available information. 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, or its evaluation of other available information. 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, or its evaluation of other available information. 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, or its evaluation of other available information. 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, or its evaluation of other available information. 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, staff expects that mitigation measures in place at Monticello (e.g., ability to use the cooling towers as needed during low river flows) 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 81º 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 41.6ºF; 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 55.0ºF or higher or when the change in temperature was 59.4ºF (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 81º 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 50ºF. 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 2,952 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), 7,385 silver redhorse (18.6 percent); 3,381 logperch (8.5 percent); 2,506 common carp (6.3 percent); 2,254 black crappie (5.7 percent); 2,121 white sucker (5.3 percent); and 1,799 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: 1,820 shorthead redhorse; 635 silver redhorse; 3,381 logperch; 215 common carp; 230 black crappie; 252 white sucker; and 1,799 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 in the early life stages into the cooling water intake system 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: 95ºF from April through October; 85ºF in November and March; and 80ºF 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 68ºF 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 49.7ºF while the discharge canal temperature was 77.9ºF. In 2003, these temperatures were 50.9ºF and 78.2ºF, respectively (Xcel Energy 2004). In winter, when ambient river temperatures were near freezing (32ºF), the discharge temperatures generally ranged between 70 and 75ºF; whereas in summer when ambient river temperatures range from approximately 70 to 80ºF, the discharge temperatures ranged from approximately 84 to 91ºF (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 9ºF plume is considered the immediate discharge zone, while the 3ºF plume is considered the intermediate discharge zone (Afzal et al. 1975). During approximately 70 percent of the period from June through September, the 9ºF 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 95ºF, but avoided the canal when temperatures reached 104ºF. 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 3ºF 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 the Draft 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 preliminary 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 176ºF, with maximum growth occurring between 122 and 140ºF. 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 106ºF or higher, but this organism is rarely found in water cooler than 95ºF 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 32ºF) in the winter to 83ºF 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 91ºF. Additionally, the plant's NPDES permit limits the maximum daily average temperature at the end of the discharge canal to 95ºF, 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 (NMC 2005a), the staff's site visit, the scoping process, or its evaluation of other available information. 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.

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

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.

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), or its evaluation of other information. 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, or its evaluation of other information. 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, or its evaluation of other information. 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, or its evaluation of other information. 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.

Environmental Impacts of Operation

- 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, or its evaluation of other information. 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, or its evaluation of other information. 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, or its evaluation of other information. 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, which 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 120ºF 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 212ºF, 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, or its evaluation of other available information. 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, or its evaluation of other available information. 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, or its evaluation of other available information. 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, or its evaluation of other available information. 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	4.7.3; 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, or its evaluation of other available information. 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, or its evaluation of other available information. 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.

Environmental Impacts of Operation

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, or its evaluation of other available information. 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, or its evaluation of other available information. 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.

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.

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.

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).

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 related to 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 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 analysis. The staff concluded 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, 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 SHPO (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 will be 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 SHPO will be notified and consulted in developing any response needed to address the discovery.

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 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 ands low-income populations within 50 mi of the site, employing the 2000 census for low-income and

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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 (USCB 2001).

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.

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, or its evaluation

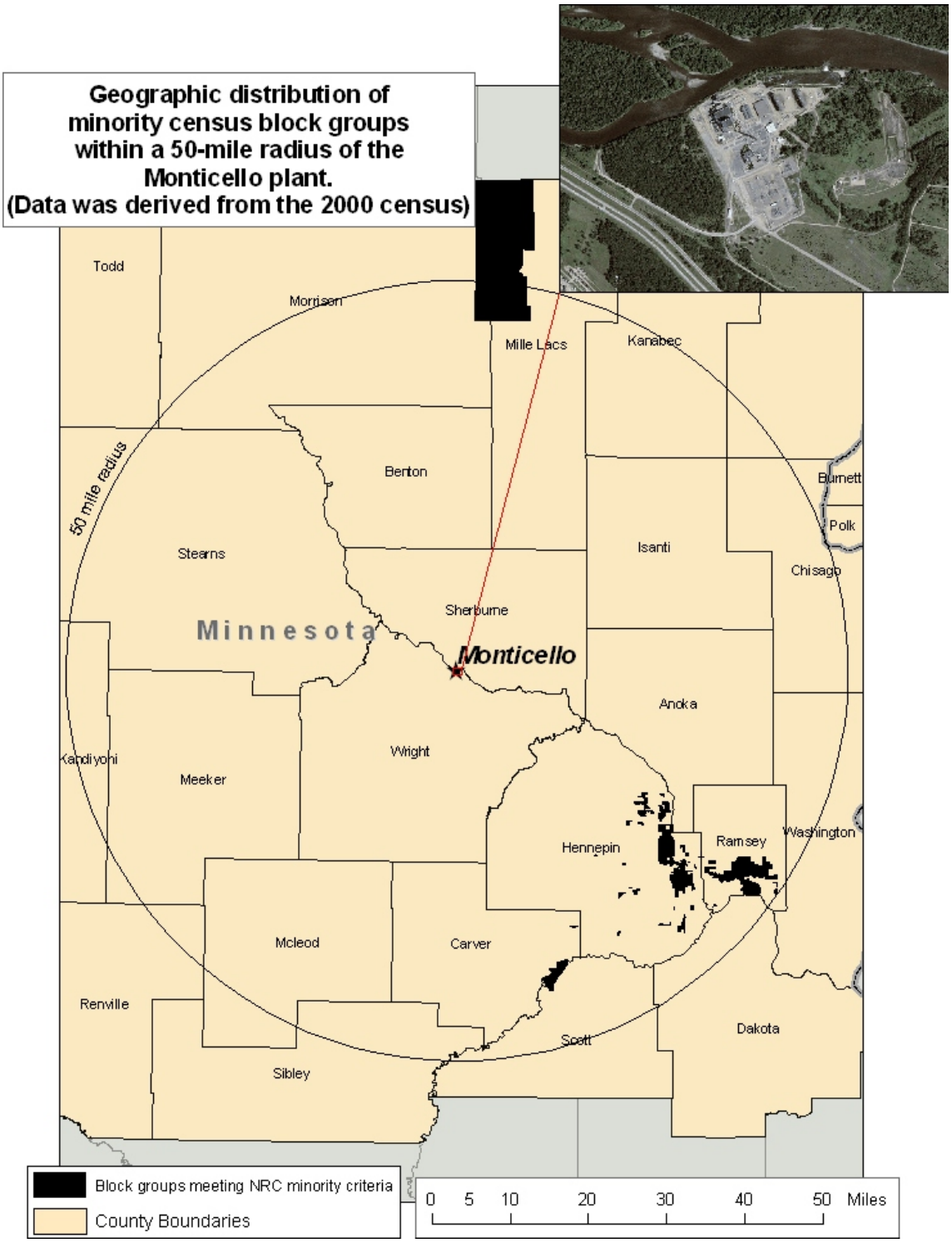

Figure 4-1. Geographic Distribution of Minority Populations (Shown in Shaded Areas) Within 50 mi of Monticello Based on Census Block Group Data

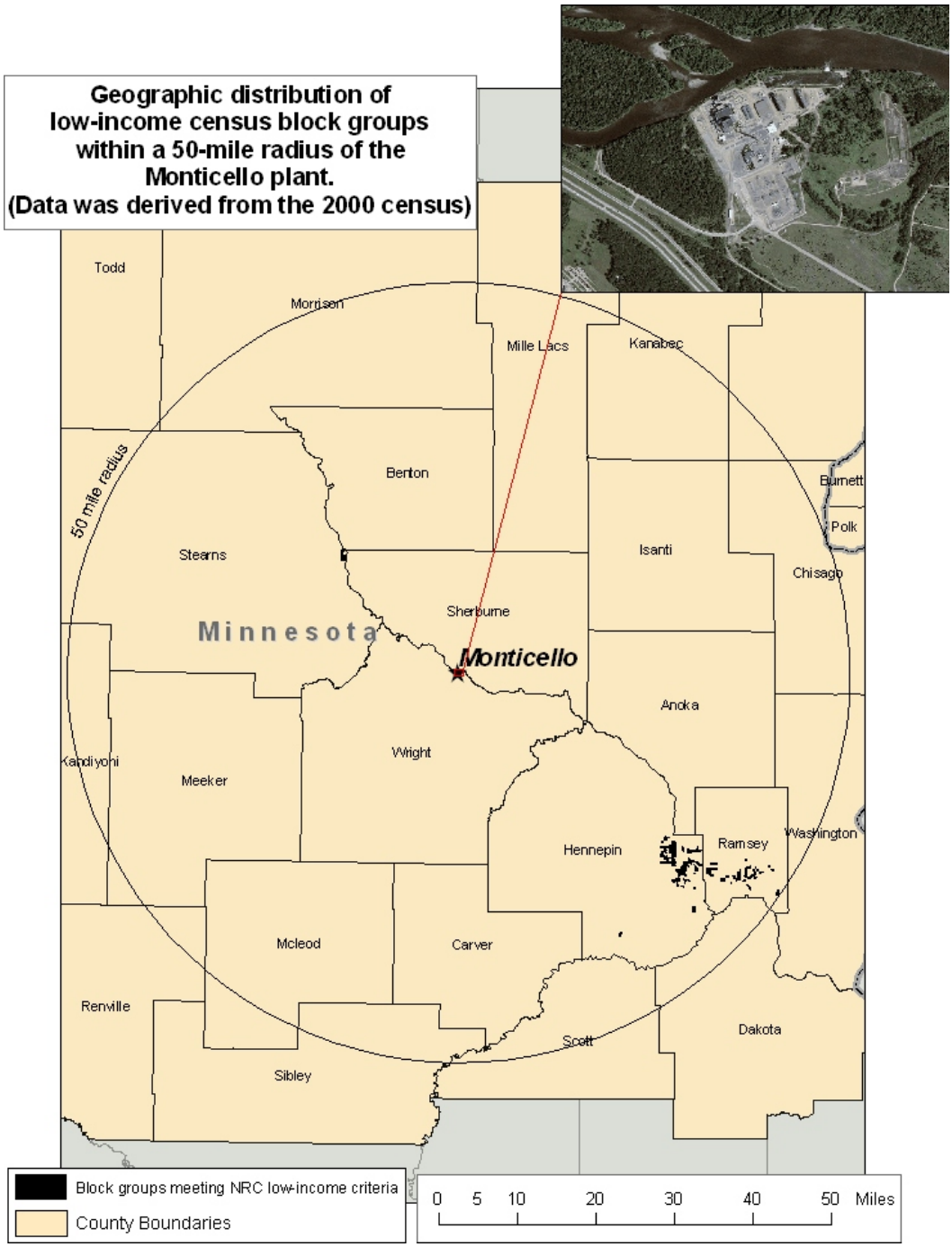

Figure 4-2. Geographic Distribution of Low-Income Populations (Shown in Shaded Areas) Within 50 mi of Monticello Based on Census Block Group Data

of other available information. 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, or its evaluation of other available information. 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. 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 and MNDNR 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 plant operation. 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.

Continued operation and maintenance of these transmission corridors are not likely to contribute to a regional decline in wildlife, aquatic biota, and habitat resources.

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. Two other remote wells have annual usage of 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 Shelburne counties. No Federally designated candidate species, nor critical habitat for any threatened or endangered species 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 an there is little or no likelihood of any impact during the renewal period the contributions to cumulative impacts to Federally listed threatened or endangered 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's preliminary determination is 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, or its evaluation of other available information. 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 staff did evaluate existing impact assessments performed by NRC and by the industry at 44 nuclear plants in the United States and concluded that the risk from sabotage and beyond design basis earthquakes at existing nuclear power plants is SMALL. Additionally, the staff concluded that the risks from other external events are adequately addressed by a generic consideration of internally initiated severe 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, or its evaluation of other available information. 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 (6 to 24 hours following event initiation) and early time frame (less than 6 hours following event initiation) 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	**38.0**	**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."

Northern States Power Company (NSP). 1992. Letter from Thomas M. Parker, NSP, to U.S. NRC Document Control Desk. Subject: "Monticello Nuclear Generating Plant, Docket No. 50-263, License No. DPR-22, Submittal of Monticello Individual Plant Examination (IPE) Report," February 27, 1992.

Northern States Power Company (NSP). 1995a. Letter from W.J. Hill, NSP, to U.S. NRC Document Control Desk. Subject: "Monticello Nuclear Generating Plant, Docket No. 50-263, License No. DPR-22, Submittal of Monticello Individual Plant Examination of External Events (IPEEE) Report," March 1, 1995.

Northern States Power Company (NSP). 1995b. Letter from W.J. Hill, NSP, to U.S. NRC Document Control Desk. Subject: "Monticello Nuclear Generating Plant, Docket No. 50-263, License No. DPR-22, Submittal of Monticello Individual Plant Examination of External Events (IPEEE) Report, Revision 1; Seismic Analysis, Revision 0, and Internal Firest Analysis, Revision 1 (TAC M83644)," November 20, 1995.

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. Letter from John T. Conway, NMC to U.S. NRC Document Control Desk. Subject: "Response to Request for Additional Information Regarding Severe Accident Mitigation Alternatives for the Monticello Nuclear Generating Plant (TAC MC6441)," July 27, 2005.

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U.S. Nuclear Regulatory Commission (NRC). 1997a. *Individual Plant Examination Program: Perspectives on Reactor Safety and Plant Performance*. NUREG-1560, Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 1997b. *Regulatory Analysis Technical Evaluation Handbook*. NUREG/BR-0184, 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. 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.

6.0 Environmental Impacts of the Uranium Fuel Cycle and Solid Waste Management

Environmental issues associated with the uranium fuel cycle and solid waste management 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) 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 not likely 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. There are no Category 2 issues for the uranium fuel cycle and solid waste management.

This chapter addresses the issues that are related to the uranium fuel cycle and solid waste management during the license 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 Monticello. The generic potential impacts of the radiological and nonradiological environmental impacts of the uranium fuel cycle and transportation of nuclear fuel and wastes are described in detail in the GEIS based, in part, on the generic impacts provided in 10 CFR 51.51(b), Table S-3, “Table of Uranium Fuel Cycle Environmental Data,” and in 10 CFR 51.52(c), Table S-4, “Environmental Impact of Transportation of Fuel and Waste to and from One Light-Water-Cooled Nuclear Power Reactor.” The staff also addresses the impacts from radon-222 and technetium-99 in the GEIS.

[(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.

6.1 The Uranium Fuel Cycle

Category 1 issues in 10 CFR Part 51, Subpart A, Appendix B, Table B-1 that are applicable to Monticello from the uranium fuel cycle and solid waste management are listed in Table 6-1.

Table 6-1. Category 1 Issues Applicable to the Uranium Fuel Cycle and Solid Waste Management During the Renewal Term

ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1	GEIS Sections
URANIUM FUEL CYCLE AND WASTE MANAGEMENT	
Offsite radiological impacts (individual effects from other than the disposal of spent fuel and high-level waste)	6.1; 6.2.1; 6.2.2.1; 6.2.2.3; 6.2.3; 6.2.4; 6.6
Offsite radiological impacts (collective effects)	6.1; 6.2.2.1; 6.2.3; 6.2.4; 6.6
Offsite radiological impacts (spent fuel and high-level waste disposal)	6.1; 6.2.2.1; 6.2.3; 6.2.4; 6.6
Nonradiological impacts of the uranium fuel cycle	6.1; 6.2.2.6; 6.2.2.7; 6.2.2.8; 6.2.2.9; 6.2.3; 6.2.4; 6.6
Low-level waste storage and disposal	6.1; 6.2.2.2; 6.4.2; 6.4.3; 6.4.3.1; 6.4.3.2; 6.4.3.3; 6.4.4; 6.4.4.1; 6.4.4.2; 6.4.4.3; 6.4.4.4; 6.4.4.5; 6.4.4.5.1; 6.4.4.5.2; 6.4.4.5.3; 6.4.4.5.4; 6.4.4.6; 6.6
Mixed waste storage and disposal	6.4.5.1; 6.4.5.2; 6.4.5.3; 6.4.5.4; 6.4.5.5; 6.4.5.6; 6.4.5.6.1; 6.4.5.6.2; 6.4.5.6.3; 6.4.5.6.4; 6.6
Onsite spent fuel	6.1; 6.4.6; 6.4.6.1; 6.4.6.2; 6.4.6.3; 6.4.6.4; 6.4.6.5; 6.4.6.6; 6.4.6.7; 6.6
Nonradiological waste	6.1; 6.5; 6.5.1; 6.5.2; 6.5.3; 6.6
Transportation	6.1; 6.3.1; 6.3.2.3; 6.3.3; 6.3.4; 6.6, Addendum 1

Nuclear Management Company (NMC) stated in its Environmental Report (ER) (NMC 2005) that it is not aware of any new and significant information associated with the renewal of the Monticello operating license (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, or its evaluation of other available information. 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 except for the collective offsite radiological impacts from the fuel cycle and from high-level waste and spent fuel

disposal, as discussed below, and that additional plant-specific mitigation measures are not likely to be sufficiently beneficial to be warranted.

A brief description of the staff review and the GEIS conclusions, as codified in Table B-1, 10 CFR Part 51, for each of these issues follows:

- Offsite radiological impacts (individual effects from other than the disposal of spent fuel and high-level waste). Based on information in the GEIS, the Commission found that

> Off-site impacts of the uranium fuel cycle have been considered by the Commission in Table S-3 of [10 CFR 51.51(b)]. Based on information in the GEIS, impacts on individuals from radioactive gaseous and liquid releases including radon-222 and technetium-99 are small.

The staff has not identified any new and significant information on this issue during its independent review of the NMC ER, the staff's site visit, the scoping process, or its evaluation of other available information. Therefore, the staff concludes that there are no offsite radiological impacts of the uranium fuel cycle during the renewal term beyond those discussed in the GEIS.

- Offsite radiological impacts (collective effects). In the GEIS, the staff found that

> The 100-year environmental dose commitment to the U.S. population from the fuel cycle, high level waste and spent fuel disposal excepted, is calculated to be about 14,800 person rem, or 12 cancer fatalities, for each additional 20-year power reactor operating term. Much of this, especially the contribution of radon releases from mines and tailing piles, consists of tiny doses summed over large populations. This same dose calculation can theoretically be extended to include many tiny doses over additional thousands of years as well as doses outside the U.S. The result of such a calculation would be thousands of cancer fatalities from the fuel cycle, but this result assumes that even tiny doses have some statistical adverse health effect which will not ever be mitigated (for example no cancer cure in the next thousand years), and that these doses projected over thousands of years are meaningful. However, these assumptions are questionable. In particular, science cannot rule out the possibility that there will be no cancer fatalities from these tiny doses. For perspective, the doses are very small fractions of regulatory limits, and even smaller fractions of natural background exposure to the same populations.
>
> Nevertheless, despite all the uncertainty, some judgement as to the regulatory National Environmental Policy Act (NEPA) implications of these matters should be made and it makes no sense to repeat the same judgement in every case. Even taking the uncertainties into account, the Commission concludes that these impacts are acceptable in that these impacts would not be sufficiently large to

> require the NEPA conclusion, for any plant, that the option of extended operation under 10 CFR Part 54 should be eliminated. Accordingly, while the Commission has not assigned a single level of significance for the collective effects of the fuel cycle, this issue is considered Category 1.

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, or its evaluation of other available information. Therefore, the staff concludes that there are no offsite radiological impacts (collective effects) from the uranium fuel cycle during the renewal term beyond those discussed in the GEIS.

- Offsite radiological impacts (spent fuel and high-level waste disposal). Based on information in the GEIS, the Commission found that

> For the high level waste and spent fuel disposal component of the fuel cycle, there are no current regulatory limits for offsite releases of radionuclides for the current candidate repository site. However, if we assume that limits are developed along the lines of the 1995 National Academy of Sciences (NAS) report, "Technical Bases for Yucca Mountain Standards," and that in accordance with the Commission's Waste Confidence Decision, 10 CFR 51.23, a repository can and likely will be developed at some site which will comply with such limits, peak doses to virtually all individuals will be 100 mrem per year or less. However, while the Commission has reasonable confidence that these assumptions will prove correct, there is considerable uncertainty since the limits are yet to be developed, no repository application has been completed or reviewed, and uncertainty is inherent in the models used to evaluate possible pathways to the human environment. The NAS report indicated that 100 mrem per year should be considered as a starting point for limits for individual doses, but notes that some measure of consensus exists among national and international bodies that the limits should be a fraction of the 100 mrem per year. The lifetime individual risk from 100 mrem annual dose limit is about 3×10^{-3}.
>
> Estimating cumulative doses to populations over thousands of years is more problematic. The likelihood and consequences of events that could seriously compromise the integrity of a deep geologic repository were evaluated by the U.S. Department of Energy in the "Final Environmental Impact Statement: Management of Commercially Generated Radioactive Waste" [DOE 1980]. The evaluation estimated the 70-year whole-body dose commitment to the maximum individual and to the regional population resulting from several modes of breaching a reference repository in the year of closure, after 1000 years, after 100,000 years, and after 100,000,000 years. Subsequently, the NRC and other Federal agencies have expended considerable effort to develop models for the design and for the licensing of a high level waste repository, especially for the candidate repository at Yucca Mountain. More meaningful estimates of doses to

population may be possible in the future as more is understood about the performance of the proposed Yucca Mountain repository. Such estimates would involve very great uncertainty, especially with respect to cumulative population doses over thousands of years. The standard proposed by the NAS is a limit on maximum individual dose. The relationship of potential new regulatory requirements, based on the NAS report, and cumulative population impacts has not been determined, although the report articulates the view that protection of individuals will adequately protect the population for a repository at Yucca Mountain. However, EPA's generic repository standards in 40 CFR Part 191 generally provide an indication of the order of magnitude of cumulative risk to population that could result from the licensing of a Yucca Mountain repository, assuming the ultimate standards will be within the range of standards now under consideration. The standards in 40 CFR Part 191 protect the population by imposing "containment requirements" that limit the cumulative amount of radioactive material released over 10,000 years. Reporting performance standards that will be required by EPA are expected to result in releases and associated health consequences in the range between 10 and 100 premature cancer deaths with an upper limit of 1000 premature cancer deaths worldwide for a 100,000 metric tonne (MTHM) repository.

Nevertheless, despite all the uncertainty, some judgement as to the regulatory NEPA implications of these matters should be made and it makes no sense to repeat the same judgement in every case. Even taking the uncertainties into account, the Commission concludes that these impacts are acceptable in that these impacts would not be sufficiently large to require the NEPA conclusion, for any plant, that the option of extended operation under 10 CFR Part 54 should be eliminated. Accordingly, while the Commission has not assigned a single level of significance for the impacts of spent fuel and high level waste disposal, this issue is considered Category 1.

Since the GEIS was originally issued in 1996, the EPA has published radiation protection standards for Yucca Mountain, Nevada in the *Federal Register* (EPA 2001). The Energy Policy Act of 1992, Public Law No. 102-486, § 801, 106 Stat. 2921 (1992) (codified at 42 USC 10141 note) directs that the NRC adopt these standards into its regulations for reviewing and licensing the proposed repository. The NRC promulgated its regulations on November 2, 2001 (NRC 2001). These standards include the following: (1) 0.15 mSv/yr (15 mrem/yr) dose limit for members of the public during the storage period prior to repository closure, (2) 0.15 mSv/yr (15 mrem/yr) dose limit for the reasonably maximally exposed individual for 10,000 years following disposal, (3) 0.15 mSv/yr (15 mrem/yr) dose limit for the reasonably maximally exposed individual as a result of a human intrusion at or before 10,000 years after disposal, and (4) a ground-water protection standard that states for 10,000 years of undisturbed performance after disposal, radioactivity in a representative volume of ground water will not exceed (a) 5 pCi/L (radium-226 and radium-228), (b)15 pCi/L (gross alpha activity), and (c) 0.04 mSv/yr (4

mrem/yr) to the whole body or any organ (from combined beta and photon emitting radionuclides).

On February 15, 2002, based on a recommendation by the Secretary of the Department of Energy, the President recommended the Yucca Mountain site for the development of a repository for the geologic disposal of spent nuclear fuel and high-level nuclear waste. The U.S. Congress approved this recommendation on July 9, 2002, in Joint Resolution 87, which designated Yucca Mountain as the repository for spent nuclear waste. On July 23, 2002, the President signed Joint Resolution 87 into law. Public Law 107-200, 116 Stat. 735 (2002) approved Yucca Mountain as the site for the development of a repository for the disposal of high-level radioactive waste and spent nuclear fuel. This development does not represent new and significant information with respect to the offsite radiological impacts from license renewal related to disposal of spent nuclear fuel and high-level nuclear waste.

EPA developed Yucca Mountain-specific repository standards, which were subsequently adopted by the NRC in 10 CFR Part 63. In an opinion, issued July 9, 2004, the U.S. Court of Appeals for the District of Columbia Circuit (the Court) vacated EPA's radiation protection standards for the candidate repository, which required compliance with certain dose limits over a 10,000 year period. *See Nuclear Energy Institute, Inc. v. EPA*, 373 F.3d 1251, 1273, 1299 (D.C. Cir. 2004). The Court's decision also vacated the compliance period in NRC's licensing criteria for the candidate repository in 10 CFR Part 63.

Therefore, for the high-level waste and spent fuel disposal component of the fuel cycle, there is some uncertainty with respect to regulatory limits for offsite releases of radioactive nuclides for the current candidate repository site. However, prior to promulgation of the affected provisions of the Commission's regulations, the staff assumed that limits would be developed along the lines of the 1995 National Academy of Sciences report, "Technical Bases for Yucca Mountain Standards," and that in accordance with the Commission's Waste Confidence Decision, 10 CFR 51.23, a repository that would comply with such limits could and likely would be developed at some site. Peak doses to virtually all individuals will be 1 mSv (100 mrem) per year or less.

Despite the current uncertainty with respect to the criteria that would ultimately apply to any license application for the proposed Yucca Mountain repository, some judgment as to the regulatory NEPA implications of offsite radiological impacts of spent fuel and high-level waste disposal should be made. The staff concludes that these impacts are acceptable in that the impacts would not be sufficiently large to require the NEPA conclusion that the option of extended operation under 10 CFR Part 54 should be eliminated.

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, or its evaluation of other available information. Therefore, the staff concludes that there are no offsite radiological impacts related to spent fuel and high-level waste disposal during the renewal term beyond those discussed in the GEIS.

- Nonradiological impacts of the uranium fuel cycle. Based on information in the GEIS, the Commission found that

> The nonradiological impacts of the uranium fuel cycle resulting from the renewal of an operating license for any plant are found to be small.

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, or its evaluation of other available information. Therefore, the staff concludes that there are no nonradiological impacts of the uranium fuel cycle during the renewal term beyond those discussed in the GEIS.

- Low-level waste storage and disposal. Based on information in the GEIS, the Commission found that

> The comprehensive regulatory controls that are in place and the low public doses being achieved at reactors ensure that the radiological impacts to the environment will remain small during the term of a renewed license. The maximum additional on-site land that may be required for low-level waste storage during the term of a renewed license and associated impacts will be small. Nonradiological impacts on air and water will be negligible. The radiological and nonradiological environmental impacts of long-term disposal of low-level waste from any individual plant at licensed sites are small. In addition, the Commission concludes that there is reasonable assurance that sufficient low-level waste disposal capacity will be made available when needed for facilities to be decommissioned consistent with NRC decommissioning requirements.

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, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts of low-level waste (LLW) storage and disposal associated with the renewal term beyond those discussed in the GEIS.

- Mixed waste storage and disposal. Based on information in the GEIS, the Commission found that

> The comprehensive regulatory controls and the facilities and procedures that are in place ensure proper handling and storage, as well as negligible doses and exposure to toxic materials for the public and the environment at all plants. License renewal will not increase the small, continuing risk to human health and the environment posed by mixed waste at all plants. The radiological and nonradiological environmental impacts of long-term disposal of mixed waste from any individual plant at licensed sites are small. In addition, the Commission concludes that there is reasonable assurance that sufficient mixed waste disposal capacity will be made available when needed for facilities to be decommissioned consistent with NRC decommissioning requirements.

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, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts of mixed waste storage and disposal associated with the renewal term beyond those discussed in the GEIS.

- Onsite spent fuel. Based on information in the GEIS, the Commission found that

> The expected increase in the volume of spent fuel from an additional 20 years of operation can be safely accommodated on site with small environmental effects through dry or pool storage at all plants if a permanent repository or monitored retrievable storage is not available.

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, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts of onsite spent fuel associated with license renewal beyond those discussed in the GEIS.

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

> No changes to generating systems are anticipated for license renewal. Facilities and procedures are in place to ensure continued proper handling and disposal at all plants.

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, or its evaluation of other available information. Therefore, the staff concludes that there are no nonradiological waste impacts during the renewal term beyond those discussed in the GEIS.

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

> The impacts of transporting spent fuel enriched up to 5 percent uranium-235 with average burnup for the peak rod to current levels approved by NRC up to 62,000 MWd/MTU and the cumulative impacts of transporting high-level waste to a single repository, such as Yucca Mountain, Nevada, are found to be consistent with the impact values contained in 10 CFR 51.52(c), Summary Table S-4 — Environmental Impact of Transportation of Fuel and Waste to and from One Light-Water-Cooled Nuclear Power Reactor. If fuel enrichment or burnup conditions are not met, the applicant must submit an assessment of the implications for the environmental impact values reported in § 51.52.

Monticello meets the fuel enrichment and burnup conditions set forth in Addendum 1 to the GEIS. 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, or its evaluation of other

available information. Therefore, the staff concludes that there are no impacts of transportation associated with license renewal beyond those discussed in the GEIS.

6.2 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."

10 CFR Part 63. Code of Federal Regulations, Title 10, *Energy,* Part 63, "Disposal of High-Level Radioactive Wastes in a Geologic Repository at Yucca Mountain, Nevada."

40 CFR Part 191. Code of Federal Regulations, Title 40, *Protection of Environment*, Part 191, "Environmental Radiation Protection Standards for Management and Disposal of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Waste."

Energy Policy Act of 1992, Public Law No. 102-486, § 801, 1069 Stat. 2921. (codified at 42 USC 10101 note).

National Academy of Sciences (NAS). 1995. *Technical Bases for Yucca Mountain Standards*. Washington, D.C.

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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, Final Report. NUREG-1437, Volume 1, Addendum 1, Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 2001. "Disposal of High-Level Radioactive Wastes in a Proposed Geological Repository at Yucca Mountain, Nevada." *Federal Register,* Vol. 66, No. 213, p. 55792. Washington, D.C. November 2, 2001.

7.0 Environmental Impacts of Decommissioning

Environmental impacts from the activities associated with the decommissioning of any reactor before or at the end of an initial or renewed license are evaluated in the *Generic Environmental Impact Statement for Decommissioning of Nuclear Facilities: Supplement 1, Regarding the Decommissioning of Nuclear Power Reactors*, NUREG-0586 (NRC 2002). The staff's evaluation of the environmental impacts of decommissioning presented in NUREG-0586, Supplement 1 identifies a range of impacts for each environmental issue.

The incremental environmental impacts associated with decommissioning activities resulting from continued plant operation 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 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) 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 of more of the criteria for Category 1, and therefore, additional plant-specific review of these issues is required. There are no Category 2 issues related to decommissioning.

[(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.

7.1 Decommissioning

Category 1 issues in Table B-1 of Title 10 of the *Code of Federal Regulations* (CFR) Part 51, Subpart A, Appendix B that are applicable to Monticello decommissioning following the renewal term are listed in Table 7-1. Nuclear Management Company (NMC) stated in its Environmental Report (ER) (NMC 2005) that it is aware of no new and significant information regarding the environmental impacts of Monticello license renewal. 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, or its evaluation of other available information. 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.

Table 7-1. Category 1 Issues Applicable to the Decommissioning of Monticello Following the Renewal Term

ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1	GEIS Sections
DECOMMISSIONING	
Radiation doses	7.3.1; 7.4
Waste management	7.3.2; 7.4
Air quality	7.3.3; 7.4
Water quality	7.3.4; 7.4
Ecological resources	7.3.5; 7.4
Socioeconomic impacts	7.3.7; 7.4

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

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

  > Doses to the public will be well below regulatory standards regardless of which decommissioning method is used. Occupational doses would increase no more than 1 man-rem [0.01 person-Sv] caused by buildup of long-lived radionuclides 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, or its evaluation of other available information. Therefore, the staff concludes that there are no radiation dose impacts associated with decommissioning following the license renewal term beyond those discussed in the GEIS.

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

> Decommissioning at the end of a 20-year license renewal period would generate no more solid wastes than at the end of the current license term. No increase in the quantities of Class C or greater than Class C wastes would be 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, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts from solid waste associated with decommissioning following the license renewal term beyond those discussed in the GEIS.

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

> Air quality impacts of decommissioning are expected to be negligible either at the end of the current operating term or at the end of 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, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts on air quality associated with decommissioning following the license renewal term beyond those discussed in the GEIS.

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

> The potential for significant water quality impacts from erosion or spills is no greater whether decommissioning occurs after a 20-year license renewal period or after the original 40-year operation period, and measures are readily available to avoid such impacts.

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, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts on water quality associated with decommissioning following the license renewal term beyond those discussed in the GEIS.

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

> Decommissioning either after the initial operating period or after a 20-year license renewal period is not likely to have any direct ecological impacts.

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, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts on ecological resources

associated with decommissioning following the license renewal term beyond those discussed in the GEIS.

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

> Decommissioning would have some short-term socioeconomic impacts. The impacts would not be increased by delaying decommissioning until the end of a 20-year relicense period, but they might be decreased by population and economic growth.

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, or its evaluation of other available information. Therefore, the staff concludes that there are no socioeconomic impacts associated with decommissioning following the license renewal term beyond those discussed in the GEIS.

7.2 References

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

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.

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). 2002. *Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities, Supplement 1, Regarding the Decommissioning of Nuclear Power Reactors*. NUREG-0586, Supplement 1, Vols. 1 and 2, Washington, D.C.

8.0 Environmental Impacts of Alternatives to License Renewal

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

> SMALL—Environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource.
>
> MODERATE—Environmental effects are sufficient to alter noticeably, but not to destabilize important attributes of the resource.
>
> LARGE—Environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource.

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

8.1 No-Action Alternative

NRC's regulations implementing the National Environmental Policy Act (NEPA) of 1969 specify that the no-action alternative be discussed in an NRC environmental impact statement (EIS), (see 10 CFR Part 51, Subpart A, Appendix A[4]). For license renewal, the no-action alternative refers to a scenario in which the NRC would not renew the Monticello OL. The Northern States Power Company (NSP) would then cease plant operations when the current license expires and initiate the decommissioning of the plant.

[(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.

NSP would be required to shut down Monticello and to comply with NRC decommissioning requirements in 10 CFR 50.82 whether or not the OL is renewed. If the Monticello OL is renewed, shutdown of the units and decommissioning activities will not be avoided, but will be postponed for up to an additional 20 years.

The environmental impacts associated with decommissioning following a license renewal period of up to 20 years or following the no-action alternative would be bounded by the discussion of impacts in Chapter 7 of the license renewal GEIS (NRC 1996), Chapter 7 of this supplemental environmental impact statement (SEIS), and the *Final Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities*, NUREG-0586, Supplement 1 (NRC 2002). The impacts of decommissioning after 60 years of operation are not expected to be significantly different from those occurring after 40 years of operation.

Impacts from the decision to permanently cease operations are not considered in NUREG-0586, Supplement 1.[(a)] Therefore, immediate impacts that occur between plant shutdown and the beginning of decommissioning are considered here. These impacts, which will occur when the unit permanently shuts down regardless of whether the license was to be renewed or not, are discussed below, with the results presented in Table 8-1. Plant shutdown will result in a net reduction in power production capacity. The power not generated by Monticello during the license renewal term would likely be replaced by (1) power purchased from other electricity providers, (2) generating alternatives other than Monticello, (3) demand-side management (DSM) and energy conservation, or (4) some combination of these options. The environmental impacts of these options are discussed in Section 8.2.

- **Land Use**

In Chapter 4, the staff concluded that the impacts on land use of continued plant operation during the renewal term would be SMALL. Onsite land use will not be affected immediately by the cessation of operations. Plant structures and other facilities are likely to remain in place until decommissioning. The transmission lines associated with the project would be expected to remain in service after the plant stops operating. As a result, maintenance of the transmission corridors will continue as before. Therefore, the staff concludes that the impacts on land use from plant shutdown would be SMALL.

(a) Appendix J of NUREG-0586 Supplement 1 discusses the socioeconomic impacts of plant closure, but the results of the analysis in Appendix J are not incorporated in the analysis presented in the main body of the NUREG.

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

Impact Category	Impact	Comment
Land Use	SMALL	Impacts are expected to be SMALL because plant shutdown is not expected to result in changes to onsite or offsite land use.
Ecology	SMALL	Impacts are expected to be SMALL because current aquatic impacts are SMALL. Terrestrial impacts are not expected because there will not be any land use changes.
Water Use and Quality—Surface Water	SMALL	Impacts are expected to be SMALL because surface water intake and discharges will decrease.
Water Use and Quality—Groundwater		Impacts are expected to be SMALL because groundwater use will decrease.
Air Quality	SMALL	Impacts are expected to be SMALL because releases related to plant operation and worker transportation will decrease.
Waste	SMALL	Impacts are expected to be SMALL because generation of high-level waste will end, and generation of low-level and mixed waste will decrease.
Human Health	SMALL	Impacts are expected to be SMALL because radiological doses to workers and members of the public, which are within regulatory limits, will be reduced.
Socioeconomics	SMALL to LARGE	Impacts are expected to be SMALL to LARGE because of a decrease in employment and tax revenues.
Socioeconomics (Transportation)	SMALL	Impacts are expected to be SMALL because the decrease in employment would reduce traffic.
Aesthetics	SMALL	Impacts are expected to be SMALL because plant structures will remain in place.
Historic and Archaeological Resources	SMALL	Impacts are expected to be SMALL because shutdown of the plant will not result in changes to onsite or offsite land use.
Environmental Justice	SMALL to LARGE	Impacts are expected to be SMALL to LARGE because loss of employment opportunities is expected.

- **Ecology**

In Chapter 4 of this SEIS, the NRC staff concluded that the ecological impacts of continued plant operation would be SMALL. Cessation of operations will be accompanied by a reduction in cooling water flow and the thermal plume from the plant. The environmental impacts to aquatic species, including threatened and endangered species, associated with these changes

are generally positive. The impact of plant closure on the terrestrial ecosystem will be negligible because the transmission lines to the plant will remain energized. Therefore, the staff concludes that ecological impacts from shutdown of the plant would be SMALL.

- **Water Use and Quality—Surface Water**

In Chapter 4 of this SEIS the NRC staff concluded that impacts of continued plant operation on surface water use and quality would be SMALL. When the plant stops operating there will be an immediate reduction in the consumptive use of water because of reduction in cooling water flow and in the amount of heat rejected to the Mississippi River. Therefore, the staff concludes that the impacts on surface water use and quality from plant shutdown would be SMALL.

- **Water Use and Quality—Groundwater**

In Chapter 4, the staff concluded that impacts of continued plant groundwater use on groundwater availability and quality would be SMALL. When the plant stops operating, there will be an immediate reduction in use of groundwater for makeup. In addition, there will be a gradual reduction in groundwater use for potable water as the plant staff decreases. Therefore, the staff concludes that groundwater use and quality impacts from shutdown of the plant would be SMALL.

- **Air Quality**

In Chapter 4, the staff found the impacts of continued plant operation on air quality would likely be SMALL. When the plant stops operating, there will be a reduction in emissions from activities related to plant operation, such as use of diesel generators and workers' transportation. Therefore, the staff concludes that the impact on air quality from shutdown of the plant would be SMALL.

- **Waste**

The impacts of waste generated by continued plant operation are discussed in Chapter 6. The impacts of low-level and mixed waste from plant operation are characterized as SMALL. When the plant stops operating, the plant will stop generating high-level waste, and generation of low-level and mixed waste associated with plant operation and maintenance will be reduced. Therefore, the staff concludes that the impact of waste generated after shutdown of the plant would be SMALL.

- **Human Health**

In Chapter 4 of this SEIS the NRC staff concluded that the impacts of continued plant operation on human health would be SMALL. After the cessation of operations the amount of radioactive material released to the environment in gaseous and liquid forms will be reduced. Therefore,

the staff concludes that the impact of shutdown of the plant on human health would be SMALL. In addition, the variety of potential accidents at the plant will be reduced to a limited set associated with shutdown events and fuel handling. In Chapter 5 of this SEIS the NRC staff concluded that the impacts of accidents during operation were SMALL. Therefore, the staff concludes that the impacts of potential accidents following permanent shutdown of the plant would be SMALL.

- **Socioeconomics**

In Chapter 4, the NRC staff concluded that the socioeconomic impacts of continued plant operation would range from SMALL to MODERATE. There would be immediate socioeconomic impacts associated with the shutdown of the plant because of the reduction in the staff at the plant. There may also be an immediate reduction in property tax revenues for Wright County. The NRC staff concludes that the socioeconomic impacts of permanent plant shutdown could range from SMALL to LARGE. Some of these impacts could be offset if new power generating facilities are built at or near the current site. See Appendix J to NUREG-0586, Supplement 1 (NRC 2002), for additional discussion of the potential impacts of plant shutdown.

- **Socioeconomics (Transportation)**

In Chapter 4, the staff concluded that the impacts of continued plant operation on transportation would be SMALL. Cessation of operations will be accompanied by a reduction of traffic in the vicinity of the plant. Most of the reduction will be associated with a reduction in the plant workforce, but there will also be a reduction in shipment of material to and from the plant. Therefore, the staff concludes that the impacts of plant shutdown on transportation would be SMALL.

- **Aesthetics**

In Chapter 4, the staff concluded that the aesthetic impacts of continued plant operation would be SMALL. Cessation of operations will be accompanied by a reduction in visible plumes from the cooling towers. Plant structures and other facilities are likely to remain in place until decommissioning. Therefore, the staff concludes that the aesthetic impacts of plant shutdown would be SMALL.

- **Historic and Archaeological Resources**

In Chapter 4, the staff concluded that the impacts of continued plant operation on historic and archaeological resources would be SMALL. Onsite land use will not be affected immediately by the cessation of operations. Plant structures and other facilities are likely to remain in place until decommissioning. The transmission lines associated with the project are expected to remain in service after the plant stops operating. As a result, maintenance of transmission line corridors will continue as before. Therefore, the staff concludes that the impacts on historic and archaeological resources from plant shutdown would be SMALL.

- **Environmental Justice**

In Chapter 4, the staff concluded that the environmental justice impact of continued operation of the plant would be SMALL because continued operation of the plant would not have a disproportionately high and adverse impact on minority and low-income populations. Permanent shutdown of the plant could have disproportionately high and adverse impacts on minority and low-income populations because of the loss of employment opportunities at the site and because of secondary socioeconomic impacts (e.g., loss of patronage at local businesses). The staff concludes that the environmental justice impacts of plant shutdown could range from SMALL to LARGE. Some of these impacts could be offset if new power generating facilities are built at or near the current site. See Appendix J to NUREG-0586, Supplement 1 (NRC 2002), for additional discussion of these impacts.

8.2 Alternative Energy Sources

This section discusses the environmental impacts associated with alternative sources of electric power to replace the power generated by Monticello, assuming that the OL for Monticello is not renewed. The order of presentation of alternative energy sources in Section 8.2 does not imply which alternative would be most likely to occur or to have the least environmental impact.

The following generation alternatives are considered in detail:

- coal-fired generation at an alternate greenfield site[(a)] (Section 8.2.1)
- natural gas-fired generation at an alternate greenfield site (Section 8.2.2)
- coal gasification at an alternate greenfield site (Section 8.2.3)
- nuclear generation at the Monticello site and an alternate greenfield site (Section 8.2.4).

The alternative of purchasing power from other sources to replace power generated Monticello is discussed in Section 8.2.5. Other power generation alternatives and conservation alternatives considered by the staff and found not to be reasonable replacements for Monticello are discussed in Section 8.2.6. Section 8.2.7 discusses the environmental impacts of a combination of generation and conservation alternatives.

Each year the Energy Information Administration (EIA), a component of the U.S. Department of Energy (DOE), issues an *Annual Energy Outlook*. In its *Annual Energy Outlook 2005 with*

[(a)] A greenfield site is assumed to be an undeveloped site with no previous construction.

Projections to 2025, EIA projects that combined-cycle[a] or combustion turbine technology fueled by natural gas is likely to account for approximately 60 percent of new electric generating capacity between the years 2005 and 2025 (DOE/EIA 2005). Both technologies are designed primarily to supply peak and intermediate capacity, but combined-cycle technology can also be used to meet baseload[b] requirements. Coal-fired plants are projected by EIA to account for approximately 35 percent of new capacity during this period (DOE/EIA 2005). Coal-fired plants are generally used to meet baseload requirements. Renewable energy sources, primarily wind, biomass gasification, and municipal solid waste units, are projected by EIA to account for the remaining 5 percent of capacity additions. EIA's projections are based on the assumption that providers of new generating capacity will seek to minimize cost while meeting applicable environmental requirements. Combined-cycle plants are projected by EIA to have the lowest generation cost in 2005 and 2025, followed by coal-fired plants and then wind generation (DOE/EIA 2005).

EIA projects that oil-fired plants will account for very little of new generation capacity in the United States during the 2005 to 2025 time period because of higher fuel costs and lower efficiencies (DOE/EIA 2005).

EIA also projects that new nuclear power plants will not account for any new generation capacity in the United States during the 2005 to 2025 time period because natural gas and coal-fired plants are projected to be more economical (DOE/EIA 2005). In spite of this projection, a new nuclear plant alternative for replacing power generated by Monticello is considered for reasons stated in Section 8.2.4. NRC established a new reactor licensing program organization in 2001 to prepare for and manage future reactor and site licensing applications (NRC 2001).

Monticello has a net rating of 600 megawatts electric (MW[e]); therefore, for the coal alternative, the staff assumed construction of a 600-MW(e) plant. For the natural gas alternative, the staff assumed construction of a 550-MW(e) plant consisting of two team combustion turbines (CTs). These assumptions are consistent with the NMC Environmental Report (ER) (NMC 2005). For the coal gasification alternative, the staff assumed construction of two 340-MW(e) modules. This assumption slightly overstates the environmental impacts of replacing the 600 MW(e) from Monticello. For the new nuclear alternative, the staff assumed construction of a 600-MW(e) plant. This assumption is roughly equivalent to the environmental impacts of replacing the 600 MW(e) from Monticello.

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[a] In a combined-cycle unit, hot combustion gas in a combustion turbine rotates the turbine to generate electricity. The hot exhaust from the combustion turbine is routed through a heat-recovery boiler to make steam to generate additional electricity.

[b] A baseload plant normally operates to supply all or part of the minimum continuous load of a system, and consequently produces electricity at an essentially constant rate. Nuclear power plants are commonly used for baseload generation; i.e., these nuclear units generally run near full load.

8.2.1 Coal-Fired Generation

The staff believes that the Monticello site would not be a viable location for a representative coal-fired plant. The configuration of the area, the proximity to County Road 75 and Interstate 94, and the fact that the river bisects the site all present significant constraints to an optimal layout of plant facilities. Potentially significant issues include the possible need to realign County Road 75 and insufficient suitable area for onsite disposal of air emission control waste south of the river. The latter constraint would necessitate transport of this waste to an existing disposal facility at NSP's Sherburne County Generating Plant site or a new facility developed offsite or on suitable land on the Monticello site north of the river.

Construction at an alternate site would necessitate approximately ten miles of new rail for delivery of coal and limestone. In addition, approximately five miles of new 345-kV transmission would be needed to connect to the grid (NMC 2005).

Unless otherwise indicated, the assumptions and numerical values used in Section 8.2.1 are from the NMC ER (NMC 2005). The staff reviewed this information and compared it to environmental impact information in the GEIS. Although the OL renewal period is only 20 years, the impact of operating the coal-fired alternative for 40 years is considered (as a reasonable projection of the operating life of a coal-fired plant).

The coal-fired plant would consume approximately 2.7 million tons per year of pulverized sub-bituminous coal with an ash content of approximately 5.7 percent. NMC assumes a heat rate[(a)] of 9800 BTU/kWh and a capacity factor[(b)] of 85 percent in its ER. After combustion, 99.9 percent of the ash would be collected. Thirty percent of this ash would go to beneficial uses such as concrete products and roadbed material. The remaining 69.9 percent would be disposed of at the plant site. In addition, approximately 51,000 tons of scrubber sludge would be disposed of at the plant site based on annual calcium hydroxide usage of approximately 31,000 tons. Calcium hydroxide is used in the scrubbing process for control of sulfur dioxide (SO_2) emissions.

For purposes of this evaluation, the staff assumed that a coal-fired plant located at an alternate site would use a closed-cycle cooling system. The overall impacts of the coal-fired generating system are discussed in the following sections and summarized in Table 8-2. The extent of impacts at an alternate greenfield site will depend on the location of the particular site selected.

(a) Heat rate is a measure of generating station thermal efficiency. In English units, it is generally expressed in British thermal units (BTUs) per net kilowatt-hour (kWh). It is computed by dividing the total BTU content of the fuel burned for electric generation by the resulting kWh generation. The corresponding metric unit for energy is the joule (J).

(b) The capacity factor is the ratio of electricity generated, for the period of time considered, to the energy that could have been generated at continuous full-power operation during the same period.

Table 8-2. Summary of Environmental Impacts of Coal-Fired Generation at an Alternate Greenfield Site Using Closed-Cycle Cooling

Impact Category	Impact	Comment
Land Use	MODERATE	The total site could consist of approximately 1700 ac for facilities and an appropriate buffer for adjacent land uses. Land occupied by a 120-ac landfill would be permanently restricted to noninvasive uses for the long term. Offsite, an estimated 60 ac of land would be converted to transportation use and 90 ac would be converted for utility use.
Ecology	SMALL to MODERATE	Impact depends on whether the site has been previously developed. Factors to consider include location and ecology of the site, transmission line route and rail spur route. In total, impacts could include habitat degradation, fragmentation, or loss as a result of construction activities and conversion of land to industrial use. Ecological communities might experience reduced productivity and biological diversity from disturbance of previously intact land.
Water Use and Quality—Surface Water	SMALL to MODERATE	The impact on the surface water is site-dependent and would depend on the volume of water needed for makeup water, the discharge volume, and the characteristics of the receiving body of water.
Water Use and Quality—Groundwater	SMALL to MODERATE	Impact depends on volume of water withdrawn and the characteristics of the groundwater source.
Air Quality	MODERATE	Sulfur oxides: 1755 tons/yr. National and regional impacts would be minimal because of emissions offsets through the SO_2 trading program. Nitrogen oxides: 486 tons/yr Particulates: 18 tons/yr of PM_{10} Carbon monoxide: 675 tons/yr Small amounts of mercury and other hazardous air pollutants and naturally occurring radioactive materials—mainly uranium and thorium.
Waste	MODERATE	Total waste volume would be approximately 107,000 tons of ash and 51,000 tons of flue gas desulfurization waste annually for 40 years. Approximately 30 percent of the ash would be beneficially used and the remainder of the waste would be disposed of onsite, accounting for approximately 120 ac of land area over the 40-year plant life.
Human Health	SMALL	Impacts are uncertain, but considered SMALL in the absence of more quantitative data.
Socioeconomics	SMALL to LARGE	Construction impacts depend on location, but could be LARGE if the plant is located in an area that is more rural than the Monticello site. Wright County would experience loss of tax base and employment, potentially offset by projected economic growth.
Socioeconomics (Transportation)	SMALL to MODERATE	Transportation impacts associated with construction workers could be SMALL to MODERATE. For rail transportation of coal and lime, the impact is considered SMALL to MODERATE. For barge transportation, the impact is considered SMALL.

Table 8-2. (contd)

Impact Category	Impact	Comment
Aesthetics	SMALL to MODERATE	Impacts could include visual impairment and infrastructure for delivery of coal and limestone. The severity of impacts is dependent on location.
Historic and Archaeological Resources	SMALL	An alternate location would necessitate cultural resource studies.
Environmental Justice	SMALL to MODERATE	Impacts will vary depending on population distribution and makeup at the site.

- **Land Use**

Although potential impacts on land use from a new coal-fired plant would be location-specific and therefore conjectural for a greenfield site, potentially affected areas are predominantly rural agricultural land interspersed in some areas with natural vegetation, all of which are abundant in the region. The total site could consist of approximately 1700 ac to provide flexibility in facility arrangement and appropriate buffer from adjacent land uses. Land uses would be entirely precluded on 380 ac onsite for plant facilities and waste disposal. The waste would be disposed of onsite, accounting for approximately 120 ac of land area over the 40-year plant life.[(a)] Offsite, an estimated 60 ac of land would be converted to transportation use (rail spur) and 90 ac would be converted to utility use (transmission line). Land occupied by the 120-ac landfill would be permanently restricted to noninvasive uses (e.g., recreation) for the long term. In view of the large amount of land affected and the permanent land use change from the landfill, the staff concludes that land use impacts would be clearly noticeable but not destabilizing. Therefore, the staff concludes that land use impacts from construction and operation of a new coal-fired plant at an alternative greenfield site would be MODERATE. The impact would be greater than the OL renewal alternative.

- **Ecology**

Potential impacts on ecological resources from construction and operation of the representative coal-fired plant are highly site-dependent. Development of the representative coal-fired plant at a greenfield site in southern Minnesota would likely result in the loss of 380 ac of terrestrial habitat for onsite plant facilities and air emission control waste landfill, loss of approximately 60 ac of offsite habitat for the rail line, and modification of 90 ac of offsite terrestrial habitat for a new transmission line to serve the plant. Development of the transmission line would limit changes in future land uses in the transmission corridor to those that are compatible with the

[(a)] Because the new coal-fired plant is assumed to have a 40-year life, only half of the land area needed for byproduct disposal is directly attributable to the alternative of renewing the Monticello OL for 20 years.

line, but most agricultural practices and other currently compatible uses could continue. Depending on route specifics, clearing of forest and shrubland, some of which may qualify as wetland, would also likely be required. However, hydrologic regimes of wetlands would not be appreciably affected and the conversion of transmission corridor areas currently in forest to open habitats could be advantageous to species with affinities for remnant prairie habitats.

The most significant potential impacts to aquatic communities relate to the operation of the cooling water system; however, regulatory controls would be expected to ensure appropriate protection of aquatic communities from thermal discharges and the location and operation of cooling water intakes. In addition, because the new coal-fired plant is assumed to use closed-cycle cooling, the cooling water intake and discharge flows would be much lower than that of Monticello, the impact from which is considered to be SMALL.

Given this information, the staff concludes that development of the representative coal-fired plant at a greenfield site would have a SMALL to MODERATE impact on ecological communities.

- **Water Use and Quality—Surface Water**

Impacts on water quality of greatest potential concern from construction of a new coal-fired plant at a greenfield site include (1) erosion and sedimentation associated with land clearing operations, and (2) suspension of bottom sediments during construction of cooling water intake and discharge structures (NRC 1996). These adverse effects would be localized and temporary.

Potential impacts on water quality and use associated with operation of the representative coal-fired plant would be site-dependent. The impact on the surface water would depend on the volume of water needed for makeup water, the discharge volume, and the characteristics of the receiving body of water. Cooling water, wastewater, and storm water discharges would be regulated under the Clean Water Act and corresponding state programs by a National Pollutant Discharge Elimination System (NPDES) permit. Cooling water intake and discharge flows for the representative coal-fired plant, assumed to use a closed-cycle cooling system, would be substantially lower than those for Monticello, which primarily operates in a once-through mode that results in SMALL impacts. The staff concludes that the impacts of surface water use and quality from operation of a representative coal-fired plant located at a greenfield site would be SMALL to MODERATE, depending on the site chosen.

- **Water Use and Quality—Groundwater**

Use of groundwater is possible for a coal-fired plant at an alternate site. Any groundwater withdrawal would require a permit from the local permitting authority. Overall, impacts to

groundwater use and quality of a new coal-fired plant with a closed-cycle cooling system at an alternate site are considered SMALL to MODERATE, depending on the volume of groundwater withdrawn and the characteristics of the groundwater source.

- **Air Quality**

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

Monticello is located in an area designated by the National Ambient Air Quality Standards as being in attainment for all criteria pollutants. The nearest area of non-attainment is the Milwaukee metropolitan area. However, Monticello is in a non-attainment area with respect to the eight-hour ozone standard (NMC 2005).

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

The U.S. Environmental Protection Agency (EPA) has various regulatory requirements for visibility protection in 40 CFR Part 51, Subpart P, including a specific requirement for review of any new major stationary source in an area designated as attainment or unclassified under the Clean Air Act (40 CFR 51.307).

Section 169A of the Clean Air Act establishes a national goal of preventing future and remedying existing impairment of visibility in mandatory Class I Federal areas when impairment results from man-made air pollution. The EPA issued a new regional haze rule in 1999 (EPA 1999). The rule specifies that for each mandatory Class I Federal area located within a State, the State must establish goals that provide for reasonable progress towards achieving natural visibility conditions. The reasonable progress goals must provide for an improvement in visibility for the most-impaired days over the period of the implementation plan and ensure no degradation in visibility for the least-impaired days over the same period [40 CFR 51.308(d)(1)]. If a coal-fired plant were located close to a mandatory Class I areas, additional air pollution control requirements could be imposed. The nearest Class I Federal area is in Northern Minnesota, several hundred miles from Monticello.

In March 2005, the EPA issued the Clean Air Interstate Rule (CAIR) (EPA 2005b). CAIR will permanently cap emissions of SO_2 and NO_x in the eastern United States. CAIR achieves large reductions of SO_2 and/or NO_x emissions across 28 eastern states and the District of Columbia. When fully implemented, CAIR will reduce SO_2 emissions in these states by over 70 percent,

and NO_x emissions by over 60 percent from 2003 levels. This will result in $85 to $100 billion in health benefits and nearly $2 billion in visibility benefits per year by 2015, and will substantially reduce premature mortality in the eastern United States. The benefits will continue to grow each year with further implementation. By 2015, CAIR will help Minnesota sources reduce emissions of SO_2 by 40,000 tons, or 36 percent, and emissions of NO_x by 53,000 tons, or 59 percent (EPA 2005a).

Impacts from the various pollutants that would be expected to result from operation of a new coal-fired plant are described below.

Sulfur oxides emissions. A new coal-fired power plant would be subject to the requirements in Title IV of the Clean Air Act (42 USC 7651-7651o). Title IV was enacted to reduce emissions of SO_2 and NO_x, the two principal precursors of acid rain, by restricting emissions of these pollutants from power plants. Title IV caps aggregate annual power plant SO_2 emissions and imposes controls on SO_2 emissions through a system of marketable allowances. The EPA issues one allowance for each ton of SO_2 that a unit is allowed to emit. New units do not receive allowances, but are required to have allowances to cover their SO_2 emissions. Owners of new units must therefore acquire allowances from owners of other power plants by purchase or reduce SO_2 emissions at other power plants they own. Allowances can be banked for use in future years. Thus, a new coal-fired power plant would not add to net regional SO_2 emissions, although it might do so locally.

Regardless, SO_2 emissions would be greater for the coal alternative than the OL renewal alternative.

NSP estimates that by using the best technology to minimize SO_x emissions, the total annual stack emissions would be approximately 1755 tons of SO_x.

Nitrogen oxides emissions. Section 407 of the Clean Air Act (42 USC 7651f) establishes technology-based emission limitations for NO_x emissions. The market-based allowance system used for SO_2 emissions is not used for NO_x emissions. A new coal-fired power plant would be subject to the new source performance standards for such plants at 40 CFR 60.44a(d)(1). This regulation, issued on September 16, 1998 (EPA 1998), limits the discharge of any gases that contain nitrogen oxides (expressed as NO_2) in excess of 200 ng/J of gross energy output (1.6 lb/MWh), based on a 30-day rolling average.

NSP estimates that by using NO_x burners with overfire air and selective catalytic reduction (SCR), the total annual NO_x emissions for a new coal-fired power plant would be approximately 486 tons. Regardless of the control technology, this level of NO_x emissions would be greater than the OL renewal alternative, because a nuclear power plant releases almost no NO_x during normal operations.

Particulate emissions. NSP estimates that the total annual stack emissions for a new coal-fired plant would include 77 tons of filterable total suspended particulates and 18 tons of particulate matter having an aerodynamic diameter less than or equal to 10 μm (PM_{10}) (40 CFR 60.6). Fabric filters or electrostatic precipitators would be used for control. In addition, coal-handling equipment would introduce fugitive particulate emissions. Particulate emissions would be greater under the coal alternative than the OL renewal alternative because a nuclear plant releases few particles during normal operations.

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

Carbon monoxide emissions. NSP estimates that the total carbon monoxide emissions from a new coal-fired plant would be approximately 675 tons per year. This level of emissions is greater than the OL renewal alternative.

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

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

Carbon dioxide. A coal-fired plant would also have unregulated carbon dioxide emissions that could contribute to global warming. The level of emissions from a coal-fired plant would be greater than the OL renewal alternative.

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

- **Waste**

Coal combustion generates waste in the form of ash, and equipment for controlling air pollution generates additional ash and scrubber sludge. The representative coal-fired plant would generate approximately 107,000 tons of ash and 51,000 tons of flue gas desulfurization waste annually for 40 years. Approximately 30 percent of the ash would be beneficially used and the remainder of the waste would be disposed of in a landfill on site, accounting for approximately 120 ac of land area over the 40-year plant life. Waste impacts to groundwater and surface water could extend beyond the operating life of the plant if leachate and runoff from the landfill occurs. Disposal of the waste could noticeably affect land use and groundwater quality, but with appropriate management and monitoring, it would not destabilize any resources. After closure of the waste site and revegetation, the land could be available for noninvasive uses.

Debris would be generated during construction activities.

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

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

- **Human Health**

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

In the GEIS, the staff stated that the operating impacts of new coal-fired plants would result in substantial human health impacts (cancer and emphysema) from inhalation of toxins and particulates, but it did not quantify these impacts (NRC 1996). In addition, the discharges of uranium and thorium from coal-fired plants can potentially produce radiological doses in excess of those arising from nuclear power plant operations (Gabbard 1993).

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

- **Socioeconomics**

Construction of the coal-fired alternative would take approximately 5 years. The staff assumed that construction would take place while Monticello continues operation and would be completed by the time Monticello permanently ceases operations. The work force would be expected to vary between 400 and 1000 workers during the 5-year construction period (NRC 1996). These workers would be in addition to the approximately 519 workers employed at Monticello. During construction, the surrounding communities would experience demands on housing and public services that could have SMALL impacts. These impacts would be tempered by construction workers commuting to the site from other parts of Wright County or from other counties. After construction, the communities would be impacted by the loss of the construction jobs, although this loss would be possibly offset by other growth currently being projected for Wright and Sherburne counties (USCB 2004).

Construction of a replacement coal-fired power plant at an alternate greenfield site would relocate some socioeconomic impacts, but would not eliminate them. The communities around Monticello would still experience the impact of Monticello operational job loss, although this impact would be potentially tempered by projected economic growth, and the communities around the new site would have to absorb the impacts of a temporary work force (up to 1000 workers at the peak of construction) and a permanent work force of approximately 80 workers.

Communities in Wright County in particular would experience losses in both employment and tax revenues due to the Monticello site closure, assuming the plant is constructed outside the area. This impact could be MODERATE to LARGE. In the GEIS, the staff noted that socioeconomic impacts at a rural site would be larger than at an urban site, because more of the peak construction work force would need to move to the area to work. Alternate greenfield sites would need to be analyzed on a case-by-case basis. Socioeconomic impacts at a rural site could be LARGE.

The appropriate characterization of socioeconomic impacts from coal-fired generation would be SMALL to LARGE.

- **Socioeconomics (Transportation)**

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

Coal and limestone would likely be delivered to an alternate site by rail or barge. Socioeconomic impacts associated with rail transportation would likely be SMALL to MODERATE. For example, there would be delays to highway traffic as trains pass and there could be negative impacts on the value of property close to the train tracks. The socioeconomic impacts of barge delivery of coal and limestone would likely be SMALL.

- **Aesthetics**

Potential aesthetic impacts of construction and operation of a coal-fired plant include visual impairment resulting from the presence of an industrial facility, particularly a 500-ft high exhaust stack and condensate plume from the cooling tower. However, the topography throughout most of southern Minnesota is rolling, and forested tracts are common in some areas. Both of these factors act to reduce the viewshed and limit potential for impairment of visual aesthetics from onsite and offsite infrastructure.

Coal-fired generation using cooling towers would introduce mechanical sources of noise that would be audible offsite. Sources contributing to total noise produced by plant operation are classified as continuous or intermittent. Continuous sources include the mechanical equipment associated with normal plant operations. Intermittent sources include the equipment related to coal handling, solid-waste disposal, transportation related to coal and lime delivery, use of outside loudspeakers, and the commuting of plant employees.

Noise impacts associated with rail delivery of coal and lime to a plant would be most significant for residents living in the vicinity of the facility and along the rail route. Although noise from passing trains significantly raises noise levels near the rail corridor, the short duration of the

noise reduces the impact. Nevertheless, given the frequency of train transport and the many residents likely to be within hearing distance of the rail route, the impacts of noise on residents in the vicinity of the facility and the rail line is considered MODERATE.

The staff assumes that adequate buffer and vegetation screens would be provided at the plant site as needed to reduce visual and noise impacts. Overall the aesthetic impacts associated with locating at an alternate site can be categorized as SMALL to MODERATE.

- **Historic and Archaeological Resources**

At an alternate site, a cultural resource inventory would likely be needed for any onsite property that has not been previously surveyed. Other lands, if any, that are acquired to support the plant would also likely need an inventory of field cultural resources, identification and documentation of existing historic and archaeological resources, and possible mitigation of adverse effects from subsequent ground-disturbing actions related to physical expansion of the plant site.

Prior to construction at an alternate greenfield site, studies would likely be needed to identify, evaluate, and address mitigation of the potential impacts of new plant construction on cultural resources. The studies would likely be needed for all areas of potential disturbance at the proposed plant site and along associated corridors where new construction would occur (e.g., roads, transmission corridors, rail lines, or other rights-of-way). Historic and archaeological resource impacts can generally be effectively managed and as such are considered SMALL.

- **Environmental Justice**

Closure of the Monticello site would result in a decrease in employment of approximately 519 operating employees, possibly offset by projected growth in Wright and Sherburne counties. Following construction of a new coal-fired plant, it is possible that the ability of local government to maintain social services could be reduced at the same time as diminished economic conditions reduce employment prospects for minority or low-income populations. Overall, impacts would be SMALL to MODERATE, and would depend on the extent to which projected economic growth is realized and the ability of minority or low-income populations to commute to other jobs outside the Wright County area. Impacts at other sites would depend upon the site chosen and the nearby population distribution, but are likely to also be SMALL to MODERATE.

8.2.2 Natural Gas-Fired Generation

The staff believes that the Monticello site would not be a viable location for a representative natural gas-fired plant. Optimal arrangement of the natural gas-fired plant would likely require locating it within 0.5 mi of Monticello spent fuel storage, which would require specific NRC approval. Assuming this constraint were overcome, approximately 35 mi of 16-in. natural gas

pipeline occupying a 30-ft wide corridor would be required to supply the plant. The Viking Gas Transmission interstate pipeline, which traverses Benton and Mille Lacs counties north of Monticello, is the closest pipeline with the potential for sufficient capacity. This additional infrastructure needed to support a natural gas-fired plant represents an economic and environmental constraint.

The environmental impacts of the natural gas-fired alternative are examined in this section for an alternate greenfield site. The staff assumed that the plant would use a closed-cycle cooling system. Construction at an alternate site would necessitate approximately 5 mi of new natural gas supply pipeline to supply the natural gas-fired plant. In addition, an estimated 5 mi of new 345-kV transmission lines would be needed to connect to the grid (NMC 2005).

The staff assumed that a replacement natural gas-fired plant would use combined-cycle technology. In a combined-cycle unit, hot combustion gases in a CT rotate the turbine to generate electricity. Waste combustion heat from the CT is routed through a heat-recovery boiler to make steam to generate additional electricity.

The staff assumed the construction of the natural gas-fired units would be timed to coincide with the expiration of the Monticello operating license period. Consistent with the NMC ER (NMC 2005), the representative plant would consist of two team CTs, each with an associated heat recovery steam generator (HRSG) that together supply steam to a single steam turbine generator. Net generating capacity of the representative plant is approximately 550 MW(e). This assumption understates the environmental impacts of replacing the 600 MW(e) from Monticello. However, the staff has determined that the differences in impacts between 550 MW(e) and 600 MW(e) of natural gas-fired generation would be less than 10 percent and would not change the magnitude (SMALL, MODERATE, or LARGE) of any impacts.

The staff assumed that the plant would use closed-cycle cooling using a mechanical-draft cooling tower, which is assumed to be approximately 45 ft tall. Exhaust from the two HRSGs would be dispersed through individual 200-ft high stacks.

Unless otherwise indicated, the assumptions and numerical values used in Section 8.2.2 are from the NMC ER (NMC 2005). The staff reviewed this information and compared it to environmental impact information in the GEIS. Although the OL renewal period is only 20 years, the impact of operating the coal-fired alternative for 40 years is considered (as a reasonable projection of the operating life of a coal-fired plant).

The overall impacts of the natural gas-generating system are discussed in the following sections and summarized in Table 8-3. The extent of impacts at an alternate greenfield site will depend on the location of the particular site selected.

- **Land Use**

Although potential impacts on land use would be location-specific and therefore conjectural for a greenfield site, potentially affected areas are predominantly rural agricultural land interspersed in some areas with natural vegetation. Approximately 110 ac of rural agricultural land and/or natural plant communities abundant in the region would be converted to industrial use, of which 25 ac would be occupied by plant facilities. The staff assumes that non-conflicting land uses (i.e., agriculture) on the balance of the plant site would remain unaffected and would provide appropriate buffer with respect to any highly incompatible land use such as residential development. Development of offsite infrastructure (i.e., transmission line, gas pipeline), involving a corridor of approximately 110 ac, would similarly limit development of future land uses; however, compatible land uses, including most agricultural practices, could continue.

Table 8-3. Summary of Environmental Impacts of Natural Gas-Fired Generation at an Alternate Greenfield Site Using Closed-Cycle Cooling

Impact Category	Impact	Comment
Land Use	SMALL to MODERATE	Approximately 110 ac of rural agricultural land and/or natural plant communities converted to industrial use, of which 25 ac would be occupied by plant facilities. An additional 110 ac would be developed as a transmission and pipeline corridor.
Ecology	SMALL to MODERATE	Impact depends on whether the site has been previously developed. Factors to consider include location and ecology of the site, transmission line route and rail spur route. In total, impacts could include habitat degradation, fragmentation, or loss as a result of construction activities and conversion of land to industrial use. Ecological communities might experience reduced productivity and biological diversity from disturbing previously intact land.
Water Use and Quality—Surface Water	SMALL to MODERATE	Intake and discharge would involve relatively small quantities of water compared to the coal alternative. The impact on the surface water would depend on the volume of water needed for makeup water, the discharge volume, and the characteristics of the receiving body of water.
Water Use and Quality—Groundwater	SMALL to MODERATE	Impact depends on volume of water withdrawn and the characteristics of the groundwater source.
Air Quality	MODERATE	Sulfur oxides: 9 tons/yr Nitrogen oxides: 134 tons/yr Carbon monoxide: 203 tons/yr Particulates: 26 tons/yr of PM_{10} Other: (1) hazardous air pollutants, including arsenic, formaldehyde, and nickel and (2) CO_2 emissions, which contribute to global warming.

Table 8-3. (contd)

Impact Category	Impact	Comment
Waste	SMALL	Natural gas-fired alternative would generate only small quantities of municipal and industrial waste, including spent catalyst used for NO_x control.
Human Health	SMALL	Impacts are considered to be minor.
Socioeconomics	SMALL to MODERATE	During construction, impacts would be MODERATE. Up to 450 additional workers would be required during the peak of the 2-year construction period. Wright County would experience loss of tax base and employment, potentially offset by projected economic growth in Wright and Sherburne counties.
Socioeconomics (Transportation)	SMALL to MODERATE	Transportation impacts associated with construction workers would be SMALL to MODERATE depending on the site selected. Transportation impacts associated with operational workers would be SMALL.
Aesthetics	SMALL to MODERATE	The significance of impacts would depend on the characteristics of the alternate site.
Historic and Archaeological Resources	SMALL	Any potential impacts can likely be effectively managed.
Environmental Justice	SMALL to MODERATE	Impacts vary depending on population distribution and makeup at the alternate site.

Regardless of where the gas-fired plant is built, additional land would be required for natural gas wells and collection stations. Partially offsetting these offsite land requirements would be the elimination of the need for uranium mining to supply fuel for Monticello. In the GEIS (NRC 1996), the staff estimated that approximately 1000 ac would be affected for mining the uranium and processing it during the operating life of a nuclear power plant. Overall, land-use impacts would be SMALL to MODERATE depending on site-specific factors.

- **Ecology**

Potential impacts on ecological resources from construction and operation of the representative natural gas-fired plant are highly site specific. Development of the representative natural gas-fired plant at a greenfield site in southern Minnesota would likely result in the loss of approximately 25 ac of terrestrial habitat for onsite plant facilities and modification of approximately 110 ac of existing offsite terrestrial habitat for a new natural gas supply pipeline and transmission line corridor. Development of the transmission line would limit changes in future land uses in the transmission corridor to those that are compatible with the line, but most agricultural practices and other currently compatible uses could continue. Depending on route specifics, clearing of forest and shrubland, some of which may qualify as wetlands, would also

likely be required. However, hydrologic regimes of wetlands would not be appreciably affected and the conversion of transmission corridor areas currently in forest and woodland habitats could be advantageous to species with affinities for remnant prairie habitats.

The most significant potential impacts to aquatic communities relate to the operation of the cooling water system, but regulatory controls would be expected to ensure appropriate protection of aquatic communities from thermal discharges and the location and operation of cooling water intakes. In addition, because the plant is assumed to use closed-cycle cooling, the cooling water intake and discharge flows would be much lower than that of Monticello, the impact from which is considered to be SMALL.

Given this information, the staff concludes that development of the representative natural gas-fired plant at a greenfield site would have a SMALL to MODERATE impact on ecological communities.

- **Water Use and Quality—Surface Water**

Each of the natural gas-fired units would include a heat-recovery boiler, using a portion of the waste heat from the combustion turbines to make steam. The steam would then turn an electric generator. The net result would be an overall reduction in the amount of waste heat rejected from the plant, with an associated reduction in the amount of cooling water required by the plant. Thus, the cooling water requirements for the natural gas-fired combined-cycle units would be much less than for conventional steam-electric generators, including the existing nuclear unit. Plant discharge would consist mostly of cooling tower blowdown, with the discharge having a higher temperature and increased concentration of dissolved solids relative to the receiving body of water and intermittent low concentrations of biocides. In addition to the cooling tower blowdown, process waste streams and sanitary wastewater might also be discharged. All discharges would be regulated through an NPDES permit. Finally, some erosion and sedimentation would probably occur during construction (NRC 1996). These adverse effects would be localized and temporary.

A natural gas-fired plant at an alternate greenfield site is assumed to use a closed-cycle cooling system with cooling towers. The staff assumed that surface water would be used for cooling makeup water and discharge. Intake and discharge would involve relatively small quantities of water compared to the coal alternative. The impact on the surface water would depend on the volume of water needed for makeup water, the discharge volume, and the characteristics of the receiving body of water. The staff expects that these impacts would range from SMALL to MODERATE.

- **Water Use and Quality—Groundwater**

Use of groundwater is possible for a natural gas-fired plant at an alternate site. Any groundwater withdrawal would require a permit from the local permitting authority. Overall,

impacts to groundwater use and quality of a new natural gas-fired plant with a closed-cycle cooling system at an alternate site are considered SMALL to MODERATE, depending on the volume of groundwater withdrawn and the characteristics of the groundwater source.

- **Air Quality**

Natural gas is a relatively clean-burning fuel. The gas-fired alternative would release similar types of emissions, but in lesser quantities than the coal-fired alternative.

A new gas-fired generating plant located in Minnesota would likely need a PSD permit and an operating permit under the Clean Air Act. A new combined-cycle natural gas power plant would also be subject to the new source performance standards for such units at 40 CFR Part 60, Subparts Da and GG. These regulations establish emission limits for particulates, opacity, SO_2, and NO_x.

In March 2005, the EPA issued CAIR, which will permanently cap emissions of SO_2 and NO_x in the eastern United States (70 CFR 25162). CAIR achieves large reductions of SO_2 and/or NO_x emissions across 28 eastern states and the District of Columbia. When fully implemented, CAIR will reduce SO_2 emissions in these states by over 70 percent and NO_x emissions by over 60 percent from 2003 levels. This will result in $85 to $100 billion in health benefits and nearly $2 billion in visibility benefits per year by 2015, and will substantially reduce premature mortality in the eastern United States. The benefits will continue to grow each year with further implementation. By 2015, CAIR will help Minnesota sources reduce emissions of SO_2 by 40,000 tons, or 36 percent, and emissions of NO_x by 53,000 tons, or 59 percent (EPA 2005a).

The EPA has various regulatory requirements for visibility protection in 40 CFR Part 51, Subpart P, including a specific requirement for review of any new major stationary source in an area designated attainment or unclassified under the Clean Air Act (40 CFR 51.307). Wright County is an area designated by the National Ambient Air Quality Standards as being in attainment for all criteria pollutants. However, the area is in non-attainment with respect to the eight hour ozone standard.

Section 169A of the Clean Air Act establishes a national goal of preventing future and remedying existing impairment of visibility in mandatory Class I Federal areas when impairment results from man-made air pollution. The EPA issued a new regional haze rule in 1999 (EPA 1999). The rule specifies that for each mandatory Class I Federal area located within a state, the State must establish goals that provide for reasonable progress towards achieving natural visibility conditions. The reasonable progress goals must provide for an improvement in visibility for the most impaired days over the period of the implementation plan and ensure no degradation in visibility for the least-impaired days over the same period [40 CFR 51.308(d)(1)]. If a natural gas-fired plant were located close to a mandatory Class I area, additional air pollution control requirements could be imposed. The nearest Class I Federal area is in Northern Minnesota, several hundred miles from Monticello.

NMC projects the following emissions for the natural gas-fired alternative (NMC 2005):

Sulfur oxides—9 tons/yr

Nitrogen oxides—134 tons/yr

Carbon monoxide—203 tons/yr

PM_{10} particulates—26 tons/yr

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

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

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

Impacts from the above emissions would be clearly noticeable, but would not be sufficient to destabilize air resources as a whole. The overall air-quality impact for a new natural gas-fired plant at an alternate greenfield site is considered MODERATE.

- **Waste**

There would be spent selective catalyst reduction (SCR) catalyst from NO_x emissions control and small amounts of solid-waste products (i.e., ash) from burning natural gas fuel. In the GEIS, the staff concluded that waste generation from gas-fired technology would be minimal (NRC 1996). Gas firing results in very few combustion byproducts because of the clean nature of the fuel. Waste-generation impacts would be so minor that they would not noticeably alter any important resource attribute. Construction-related debris would be generated during construction activities.

Overall, the waste impacts would be SMALL for a natural gas-fired plant sited at an alternate greenfield site.

- **Human Health**

In Table 8-2 of the GEIS, the staff identifies cancer and emphysema as potential health risks from gas-fired plants (NRC 1996). The risk may be attributable to NO_x emissions that

contribute to ozone formation, which in turn contribute to health risks. NO_x emissions from any gas-fired plant would be regulated. For a plant sited in Minnesota, NO_x emissions would be regulated by the Minnesota Pollution Control Agency. Human health effects would not be detectable or would be sufficiently minor that they would neither destabilize nor noticeably alter any important attribute of the resource. Overall, the impacts on human health of the natural gas-fired alternative sited at an alternate greenfield site are considered SMALL.

- **Socioeconomics**

Construction of a natural gas-fired plant would take approximately 2 years. Peak employment would be approximately 450 workers (NMC 2005). The staff assumed that construction would take place while Monticello continues operation and would be completed by the time it permanently ceases operations. During construction, the communities surrounding the Monticello site would experience demands on housing and public services that could have MODERATE impacts. These impacts would be tempered by construction workers commuting to the site from other parts of Wright County or from other counties. After construction, the communities would be impacted by the loss of jobs. The current Monticello work force (519 workers) would decline through a decommissioning period to a minimal maintenance size. The gas-fired plant would introduce a replacement tax base at an alternate greenfield site and approximately 24 new permanent jobs. For siting at an alternate greenfield site, impacts in Wright County resulting from decommissioning of Monticello may be offset by economic growth projected to occur in Wright and Sherburne counties.

In the GEIS (NRC 1996), the staff concluded that socioeconomic impacts from constructing a natural gas-fired plant would not be very noticeable and that the small operational work force would have the lowest socioeconomic impacts of any nonrenewable technology. Also, the shorter construction time frame and the smaller size of the operations work force for a natural gas-fired plant would result in smaller socioeconomic impacts than the coal-fired or nuclear alternatives.

For these reasons, gas-fired generation socioeconomic impacts associated with construction and operation of a natural gas-fired power plant would be SMALL to MODERATE for siting at an alternate greenfield site. Depending on other growth in the area, socioeconomic effects could be noticed, but they would not destabilize any important socioeconomic attribute.

- **Socioeconomics (Transportation)**

Transportation-related impacts associated with commuting construction workers at an alternate greenfield site are site-dependent, but could be SMALL to MODERATE. Transportation impacts related to commuting of plant operating personnel can be characterized as SMALL.

- **Aesthetics**

Potential aesthetic impacts of construction and operation of a natural gas-fired plant include visual impairment resulting from the presence of an industrial facility and associated transmission line corridors, particularly 200-ft high exhaust stacks and the condensate plume from the cooling tower. However, the topography throughout most of southern Minnesota is rolling, and forested tracts are common in some areas. Both of these factors act to reduce the viewshed and limit potential for impairment of visual aesthetics from onsite and offsite infrastructure.

Natural gas generation would introduce mechanical sources of noise that would be audible offsite. Sources contributing to total noise produced by plant operation are classified as continuous or intermittent. Continuous sources include the mechanical equipment associated with normal plant operations. Intermittent sources include the use of outside loudspeakers and the commuting of plant employees.

The staff assumes that adequate buffer and vegetation screens would be provided at the plant site as needed to reduce visual and noise impacts. Overall the aesthetic impacts associated with locating at an alternate site can be categorized as SMALL to MODERATE, depending on the location.

- **Historic and Archaeological Resources**

At an alternate greenfield site, a cultural resource inventory would likely be needed for any onsite property that has not been previously surveyed. Other lands, if any, that are acquired to support the plant would also likely need an inventory of field cultural resources, identification and recording of existing historic and archaeological resources, and possible mitigation of adverse effects from subsequent ground-disturbing actions related to physical expansion of the plant site.

Before construction at an alternate greenfield site, studies would likely be needed to identify, evaluate, and address mitigation of the potential impacts of new plant construction on cultural resources. The studies would likely be needed for all areas of potential disturbance at the proposed plant site and along associated corridors where new construction would occur (e.g., roads, transmission and pipeline corridors, or other rights-of-way). Impacts to cultural resources can be effectively managed under current laws and regulations and kept SMALL.

- **Environmental Justice**

Closure of Monticello would result in a decrease in employment of approximately 519 operating employees, possibly offset by growth in Wright and Sherburne counties. Following construction, it is possible that the ability of local government to maintain social services could be reduced at the same time as diminished economic conditions reduce employment prospects

for minority or low-income populations. Overall, impacts would be SMALL to MODERATE, and would depend on the extent to which projected economic growth is realized and the ability of minority or low-income populations to commute to other jobs outside the Wright County area. Impacts at other sites would depend upon the site chosen and the nearby population distribution, but are likely to also be SMALL to MODERATE.

8.2.3 Coal Gasification

Coal gasification is a method of producing relatively clean, burnable gas from almost any type of coal or from petroleum coke. The basic process involves crushing the coal and partially oxidizing the carbon in the coal. Partial oxidation converts the coal into a gaseous fuel composed primarily of combustible hydrogen and carbon monoxide. The gas can be piped directly into a gas turbine to generate electricity. The exhaust from the gas turbine is ducted into a heat recovery steam generator to produce steam for a conventional steam turbine generator. To make the overall process both environmentally safe and thermally efficient, a coal gasification plant must integrate a number of different technologies. Major systems include fuel preparation, an air separation unit, a gasifier, acid gas removal, sulfur recovery, a combustion turbine generator, a heat recovery steam generator, and a steam turbine generator (TVA 2003).

Consideration of a coal gasification generating plant to replace Monticello was not included in the NMC ER. Due to size constraints, the staff believes that the Monticello site would not be a viable location for a representative coal gasification plant. The environmental impacts of the coal gasification alternative are examined in this section for an alternate greenfield site. The staff assumed that the plant would use a closed-cycle cooling system. To replace the 600-MW(e) generating capacity of Monticello the coal gasification plant would have two 340-MW(e) modules, each consisting of one coal gasification plant, one combustion turbine, and one heat recovery steam generator. The steam recovered from each module would be collected and routed to a low-pressure steam turbine generator. An air separation plant would be constructed for each gasifier to supply the pressurized 95 percent (by volume) oxygen required for the oxygen-blown gasifiers (TVA 2003). This assumption overstates the environmental impacts of replacing the 600 MW(e) from Monticello. However, the staff has determined that the differences in impacts between 680 MW(e) and 600 MW(e) of coal gasification would not be significant and would not change the standard of significance (SMALL, MODERATE, or LARGE) of any impacts.

Delivery of coal and/or petroleum coke to an alternate greenfield site would be needed. Approximately 3698 tons would be shipped in daily, probably via barge (TVA 2003). Approximately 38 tons of limestone per day would likely be required for air pollution control. Trucking would be used for limestone delivery. Fuel oil would be required for startup activities, but would not be used as a backup fuel (TVA 2003).

Environmental Impacts of Alternatives

The overall impacts of constructing a coal gasification plant using closed-cycle cooling at an alternate greenfield site are discussed in the following sections and summarized in Table 8-4. The impact categorizations in Table 8-4 are based on 680 MW(e) of coal gasification generating capacity.

Table 8-4. Summary of Environmental Impacts of a Coal Gasification Generation Plant at an Alternate Greenfield Site Using Closed-Cycle Cooling

Impact Category	Impact	Comment
Land Use	MODERATE to LARGE	Several hundred acres would be impacted for the power block; fuel handling, storage and transportation facilities; infrastructure facilities; waste disposal; and an appropriate buffer for adjacent land uses. There would be additional land impacts for coal and limestone mining, electric power transmission lines, and cooling water intake and discharge pipelines.
Ecology	SMALL to LARGE	Impact depends on whether the site has been previously developed. Factors to consider include location and ecology of the site, transmission line route, and rail spur route. In total, impacts could include habitat degradation, fragmentation, or loss as a result of construction activities and conversion of land to industrial use. Ecological communities might experience reduced productivity and biological diversity from disturbing previously intact land.
Water Use and Quality—Surface Water	SMALL to MODERATE	Total impacts depend on the volume of water withdrawn, the constituents of the discharge water, the characteristics of the surface water body, and the new intake structures required.
Water Use and Quality—Groundwater	SMALL to MODERATE	Impact depends on volume of water withdrawn and the characteristics of the groundwater source.
Air Quality	MODERATE	Sulfur oxides: 1815 tons/yr. National and regional impacts would be minimal because of emissions offsets through the SO_2 trading program. Nitrogen oxides: 828 tons/yr. Particulates: 259 tons/yr of PM_{10}. Carbon monoxide: 960 tons/yr. Small amounts of mercury and other hazardous air pollutants would be discharged along with approximately 4.7 million tons/yr of unregulated carbon dioxide.
Waste	MODERATE	Waste streams from the 680-MW(e) plant would be approximately 126,000 tons/yr of slag, 10,000 tons/yr of fly ash, 50,000 tons/yr of sulfur, 320 tons/yr of raw water treatment sludge, 201 tons/yr of general waste water treatment sludge, and 10 tons/yr of sludges from the biotreatment of gasification process waste water.

Table 8-4. (contd)

Impact Category	Impact	Comment
Human Health	SMALL	Impacts are uncertain, but considered SMALL in the absence of more quantitative data.
Socioeconomics	SMALL to LARGE	Peak construction employment would be approximately 1000 workers. The operating workforce would be between 100 to 150 employees. Construction impacts depend on location, but could be LARGE if plant is located in an area that is more rural than the Monticello site. Wright County would experience loss of tax base and employment, potentially offset by projected economic growth.
Socioeconomics (Transportation)	SMALL to MODERATE	Transportation impacts associated with construction workers could be SMALL to MODERATE. For rail transportation of coal and lime, the impact is considered SMALL to MODERATE. For barge transportation, the impact is considered SMALL.
Aesthetics	SMALL to LARGE	Impacts could include visual impairment, infrastructure for delivery of coal and limestone, and noise. The severity of impacts range from SMALL to LARGE and are dependent on location.
Historic and Archaeological Resources	SMALL	A new plant at a greenfield location would necessitate cultural resource studies. Any potential impacts can likely be effectively managed.
Environmental Justice	SMALL to MODERATE	Impacts will vary depending on population distribution and makeup at the site.

- **Land Use**

NMC assumes siting of the coal gasification plant at an alternate greenfield site. Approximately 1700 ac would be impacted for the power block; fuel handling, storage and transportation facilities; infrastructure facilities; and waste disposal. There would be additional land impacts for coal and limestone mining, electric power transmission lines, and cooling water intake and discharge pipelines.

In the GEIS, the staff estimated that approximately 21,745 ac would be affected for mining the coal and disposing of the waste to support a 1000-MW(e) coal plant during its operational life (NRC 1996). A replacement coal gasification plant to replace the 600-MW(e) capacity of Monticello would affect proportionately less land.

Overall, land use impacts can be characterized as MODERATE to LARGE.

- **Ecology**

At an alternate site, the coal gasification alternative would introduce construction impacts and operational impacts. Even assuming siting at a previously disturbed area, the impacts would alter the ecology. Impacts could include wildlife habitat loss, reduced productivity, habitat fragmentation, and a local reduction in biological diversity. Use of cooling makeup water from a nearby surface water body could have adverse aquatic resource impacts. Construction and maintenance of a transmission line and a rail spur or barge facility, if needed, would also have ecological impacts.

Overall, with the large degree of uncertainty in the magnitude of impacts resulting from not analyzing a specific site or design, the ecological impacts from a new coal gasification generating plant at an alternate greenfield site could range from SMALL to LARGE.

- **Water Use and Quality—Surface Water**

At an alternate site, water use and quality impacts would depend on the volume of water withdrawn and discharged, the constituents in the discharge water, and the characteristics of the surface water body. The highest sustained water needs during operation would be approximately 5645 gpm. Of the 5645 gpm almost half would be for cooling system makeup water (TVA 2003). Discharges would be regulated by the State or by the EPA. Construction-related impacts would be mitigable and temporary.

Overall, surface water use and quality impacts at an alternate greenfield site can be characterized as SMALL to MODERATE depending on the location chosen.

- **Water Use and Quality—Groundwater**

Any impacts to groundwater during operation would most likely be associated with storage and handling of feedstocks and the storage, handling, and disposal of wastes generated. Runoff from the coal and petroleum coke storage areas would be collected in a drainage basin and treated as needed (TVA 2003). Impacts would depend on the volume of groundwater withdrawn and the characteristics of the groundwater source.

Overall, groundwater use and quality impacts at an alternate greenfield site can be characterized as SMALL to MODERATE depending on the location chosen.

- **Air Quality**

The air quality impacts of coal-fired generation vary considerably from those of nuclear generation emissions of SO_2, NO_x, particulates, carbon monoxide, hazardous air pollutants such as mercury, and naturally occurring radioactive materials.

Estimated air emissions for a coal gasification plant meeting all applicable regulatory requirements and sized to fully replace the 600-MW(e) capacity of Monticello are shown in Table 8-4 (TVA 2003). The estimated emissions are based on using petroleum coke as fuel. Emissions of SO_x are higher for petroleum coke than if coal is used as the fuel.

A new coal gasification generating plant would need to meet the new source review requirements in Title I of the Clean Air Act (42 USC 7401-7515). The plant would need an operating permit issued under Title V of the Clean Air Act (42 USC 7661-7661f). The plant would also need to comply with the new source performance standards for new generating plants in 40 CFR Part 60, Subpart D. The standards establish limits for particulate matter and opacity, SO_2, and NO_x.

The EPA has various regulatory requirements for visibility protection in 40 CFR Part 51, Subpart P, including a specific requirement for review of any new major stationary source in an area designated as attainment or unclassified under the Clean Air Act (40 CFR 51.307).

Section 169A of the Clean Air Act establishes a national goal of preventing future and remedying existing impairment of visibility in mandatory Class I Federal areas when impairment is from air pollution resulting from human activities. In addition, the EPA issued a new regional haze rule in 1999 (EPA 1999). The rule specifies that for each mandatory Class I Federal area located within a state, state agencies must establish goals that provide for reasonable progress towards achieving natural visibility conditions. The reasonable progress goals must provide for an improvement in visibility for the most-impaired days over the period of the implementation plan and ensure no degradation in visibility for the least-impaired days over the same period (40 CFR 51). If a new coal gasification power plan were located close to a mandatory Class I Federal area, additional air pollution control requirements could be imposed.

In March 2005, the EPA issued CAIR, which will permanently cap emissions of SO_2 and NO_x in the eastern United States (EPA 2005b). CAIR achieves large reductions of SO_2 and/or NO_x emissions across 28 eastern states and the District of Columbia. When fully implemented, CAIR will reduce SO_2 emissions in these states by over 70 percent, and NO_x emissions by over 60 percent from 2003 levels. This will result in $85 to $100 billion in health benefits, and nearly $2 billion in visibility benefits per year by 2015, and will substantially reduce premature mortality in the eastern United States. The benefits will continue to grow each year with further implementation. By 2015, CAIR will help Minnesota sources reduce emissions of SO_2 by 40,000 tons, or 36 percent, and emissions of NO_x by 53,000 tons, or 59 percent (EPA 2005a). Any new fossil-fired power plant sited in Minnesota would be subject to the CAIR limitations.

A coal gasification plant would also have unregulated carbon dioxide emissions that could contribute to global warming. The staff estimates that coal gasification plants sufficient to replace the power generated at Monticello would emit approximately 4.7 million tons per year of carbon dioxide (TVA 2003).

Overall, the air quality impacts associated with new coal gasification plants to replace the power generated at Monticello would be MODERATE. The impacts would be clearly noticeable, but would not destabilize air quality.

- **Waste**

The major solid waste and by-product streams would be generated by the gasifiers. Slag, fly ash, and sulfur account for more than 99 percent of the solids produced by coal gasification plants, with the remaining 1 percent consisting of spent catalysts and water treatment sludges. The generation rates in tons per year for a 680-MW(e) plant are shown in Table 8-4 (TVA 2003). The slag produced is an inert, glass-like material that has been found in coal gasification demonstrations to be non-leachable (TVA 2003). Based on testing at gasification demonstration plants, the slag and fly ash from gasification of eastern bituminous coal is expected to be below the RCRA threshold limits for hazardous designation (TVA 2003). Most of the sulfur in the coal is converted to hydrogen sulfide in the synthetic gas. The hydrogen sulfide is removed by acid gas removal and then converted to elemental sulfur by-product in the sulfur recovery system.

There would be three process solid waste streams composed of sludges from raw water or waste water treatment: raw water treatment sludge, general waste water treatment sludge, and sludge from the biotreatment of gasification process waste water. Generation amounts are shown in Table 8-4. These sludges are typically not hazardous and would be disposed of at nearby State-approved municipal disposal sites (TVA 2003).

Construction-related debris would be generated during construction activities for the coal gasification units and disposed at a landfill.

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

- **Human Health**

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

The staff stated in the GEIS that there could be human health impacts (cancer and emphysema) from inhalation of toxins and particulates from a coal-fired plant, but did not identify the significance of these impacts (NRC 1996). In addition, the discharges of uranium

and thorium from coal-fired plants can produce radiological doses in excess of those arising from nuclear power plant operations (Gabbard 1993).

Regulatory agencies, including the EPA and State agencies, set air emission standards and requirements based on human health impacts. These agencies also impose site-specific emission limits as needed to protect human health.

Overall, human health impacts from radiological doses and inhaling toxins, and particulates generated by burning coal at a newly constructed coal gasification plant are characterized as SMALL.

- **Socioeconomics**

Peak employment during construction would be approximately 1000 workers (Bily 2005). During construction of the coal gasification plant, the surrounding communities would experience demands on housing and public services that could have SMALL impacts. These impacts would be tempered by construction workers commuting to the site from other parts of Wright County or from other counties. After construction, the communities would be impacted by the loss of the construction jobs, although this loss would be possibly offset by other growth currently being projected for Wright and Sherburne counties (USCB 2004). The permanent operating staff would be between 100 to 150 workers (Bily 2005).

Construction of a replacement coal gasification plant at an alternate greenfield site would relocate some socioeconomic impacts, but would not eliminate them. The communities around Monticello would still experience the impact of the loss of permanent employees, contractors, and temporary workers associated with Monticello operations. This would be partially offset by projected economic growth; the communities around the new site would have to absorb the impacts of a temporary work force and a permanent work force of approximately 100 to 150 workers (Bily 2005). Communities in Wright County in particular would experience losses in both employment and tax revenues due to the Monticello site closure, assuming the plant is constructed outside the area. This impact could be MODERATE to LARGE. In the GEIS, the staff stated that socioeconomic impacts at a rural site would be larger than at an urban site, because more of the peak construction work force would need to move to the area to work. Alternate greenfield sites would need to be analyzed on a case-by-case basis. Socioeconomic impacts at a rural site could be LARGE.

Overall, socioeconomic impacts of a new coal gasification plant would be SMALL to LARGE depending on the site.

- **Socioeconomics (Transportation)**

Transportation-related impacts associated with commuting construction workers at an alternate greenfield site are site-dependent, but could be SMALL to MODERATE. Transportation

impacts related to commuting of plant operating personnel would also be site-dependent, but can be characterized as SMALL to MODERATE.

Coal and limestone would likely be delivered to an alternate site by rail or barge. Socioeconomic impacts associated with rail transportation would likely be SMALL to MODERATE. For example, there would be delays to highway traffic as trains pass and there could be negative impacts on the value of property close to the train tracks. The socioeconomic impacts of barge delivery of coal and limestone would likely be SMALL.

- **Aesthetics**

Potential aesthetic impacts of construction and operation of a coal gasification plant include visual impairment resulting from the presence of an industrial facility, particularly exhaust stacks and flaring stacks to burn waste gas. Flaring operations would generally be visible within a 3-mi radius, particularly at night. Vapor fog from the cooling towers and stack emissions could be visible up to 10 mi or more. However, the topography throughout most of southern Minnesota is rolling, with forested tracts common in some areas. Both of these factors act to reduce the viewshed and limit potential for impairment of visual aesthetics from onsite and offsite infrastructure. If needed, new electric power transmission lines and/or a rail spur could have significant aesthetic impacts.

Overall, the aesthetic impacts at an alternate site would be SMALL to LARGE depending on the location chosen.

A coal gasification plant would introduce mechanical sources of noise that would be audible offsite. Sources contributing to total noise produced by plant operation are classified as continuous or intermittent. Continuous sources include the mechanical equipment associated with normal plant operations. Intermittent sources include the equipment related to coal handling, solid-waste disposal, transportation related to coal and lime delivery, use of outside loudspeakers, and the commuting of plant employees.

Noise impacts associated with rail delivery of coal and lime to a plant would be most significant for residents living in the vicinity of the facility and along the rail route. Although noise from passing trains significantly raises noise levels near the rail corridor, the short duration of the noise reduces the impact. Nevertheless, given the frequency of train transport and the many residents likely to be within hearing distance of the rail route, the impacts of noise on residents in the vicinity of the facility and the rail line is considered MODERATE. Overall, the noise impacts at an alternate site would be MODERATE to LARGE depending on the location chosen.

- **Historic and Archaeological Resources**

At an alternate site, a cultural resource inventory would likely be needed for any onsite property that has not been previously surveyed. Other lands, if any, that are acquired to support the plant would also likely need an inventory of field cultural resources, identification and recording of existing historic and archaeological resources, and possible mitigation of adverse effects from subsequent ground-disturbing actions related to physical expansion of the plant site.

Before construction at an alternate greenfield site, studies would likely be needed to identify, evaluate, and address mitigation of the potential impacts of new plant construction on cultural resources. The studies would likely be needed for all areas of potential disturbance at the proposed plant site and along associated corridors where new construction would occur (e.g., roads, transmission corridors, rail lines, or other rights-of-way). Historic and archaeological resource impacts can generally be effectively managed and as such are considered SMALL.

- **Environmental Justice**

Environmental justice impacts would depend upon the population distribution around the chosen location. Construction activities would offer new employment possibilities, but could have negative impacts on the availability and cost of housing, which could disproportionately affect minority and low-income populations. Overall, environmental justice impacts are likely to be SMALL to MODERATE.

8.2.4 Nuclear Power Generation

Since 1997, the NRC has certified three new standard designs for nuclear power plants under 10 CFR Part 52, Subpart B. These designs are the 1300-MW(e) U.S. Advanced Boiling Water Reactor (10 CFR Part 52, Appendix A), the 1300-MW(e) System 80+ Design (10 CFR Part 52, Appendix B), and the 600-MW(e) AP600 Design (10 CFR Part 52, Appendix C). All of these plant designs are light-water reactors. Although no applications for a construction permit or a combined license based on these certified designs have been submitted to NRC, the submission of the design certification applications indicates continuing interest in the possibility of licensing new nuclear power plants. In addition, recent escalation in prices of natural gas and electricity have made new nuclear power plant construction more attractive from a cost standpoint. Consequently, construction of a new nuclear power plant at either the Monticello site or an alternate greenfield is considered in this section. The staff assumed that the new nuclear plant would have a 40-year period of plant operation. Consideration of a new nuclear generating plant to replace Monticello was not included in the NMC ER.

NRC has summarized environmental data associated with the uranium fuel cycle in Table S-3 of 10 CFR 51.51. The impacts shown in Table S-3 are representative of the impacts that would be associated with a replacement nuclear power plant built to one of the certified designs, sited at Monticello or an alternate greenfield site. The impacts shown in Table S-3 are for a

1000-MW(e) reactor and would need to be adjusted to reflect impacts of 600 MW(e) of new nuclear power. The environmental impacts associated with transporting fuel and waste to and from a light-water cooled nuclear power reactor are summarized in Table S-4 of 10 CFR 51.52. The summary of NRC's findings on NEPA issues for license renewal of nuclear power plants in Table B-1 of 10 CFR Part 51, Subpart A, Appendix B, is also relevant, although not directly applicable, for consideration of environmental impacts associated with the operation of a replacement nuclear power plant. Additional environmental impact information for a replacement nuclear power plant using closed-cycle cooling is presented in Section 8.2.4.1 and using open-cycle cooling in Section 8.2.4.2.

8.2.4.1 Closed-Cycle Cooling System

The overall impacts of the nuclear generating system are discussed in the following sections. The impacts are summarized in Table 8-5. The extent of impacts at an alternate greenfield site will depend on the location of the particular site selected.

- **Land Use**

The existing facilities and infrastructure at the Monticello site would be used to the extent practicable, limiting the amount of new construction that would be required. Specifically, the staff assumed that a replacement nuclear power plant would use the existing circulating water system, switchyard, offices, and transmission line rights-of-way. Much of the land that would be used has been previously disturbed.

A replacement nuclear power plant at the Monticello site would alter approximately 500 to 1000 ac of land to industrial use. There would be no net change in land needed for uranium mining because land needed for the new nuclear plant would offset land needed to supply uranium for fuel for Monticello.

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

Land-use impacts at an alternate greenfield site would be similar to siting at Monticello except for the land needed for a transmission line to connect to existing lines to transmit power to NSP's customers in the Southern Minnesota area. Assuming a 60-mi transmission line, an additional 2500 ac would be needed. In addition, it may be necessary to construct a rail spur to an alternate site to bring in equipment during construction. Depending particularly on transmission line routing, siting a new nuclear plant at an alternate greenfield site would result in MODERATE to LARGE land-use impacts.

- **Ecology**

Locating a replacement nuclear power plant at the Monticello site would alter ecological resources because of the need to convert roughly 500 to 1000 ac of land to industrial use. Some of this land, however, would have been previously disturbed.

Table 8-5. Summary of Environmental Impacts of New Nuclear Power Generation at the Monticello Site and an Alternate Site Using Closed-Cycle Cooling

Impact	Monticello Site		Alternate Greenfield Site	
Category	**Impact**	**Comment**	**Impact**	**Comment**
Land Use	MODERATE	Requires approximately 500 to 1000 ac for the plant and 1000 ac for uranium mining.	MODERATE to LARGE	Same as Monticello site plus land for transmission line (2500 ac assuming a 60-mi line).
Ecology	MODERATE	Uses undeveloped areas at current Monticello site.	MODERATE to LARGE	Impact depends on location and ecology of the site, surface water body used for intake and discharge, and transmission line route; potential habitat loss and fragmentation; reduced productivity and biological diversity.
Water Use and Quality—Surface Water	SMALL	Uses existing cooling canal system.	SMALL to MODERATE	Impact will depend on the volume of water withdrawn and discharged and the characteristics of the surface water body.
Water Use and Quality—Groundwater	SMALL	Uses existing cooling canal system.	SMALL to MODERATE	Impact will depend on the volume of water withdrawn and discharged and the characteristics of the groundwater source.
Air Quality	SMALL	Fugitive emissions and emissions from vehicles and equipment during construction. Small amount of emissions from diesel generators and possibly other sources during operation.	SMALL	Same impacts as Monticello site.

Table 8-5. (contd)

Impact	Monticello Site		Alternate Greenfield Site	
Category	**Impact**	**Comment**	**Impact**	**Comment**
Waste	SMALL	Waste impacts for an operating nuclear power plant are set out in 10 CFR 51, Appendix B, Table B-1. Debris would be generated and removed during construction.	SMALL	Same impacts as Monticello site.
Human Health	SMALL	Human health impacts for an operating nuclear power plant are set out in 10 CFR 51, Appendix B, Table B-1.	SMALL	Same impacts as Monticello site.
Socio-economics	SMALL to MODERATE	During construction, impacts would be MODERATE. Up to 2500 workers during peak period of the 6-year construction period. Operating work force assumed to be similar to current Monticello plant; tax base preserved. Impacts during operation would be SMALL.	SMALL to LARGE	Construction impacts depend on location. Impacts at a rural location could be LARGE. Wright County would experience loss of tax base and employment, possibly offset by economic growth.
Socio-economics (Transpor-tation)	SMALL to LARGE	Transportation impacts associated with construction workers could be MODERATE to LARGE. Transportation impacts of commuting plant personnel would be SMALL.	SMALL to LARGE	Transportation impacts of construction workers could be MODERATE to LARGE. Transportation impacts of commuting plant personnel could be SMALL to MODERATE.
Aesthetics	SMALL	No exhaust stacks or cooling towers would be needed. Daytime visual impact could be mitigated by landscaping and appropriate color selection for buildings. Visual impact at night could be mitigated by reduced use of lighting and appropriate shielding. Noise impacts would be relatively small and could be mitigated.	SMALL to LARGE	Greatest impact is from the new transmission line that would be needed.

Table 8-5. (contd)

Impact	Monticello Site		Alternate Greenfield Site	
Category	**Impact**	**Comment**	**Impact**	**Comment**
Historic and Archaeo-logical Resources	SMALL	Any potential impacts can likely be effectively managed.	SMALL	Any potential impacts can likely be effectively managed.
Environ-mental Justice	SMALL	Impacts on minority and low-income communities should be similar to those experienced by the population as a whole. Some impacts on housing may occur during construction.	SMALL to MODERATE	Impacts will vary depending on population distribution and makeup at the site. Impacts to minority and low-income residents of Wright County associated with closure of Monticello could be significant, but could also be mitigated by projected economic growth for the area.

Siting a replacement nuclear plant at Monticello would have a MODERATE ecological impact that would be greater than renewal of the Monticello OL.

At an alternate site, there would be construction impacts and new incremental operational impacts. Even assuming siting at a previously disturbed area, the impacts would alter the ecology. Impacts could include wildlife habitat loss, reduced productivity, habitat fragmentation, and a local reduction in biological diversity. Use of cooling makeup water from a nearby surface water body could have adverse aquatic resource impacts. Construction and maintenance of the transmission line, if needed, would also have ecological impacts. Overall, the ecological impacts of a replacement nuclear plant at an alternate site could range from MODERATE to LARGE.

- **Water Use and Quality—Surface Water**

The replacement nuclear plant alternative at the Monticello site is assumed to use the existing circulating water system, which would minimize incremental water-use and quality impacts. Surface-water impacts are expected to remain SMALL; the impacts would be sufficiently minor that they would not noticeably alter any important attribute of the resource.

Cooling towers would likely be used at an alternate site. For an alternate site, the impact on the surface water would depend on the volume of water needed for makeup water, the discharge volume, and the characteristics of the receiving body of water. Intake from and discharge to any surface body of water would be regulated the Minnesota Department of Natural Resources (MNDNR). The impacts would be SMALL to MODERATE.

- **Water Use and Quality—Groundwater**

The staff assumed that a new nuclear power plant located at Monticello would obtain potable, process, and fire-protection water from onsite wells similar to the current practice for Monticello (see Section 2.2.2). NMC operates four groundwater wells to meet the domestic water needs of the Monticello site. It is unlikely that groundwater use for an alternative nuclear power plant at Monticello would be significantly different than existing use at Monticello. Any groundwater withdrawal would require a permit from the local permitting authority.

Overall, the impacts of the nuclear alternative at the Monticello site would be SMALL. The impacts of the nuclear alternative at an alternate site would be SMALL to MODERATE.

- **Air Quality**

Construction of a new nuclear plant at Monticello or an alternate site would result in fugitive emissions during the construction process. Exhaust emissions would also come from vehicles and motorized equipment used during the construction process. These emissions are not regulated. An operating nuclear plant would have minor air emissions associated with diesel generators and other minor intermittent sources. These minor operating emissions for a plant sited in Minnesota would be regulated by the Minnesota Pollution Control Agency. Overall, emissions and associated impacts at either the Monticello site or an alternate site are considered SMALL.

- **Waste**

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

- **Human Health**

Human health impacts for an operating nuclear power plant are set out in 10 CFR Part 51, Subpart A, Appendix B, Table B-1. Overall, human health impacts of a new nuclear plant at either the Monticello site or an alternate site are considered SMALL.

- **Socioeconomics**

The construction period and the peak work force associated with construction of a new nuclear power plant are currently unquantified (NRC 1996). In the absence of quantitative data, staff assumed a construction period of 6 years and a peak work force of 2500. The staff assumed that construction would take place while the existing nuclear unit continues operation and would

be completed by the time Monticello permanently ceases operations. During construction, the communities surrounding the Monticello site would experience demands on housing and public services that could have MODERATE impacts. These impacts could be tempered by construction workers commuting to the site from other parts of Wright County or from other counties. After construction, the communities would be impacted by the loss of the construction jobs, although this loss would be possibly offset by other growth currently being projected for Wright and Sherburne counties.

The replacement nuclear unit is assumed to have an operating work force comparable to the 519 workers currently working at Monticello. The replacement nuclear unit would provide a new tax base to offset the loss of tax base associated with decommissioning of Monticello.

For all of these reasons, the appropriate characterization of non-transportation socioeconomic impacts for replacement nuclear units constructed at Monticello would be SMALL to MODERATE; the socioeconomic impacts would be noticeable, but would be unlikely to destabilize the area.

Construction of a replacement nuclear power plant at an alternate greenfield site would relocate some socioeconomic impacts, but would not eliminate them. The communities around the Monticello site would still experience the impact of Monticello operational job loss (although potentially tempered by projected economic growth). The communities around the new site would have to absorb the impacts of a large, temporary work force (up to 2500 workers at the peak of construction) and a permanent work force of approximately 519 workers. In the GEIS (NRC 1996), the staff indicated that socioeconomic impacts at a rural site would be larger than at an urban site because more of the peak construction work force would need to move to the area to work. The Monticello site is within commuting distance of the Minneapolis/St. Paul metropolitan area and is therefore not considered a rural site. Impacts at an alternate greenfield site would need to be analyzed on a case-by-case basis and could range from SMALL to LARGE.

- **Socioeconomics (Transportation)**

During the 6-year construction period, up to 2500 construction workers would be working at the Monticello site in addition to the 519 workers at Monticello. The addition of the construction workers could place significant traffic loads on existing highways, particularly those leading to the Monticello site. Such impacts would be MODERATE to LARGE. Transportation impacts related to commuting of plant operating personnel would be similar to current impacts associated with operation of Monticello and are considered SMALL.

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

- **Aesthetics**

The containment buildings for a replacement nuclear power plant sited at Monticello and other associated buildings would likely be visible in daylight hours over many miles. The replacement nuclear units would also likely be visible at night because of outside lighting. Visual impacts could be mitigated by landscaping and selecting a color for buildings that is consistent with the environment. Visual impact at night could be mitigated by reduced use of lighting and appropriate use of shielding. No exhaust stacks would be needed.

Noise impacts from a new nuclear plant would be similar to those from the existing Monticello site. Mitigation measures, such as reduced or no use of outside loudspeakers, can be employed to reduce noise levels and maintain the impact of noise SMALL.

At an alternate greenfield site, there would be an aesthetic impact from the buildings, cooling towers, and the plume associated with the cooling towers. There would also be a significant aesthetic impact associated with construction of a new 60-mi transmission line to connect to other lines to enable delivery of electricity to the southern Minnesota area. Noise impacts from a new nuclear plant would be similar to those from the existing Monticello site. Mitigation measures, such as reduced or no use of outside loudspeakers, can be employed to reduce noise levels and maintain the impact of noise SMALL. Aesthetic impacts at a greenfield site would be mitigated if the plant is located in an industrial area adjacent to other power plants. Overall the aesthetic impacts associated with locating at an alternative site can be categorized as SMALL to LARGE. The greatest contributor to this categorization is the aesthetic impact of the new transmission line, if needed.

- **Historic and Archaeological Resources**

At both Monticello and an alternate greenfield site, a cultural resource inventory would likely be needed for any onsite property that has not been previously surveyed. Other lands, if any, that are acquired to support the plant would also likely need an inventory of field cultural resources, identification and recording of existing historic and archaeological resources, and possible mitigation of adverse effects from subsequent ground-disturbing actions related to physical expansion of the plant site.

Before construction at Monticello or another site, studies would likely be needed to identify, evaluate, and address mitigation of the potential impacts of new plant construction on cultural resources. The studies would likely be needed for all areas of potential disturbance at the proposed plant site and along associated corridors where new construction would occur (e.g., roads, transmission corridors, rail lines, or other rights-of-way). Historic and archaeological resource impacts can generally be effectively managed and would be SMALL at either Monticello or a greenfield site.

- **Environmental Justice**

No environmental pathways or locations have been identified that would result in disproportionately high and adverse environmental impacts on minority and low-income populations if a replacement nuclear plant were built at the Monticello site. Some impacts on housing availability and prices during construction might occur, and this could disproportionately affect the minority and low-income populations. After completion of construction, it is possible that the ability of the local government to maintain social services could be reduced at the same time as diminished economic conditions reduce employment prospects for the minority and low-income populations. Overall, impacts are expected to be SMALL. Projected economic growth in Wright and Sherburne counties and the ability of minority and low-income populations to commute to other jobs outside the Wright County area could mitigate any adverse effects.

Impacts at other sites would depend upon the site chosen and the nearby population distribution, but are likely to be SMALL to MODERATE. Impacts to minority and low income residents of Wright County associated with closure of Monticello could be significant, but could also be mitigated by projected economic growth for the area.

8.2.4.2 Once-Through Cooling System

This section discusses the environmental impacts of constructing a nuclear power plant at the Monticello site using once-through cooling. The impacts (SMALL, MODERATE, or LARGE) of this option are the same as the impacts for a nuclear power plant using a closed-cycle system. However, there are minor environmental differences between the closed-cycle and once-through cooling systems. Table 8-6 summarizes the incremental differences.

Table 8-6. Summary of a Comparison of Environmental Impacts of a New Nuclear Power Plant Sited at the Monticello Site with Once-Through Cooling

Impact Category	Change in Impacts from Closed-Cycle Cooling
Land Use	Impacts may be less (e.g., through elimination of cooling towers) or greater (e.g., if a reservoir is required).
Ecology	Impacts would depend on ecology at the site. Possible impacts associated with entrainment of fish and shellfish in early life stages, impingement of fish and shellfish, and heat shock.
Water Use and Quality—Surface Water	Increased water withdrawal leading to possible water-use conflicts, thermal load higher than with closed-cycle cooling.
Water Use and Quality—Groundwater	No change.
Air Quality	No change.
Waste	No change.
Human Health	No change.

Table 8-6. (contd)

Impact Category	Change in Impacts from Closed-Cycle Cooling
Socioeconomics	No change.
Socioeconomics (Transportation)	No change.
Aesthetics	Elimination of cooling towers.
Historic and Archaeological Resources	No change.
Environmental Justice	No change.

8.2.5 Purchased Electrical Power

If available, purchased power from other sources could potentially obviate the need to renew the Monticello OL. Purchased power accounted for approximately 25 percent of NSP power sales in 2004 (NSP 2004).

In Canada, 62 percent of the country's electrical generation capacity is derived from renewable energy sources, principally hydropower (DOE/EIA 2001). Canada has plans to continue developing hydroelectric power, but the plans generally do not include large-scale projects (DOE/EIA 2001). Canada's nuclear generation is projected to increase by 1.7 percent by 2020, but its share of power generation in Canada is projected to decrease from 14 percent currently to 13 percent by 2020 (DOE/EIA 2001). Consequently, it is unlikely that electricity imported from Canada would be able to replace the Monticello generating capacity.

The staff assumes that 100 mi of new 345-kV transmission lines on a 150-ft wide corridor in southern Minnesota, potentially affecting approximately 1800 ac, would be required to import purchased power. Considering the nature of transmission line development and potential mitigation measures available, impacts of greatest concern are those related to change in land use, terrestrial ecological communities, and aesthetics. Land use and terrestrial ecological habitats in the region where it is assumed the line would be built consists predominantly of rural agricultural land interspersed in some areas with natural vegetation. Development of the transmission line would limit changes in future land uses on the corridor to those that are compatible with the line, but most agricultural practices and other currently compatible uses could continue.

Establishment of a corridor for the transmission line would have little effect on either the amount or value of habitat represented by agricultural land, the predominant habitat expected on lands traversed by these facilities, because compatible agricultural practices could continue. Similarly, open wetlands would be spanned and therefore little effected. Some visual impairment of rural landscape could result from development of the transmission line.

However, the topography throughout most of southern Minnesota is rolling, and forested tracts occur in some parts of the area. Both of these attributes would act to reduce the viewshed and limit potential for impairment of visual aesthetics. In addition, the presence of transmission lines is not out of character for the existing rural southern Minnesota landscape. The staff expects that routing of the line could be accomplished such that highly incompatible land uses, important habitats and associated important species, and areas of potentially high impact on visual aesthetics would be recognized and avoided or appropriately mitigated such that important attributes of these resources would not be destabilized.

If power to replace Monticello capacity were to be purchased from sources within the United States or a foreign country, the generating technology would likely be one of those described in this SEIS and in the GEIS (probably coal, natural gas, coal gasification, or nuclear). The description of the environmental impacts of other technologies in Chapter 8 of the GEIS is representative of the purchased electrical power alternative to renewal of the Monticello OL. Thus, the environmental impacts of imported power would still occur but would be located elsewhere within the region, nation, or another country.

8.2.6 Other Alternatives

Other generation technologies considered by the staff in its analyses are discussed in the following subsections.

8.2.6.1 Oil-Fired Generation

EIA projects that oil-fired plants will account for very little of the new generation capacity in the United States during the 2000 to 2020 time period because of higher fuel costs and lower efficiencies (DOE/EIA 2000).

NSP has several oil-fired units; however, they produce less than one percent of NSP's power generation (NSP 2004). Oil-fired operation is more expensive than nuclear or coal-fired operation. In addition, future increases in oil prices are expected to make oil-fired generation increasingly more expensive than coal-fired generation. The high cost of oil has prompted a steady decline in its use for electricity generation. In 2001, only 0.82 billion kWh of electricity was generated from petroleum in the Mid-Continent Area Power Pool (MAPP), 0.5 percent of the total generation in the region. The percentage of total generation from oil in MAPP is projected to decrease to 0.1 percent by 2010 (DOE/EIA 2004).

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

For these reasons, the staff does not consider oil-fired generation, by itself, a feasible alternative to replace the baseload generating capacity at Monticello.

8.2.6.2 Wind Power

Wind power, by itself, is not suitable for large baseload capacity. As discussed in Section 8.3.1 of the GEIS, wind has a high degree of intermittency, and average annual capacity factors for wind plants are relatively low (on the order of 30 percent). Wind power, in conjunction with energy storage mechanisms, might serve as a means of providing baseload power. However, current energy storage technologies are too expensive for wind power to serve as a large baseload generator.

Wind turbines are economical in wind power Classes 4 through 7 (average wind speeds of 12.5 to 21.1 mph) (DOE 2001). In Minnesota, Class 4 wind potential exists in exposed uplands in the southern part of the state and in the Red River Valley between North Dakota and northern Minnesota. These resources, particularly in the Buffalo Ridge area in the southwestern part of the state, could support development approaching 3000 MW(e) by 2010, but significant transmission constraints exist (MDC 2004). EIA projects that wind-power generating capacity in MAPP totaled 1120 MW(e) in 2004 and will increase by 590 MW(e) by 2010 (DOE/EIA 2004). From a practical perspective, the scale of this technology is too small to directly replace a power generating plant equivalent to the output capacity of Monticello.

There are substantial impacts to natural resources (wildlife habitat, land-use, and aesthetic impacts) from construction of wind power facilities. As stated in the GEIS, land requirements are high—150,000 ac of land to generate 1000 MW(e) of power. Approximately 90,000 ac would be required for 600 MW(e) of wind power generating capacity to replace the Monticello plant. The installation of large-scale wind farms requires construction of access roads for turbine installation and maintenance and installation of transmission lines.

The impacts associated with large-scale construction, particularly in remote or sensitive areas, could be LARGE. After the turbines and transmission lines are installed, the continuing impacts from operation would include the aesthetic impact of the turbines and transmission lines, and impacts to terrestrial biota, primarily birds, as a result of physical impacts with the turbine blades.

For these reasons, the staff concludes that wind power alone is not a feasible substitute at this time for the base load generation from Monticello. However, the staff recognizes that wind power projects are being developed in areas with significant wind potential. Therefore, it is reasonable to include wind power in a combination of alternatives that could replace the generation from Monticello. Combined alternatives are discussed in Section 8.2.7.

8.2.6.3 Solar Power

Solar technologies use the sun's energy and light to provide heat and cooling, light, hot water, and electricity for homes, businesses, and industry. The two leading solar technologies are photovoltaic and solar thermal. Photovoltaic devices use semiconducting materials that absorb sunlight and convert it directly into electricity. Solar thermal devices use direct heat from the sun, concentrating it in some manner (such as by reflection) to heat a transfer fluid to useful temperatures. In the GEIS, the staff noted that by its nature, solar power is intermittent. Therefore, solar power by itself is not suitable for baseload capacity and is not a feasible alternative to license renewal at Monticello. The average capacity factor of photovoltaic cells is about 25 percent, and the capacity factor for solar thermal systems is about 25 percent to 40 percent. Solar power, in conjunction with energy storage mechanisms, might serve as a means of providing baseload power. However, current energy storage technologies are too expensive to permit solar power to serve as a large baseload generator. In addition, solar technologies require high operation and maintenance cost, due to the need to clean reflectors or collectors to ensure efficient operation.

Therefore, solar power technologies (photovoltaic and thermal) cannot currently compete with conventional fossil-fueled technologies in grid-connected applications, due to high costs per kilowatt of capacity (NRC 1996).

There are substantial impacts to natural resources (wildlife habitat, land-use, and aesthetic impacts) from construction of solar-generating facilities. As stated in the GEIS, land requirements are high—approximately 14,000 ac per 1000 MW(e) for solar thermal and 35,000 ac per 1000 MW(e) for photovoltaic systems. Approximately 8000 and 21,000 ac would be required for 600 MW(e) of solar thermal or solar photovoltaic generating capability, respectively, to replace the Monticello site. Neither type of solar electric system could be accommodated at the Monticello site, and both would have large environmental impacts at a greenfield site.

The Monticello site receives approximately 3.3 to 4.4 kWh of solar radiation per square meter per day, compared to 6 to 8 kWh of solar radiation per square meter per day in areas of the western United States, such as California, which are most promising for solar technologies (NMC 2005). Some solar power may substitute for electric power in rooftop and building applications. Implementation of non-rooftop solar generation on a scale large enough to replace Monticello would likely result in LARGE environmental impacts.

Because of the natural resource impacts (land and ecological), the area's relatively low rate of solar radiation, and high cost, solar power is not deemed a feasible baseload alternative to renewal of the Monticello OL. However, the staff recognizes that distributed solar power can provide generation and that during the license renewal period generation from solar power could continue to grow.

8.2.6.4 Hydropower

Minnesota has an estimated 137 MW(e) of undeveloped hydroelectric resources (NMC 2005). This amount is far less than needed to replace the 600 MW(e) capacity of Monticello. In Section 8.3.4 of the GEIS, the staff points out hydropower's percentage of U.S. generating capacity is expected to decline because hydroelectric facilities have become difficult to site as a result of public concern about flooding, destruction of natural habitat, and alteration of natural river courses.

The staff estimated in the GEIS that land requirements for hydroelectric power are approximately 1 million ac per 1000 MW(e). Replacement of Monticello's generating capacity would require flooding approximately 600,000 ac. Due to the large land-use and related environmental and ecological resource impacts associated with siting hydroelectric facilities large enough to replace Monticello, the staff concludes that local hydropower is not a feasible alternative to Monticello OL renewal on its own. Any attempts to site hydroelectric facilities large enough to replace Monticello would result in LARGE environmental impacts.

8.2.6.5 Geothermal Energy

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

8.2.6.6 Wood Waste

The use of wood waste to generate electricity is largely limited to those states with significant wood resources, such as California, Maine, Georgia, Minnesota, Oregon, Washington, and Michigan. Electric power is generated in these states by the pulp, paper, and paperboard industries, which consume wood and wood waste for energy, benefitting from the use of waste materials that could otherwise represent a disposal problem.

A wood-burning facility can provide baseload power and operate with an average annual capacity factor of around 70 to 80 percent and with 20 to 25 percent efficiency (NRC 1996). The fuels required are variable and site-specific. A significant barrier to the use of wood waste to generate electricity is the high delivered-fuel cost and high construction cost per MW of generating capacity. The larger wood-waste power plants are only 40 to 50 MW(e) in size. Estimates in the GEIS suggest that the overall level of construction impact per MW of installed

capacity should be approximately the same as that for a coal-fired plant, although facilities using wood waste for fuel would be built at smaller scales. Like coal-fired plants, wood-waste plants require large areas for fuel storage and processing and involve the same type of combustion equipment.

The biomass power generating capacity in MAPP was 160 MW(e) in 2004 and is not expected to increase through 2025 (DOE/EIA 2004). Due to uncertainties associated with obtaining sufficient wood and wood waste to fuel a baseload generating facility, ecological impacts of large-scale timber cutting (e.g., soil erosion and loss of wildlife habitat), and high inefficiency, the staff has determined that wood waste is not a feasible alternative to renewing the Monticello OL.

8.2.6.7 Municipal Solid Waste

Municipal waste combustors incinerate the waste and use the resultant heat to generate steam, hot water, or electricity. The combustion process can reduce the volume of waste by up to 90 percent and the weight of the waste by up to 75 percent (EPA 2001). Municipal waste combustors use three basic types of technologies: mass burn, modular, and refuse-derived fuel (DOE/EIA 2001). Mass burning technologies are most commonly used in the United States. This group of technologies process raw municipal solid waste "as is," with little or no sizing, shredding, or separation before combustion.

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

The decision to burn municipal waste to generate energy is usually driven by the need for an alternative to landfills rather than by energy considerations. The use of landfills as a waste disposal option is likely to increase in the near term; however, it is unlikely that many landfills will begin converting waste to energy because of unfavorable economics, particularly with electricity prices declining in real terms. In 2002, only 110 MW(e) of municipal solid waste generating capacity was available in MAPP, and only 10 MW(e) of additional capacity is anticipated to be developed in the region through 2025 (DOE/EIA 2004).

Municipal solid waste combustors generate an ash residue that is buried in landfills. The ash residue is composed of bottom ash and fly ash. Bottom ash refers to that portion of the

unburned waste that falls to the bottom of the grate or furnace. Fly ash represents the small particles that rise from the furnace during the combustion process. Fly ash is generally removed from flue-gases using fabric filters and/or scrubbers (DOE/EIA 2001).

Currently there are approximately 102 waste-to-energy plants operating in the United States. These plants generate approximately 2800 MW(e), or an average of approximately 28 MW(e) per plant (IWSA 2004), much smaller than needed to replace the Monticello site.

The initial capital costs for municipal solid-waste plants are greater than for comparable steam-turbine technology at wood-waste facilities. This is due to the need for specialized waste-separation and -handling equipment for municipal solid waste (NRC 1996). Furthermore, estimates in the GEIS suggest that the overall level of construction impact from a waste-fired plant should be approximately the same as that for a coal-fired plant. Additionally, waste-fired plants have the same or greater operational impacts (including impacts on the aquatic environment, air, and waste disposal). Some of these impacts would be moderate, but still larger than the environmental effects of license renewal of Monticello. Therefore, municipal solid waste would not be a feasible alternative to renewal of the Monticello OL, particularly at the scale required.

8.2.6.8 Other Biomass-Derived Fuels

In addition to wood and municipal solid-waste fuels, there are several other concepts for fueling electric generators, including burning crops, converting crops to a liquid fuel such as ethanol, and gasifying crops (including wood waste). In the GEIS, the staff points out that none of these technologies has progressed to the point of being competitive on a large scale or of being reliable enough to replace a baseload plant such as Monticello. For these reasons, such fuels do not offer a feasible alternative to renewal of the Monticello OL.

8.2.6.9 Fuel Cells

Fuel cells work without combustion and its environmental side effects. Power is produced electrochemically by passing a hydrogen-rich fuel over an anode and air over a cathode and separating the two by an electrolyte. The only by-products are heat, water, and carbon dioxide. Hydrogen fuel can come from a variety of hydrocarbon resources by subjecting them to steam under pressure. Natural gas is typically used as the source of hydrogen.

Phosphoric acid fuel cells are generally considered first-generation technology. These fuel cells are commercially available at cost of approximately $4500 per kilowatt of installed capacity. By contrast, a diesel generator costs $800 to $1500 per kilowatt, and a natural gas turbine can be even less (DOE 2004). Higher-temperature second-generation fuel cells achieve higher fuel-to-electricity and thermal efficiencies. The higher temperatures contribute to improved efficiencies and give the second-generation fuel cells the capability to generate steam for

cogeneration and combined-cycle operations. DOE has a performance target to reduce the cost of fuel cells to $400 per kilowatt by 2010 (DOE 2004).

Two second-generation fuel cell technologies using molten carbonate and solid oxide technology are currently being developed for commercial use. As market acceptance and manufacturing capacity increase, natural gas-fueled fuel cell plants are projected to become available (DOE 2004). At the present time, fuel cells are not economically or technologically competitive with other alternatives for baseload electricity generation. Fuel cells are, consequently, not a feasible alternative to renewal of the Monticello OL.

8.2.6.10 Delayed Retirement

Extending the lives of existing non-nuclear generating plants beyond the time they were originally scheduled for retirement represents another potential alternative to license renewal. However, delaying retirement in order to compensate for Monticello generally would be unreasonable without major construction to upgrade or replace plant components. NSP undertakes upgrades of its older baseload plants in cases where it is reasonable to do so. Such actions are currently accounted for in NSP's plans to meet anticipated demands irrespective of the loss of generating capacity if the Monticello OL is not renewed and, therefore, does not represent a realistic option.

For this reason, delayed retirement of other NSP generating units would not be a feasible alternative to renewal of the Monticello OL.

8.2.6.11 Utility-Sponsored Conservation

The utility-sponsored conservation alternative refers to a situation in which Monticello ceases to operate, no new generation is brought online to meet the lost generation, and the lost generation is instead replaced by more efficient use of electricity. More efficient use would arise from utility-sponsored conservation programs, potentially including energy audits, incentives to install energy-efficient equipment, and informational programs to inform electricity consumers of the benefits of, and possibilities for, electricity conservation.

Under provisions of Minnesota Statute 216B.241, Minnesota public utilities, rural electric cooperatives, and municipal utilities are required to invest 1.5 percent of in-state revenues in projects designed to reduce their customers' consumption of electricity and improve efficient use of energy resources. Utilities that operate nuclear generating facilities like Monticello are required to invest 2.0 percent of revenues in this manner. NSP has in place a wide variety of electrical energy conservation programs and activities including conservation programs, energy efficiency programs, and load management programs. Conservation programs such as NSP's Energy Solutions newsletter and internet-based information resources are designed to educate and inform customers about energy efficiency and NSP offerings. Energy efficiency programs like ConservationWise from Xcel Energy help customers increase energy efficiency by

providing rebates, pricing, or other incentives to purchase energy-efficient systems or components; renovate facilities that meet specific energy efficiency standards; undertake energy conservation assessments; and obtain expert energy conservation design assistance. Load management programs such as OperationWise from Xcel Energy encourage customers to switch load to customer-owned standby generators during periods of peak demand, and include features like Saver's Switch that encourages customers to allow a portion of their load to be interrupted during periods of peak demand.

In its order approving Xcel Energy's 2000 Integrated Resource Plan, the Minnesota Public Utilities Commission (MPUC) adopted the DSM goal referred to as the 175 percent incentive scenario for the 2000-2014 planning period. This scenario established aggressive targets of 3253 gigawatt-hours (GWh) of cumulative energy savings and 1174 MW of cumulative peak demand savings in NSP's service area over this period. NSP surpassed its annual goals in the early years of the program, but anticipates that it will become increasingly difficult to cost-effectively maintain annual targets (50 to 80 MW) in the future.

Additionally, even if these aggressive annual DSM savings targets are achieved, the cumulative savings through 2010 would be insufficient to replace generation lost as a result of Monticello operations termination at the end of its current operating license. Moreover, NSP credits these DSM goals in its demand forecasts; therefore, they cannot be used as credits to offset the power generated by Monticello.

Therefore, the staff does not consider energy efficiency, by itself, as a feasible alternative to license renewal. However, the staff recognizes that energy conservation is promoted and increases in energy efficiency occur as a normal result of replacing older equipment with modern equipment. It is reasonable to include conservation in a combination of generation sources that could replace Monticello. Combined alternatives are discussed in Section 8.2.7.

8.2.7 Combination of Alternatives

Even though individual alternatives to renewal of the Monticello OL might not be sufficient on their own to replace Monticello's generating capacity due to the small potential generating capacity of the resource or lack of cost-effective opportunities, it is conceivable that a combination of alternatives might be cost-effective.

There are many possible combinations of alternatives. As discussed previously, these combinations could include baseload gas-fired or coal-fired plants, purchased power, alternative and renewable technologies, and conservation. For the purpose of this discussion, one combination of alternatives has been assumed: 300 MW(e) of combined-cycle natural gas-fired generation using closed-cycle cooling, 150 MW(e) purchased from other generators, 50 MW(e) produced by new wind power facilities in southern Minnesota state, and 100 MW(e) of energy conservation. The impacts of other combinations, such as those from combinations that include solar power, would be different and possibly less than from the assumed combination. In some areas, such as the aesthetic impact of solar panels, the impacts would

be at least as large as the impact of the assumed combination of alternatives. In other areas, such as waste, impacts would be smaller for these alternative technologies.

Table 8-7 contains a summary of the environmental impacts of the assumed combination of alternatives. The impacts are based on the gas-fired generation impact assumptions discussed in Section 8.2.2, adjusted for the reduced generating capacity. While the DSM measures would have few environmental impacts, operation of the new gas-fired plant would result in increased emissions and environmental impacts. The environmental impacts associated with power purchased from other generators would still occur but would be located elsewhere within the region or nation, as discussed in Section 8.2.5. The impacts of purchased power are not shown in Table 8-7. The staff concludes that it is very unlikely that the environmental impacts of any reasonable combination of generating and conservation options could be reduced to the level of impacts associated with renewal of the Monticello OL.

Table 8-7. Summary of Environmental Impacts for an Assumed Combination of Generating (Combined-Cycle Natural Gas-Fired Generation, Wind Power, and DSM) and Acquisition Alternatives at Monticello and a Greenfield Site

Impact	Monticello Site		Alternate Greenfield Site	
Category	**Impact**	**Comment**	**Impact**	**Comment**
Land Use	SMALL to MODERATE	23 ac for gas-fired plant power block, offices, roads, and parking areas. Additional impact at wind power sites (at least 50 ac). Additional impact for construction of underground natural gas pipeline, electric power transmission line, and cooling-water intake/discharge piping.	SMALL to MODERATE	Same as Monticello site.
Ecology	SMALL to MODERATE	Uses undeveloped areas at current Monticello site, plus gas pipeline. Habitat loss due to development of wind power sites could have a MODERATE impact. Some increase in bird mortality at wind turbines.	SMALL to MODERATE	Impact depends on location and ecology of the sites, surface water body used for intake and discharge, and transmission and pipeline routes; potential habitat loss and fragmentation; reduced productivity and biological diversity. Some increase in bird mortality at wind turbines.
Water Use and Quality—Surface Water	SMALL	Uses existing circulating water system.	SMALL to MODERATE	Impact depends on volume of water withdrawn, the constituents in the discharge water, and the characteristics of surface water body.

Table 8-7. (contd)

Impact	Monticello Site		Alternate Greenfield Site	
Category	**Impact**	**Comment**	**Impact**	**Comment**
Water Use and Quality—Groundwater	SMALL	Uses existing groundwater wells.	SMALL to MODERATE	Impact depends on volume of water withdrawn.
Air Quality	MODERATE	Sulfur oxides: 4.5 tons/yr Nitrogen oxides: 67 tons/yr Carbon monoxide: 102 tons/yr PM_{10} particulates: 13 tons/yr Some hazardous air pollutants. Additional emissions from producers of purchased power.	MODERATE	Same as Monticello site.
Waste	SMALL	Minimal waste generated.	SMALL	Same as Monticello site.
Human Health	SMALL	Impacts considered to be minor.	SMALL	Same as Monticello site.
Socio-economics	SMALL to MODERATE	During construction, impacts would be SMALL to MODERATE. Up to 250 additional workers during the peak of the 2-year construction period, followed by reduction from current Monticello work force of 519 to 24. Impacts during operation would be SMALL.	SMALL to MODERATE	Construction impacts depend on location, but could be significant if location is in a more rural area than Monticello. Wright County would experience loss of tax base and employment with potentially SMALL to MODERATE impacts.
Socio-economics (Transpor-tation)	MODERATE	Transportation impacts associated with construction workers would be MODERATE.	MODERATE	Same as Monticello site.
Aesthetics	SMALL	SMALL aesthetic impacts due to impacts of plant units and stacks for gas plant (similar to current Monticello plant). Additional impact from wind turbines.	MODERATE to LARGE	MODERATE to LARGE impact from wind turbine towers as well as the gas-fired plant, stacks, and cooling towers and associated plumes. Additional impact that could be LARGE if a lengthy new electrical power transmission line is needed.

Table 8-7. (contd)

Impact	Monticello Site		Alternate Greenfield Site	
Category	**Impact**	**Comment**	**Impact**	**Comment**
Historic and Archaeo-logical Resources	SMALL to MODERATE	Impacts can generally be managed or mitigated. Wind turbines often placed along ridgelines that may have higher likelihood of historic or archaeological significance.	SMALL to MODERATE	Same as Monticello site.
Environ-mental Justice	SMALL	Impacts on minority and low-income communities should be similar to those experienced by the population as a whole. Some impacts on housing may occur during construction; loss of 519 operating jobs at Monticello likely SMALL due to the proximity of the plant to a diverse urban job market.	SMALL	Impacts vary depending on population distribution and makeup at site. Wright County would lose tax revenue and jobs; however, the impacts on minority and low-income populations would be SMALL.

8.3 Summary of Alternatives Considered

The environmental impacts of the proposed action, renewal of the Monticello OL, are SMALL for all impact categories, except for collective offsite radiological impacts from the fuel cycle and from high-level waste and spent fuel disposal. Collective offsite radiological impacts from the fuel cycle and from high-level waste and spent fuel disposal were not assigned a single significance level but were determined by the Commission to be Category 1 issues nonetheless. The alternative actions, i.e., no-action alternative (discussed in Section 8.1), new generation alternatives (from coal, natural gas, coal gasification, and nuclear power, discussed in Sections 8.2.1 through 8.2.4, respectively), purchased electrical power (discussed in Section 8.2.5), alternative technologies (discussed in Section 8.2.6), and a combination of alternatives (discussed in Section 8.2.7) were considered.

The no-action alternative would require the replacement of electrical generating capacity by (1) demand-side management and energy conservation, (2) power purchased from other electricity providers, (3) generating alternatives other than Monticello, or (4) some combination of these options. For each of the new generation alternatives (coal, natural gas, coal gasification, and nuclear power), the environmental impacts would not be less than the impacts of license renewal. For example, the land-disturbance impacts resulting from construction of any new facility would be greater than the impacts of continued operation of Monticello. The

impacts of purchased electrical power (imported power) would still occur, but would occur elsewhere. Alternative technologies are not considered feasible at this time and it is very unlikely that the environmental impacts of any reasonable combination of generation and conservation options could be reduced to the level of impacts associated with renewal of the Monticello OL.

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

8.4 References

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

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

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

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

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

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9.0 Summary and Conclusions

By letter dated March 16, 2005, Nuclear Management Company, LLC (NMC), submitted an application to the U.S. Nuclear Regulatory Commission (NRC) to renew the operating license (OL) for Monticello Nuclear Generating Plant (Monticello) for an additional 20-year period (NMC 2005a). If the OL is renewed, State regulatory agencies and NMC 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. If the OL is not renewed, then the plant must be shut down at or before the expiration of the current OL, which expires on September 8, 2010.

Section 102 of the National Environmental Policy Act (NEPA) (42 USC 4332) directs that an environmental impact statement (EIS) is required for major Federal actions that significantly affect the quality of the human environment. The NRC has implemented Section 102 of NEPA in Title 10 of the *Code of Federal Regulations* (CFR) Part 51. Part 51 identifies licensing and regulatory actions that require an EIS. In 10 CFR 51.20(b)(2), the Commission requires preparation of an EIS or a supplement to an EIS for renewal of a reactor OL. Further, 10 CFR 51.95(c) states that the EIS prepared at the OL renewal stage will be a supplement to the Generic Environmental Impact Statement for License Renewal of Nuclear Plants (GEIS), NUREG-1437, Volumes 1 and 2 (NRC 1996; 1999).[(a)]

Upon acceptance of the NMC application, the NRC began the environmental review process described in 10 CFR Part 51 by publishing a notice of intent in the *Federal Register* to prepare an EIS and conduct scoping (NRC 2005a) on June 2, 2005. The staff visited the Monticello site in June 2005 and held public scoping meetings on June 30, 2005, in Monticello, Minnesota (NRC 2005b). The staff reviewed the NMC Environmental Report (ER) (NMC 2005b) and compared it to the GEIS, consulted with other agencies, and conducted an independent review of the issues following the guidance set forth in NUREG-1555, the *Standard Review Plans for Environmental Reviews for Nuclear Power Plants, Supplement 1: Operating License Renewal* (NRC 2000). The staff also considered the public comments received during the scoping process for preparation of this draft Supplemental Environmental Impact Statement (SEIS) for Monticello. The public comments received during the scoping process that were considered to be within the scope of the environmental review are provided in Appendix A, Part 1, of this SEIS.

The staff will hold two public meetings in Monticello, Minnesota in March 2006 to describe the preliminary results of the NRC environmental review and to answer questions to provide members of the public with information to assist them in formulating their comments on this draft SEIS. When the comment period ends, the staff will consider and address all of the comments received. These comments will be addressed in Appendix A, Part 2, of the final SEIS.

(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.

Summary and Conclusions

This draft SEIS includes the NRC staff's preliminary analysis that considers and weighs the environmental effects of the proposed action, including cumulative impacts, the environmental impacts of alternatives to the proposed action, and mitigation measures available for reducing or avoiding adverse effects. It also includes the staff's preliminary recommendation regarding the proposed action.

The NRC has adopted the following statement of purpose and need for license renewal from the GEIS:

> 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.

The evaluation criterion of the staff's environmental review, as defined in 10 CFR 51.95(c)(4) and the GEIS, is to determine:

> ... 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.

Both the statement of purpose and need and the evaluation criterion implicitly acknowledge that there are factors, in addition to license renewal, that will ultimately determine whether an existing nuclear power plant continues to operate beyond the period of the current OL.

NRC regulations [10 CFR 51.95(c)(2)] contain the following statement regarding the content of SEISs prepared at the license renewal stage:

> The supplemental environmental impact statement for license renewal is not required to include discussion of need for power or the economic costs and economic benefits of the proposed action or of alternatives to the proposed action except insofar as such benefits and costs are either essential for a determination regarding the inclusion of an alternative in the range of alternatives considered or relevant to mitigation. In addition, the supplemental environmental impact statement prepared at the license renewal stage need not discuss other issues not related to the environmental effects of the proposed action and the alternatives, or any aspect of the storage of spent fuel for the facility within the scope of the generic determination in § 51.23(a) and in accordance with §51.23(b).[(a)]

(a) The title of 10 CFR 51.23 is “Temporary Storage of Spent Fuel After Cessation of Reactor Operations—Generic Determination of No Significant Environmental Impact.”

The GEIS contains the results of a systematic evaluation of the consequences of renewing an OL and operating a nuclear power plant for an additional 20 years. It evaluates 92 environmental issues using the NRC's three-level standard of significance—SMALL, MODERATE, or LARGE—developed using the Council on Environmental Quality guidelines. The following 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:

> 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.

For 69 of the 92 issues considered in the GEIS, the staff analysis in the GEIS shows the following:

(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 [HLW] 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.

These 69 issues were identified in the GEIS as Category 1 issues. In the absence of new and significant information, the staff relied on conclusions as amplified by supporting information in the GEIS for issues designated Category 1 in Table B-1 of 10 CFR Part 51, Subpart A, Appendix B. The staff also determined that information provided during the public comment period did not identify any new issue that requires site-specific assessment.

Of the 23 issues that do not meet the criteria set forth above, 21 are classified as Category 2 issues requiring analysis in a plant-specific supplement to the GEIS. The remaining two issues, environmental justice and chronic effects of electromagnetic fields, were not categorized. Environmental justice was not evaluated on a generic basis and, therefore, must be addressed in a plant-specific supplement to the GEIS. Information on the chronic effects of electromagnetic fields was not conclusive at the time the GEIS was prepared.

This draft SEIS documents the staff's consideration of all 92 environmental issues identified in the GEIS. The staff considered the environmental impacts associated with alternatives to license renewal and compared the environmental impacts of license renewal and the alternatives. The alternatives to license renewal that were considered include the no-action alternative (not renewing the OL for Monticello) and alternative methods of power generation. These alternatives were evaluated assuming that the replacement power generation plant is located at either the Monticello site (nuclear generation) or some other unspecified greenfield location.

9.1 Environmental Impacts of the Proposed Action – License Renewal

NMC and the staff have established independent processes for identifying and evaluating the significance of any new information on the environmental impacts of license renewal. Neither NMC nor the staff has identified information that is both new and significant related to Category 1 issues that would call into question the conclusions in the GEIS. Similarly, neither the scoping process, NMC, nor the staff has identified any new issue applicable to Monticello that has a significant environmental impact. Therefore, the staff relies upon the conclusions of the GEIS for all Category 1 issues that are applicable to Monticello.

NMC's license renewal application presents an analysis of the Category 2 issues that are applicable to Monticello, plus environmental justice and chronic effects from electromagnetic fields. The staff has reviewed the NMC analysis for each issue and has conducted an independent review of each issue plus environmental justice and chronic effects from electromagnetic fields. Three Category 2 issues are not applicable because they are related to plant design features or site characteristics not found at Monticello. Four Category 2 issues are not discussed in this draft SEIS because they are specifically related to refurbishment. NMC has stated that its evaluation of structures and components, as required by 10 CFR 54.21, did not identify any major plant refurbishment activities or modifications as necessary to support the continued operation of Monticello for the license renewal period. In addition, any replacement of components or additional inspection activities are within the bounds of normal plant component replacement and, therefore, are not expected to affect the environment outside of the bounds of the plant operations evaluated in the *Final Environmental Statement Related to Operation of Monticello Nuclear Generating Plant* (AEC 1972).

Fourteen Category 2 issues related to operational impacts and postulated accidents during the renewal term, as well as environmental justice and chronic effects of electromagnetic fields, are discussed in detail in this draft SEIS. Five of the Category 2 issues and environmental justice apply to both refurbishment and to operation during the renewal term and are only discussed in this draft SEIS in relation to operation during the renewal term. For all 14 Category 2 issues and environmental justice, the staff concludes that the potential environmental effects are of SMALL significance in the context of the standards set forth in

the GEIS. In addition, the staff determined that appropriate Federal health agencies have not reached a consensus on the existence of chronic adverse effects from electromagnetic fields. Therefore, no further evaluation of this issue is required.

For severe accident mitigation alternatives (SAMAs), the staff concludes that a reasonable, comprehensive effort was made to identify and evaluate SAMAs. Based on its review of the SAMAs for Monticello, and the plant improvements already made, the staff concludes that one of the candidate SAMAs is potentially cost-beneficial. However, this SAMA does not relate to adequately managing the effects of aging during the period of extended operation. Therefore, it does not need to be implemented as part of license renewal pursuant to 10 CFR Part 54.

Mitigation measures were considered for each Category 2 issue. Current measures to mitigate the environmental impacts of plant operation were found to be adequate, and no additional mitigation measures were deemed sufficiently beneficial to be warranted.

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.

The following sections discuss unavoidable adverse impacts, irreversible or irretrievable commitments of resources, and the relationship between local short-term use of the environment and long-term productivity.

9.1.1 Unavoidable Adverse Impacts

An environmental review conducted at the license renewal stage differs from the review conducted in support of a construction permit because the plant is in existence at the license renewal stage and has operated for a number of years. As a result, adverse impacts associated with the initial construction have been avoided, have been mitigated, or have already occurred. The environmental impacts to be evaluated for license renewal are those associated with refurbishment and continued operation during the renewal term.

The adverse impacts of continued operation identified are considered to be of SMALL significance, and none warrants implementation of additional mitigation measures. The adverse impacts of likely alternatives if Monticello ceases operation at or before the expiration of the current OL will not be smaller than those associated with continued operation of this unit, and they may be greater for some impact categories in some locations.

9.1.2 Irreversible or Irretrievable Resource Commitments

The commitment of resources related to construction and operation of Monticello during the current license period was made when the plant was built. The resource commitments to be considered in this draft SEIS are associated with continued operation of the plant for an additional 20 years. These resources include materials and equipment required for plant maintenance and operation, the nuclear fuel used by the reactors, and ultimately, permanent offsite storage space for the spent fuel assemblies.

The most significant resource commitments related to operation during the renewal term are the fuel and the permanent storage space. Monticello replaces approximately thirty percent of the fuel assemblies in the unit during every refueling outage, which occurs on a nominal 24-month cycle.

The likely power generation alternatives if Monticello ceases operation on or before the expiration of the current OL will require a commitment of resources for construction of the replacement plants as well as for fuel to run the plants.

9.1.3 Short-Term Use Versus Long-Term Productivity

An initial balance between short-term use and long-term productivity of the environment at the Monticello site was set when the plant was approved and construction began. That balance is now well established. Renewal of the OL for Monticello and continued operation of the plant will not alter the existing balance, but may postpone the availability of the site for other uses. Denial of the application to renew the OL will lead to shutdown of the plant and will alter the balance in a manner that depends on subsequent uses of the site. For example, the environmental consequences of turning the Monticello site into a park or an industrial facility are quite different.

9.2 Relative Significance of the Environmental Impacts of License Renewal and Alternatives

The proposed action is renewal of the OL for Monticello. Chapter 2 describes the site, power plant, and interactions of the plant with the environment. As noted in Chapter 3, no refurbishment and no refurbishment impacts are expected at Monticello. Chapters 4 through 7 discuss environmental issues associated with renewal of the OL. Environmental issues associated with the no-action alternative and alternatives involving power generation and use reduction are discussed in Chapter 8.

The significance of the environmental impacts from the proposed action (approval of the application for renewal of the OL), the no-action alternative (denial of the application), alternatives involving nuclear, coal, coal gasification, or natural gas-generation of power, and a

combination of alternatives are compared in Table 9-1. Continued use of an open-cycle cooling system for Monticello is assumed for Table 9-1.

Table 9-1 shows that the significance of the environmental effects of the proposed action are SMALL for all impact categories (except for collective offsite radiological impacts from the fuel cycle and from HLW and spent fuel disposal, for which a single significance level was not assigned [see Chapter 6]). The alternative actions, including the no-action alternative, may have environmental effects in at least some impact categories that reach MODERATE or LARGE significance.

9.3 Staff Conclusions and Recommendations

Based on (1) the analysis and findings in the GEIS (NRC 1996, 1999), (2) the ER submitted by NMC (NMC 2005b), (3) consultation with Federal, State, and local agencies, (4) the staff's own independent review, and (5) the staff's consideration of public comments received during the scoping process, the preliminary recommendation of the staff is that the Commission determine that the adverse environmental impacts of license renewal for Monticello are not so great that preserving the option of license renewal for energy planning decisionmakers would be unreasonable.

Table 9-1. Summary of Environmental Significance of License Renewal, the No-Action Alternative, and Alternative Methods of Generation Using Once-Through Cooling

Proposed Action	No-Action Alternative		Coal-Fired Generation	Natural Gas-Fired Generation	Coal Gasification	New Nuclear Generation		Combination of Alternatives	
Impact Category	**License Renewal**	**Denial of Renewal**	**Alternate Greenfield Site**	**Alternate Greenfield Site**	**Alternate Greenfield Site**	**Monticello Site**	**Alternate Greenfield Site**	**Monticello Site**	**Alternate Greenfield Site**
Land Use	SMALL	SMALL	MODERATE	SMALL to MODERATE	MODERATE to LARGE	MODERATE	MODERATE to LARGE	SMALL to MODERATE	SMALL to MODERATE
Ecology	SMALL	SMALL	SMALL to MODERATE	SMALL to MODERATE	SMALL to LARGE	MODERATE	MODERATE to LARGE	SMALL to MODERATE	SMALL to MODERATE
Water Use and Quality—Surface Water	SMALL	SMALL	SMALL to MODERATE	SMALL to MODERATE	SMALL to MODERATE	SMALL	SMALL to MODERATE	SMALL	SMALL to MODERATE
Water Use and Quality—Groundwater	SMALL	SMALL	SMALL to MODERATE	SMALL to MODERATE	SMALL to MODERATE	SMALL	SMALL to MODERATE	SMALL	SMALL to MODERATE
Air Quality	SMALL	SMALL	MODERATE	MODERATE	MODERATE	SMALL	SMALL	MODERATE	MODERATE
Waste	SMALL	SMALL	MODERATE	SMALL	MODERATE	SMALL	SMALL	SMALL	SMALL
Human Health	SMALL	SMALL	SMALL	SMALL	SMALL	SMALL	SMALL	SMALL	SMALL
Socioeconomics	SMALL	SMALL to LARGE	SMALL to LARGE	SMALL to MODERATE	SMALL to LARGE	SMALL to MODERATE	SMALL to LARGE	SMALL to MODERATE	SMALL to MODERATE
Socioeconomics (Transportation)	SMALL	SMALL	SMALL to MODERATE	SMALL to MODERATE	SMALL to MODERATE	SMALL to LARGE	SMALL to LARGE	MODERATE	MODERATE
Aesthetics	SMALL	SMALL	SMALL to MODERATE	SMALL to MODERATE	SMALL to LARGE	SMALL	SMALL to LARGE	SMALL	MODERATE to LARGE
Historic and Archaeological Resources	SMALL	SMALL	SMALL	SMALL	SMALL	SMALL	SMALL	SMALL to MODERATE	SMALL to MODERATE
Environmental Justice	SMALL	SMALL to LARGE	SMALL to MODERATE	SMALL to MODERATE	SMALL to MODERATE	SMALL	SMALL to MODERATE	SMALL	SMALL

9.4 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."

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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, Final Report. NUREG-1437, Volume 1, Addendum 1, Washington, D.C.

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Appendix A

Comments Received on the Environmental Review

Appendix A: Comments Received on the Environmental Review

Part I—Comments Received During Scoping

On June 2, 2005, the U.S. Nuclear Regulatory Commission (NRC) published a Notice of Intent in the Federal Register (70 FR 32381), to notify the public of the staff's intent to prepare a plant-specific supplement to the *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS), NUREG-1437, Volumes 1 and 2, to support the renewal application for the Monticello Nuclear Generating Plant operating license and to conduct scoping. The plant-specific supplement to the GEIS has been prepared in accordance with the National Environmental Policy Act (NEPA), Council on Environmental Quality (CEQ) guidance, and 10 CFR Part 51. As outlined by NEPA, the NRC initiated the scoping process with the issuance of the Federal Register Notice. The NRC invited the applicant; Federal, State, and local government agencies; Native American tribal organizations; local organizations; and individuals to participate in the scoping process by providing oral comments at the scheduled public meetings and/or submitting written suggestions and comments no later than August 2, 2005.

The scoping process included two public scoping meetings, which were held at the Monticello Community Center in Monticello, Minnesota on June 30, 2005. Approximately 50 members of the public attended the meetings. Both sessions began with NRC staff members providing a brief overview of the license renewal process and the NEPA process. After the NRC's prepared statements, the meetings were open for public comments. Ten attendees provided oral statements that were recorded and transcribed by a certified court reporter. The meeting transcripts are an attachment to the July 28, 2005, Scoping Meeting Summary. In addition to the comments received during the public meetings, thirteen comment letters and seven e-mail messages were received by the NRC in response to the Notice of Intent.

At the conclusion of the scoping period, the NRC staff and its contractors reviewed the transcripts and all written material to identify specific comments and issues. Each set of comments from a given commenter was given a unique identifier (Commenter ID), so that each set of comments from a commenter could be traced back to the transcript or letter by which the comments were submitted. Specific comments were numbered sequentially within each comment set. Several commenters submitted comments through multiple sources (e.g., afternoon and evening scoping meetings). All of the comments received and the staff responses are included in the Monticello Scoping Summary Report dated October 7, 2005.

Table A-1 identifies the individuals who provided comments applicable to the environmental review and the Commenter ID associated with each person's set of comments. The individuals are listed in the order in which they spoke at the public meeting. To maintain consistency with the Scoping Summary Report, the unique identifier used in that report for each set of comments is retained in this appendix.

Specific comments were categorized and consolidated by topic. Comments with similar specific objectives were combined to capture the common essential issues raised by the commenters. The comments fall into one of the following general groups:

- Specific comments that address environmental issues within the purview of the NRC environmental regulations related to license renewal. These comments address Category 1 or Category 2 issues or issues that were not addressed in the GEIS. They also address alternatives and related Federal actions.

- General comments (1) in support of or opposed to nuclear power or license renewal or (2) on the renewal process, the NRC's regulations, and the regulatory process. These comments may or may not be specifically related to the Monticello license renewal application.

- Questions that do not provide new information.

- Specific comments that address issues that do not fall within or are specifically excluded from the purview of NRC environmental regulations related to license renewal. These comments typically address issues such as the need for power, emergency preparedness, security, current operational safety issues, and safety issues related to operation during the renewal period.

Table A-1. Individuals Providing Comments During Scoping Comment Period

Commenter ID	Commenter	Affiliation (if stated)	Comment Source and ADAMS Accession Number[(a)]
MS-A	John Grubb	Nuclear Management Company	Afternoon Scoping Meeting
MS-B	Charles Bomberger	Xcel Energy	Afternoon Scoping Meeting
MS-C	Wayne Mayer	Magic Moments Photographic Studio	Afternoon Scoping Meeting
MS-D	George Crocker	North American Water Office	Afternoon Scoping Meeting
MS-E	Lea Foushee	North American Water Office	Afternoon Scoping Meeting
MS-F	Kristen Eide-Tollefson	R-CURE	Afternoon Scoping Meeting

	Commenter ID	Commenter	Affiliation (if stated)	Comment Source and ADAMS Accession Number[(a)]
1	MS-G	Carol Overland	Overland Law Office	Afternoon Scoping Meeting
2	MS-H	Clint Herbst	City of Monticello	Evening Scoping Meeting
3	MS-I	Tom Palmisano	Nuclear Management Company	Evening Scoping Meeting
4	MS-J	Kent Larsen	Xcel Energy	Evening Scoping Meeting
5	MS-K	Joseph Steffel	City of Buffalo	Letter (ML051960028)
6	MS-L	Lynne Dahl-Fleming	DESIGN for PRINT [&Web!]	Letter (ML051810330)
7	MS-M	Alan Loch	Loch Jewelers	Letter (ML051810327)
8	MS-N	Mike Benedetto	Monticello Public Schools	Letter (ML051810325)
9	MS-O	Barbara Schwientek	Monticello-Big Lake Community Hospital District	Letter (ML051810324)
10	MS-P	Dan Olson	State Farm Insurance	Letter (ML051810543)
11	MS-Q	Mark Ourada	State of Minnesota Senate District 19	Letter (ML052090152)
12	MS-R	Susan Struckness	Monticello Chamber of Commerce	Letter (ML051810333)
13	MS-S	Julie Risser	Citizen of Edina, Minnesota	Email (ML052220380)
14	MS-T	Pat Sawatzke	Commissioner-District 2	Email (ML052220387)
15	MS-U	Susu Jeffrey	Citizen of Minneapolis	Email (ML052220381)
16	MS-V	Carol Overland	Overland Law Office	Email (ML052220353)
17	MS-W	George Crocker	North American Water Office	Email (ML052220384)
18	MS-X	Justin Eibenholzl	Southeast Minneapolis Neighborhoods	Email (ML052220382)
19	MS-Y	Christine Ziebold	Citizen of Minneapolis	Email (ML052220355)
20	MS-Z	Bruce Anderson	Minnesota House of Representatives	Letter (ML052220378)
21	MS-AA	Don Orrock	Big Lake City Council	Letter (ML052220378)
22	MS-AB	Ewald Petersen	Big Lake Township Board of Supervisors	Letter (ML052220378)
23	MS-AC	Bruce Thielen	Monticello City Council	Letter (ML052220378)

Commenter ID	Commenter	Affiliation (if stated)	Comment Source and ADAMS Accession Number[a]
MS-AD	Tom Fenski	Monticello Chamber of Commerce	Letter (ML052220378)

[a]The afternoon and evening transcripts can be found as an attachment under accession number ML052030005.

The subject areas the comments were grouped into are as follows:

1. Comments in Support of License Renewal at Monticello Nuclear Generating Plant
2. Comments in Opposition to License Renewal at Monticello Nuclear Generating Plant
3. General Comments Regarding License Renewal and Its Processes
4. Comments Concerning Water Quality and Use Issues
5. Comments Concerning Aquatic Ecology Issues
6. Comments Concerning Terrestrial Resource Issues
7. Comments Concerning Air Quality Issues
8. Comments Concerning Land Use Issues
9. Comments Concerning Human Health Issues
10. Comments Concerning Socioeconomic Issues
11. Comments Concerning Postulated Accidents
12. Comments Concerning Uranium Fuel Cycle and Waste Management Issues
13. Comments Concerning Alternatives
14. Comments Concerning Aging Management

Each comment is summarized in the following pages. For reference, the unique identifier for each comment (Commenter ID letter listed in Table A-1 plus the comment number) is provided. In those cases where no new information was provided by the commenter, no further evaluation will be performed.

The preparation of the plant-specific supplement to the GEIS (which is the SEIS) will take into account all the relevant issues raised during the scoping process. The SEIS will address both Category 1 and 2 issues, along with any new information identified as a result of scoping. The SEIS will rely on conclusions supported by information in the GEIS for Category 1 issues, and will include the analysis of Category 2 issues and any new and significant information. The draft plant-specific supplement to the GEIS will be made available for public comment. The comment period will offer the next opportunity for the applicant; interested Federal, State, and local government agencies; local organizations; and members of the public to provide input to the NRC's environmental review process. The comments received on the draft SEIS will be considered in the preparation of the final SEIS. The final SEIS, along with the staff's Safety Evaluation Report (SER), will provide much of the basis for the NRC's decision on the Monticello license renewal application.

A.1 Comments and Responses

1. Comments in Support of License Renewal at Monticello Nuclear Generating Plant

Comment: I'm here today to provide my support for this request for license renewal from the Monticello station. The mission of everybody who works and supports Monticello is clear; and that's safe, reliable, economic operation of the plant. The safety of the public and the employees being the No. 1 priority. Two of our key values include being a good neighbor, a steward of the environment in which we operate. (MS-A-1)

Comment: In conclusion, the Monticello plant has been a productive contributor to the energy needs of the State of Minnesota and a valuable asset and good neighbor to the surrounding communities. We remain committed to operating safely, reliably, economically, and focus on being a good neighbor and a good steward of the environment. I and the rest of the employees at Monticello look forward to serving you and meeting the needs of the community for many years to come. (MS-A-8; MS-I-8)

Comment: And I would like to share why license renewal is the most economic and responsible energy choice for our million and a half customers here in the Upper Midwest. (MS-B-1; MS-J-1)

Comment: In closing, we believe that continued operation of Monticello is vitally important to the state's energy needs, important to the local economy, and important to more than 500 employees who keep it running every day. We look forward to operating Monticello safely for many years to come. (MS-B-9; MS-J-9)

Comment: The City looks forward to working with Xcel Energy into the future, especially as our city continues its growth and expands its boundaries towards the west. In closing, I would

like to commend all personnel working at the Monticello nuclear generating facility for their excellent safety management. (MS-C-3)

Comment: I guess I was asked to come and speak just a little bit about what I feel Xcel has been for the community. And I kind of consider myself an expert, not as far as the day-to-day operations, but being that we moved here in 1972 and I've continued to raise my family here. Also, I feel that it's a very safe operation, a much needed operation, being that now I'm on the government side of it, to see what kind of impact Xcel does have on the community and what kind of impact they could potentially have on the community if there was any problem with relays and things.

I feel very confident that I can speak for previous councils because this is an issue that came up quite some time ago, and Xcel kind of delayed it for some reason. They're looking at different things. But, past councils and the present council, I think are well behind Xcel, hoping that everything goes well, hoping that they stay a part of, a huge part of the community like they have been. (MS-H-1)

Comment: I'm here tonight to provide my support and comments on our request to renew the operating license for the Monticello plant. The mission of everyone who works at Monticello is very clear and very simple: safe, reliable, and economic operation of the plant. And, quite frankly, the safety of the public and the safety of our employees is the No. 1 priority and has been and continues to be as we operate. And as part of that, two of our key values includes being a good neighbor and a good steward of the environment in which we operate, and certainly that's very pertinent to tonight. (MS-I-1)

Comment: I would like to recommend to the U.S. Nuclear Regulatory Commission that Xcel Energy be granted an operating license renewal for the Monticello Nuclear Generating Plant. (MS-K-1)

Comment: I am writing to express my support for the relicensing of the Monticello Xcel (sic) Energy Nuclear Power Plant. I have been a resident of Monticello for over forty years. During that time, I have had ample opportunity to see the impact of the plant in our community. This impact has been nothing but positive throughout that time. (MS-L-1)

Comment: I am writing to give my support for the renewal of the license of the Xcel Energy Monticello plant. Loch Jewelers has been in Monticello since 1977. Our personal experience with the staff and employees of the Xcel plant has been very positive. They have always worked well with the business community, exhibiting good ethics and sound business practices and putting the safety of the community first. (MS-M-1)

Comment: Please accept this letter as our school district's [Monticello Public Schools] support for the license renewal of the Monticello Nuclear Plant. (MS-N-1)

Comment: The Monticello-Big Lake Community Hospital District Board of Directors and staff members support the license renewal for the Monticello Nuclear Generating Plant. (MS-O-1)

Comment: I have lived and worked in Monticello for the past twenty one years. I am writing you a letter in support of the license renewal for the Monticello plant. I cannot think of any local business who has been a better good neighbor than our local nuclear plant. (MS-P-1)

Comment: I would like to express my strong support for the license renewal application for the Monticello Nuclear Power Plant. (MS-Q-1)

Comment: BE IT RESOLVED, THAT the Monticello Chamber of Commerce, located in Monticello, Minnesota, does hereby take a position of support for the re-licensing of the Monticello Nuclear Generating Plant. The Nuclear Plant and its employees are of great importance to the City of Monticello, and to Minnesota as a whole. (MS-R-1)

Comment: The Monticello Chamber of Commerce also is a strong supporter of nuclear energy as a power source for our State, thereby working to produce energy with no greenhouse gas effects. Nuclear is a clean, reliable source of energy for our state. (MS-R-3)

Comment: As a member of the Wright County Board of Commissioners that represents the area in which the plant exists, please let me extend my support to NMC in their efforts to re-license the Nuclear Power Plant in Monticello, Minnesota. (MS-T-4)

Comment: I write today in support of the Monticello Nuclear Generating Plant and advocate for a license extension for its continued operation. (MS-Z-1)

Comment: NOW THEREFORE BE IT RESOLVED by the City Council of the City of Big Lake, Minnesota, that the City of Big Lake go on record supporting construction of an Independent Spent Fuel Storage Installation, and License Renewal at the Monticello Nuclear Generating Plant. (MS-AA-5)

Comment: NOW, THEREFORE, BE IT RESOLVED that the Town of Big Lake, Sherburne County, supports the license renewal to continue operations for up to 20 years,... (MS-AB-3)

Comment: NOW THEREFORE BE IT RESOLVED, That the City of Monticello go on record supporting construction of an Independent Spent Fuel Storage Installation, and License Renewal at the Monticello Nuclear Generating Plant. (MS-AC-6)

Comment: We, the Monticello Chamber of Commerce, support construction of an Independent Spent Fuel Storage Installation, and License Renewal of our local Monticello Nuclear Generating Plant, owned by Xcel Energy and managed by Nuclear Management Company. (MS-AD-1)

Comment: NOW THEREFORE BE IT RESOLVED, that the Monticello Chamber of Commerce Board of Directors, go on record supporting construction of an Independent Spent Fuel Installation, and License Renewal at the Monticello Nuclear Generating Plant. (MS-AD-6)

Response: *The comments are supportive of license renewal at Monticello Nuclear Generating Plant and are general in nature. The comments provide no new and significant information; therefore, the comments will not be evaluated further.*

2. Comments in Opposition to License Renewal at Monticello Nuclear Generation Plant

Comment: And you're going to find that the political support for the commercial nuclear industry may be broad, but it's skin deep. And when that event happens, and when you've made the commitment to keep us committed to nuclear operations, what will happen then is we'll have chaos in the utility industry because we can't use the reactors anymore, and that will be piled on top of somebody's nuclear nightmare. (MS-D-14)

Comment: Extending the license to operate until 2030 will mean future generations will have to spend valuable resources safeguarding and storing more spent nuclear fuel; this is hardly beneficial to environmental resources. (MS-S-11)

Comment: Remaining dependent on nuclear power puts Minnesotans at risk for bearing the environmental and economic costs of maintaining toxic waste for centuries; the economic cost of maintaining this waste outweighs the value of the energy generated by it. (MS-S-19)

Comment: Given the location of the Monticello plant upstream from a densely populated urban area, the fact that Minnesota's current economic and political climate is weak, the fact that political leaders from the two major parties cannot function adequately to keep the government running under normal circumstances, and the fact that the soils at Monticello raise the prospects of groundwater contamination, it is clear that relicensing Monticello is inappropriate and irresponsible at this time. The NRC should reject Xcel Energy's application for license renewal. (MS-S-27)

Comment: We have no guarantees. We do however have a rising cancer rate, relative disincentives for alternative, decentralized energy production, and huge inefficiencies in energy use accounting for about half of the energy produced according to experts. It would be safer and cheaper to become efficient. Where is the leadership for tightening-up? (MS-U-6)

Comment: Nuclear technology is dinosauric it's from the last millennium. It's too big, inappropriate, uncontrollable. Transmitting electricity from big generating stations is wasteful, destructive of the environment, and extremely profitable until something goes wrong. (MS-U-8)

Comment: Are you the heroes who will say no to nukes and yes to progressive, decentralized, safe energy production? This is America. We invented modern citizen democracy. We are an inventive society. We can supply the world with smart power tools or continue our decline and deliver to ourselves a dirty bomb of our own making. "The peaceful atom is a bomb." (MS-U-10)

Comment: NRC currently gravely underestimates the risk of Monticello's operations to human and ecosystem health, uses outdated non-protective radiation standards, procures no tracking of health effects, provides lax oversight over safety and security, and by delivering a flawed alternatives-analysis seeks to ensure Xcel Energy's continued nuclear power operations. (MS-Y-41)

Response: *The comments oppose license renewal at Monticello Nuclear Generating Plant and are general in nature. The comments provide no new and significant information; therefore, the comments will not be evaluated further.*

3. General Comments Regarding License Renewal and Its Processes

Comment: Because the scope of public outreach was limited to Buffalo, Minnesota and Monticello, Minnesota the Nuclear Regulatory Commission (NRC) failed to provide residents of other effected communities with information and opportunities to participate in the EIS Scoping process; people were denied the chance to weigh in on whether or not the Monticello nuclear power plant should be relicensed. Furthermore the NRC appears to have intensionally (sic) undermined the process for allowing the public to participate at the public meetings that it did hold in Monticello to discuss the EIS Scoping. (MS-S-1)

Comment: The residents of the Twin Cities Metro Area have a vested interest in this resource it is a fundamental component of their survival - and they need to be included in public discussion about license renewal for Monticello. (MS-S-4)

Comment: The NRC failed to hold one public meeting in the Twin Cities during the EIS Scoping period.

The NRC failed to publish information about the Open Houses that it held in Monticello, MN on June 30th in both the Minneapolis Star Tribune and the Saint Paul Pioneer Press.

The NRC failed to get any local television stations to provide information about the Open Houses in Monticello.

The NRC failed to get any radio stations to provide information about the Open Houses in Monticello.

The NRC failed to provide transport from the Twin Cities to Monticello for those who do not own cars or have the financial resources to take a taxi to Monticello. (MS-S-5)

Comment: During the EIS Scoping period the NRC failed to provide libraries in the Twin Cities Metro Area with any documentation regarding the license renewal for Monticello; the NRC made this documentation available only at public libraries in Buffalo and Monticello.

People who learned about the Open Houses were instructed to contact Jennifer A. Davis 301-415-3835 or Jason Flemming 301-415-5787. I called Jason Flemming long-distance and left messages twice. Jason Flemming never returned my calls even though I clearly stated in both messages that I wanted to participate in the Monticello Open House as a concerned member of the public.

The NRC failed to provide people with a toll-free number so they could learn about the forum; public comments are likely to be skewed toward views of the middle-class and wealthy the poor were not provided a means to participate in this basic dialog.

The NRC failed to provide people with contacts who would respond to their questions in a timely way; the NRC undermined the ability of the public to participate.

People who were able to make it to the June 30th Open House in Monticello were given a handout "Welcome to the NRC's Open House Associated with the Environmental Review for License Renewal at the Monticello Nuclear Generating Plant" that clearly stated in the first sentence of the second paragraph that the NRC was seeking comments supporting relicensing: "The NRC is gathering information necessary to prepare an Environmental Impact Statement (EIS) *in support of* the proposed renewal of the operating license for the Monticello Nuclear Generating Plant" (I have added the italics). This sentence alone may have discouraged members of the public who showed up intending to make a statement against the relicensing from voicing their concerns or entering them into the record.

In the "Welcome to the NRC's Open House Associated with the Environmental Review for License Renewal at the Monticello Nuclear Generating Plant" the first sentence of the second paragraph makes it clear that the EIS Scoping period was not a time for the NRC to consider the pros and cons of relicensing; for the NRC it was a time to gather information that supported a predetermined course of action relicense the plant. (MS-S-6)

Comment: Because the NRC failed to inform large communities that will be effected by the relicensing of Monticello about the EIS Scoping, because the NRC did not demonstrate a credible effort to engage members of the public in the EIS Scoping process, and because the NRC appears to have consciously set out to undermine participation from members of the public who are against the relicensing of Monticello the entire EIS Scoping Process needs to start over. To fail to do so will result in damage to Xcel Energy's reputation and damage to the credibility of all relicensing efforts for nuclear reactors throughout the United States. At this point in our nation's history undermining the democratic process for something as serious as

relicensing nuclear power plants could have significant and harmful negative fallout as far as public confidence in the government's ability to put the long-term needs of the people before corporate desires for profit and gaining market share is concerned. Failure to engage in honest dialog regarding relicensing the plant creates the very real possibility that Monticello will be relicensed without the public or the NRC considering very serious problems; this is public policy at its worst. (MS-S-8)

Comment: I wish to underscore the opening comments made by Christine Ziebold, MD, PhD, MPH, and Julie Risser, who both pointed out ways in which the NRC, and NRC process, worked against public participation. I have an anecdote of my own: I emailed the contact person listed, Jennifer Davis, a day or two prior to the June 30 meeting to verify place and time because it was listed as "tentative" on the site, and did not receive a response until July 5! I live in Red Wing, and Monticello is a ways away, and I had no way to confirm.

It was not clarified for the audience the purpose of the meeting, that it is for determining the scope of the EIS, and what that meant, what types of Comments were specifically being solicited. Because this is not clear, the record contains comments from people supporting nuclear power (!) and Monticello, but not offering anything relevant to the comment purpose. People attending the meeting were not able to tailor their comments to be effective. (MS-V-1)

Comment: The Nuclear Regulatory Commission's (NRC) relicensing process has dramatically deteriorated over the past decade.

NRC needs to clearly communicate, best establish a SEARCHABLE website, indexed on major search engines regarding Monticello. NRC's EIS scoping is a non-transparent process, EXTREMELY poorly communicated through the media. The search engine on NRC's website will not retrieve the website for Monticello on the first 20 hits, and neither will Google. If NRC wants to enjoy any credibility for its "seeking public involvement" it needs to fix this problem. (MS-Y-1)

Comment: NRC needs to honestly relate information about realistic health and environmental concerns due to the routine release of fission products to air, water and land and the unsolved long term storage situation, aside from issues due to catastrophic events. The NRC EIS scoping process as is and NRC communications in general keep the public at large uninformed. In my experience NRC meetings are tightly controlled and orchestrated. NRC's public relations have replaced solid information or even public health education. The process is virtually exclusive of the public at large. (MS-Y-3)

Comment: I kindly request that NRC hold another EIS scoping meeting in the Twin Cities ASAP.

The Monticello meeting on June 30, 2005 serves as a case in point. The public meeting (which really was one, not two as stated in the NRC press release, even though there might have been

two basically back to back sessions within the same 12 hours) took place at the virtual exclusion of Twin Cities stakeholders, due to its location at Monticello and its timing. Twin Cities residents are stakeholders too, since a catastrophic event would affect a disproportionately larger number of us. (MS-Y-4)

Response: *As outlined in the Introduction section, the NRC published a Notice of Intent in the* Federal Register *(70 FR 32381) on June 2, 2005. This was the official notice to inform the public of its opportunity to participate as the NRC undertakes the environmental review of the request to renew the operating license of the Monticello Nuclear Generating Plant. Every Federal agency is required to publish its notices in the* Federal Register*, which is issued every work day, to ensure that the public is informed of its opportunity to participate in the work of the Federal Government. In the Notice of Intent, the NRC invited the applicant; Federal, State, and local government agencies; local organizations; and individuals to participate in the scoping process and to provide comments to the NRC about the scope of the environmental review no later than August 2, 2005. The NRC staff is supported by its contractors and any interested member of the public in undertaking this environmental review. The outcome is not predetermined, but an environmental review will be performed and an EIS will be prepared to support the review whether or not the request to renew the license is granted. The NRC provided the public with information on the application located in the NRC Public Document Room or from the Publicly Available Records (PARS) component of NRC's document system (ADAMS). ADAMS is accessible from the NRC Web site at www.nrc.gov/reading-rm.html, the Public Electronic Reading Room. Toll free telephone numbers were provided in the Notice to assist the public with the use of ADAMS and in contacting key NRC personnel on the project.*

Although not required by NEPA, the NRC has elected to take steps during the scoping process to ensure that interested parties have additional opportunities to become informed about the project and to gain access to process and site-specific information to enhance their participation at the level they so choose. In addition to the official source of information in the NRC Public Document Room and ADAMS, the NRC believed that it would be useful to the public to provide a copy of the environmental information associated with the application for inspection at a public library close to the site area; for the Monticello project, two public libraries (Monticello and Buffalo) were kind enough to support our effort. The local libraries also have information to assist the public in using ADAMS if an individual does not have internet access from another source. Consequently, any individual who is interested in obtaining information from the NRC related to any environmental review for any license renewal project can go to any public library and use library resources to obtain access.

The NRC has established an open process to permit all members of the public to participate in the scoping process. Comments can be provided to the NRC in person, by mail, and by e-mail. In addition, the NRC has elected to conduct public meetings during the scoping process to ensure that interested parties have an additional opportunity to gain access to information about the project and the process to effectively participate. The NRC provided the information about the public meetings in the Federal Register Notice and posted the meeting time and location at the NRC's website (www.nrc.gov). The NRC also published a press release to inform the

media about the purpose, time and location of the meetings, but the NRC does not control the actions of the media; consequently, the NRC also pays for advertisements in a reasonable set of local newspapers (the St. Cloud Times and the Monticello Times) to share the information with the public. The NRC meetings were facilitated and, in advance of the meetings, the facilitator contacted elected and appointed officials as well as known representatives of interest groups so that they could inform their constituencies of the opportunity to participate in the meetings. Finally, the NRC placed posters about the meeting in public places in the Monticello site area.

Two meetings were held on the same day to make it convenient for interested parties who had obligations (e.g., work or family) to choose whether they would participate in one or both meetings. Preregistering for either of the meetings assists the staff in determining the quantity of materials that it should bring to enhance the level of understanding and participation. During the days leading up to the meetings, the environmental review team generally conducts an audit in the site area and may no longer have access to office resources; consequently, the public was encouraged to contact the staff by June 23, 2005, to preregister. However, the NRC attempts to accommodate all interested parties at the public meetings whether they were preregistered or not. No member of the public was denied the opportunity to participate in the scoping process. If an individual made the effort to attend the public meeting, then she or he was given the opportunity to share her or his views on the record to ensure that it would be captured by the NRC and treated equally as any written comment submitted by August 2, 2005. If an individual was unable to attend the meeting or elected to defer offering her or his comments at that time, then she or he still had the opportunity to share views with the NRC through the end of the comment period as outlined in the Notice. Those who provided comments at the public meetings were not precluded in any way from providing additional comments through the end of the comment period.

The comments raised concerns about the additional opportunities provided by the NRC to comment during the scoping process, but do not provide new and significant information. Therefore, the comments will not be evaluated further.

Comment: In a telephone conversation with Jennifer Davis, NRC contact for Monticello on 8/1/05 at 3pm CST I learned that NRC has a generic EIS for all nuclear plants and that "2/3 of the issues contained therein won't be revisited." Even if true, this was not a great motivation to submit comment. This generic EIS however is NOT posted under "Documents Available for Comment" which is the hyperlink provided for Public Involvement on NRC's Monticello website, which I only found today. (MS-Y-2)

Response: *The impact evaluation performed by the staff and presented in the Generic Environmental Impact Statement for License Renewal of Nuclear Plants NUREG-1437 (GEIS) identified 92 environmental issues that were considered within the scope of a license renewal review. For each of the 92 issues, the staff evaluated existing data from the nuclear power plants throughout the U.S. From this evaluation, the staff determined which issues were amenable to generic consideration and which issues can only be resolved on a site-specific*

basis. Sixty-nine of the issues were found to be generic to all sites, whereas, 23 of the issues would require a site-specific analysis. Generic issues are termed Category 1 because the conclusions related to their environmental impacts were found to be common to all plants or all plants with certain design features (e.g., cooling towers), mitigation of adverse impacts was considered, and it has been determined that additional mitigation measures are likely not to be beneficial to warrant implementation. Absent "new and significant information" that the NRC may obtain during its independent site-specific review, which includes public comments in the scoping process, Category 1 issues are not reevaluated in the site-specific EIS. Nevertheless, the conclusions from the applicable 69 Category 1 issues are adopted (using a NEPA concept known as tiering) in the site-specific EIS.

Category 2 issues are those that require a site-specific review, prepared in the staff's site specific supplement to the GEIS. The NRC staff evaluates site-specific data provided by the applicant, other Federal Agencies, State agencies, tribal and local governments, as well as information from members of the public.

The GEIS is available on the NRC's website at http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1437/. The comment provides no new and significant information; therefore, the comment will not be evaluated further.

Comment: The NRC must evaluate the environmental impact of ownership and operation scheme, in this case, where Xcel is the owner of the plant with full liability for operations as conducted by NMC.

The application was made in the name of Nuclear Management Company, LLC. Xcel Energy, the owner of Monticello, should also be an applicant. (MS-V-6)

Response: *Nuclear Management Company (NMC) is the holder of the operating license, and has applied for license renewal of the operating license of Monticello Nuclear Generating Plant. NMC submitted the application, dated March 16, 2005, individually and as agent for the owner of the plant, Northern States Power Company, a wholly owned subsidiary of Xcel Energy Corporation.*

4. Comments Concerning Water Quality and Use Issues

Comment: There is (sic) some thermal issues. They may be generic, but they may be pretty specific to Monticello, being as Monticello is really on the upper waters of the Mississippi River. You cannot count on the cooling that this river has historically provided over the forecast period for a re-licensing period. (MS-D-10)

Comment: The NRC analysis on water quality and surface runoff fails to adequately address issues concerning erosion, changing weather patterns we are experiencing in Minnesota, and the risks to ground water contamination. (MS-S-23)

Comment: The EIS needs to define the impact on water. The EIS needs to assess in detail how reactor operations impacts water contamination. (MS-Y-33)

Response: *Temperature effects and other water quality issues were evaluated in the GEIS and determined to be Category 1 issues. Water quality will be discussed in Chapters 2 and 4 of the SEIS.*

Comment: And it was '95 -- or '85 or '86, maybe it was '87 when we did experience extremely low flow. Some of you who were here at the plant at that time remember those low flows. 7Q10 I believe it's called, is what we named it. Very, very close to opening up some of the reservoirs in the dams upstream from Monticello certainly, upstream from the Twin Cities to provide greater flows. We're going to see more and more of that. We're going to see less flows with higher temperatures. We know what happened a year ago in France when they had very, very high temperatures and the waters were too hot to take the cooling water from the reactors, and they had to shut the reactors down. Your EIS needs to take much more account of that than I think we historically have. (MS-D-11)

Comment: The NRC does not address the fact that while torrential down pours followed by days of hot dry weather used to be unusual in the state ten years ago, they have become common; cities are scrambling to address rapidly changing water levels that fluctuate from unusually high to unusually low. (MS-S-24)

Comment: Item 12 & 13, Physical Impacts on Water resources, Water Use. Xcel Energy uses water to cool reactors and this topic should be addressed in the EIS, because of the definite and apparent impacts on local aquifers and water resources. (MS-X-4)

Comment: The EIS needs to tabulate concisely how much of which contaminant is estimated to have been released for the past 2 decades of operation. The EIS needs to show water flow rates and respective volumes in which continuous and batch releases have and are expected to occur, and model the effects of these releases, taking into consideration latest scientific evidence (see 3,4,5)- not the references from 10 years ago as in the generic EIS. This modeling should include mitigating factors related to global climate change, such as volatile changes in available water quantity, especially of the Mississippi River. The EIS needs to show how adequate water monitoring would be performed, by whom and who would pay for it. (MS-Y-35)

Response: *The specific impacts of climate change within a particular region or watershed are highly speculative, and are therefore beyond the scope of a NEPA review for reactor license renewal. Furthermore, any changes in watershed characteristics would likely be gradual, allowing water use conflicts to be resolved as needed. Operating license holders are required to submit Annual Effluent Monitoring Reports and are also required to submit event reports during abnormal conditions. Water use conflicts will be discussed in Chapter 4 of the SEIS.*

5. Comments Concerning Aquatic Ecology Issues

Comment: The EIS must consider the impact of hot water discharges into the Mississippi river on aquatic plant, animal and human life. (MS-V-10)

Response: *The comment is related to aquatic ecology. Impacts to aquatic species will be addressed in Chapter 4 of the SEIS.*

6. Comments Concerning Terrestrial Resource Issues

Comment: Monticello is a strong supporter of the environment. We take great care in our daily activities to ensure that the environment is well protected. Our employees feel fortunate that the location of Monticello rests on the bank of the Mississippi River within the reaches of the Montissippi County Park and the Lake Maria State Park. The site is home to numerous wildlife, aquatic species and plant life. Our efforts have made Monticello a safe and sound habitat for many years, and it remains our commitment to maintain that for years to come. (MS-A-6; MS-I-6)

Comment: Item 25, Nearby resources. First glance appears to be an incomplete list which does not include resources identified by the local community other than one "biologically sensitive area." This section also needs more discussion about impacts in the event of a release or accident. (MS-X-8)

Response: *The comments are related to terrestrial resource issues, which will be addressed in Chapters 2 and 4 of the SEIS.*

7. Comments Concerning Air Quality Issues

Comment: The next thing I would like to just mention briefly is that we are moving into a totally different climate paradigm. Global warming is on us. Nuclear reactors were not designed and built, and the functions that are provided within the redundant safety systems and so forth were not designed for the brave, new global warming world. (MS-D-9)

Comment: The EIS must consider the CO_2 releases of the nuclear cycle in comparison with other generation fuels, including uranium mining, milling, and other aspects of fuel production, transportation and concrete CO_2 emissions. (MS-V-9)

Comment: Item 22, Vehicle Emissions. More discussion is needed as this is the only identifiable source of air emissions. Trucks, hauling equipment, and vehicles used to perform ongoing maintenance need to be quantified and compared to USEPA guidelines especially considering the fact that this area is in danger of falling out of "attainment" for ozone. Vehicle emissions are a primary source of ozone precursors as identified by the Minnesota Pollution Control Agency and Xcel Energy in various publications. (MS-X-6)

Comment: Item 23, Stationary Source Emissions. This topic should include a more complete discussion of the radioactive emissions and also the impacts of particulate from construction of cask storage facilities and other activities related to plant operation that are on-going (back up systems for heating, cooling, etc). (MS-X-7)

Comment: The EIS needs to describe the impact on air quality and green house gas emissions.

The specific EIS needs to consider CO_2 production. The EIS needs to include data on CO_2 production numbers by the nuclear fuel cycle. (how much has been released should be concisely presented in table format for the past 2 decades of operation). In comparison to renewable energy, energy from nuclear power releases 4-5 times more CO_2 per unit of energy produced. Contrary to the generic EIS and public belief, CO_2 is emitted at every stage of the 7 stages of the nuclear fuel cycle: mining uranium milling, conversion, enrichment (90% of CO_2 production), fabrication into fuel rods, reactor operations and finally waste "disposal". (MS-Y-36)

Comment: The EIS needs to quantify air releases, show how adequate air monitoring would be performed, by whom and who would pay for it. The generic EIS only admits that small amounts of ozone and smaller amounts of oxides of nitrogen are produced by transmission lines (how much should be concisely presented in table format for the past 2 decades of operation). (MS-Y-37)

Comment: The power created is clean, with virtually no harmful air emissions. (MS-Z-3)

Response: *Air quality issues were evaluated in the GEIS and determined to be Category 1 issues. The comments provide no new and significant information on air quality and will, therefore, not be evaluated further.*

8. Comments Concerning Land Use Issues

Comment: The EIS must consider the impact of the growth of the Metropolitan area, which is now encroaching on the plant, putting more people in harms way, downwind and downriver. (MS-V-11)

Response: *Land use issues were evaluated in the GEIS and determined to be Category 1 issues. The comment provides no new and significant information on land use and will, therefore, not be evaluated further.*

9. Comments Concerning Human Health Issues

Comment: The second issue I would like to address has to do with, well, this new information out. As we spoke yesterday or the day before, the National Academy of Scientists, it's not the

BEIR [Biological Effects of Ionizing Radiation] reports anymore. They don't call them the BEIR, but the panel of the National Academy of Science that looks at biological consequences of long-term, low-level exposure released the next round. And they confirm that there is no safe threshold. In other words, if you are exposed to the degree that you are exposed, particularly we will find if the exposure is not background, but rather internal because then it's ongoing, it doesn't stop. It never stops if it's internal. And you can't escape it if it's internal, if you've ingested or inhaled beta in particular. There is no safe threshold for that; and the degree of exposure, the symptoms that will be exhibited increase proportional to the amount of exposure that has happened all the way down to zero.

So based on that knowledge, why, we have a problem, in my opinion, with the monitoring that goes on because we don't know -- we do know that these reactors as they explode uranium atoms and provide the entire periodic chart of other elements, including all of their radioactive sons and daughters. And then we release many of them because they're gases in particular.

And we store them for a while. And then we wait for a while. And then at some point we decide it's time to let them go. And they report them to the NRC, and we've got a boxful of reports as to how many curies of this and that went out. And the monitoring looks very convincing if you don't know what you're looking at because it's dominated with TLD's, thermoluminescent dosimeters, which are gamma ray detectors.

Well, that's fine. We have a monitoring system that essentially will tell us when we have an accident. We shouldn't need a monitoring system to tell us that. We should know that from other sources. And what we should know is where are the reported releases going? Because unless we know where they go, we don't know where the receptors are. And unless we know where the receptors are, we don't know what the biological consequences of that reception are.

And so the scope of this EIS needs to include a requirement -- you need to have data included in this EIS if what you're talking about is whether the consequences -- I saw it on the slide. What are the consequences of continued operation? You need to know before you can say with any veracity what the consequences of continued operations are. You need to know where do reported releases go? If you don't know that and if the EIS can't say that, you have no business making any conclusions on whether the consequences, the environmental consequences of your continued operations. (MS-D-7)

Comment: Extending operations at Monticello for 20 more years will also mean more cancer-causing radiation emissions will be pumped into the atmosphere. (MS-S-10)

Comment: As with problems surrounding public involvement, problems surrounding environmental concerns reveal broad segments of the population have been ignored by the NRC. The NRC relies on studies that assume a healthy adult male who weighs approximately 150 pounds is the recipient of radiation emissions. (MS-S-12)

Comment: The NRC does not consider how radiation effects women, children, developing fetuses, the elderly, people with immune deficiency problems, people who are obese, and people who are underweight. The studies of radiation used by the NRC reveals a clear discrimination against well over 50% of the population; it is sexist, ageist, and elitist. On this latter point subjects are assumed to be healthy, i.e., individuals who have the resources to care for their bodies and their diets. (MS-S-14)

Comment: The NRC does not consider long-term radiation exposure. It does not weigh basic facts about human physiology. For example girls are born with all of their eggs intact. What is the effect of long-term exposure to human eggs? Will there be decline in human health and abilities over the next two to ten generations? (MS-S-15)

Comment: Generating electricity from nuclear material requires tremendous amounts of energy to process the uranium. Much of this electricity comes from coal plants which produce high levels of global warming carbon dioxide and high levels of mercury emissions which ultimately end up in human bodies; the EPA now estimates that one in six pregnant women have levels of mercury in their bodies high enough to jeopardize the development of the fetal nervous system. (MS-S-17)

Comment: The EIS needs to acknowledge that there is no safe threshold for radiation exposure. The widely acknowledged absence of a "safe" threshold for radiation exposure should provide a strong reason for NRC not to renew Xcel Energy's reactor license. Its routine operations cause radioactive pollution. "The fact that humans cannot escape exposure to ionizing radiation from various natural sources, is no reason to let human activities increase the exposure." (MS-Y-5)

Comment: The EIS needs to accurately reflect actual radiation exposure.

The EIS needs to consider the so-called "routine radioactive releases" for Monticello specifically. During Monticello's operation radioactivity is both continuously emitted and periodically batch-released to air and water. It is unclear in what quantities, and how often. These data should be presented in concise table format for the past two decades of operation. Dilution with large volumes of station circulating water into reservoirs, rivers and lakes makes the releases "disappear." This is not "natural background" radiation. (MS-Y-6)

Comment: The EIS needs to consider that NRC does not tightly regulate radioactive releases. NRC only asks Xcel Energy to "make every reasonable effort to maintain radiation exposures, and releases of radioactive materials in effluents to unrestricted areas, as low as reasonably achievable" (ALARA, 10 CFR 20). This is unacceptably vague and not considered a standard procedure for health risk limit settings in regulatory toxicology. (MS-Y-7)

Comment: The EIS needs to consider, and if none is available or found, fund the collection of up-to-date, in vivo radiation exposure data. NRC's generic EIS at 4.6.2 "Public Radiation

Doses" presents unacceptably outdated, crudely modeled and ultimately uninformative data of "maximally exposed individuals" from 1985-87. NRC's so-called "latest" report, *Population Dose Commitments Due to Radioactive Releases from Nuclear Power Plant Sites* (1989), is 16 years old. None of the data are actual in-vivo measurements. (MS-Y-8)

Comment: The EIS must not exclusively rely on projections of radiation exposures. NRC needs to review the population density around the plant. NRC need to review and reference recent health studies that would confirm any low cancer incidence it assumes in the generic EIS. (MS-Y-9)

Comment: The EIS for Monticello needs to use a dose commitment that integrates radiation dose over time. NRC calculates radiation exposure only for the year of radiation release. In contrast, most European nations use a dose commitment that integrates dose over time, rather than only a one-time release. This non-dynamic modeling is akin to determining the cost of a loan merely on the basis of the principal. (MS-Y-10)

Comment: The EIS needs to consider the effects and costs of long-term exposures by several radionuclides including tritium. While most radionuclides emitted from Monticellos' nuclear power reactor are relatively short-lived, there are some with long half-lives (like C14), and some with infinitely long half lives (Ur238, 4.5 billion years) that can deliver harmful exposures for months, years, thousands and millions of years. Despite of its relatively short half-life (12 y) tritium is of high concern. It is a highly mobile radionuclide moving anywhere hydrogen does. While it is a relatively weak beta emitter, humans can inhale, ingest and absorb tritiated water and food, where it becomes an internal hazard, irradiating the tissue. Tritium can bioaccumulate through the aquatic foodchain. However, NRC 's generic EIS at 4.6.1.1 (Radionuclide Deposition) argues on the one hand that Tritium is not known to build up, but admits on the other hand that buildup is not explicitly accounted for in the aquatic food pathway. NRC 's tritium release limits remain lax, despite animal, human cell and DNA studies indicating its toxicity. Paragraph 4.6.1 on public exposure falls woefully short on what needs to be considered at Monticello, and seems more intent to deliver assurances than science based information. (MS-Y-11)

Comment: The EIS needs to consider physiological or ecological interactions that would mitigate exposures. Radionuclides can unite with carbon in the human body, plants, or animals. Even though Tritium passes through the human body in 12 days, some becomes organically bound and can remain in a person for much longer (450 to 650 days). One study even found traces of tritium in the body 10 years after exposure. Similar processes happen in the natural environment: As released radioactive gases decay, some form particulate and join other persistent radioactive isotopes released as fallout. Long-lived isotopes persist, accumulate and "bio-magnify" in biota through the food chain. (MS-Y-12)

Comment: The EIS needs to accurately estimate radiation-induced health risks in the general population both at Monticello and the larger region.

NRC needs to include emerging evidence on health effects in its EIS. More specifically the 1992 Energy Policy Act requires EPA to set public health and safety standards "based upon and consistent with" the recommendations of the National Academy of Sciences. NAS just published their latest report on radiation risk in June 2005 (BEIR VII report). Sixty years after Hiroshima, the full scope of effects of radiation on human beings is still incompletely understood, but progress has been made in the past 10 years since writing of NRC's (sic) generic EIS. (MS-Y-14)

Comment: The EIS needs to consider that NRC's radiation protection standards are not protective of the majority of the US population. (MS-Y-16)

Comment: The EIS needs to consider that cancer risks from radiation exposure are higher than previously estimated. The BEIR VII report is an improvement in so far as it estimates cancer incidence and mortality according to age of exposure, gender and by cancer type. The average risks to the population are estimated to be 10-15 % higher than the reference value currently used for radiation protection of the general population (565 cancer fatalities per million rem exposure in BEIR VII compared to 500). (MS-Y-17)

Comment: The EIS needs to consider non-cancer health risks. Newly emerging evidence points to the fact that radiation can cause a spectrum of effects, such as reproductive and cognitive impairment. We now know that certain life stages and situations exist, when exposure to both radiation and hormonally-active compounds pose an increased risk to human health. As the BEIR VII report does not touch on publications after 2000, it is likely still underestimating the true health impact. See below. (MS-Y-18)

Comment: The EIS needs to show how NRC intends to monitor for health effects in the general population. The EIS needs to specify how NRC would achieve the monitoring rather than relying on projections assisted by third parties with significant interest in a downplaying of effects. In the absence of other tracking systems in Minnesota this should include at a minimum an annual review of data from the state's cancer surveillance and birth defect registry, and the specification as to who would pay for the monitoring of health effects. (MS-Y-19)

Comment: The EIS needs to account for sensitive subpopulations. NRC models still use a hypothetical 154-lb. adult white male for dosimetric modeling and protection standard setting. This does not take sensitive or divergent populations into account, such as

a) women

b) infants and children

c) the unborn

d) the elderly

e) immunocompromised (MS-Y-20)

Comment: The EIS needs to account for women's increased vulnerability. Women's critical organ doses and effective doses (as defined in International Commission on Radiological Protection 60) are about 25% higher than for men. Women's gonad doses may even be as much as factors of 10-30 higher than in men. The risk for women to contract solid tumors like lung, breast, kidney, and liver cancer due to radiation exposure is about double those for men. The cancer mortality risks for females are 38% higher. Only for a few cancers, including leukemia, the risk estimates for men are higher. The special hormonal status of females increases cancer risk from exposure to ionizing radiation. Pregnant women appear to have an increased risk of cancer. Furthermore, research in both humans and animals has shown that interactions between hormonally-active chemicals and ionizing radiation may increase some types of cancer. For instance, low doses of neutrons were more effective in inducing breast cancer in female rats in combination with prolactin than without it. Hence radiation during pregnancy, when prolactin is increased is adding to the cancer risk. (MS-Y-21)

Comment: The EIS needs to account for infants and children's increased vulnerability. Current NRC standards and models do not consider newborn's special vulnerability to radiation. Many radionuclides are excreted in breast milk, providing a special exposure pathway for infants. The brain continues to develop during the first 2 years of life. Numerous studies show that ionizing radiation can impair the developing human brain and affect cognitive processes. Further evidence is from children treated for leukemia or brain tumors, although confounding factors cloud the issue somewhat. A recent study from Sweden examined 3000 men who received irradiation for a skin problem as young children. It clearly demonstrated a significant dose-response relationship for all cognitive tests at doses equivalent to those from computed tomography of the skull. IQ loss is a lifelong health effect. Several longitudinal birth cohort studies have shown that optimal brain development in utero and in the first years of life are a determinant for how well cognitive abilities are preserved in old age. In other words brain development impaired through radiation exposure during infancy and early childhood predicts cognitive decline in old age. Therefore costs from this health effect accrue over a long time. The risk for children to contract radiation-induced cancer is high, even higher than for women. For instance, the same radiation in the first year of life for boys produces 3-4 times the cancer risk as exposure between age 20 and 50. Female infants have almost double the risk as male infants. A study in the August 2003 issue of the Archives of Environmental Health showed that children growing up in regions with nuclear power plants develop cancer twice as frequently as controls/the national average. Milk teeth from the 47 cancer-stricken children contained higher levels of Sr-90. Radiation induced child health effects that need to be considered in the EIS are not merely loss of life and cancer, like leukemia later in life, but also chronic health conditions, such as an increased chance of birth defects, impaired fertility or IQ loss. The societal impacts and costs due to lost earning potential and mental retardation deserve NRC's special consideration. Unfortunately NRC de facto ignores the risk of low dose radiation in its protection standards. (MS-Y-22)

Comment: The EIS needs to account for the increased vulnerability of the developing fetus. Since the bombing of Hiroshima and Nagasaki it is well known that the unborn child is very sensitive to the effects of radiation. One reason is that the cells of the embryo are rapidly dividing and growing into specialized cells and tissues. This is accomplished through a complicated orchestration of high-level hormonal activity. A growing body of literature informs on synergism between hormonally-active compounds and radiation. The hypothalamo pituitary axis is a major regulator for endocrine activities, which are increasingly impacted by ubiquitous endocrine disrupting chemicals. There is general support for the view that development and programming of this axis during fetal life is the most sensitive window to permanently alter the homeostatic mechanisms of the endocrine system, including the mature reproductive system. Prenatal radiation exposures clearly are causes of endocrine-related cancers or susceptibility thereto. Low doses of X-rays to the fetus, especially during the last trimester, cause an increased risk of leukemia and all other types of cancer during childhood. Even use of therapeutic X ray of infants is associated with thyroid and breast cancer later in life. It is my understanding that current models to calculate internal radiation doses do not permit adequate modeling of the dose to individual organs within the fetus, even though this would obviously be quite important for safety assessments. Very few authors have attempted to make such individual organ dose estimates. However, with each additional study it is becoming clearer that placental transfer and fetal dose estimates have historically been underestimated. For example, the fetus is cradled above and behind the mother's bladder, which concentrates radionnuclides and can provide additional radiation exposure, a source previously discounted. Despite available evidence the quantification of the unborn child's health risks from exposure of parents to radiation is a task that NAS still has to tackle. Yet, NRC cannot afford to wait another 15 years fort the next NAS report. NRC needs to err on the side of caution and consider birth defects, intellectual and reproductive impairment as radiation related health effect in its impact analysis. (MS-Y-23)

Comment: The EIS needs to account for the increased vulnerability of the elderly. Older age radiation exposures are associated with higher cancer mortality. (MS-Y-24)

Comment: The EIS needs to account for the increased vulnerability of the immunocompromised. Radiation-induced cell damages are less likely to be repaired by a person with an incompetent immune system as can be gleaned from the secondary cancer rate in cancer survivors after radiation therapy. The number of people whose immune system is compromised is rapidly increasing in our region due to immunosuppressive medical treatments and increased survival of people with infections and congenital immune deficiencies. (MS-Y-25)

Response: *The comments are related to human health issues. Human health issues were evaluated in the GEIS and were determined to be Category 1 issues. The GEIS evaluated radiation exposures to the public for all plants including Monticello, and concluded that the impact was small. During the plant-specific environmental review of Monticello, the NRC will determine whether there is any new and significant information bearing on the previous analysis*

in the GEIS. The information provided by the comments will be reviewed as part of that search. In addition, evaluation of new studies and analyses of the health effects of radiation exposure, such as BEIR VII, is an ongoing effort at the NRC. If significant new information is found, the NRC will perform a plant-specific analysis of this environmental impact. This issue will be addressed in Chapter 4 of the SEIS.

10. Comments Concerning Socioeconomic Issues

Comment: On a different note, Monticello is more than a power plant operated by highly skilled workers. Monticello is part of this community. Not only does the plant rely upon many local companies for goods and services, but our employees live in and contribute to these communities and the surrounding communities on a daily basis.

We're proud to participate and give back to the community in a variety of ways, including serving on city and town boards, as leaders in civic and community organizations, as sports coaches, on church committees, boards and councils, and as members of charitable organizations. Our employees also help raise money for our local United Way organizations, the Relay for Life, the American Cancer Society, the Rotary Club, STARS Hockey Association, just to list a few. (MS-A-7; MS-I-7)

Comment: Monticello provides significant benefits, as John has pointed out, to the local and state economies by providing more than 500 full-time, family-supporting jobs. The plants and its employees purchase numerous goods and services from the local businesses and contribute and support the local charities and community organizations.

The plant also provides significant tax support to the local community. Xcel Energy is committed to being a good neighbor and fostering those continued economic growth in the region. (MS-B-8; MS-J-8)

Comment: This facility with the 500 jobs it does offer our community offers excellent career growth and retirement for the residents. It brings about economic vitality to all of our community.

Xcel closely works with city officials and county officials dealing with safety and security issues. During refueling, hundreds more contractors and subcontractors frequent our hotel, motels and restaurants, bringing more economic vitality to our community. (MS-C-1)

Comment: Previously you heard many examples of Xcel being a good neighbor. Another example is its commitment to youth and actually other older residents, such as myself. They have provided excellent softball and youth league baseball/softball facilities. It's a modern facility where many residents and non-resident families come to spend quality time. Prior to this location, NSP had provided a men's softball complex adjacent to Montissippi Park. This has now been converted to an area for radio-controlled model airplane enthusiasts. (MS-C-2)

Comment: The plant has provided stable good paying jobs for many people in the community and has aided the community in this respect by bringing many people to Monticello for employment. A great number of these individuals have contributed much to the town in terms of leadership and volunteerism. (MS-L-2)

Comment: Xcel (sic) has made it a policy to aggressively seek to provide sponsorship for a great for a large number of community activities designed to make Monticello a cleaner, safer and better place to live. Their contribution to Monticello's tax base alone has also assisted many community residents by lowering property taxes. (MS-L-4)

Comment: The Monticello Nuclear Plant has been an excellent neighbor to our community and school district for more than 35 years. Over the years many of the employees have resided in our community and sent their children to our schools. In addition, the employees have been civic minded members of our community. Numerous employees have joined local organizations and have served as community volunteers. Members of the Monticello Nuclear Plant have historically supported various community events such as the United Way and the annual River Fest Celebration. (MS-N-2)

Comment: The plant has also provided the area with a substantial tax base for our city, township and school district. (MS-N-4)

Comment: The Hospital District provides several programs such as Home Delivered Meals, Childbirth Education Classes, and music therapy for our Nursing Home residents that receive financial support from the United Way. Employees of the nuclear plant have supported the United Way. Plant employees are a part of our volunteer activities for our patients and residents. The local economy is better with the tax support provided by the nuclear plant. Monticello is growing rapidly and having the license renewal for the nuclear plant will provide stability for our community. (MS-O-3)

Comment: I also operate a local business and we say that many of our best customers are employees of the plant. They have been known to hire first class people and pay a very nice wage. In addition you will find employees to be active in local churches, coaching a youth hockey and baseball team, president of a local group like rotary. They do a wonderful job of having a quiet and almost invisible physical location while being very visible around the community. In addition to the employees it is easy to see and notice how the plant itself prides itself in supporting a whole variety of local efforts and charitable type events. (MS-P-3)

Comment: Last but not least is that I know they pay a whole lot of money in taxes. This is critical for all of us locally here in Monticello, but also spreads much further throughout all of Minnesota. (MS-P-4)

Comment: The plant employs nearly 500 people with an annual payroll of over $50 million dollars, which is of course of great benefit to our community. But these employees are also a

wonderful asset to the spirit of Monticello with their generosity, volunteerism and support of our local business and school district. Both the employees and the Company have been extremely generous to the United Way and many additional local charities in our continuing quest for an active and vibrant community. (MS-R-2)

Comment: Beyond this fact, there are many local benefits to the Nuclear Plant in Monticello. It plays an important role in the local economy, both as an employer and taxpayer to local families and governments. The company and its employees have demonstrated their support to the community through donations and volunteer efforts to various local groups, organizations and charities. (MS-T-2)

Comment: The plant is a vital asset to our state and important to my community. More than 500 people are employed full time at the plant. (MS-Z-2)

Comment: WHEREAS, a reliable, low cost and environmentally sound electric supply with a diverse energy mix is critical to economic well-being; (MS-AA-1; MS-AC-1)

Comment: WHEREAS, the Monticello Nuclear Generating Plant provides nearly 500 full-time jobs and contributes significantly to the local and state economy; (MS-AA-3; MS-AC-3; MS-AD-4)

Comment: WHEREAS, the Monticello Nuclear Generating Plant is now, and will continue to be, a significant contributor to the local tax base, ... (MS-AC-5)

Comment: WHEREAS, nuclear power is a reliable, low cost and environmentally sound source of electricity, and is an important factor in a diverse energy mix that is critical to our economic well-being; (MS-AD-2)

Response: *The comments are supportive of license renewal at Monticello Nuclear Generating Plant, and are general in nature. The comments provide no new and significant information on socioeconomic issues, and therefore, will not be evaluated further.*

Comment: The EIS needs to assess the negative socioeconomic impacts on Monticello

a) The EIS should specify Monticello nuclear plant tax payments as the percentage of the total city and county revenue. The data under 4.7.2 Taxes in the generic EIS show tremendous variation and are not helpful (<1 - 88%).

b) The EIS should specify how many jobs and how many families depend on the Monticello nuclear plant as the percentage of the total city and county population. This would better illustrate an impact that needs to be explicitly considered, not projected. Dependence on the nuclear plant is a risk factor to the region.

c) The EIS should provide actual details about the change in land use pattern since licensing of the reactor. The generic EIS paragraph 4.7.4 Off-Site Land Use is insufficient in judging whether sprawl with all its negative human and ecosystem health impacts is a result of the plant. The area to the immediate southeast of the reactor is one of the fastest growing communities in Minnesota. (MS-Y-32)

Response: *The comment is related to socioeconomic impacts on taxes, employment, and land use issues specific to Monticello. Socioeconomic impacts such as taxes, employment, and land use are Category 2 issues. These issues will be addressed in Chapters 2 and 4 of the SEIS.*

Comment: It's interesting as the severe accident mitigation alternatives, whatever that is, we have a substantial southeast Asian immigrant population in Minnesota, and they don't speak English and they eat a lot of fish. And so if we have a severe accident at Monticello and we contaminate a stretch of the river, we need to have a specific methodology of notification of all those communities and those individuals that may fish in the upper reaches of the Mississippi.

And so that includes like four southeast Asian languages and all that type of thing. And they don't necessarily follow the strict rules and regulations that we might have. And so it's going to be a substantial effort of notification. Otherwise you're going to have missed a large population that would be directly impacted. And also a large Hispanic, Latino community as well that in fact probably also does not speak English. And so you have all these groups that you must include in your analysis. (MS-E-3)

Comment: The NRC also fails to address how low-income people in the Twin Cities Metro area would be able to procure safe drinking water in the event that the Mississippi River became contaminated by nuclear material. (MS-S-13)

Response: *Environmental justice is an issue specific to Monticello and will be discussed in Chapter 4 of the SEIS.*

11. Comments Concerning Postulated Accidents

Comment: I also work with the North American Water Office, and my primary interest is that the Monticello Nuclear Facility is upstream from water intake, drinking water intake, for the Minneapolis city. And it is the only source of drinking water.

And so I would charge the NRC in their EIS analysis if there is an accident and there is a substantive discharge into that waterway, we have no alternative drinking water. And I would charge you that it is a severe environmental justice issue because people can't go and buy bottled water. Who is going to supply the water supply for 2 million people? And what are the costs of that, and how are you going to protect the water supply of Minneapolis?

St. Paul also gets a substantive percentage of its water from the Mississippi. They do have some deep wells and some lakes that they can also -- that they do also use. And so there is an additional exposure for St. Paul that you must consider. (MS-E-1)

Comment: So I'm inquiring about the severe accident mitigation alternatives. I found the analysis in they call it consequence bins quite helpful and, you know, easy to follow. But what was very unclear to me when the EIS explained these different categories of release potential, extreme, more than 50 percent of the inventory of cesium iodine being released. And then large, between 20 and 50 percent, which, of course, is really a huge range I think in terms of impact. Medium, small and negligible.

It explained that the severity depends upon the amount of the release in relation to the time in which general emergency was declared and people were alerted and were able to be, mitigation measures were able to be taken.

What was completely unclear to me in the environmental review is whether or not the NRC has any specific standards for this. How that decision is made? Who makes the decision as to whether the general emergency is declared? When people are notified? Whether they're -- and I think this bears upon the question of the water supply as well. I became aware of this question when I was sitting in on a technical representatives meeting, which they have monthly in the Environmental Quality Board.

And I think it's the Health Department. I'm not sure if it's the Health Department or the PCA, but many of the agencies are involved right now in a review of protections for service waters that serve as drinking waters under the EPA requirement, voluntary requirement.

And there were ten -- this has been like a six-month or eight-month, year-long process identifying the inventory, the service water inventories. And then determining what the priority contaminants were that they were going to consider. And one of those priority contaminants was specifically radioactive contamination from Monticello plant. And so this is something that is on the docket in this review, EPA review. (MS-F-1)

Comment: The Monticello nuclear power plant is located upstream from the Twin Cities on the Mississippi River. Residents of Minneapolis, St. Paul, as well as substantial numbers of people who live in sections of first-ring suburbs such as Edina get their drinking water from the Mississippi. (MS-S-2)

Comment: The NRC has failed to adequately address risks to ground water contamination. According to the NRC's own study the soils at the Monticello site are primarily Hubbards which are highly permeable and also have limited available water capacity. These soils readily transmit rainwater and surface water to groundwater supplies. In the event of radio-active material seeping out of containment units it is quite likely that groundwater sources and even aquifers could become contaminated. (MS-S-25)

Response: *The comments are related to the impacts of design basis accidents and severe accidents. The impacts of design basis accidents were evaluated in the GEIS and determined to be small for all plants; therefore, it is a Category 1 issue. The GEIS evaluated severe accidents for all plants including Monticello, and concluded that the impact was small. However, alternatives to mitigate severe accidents must be considered for all plants that have not considered such alternatives. During the plant-specific environmental review of Monticello, the NRC will determine whether there is any new and significant information bearing on the previous analysis in the GEIS. Section 5.1.2 of the plant-specific SEIS for Monticello will address severe accidents. The applicant provided a severe accident mitigation alternatives (SAMA) analysis as part of the license renewal application for Monticello. The NRC staff's review of the SAMA analysis will discussed in Section 5.2 of the plant-specific SEIS for Monticello.*

12. Comments Concerning Uranium Fuel Cycle and Waste Management Issues

Comment: Relicensing Monticello will result in more spent nuclear waste being generated near this valuable water resource. (MS-S-3)

Comment: The NRC makes no provisions to ensure that the energy needed to process uranium, and extract uranium is generated by sources such as wind or solar that do not produce harmful mercury, carbon dioxide, and nitrogen oxide emissions. (MS-S-18)

Comment: The NRC fails to acknowledge that there is no way to access accurately the true cost of securing and storing spent nuclear fuel for future taxpayers. Such an exercise is futile as there is no way to know how strong future economies will be.

The NRC fails to acknowledge that a large percentage of our financial resources will be diverted from other areas in order to provide financial resources for securing nuclear facilities and storing nuclear waste. (MS-S-20)

Comment: An obscure amendment to the federal energy bill (S706, HR2189) just passed 7/29/05, eases the restriction on overseas export of bomb grade uranium. (Sorry, I don't have the section number.) Exporting toxic and hazardous waste is a common practice for a rich country such as ours.

With the clear and present threat of nuclear terrorism, exporting bomb grade uranium would be unthinkable if it were not real. Amassing deadly bomb-grade materials tempts corporate decision-makers to take the export "solution." What guarantees exist to keep this waste in our own state or nation? (MS-U-1)

Comment: There is an assumption that the federal government will somehow "take care of" the N-waste. However, since the last century when nuclear weapons/power came on-line there

is no clear solution about long term storage. There has been a lot of money spent and rhetoric said, but nothing is settled. (MS-U-5)

Comment: The EIS must address the environmental impact due to continued operation for an extended (sic) license term, where there is more radioactive material to be stored, higher burnup rate waste is dangerous for longer periods, more casks needed, etc. Assemblies will increase from 1630 to 4512, nearly tripled, by 2030. (MS-V-8)

Comment: Is this temporary or permanent storage? The EIS must determine what will happen to the nuclear waste at the end of the term of licensure. If there is no answer, a number of reasonable scenarios must be fully analyzed, with caretaking of waste and maintenance of casks and facility assured to end point. (MS-V-13)

Comment: Additionally, due to the fact that a long-term storage facility is unlikely to be built anytime soon, and that facility will not have room for additional waste from Monticello, this issue will be affecting generations of Minnesotans and metro residents. (MS-X-1)

Comment: Item 28, Infrastructure impacts. More information needs to be included including impacts of transporting nuclear fuel to the facility by truck or rail and explanation of why the plant needs electricity, it is a nuclear power plant after all. (MS-X-9)

Comment: Item 30, Social, Economic, and Community impacts (Other). There needs to be a discussion of the larger impacts of transporting nuclear fuel into the Monticello Community and metro area, the ongoing operations of the plant, and the long term impacts of storing highly reactive nuclear waste at a site for 200-10,000 years. (MS-X-11)

Comment: The long-term ability of humans to store, contain, and manage nuclear waste is something yet untested. While some may argue that we have done so effectively for the most of the last 50 years there are numerous case studies to argue the opposite point (e.g. Three Mile Island, Chernoble Disaster). Since the production of nuclear electricity is non-sustainable in its current form and since there are no methods to properly address long-term storage of deadly nuclear waste we think it is fairly myopic and somewhat reckless to move forward unless all risks are clearly delineated in the public's view. (MS-X-12)

Comment: The EIS needs to consider transportation accidents involving nuclear material. (MS-Y-27)

Response: *The comments are related to the environmental impacts associated with the uranium fuel cycle, which were evaluated in the GEIS and determined to be Category 1 issues. The GEIS evaluated impacts associated with the uranium fuel cycle for all plants including Monticello, and determined that the impact was small. During the plant-specific environmental review of Monticello, the NRC will determine whether there is any new and significant information bearing on the previous analysis in the GEIS. If significant new information is*

found, the NRC will perform a plant-specific analysis of these environmental impacts. Chapter 6.0 of the plant-specific SEIS for Monticello will address these issues. The comments provide no new information and, therefore, will not be evaluated further.

13. Comments Concerning Alternatives

Comment: Our analyses show that keeping Monticello and Prairie Island as part of that diverse energy mix will benefit our customers by an estimated $1billion in today's dollars during the life extension periods, compared with the next best replacement options. Our analysis also shows that keeping the plants running will result in significantly lower air emissions than would occur if they were shut down and replaced with the only realistic alternatives, which are coal or natural gas-fired plants. (MS-B-5; MS-J-5)

Comment: And it's incumbent upon the Nuclear Regulatory Commission in its scoping of a commitment for an additional 20 years of reactor operations to at least be mindful of what's happening in the next five years relative to how electric utility services are going to be delivered.

CBED stands for Community Based Energy Development. And what it means is that we have an opportunity of taking advantage of the modern technologies, as opposed to the obsolete ones, which we're talking about here today, to look at the distributed dispersed capacity that can and will be coming on-line very rapidly in the next five years.

CBED enables those energy systems to come on line in a way that we've never experienced before. It provides a negotiating framework for the power companies to negotiate power purchase agreements with independent qualifying producers of energy. Locally owned, community-based energy. The type of energy development that will have to happen if we are ever to get out of our commitments to central station power and all of the problems that that represents in terms of how you manage nuclear waste for 140,000 years or more. What do we do about the mercury contamination? What do we do about global warming in particular from the coal chain? What about all the security threats from the nukes and all of the routine releases from the nukes and the catastrophic threats that nuclear power represents?

If we're going to work out of those binds, we will need to make a transition. And CBED is a profound tool that will enable that transition to happen. Right now it's true. It's for wind, and we recognize that wind can be an intermittent resource, not a base-load resource. And we all like to have the lights turned on even when the wind isn't blowing.

But it's also true that CBED projects provide an opportunity for us to now move forward to the hybrid systems where wind is married to combustion technologies. And right now -- well, there is the Public Utilities Commission meets next week, where we will be authorizing a test burn of a 2-megawatt diesel generator to a wind system in Southwest Minnesota in Rock County by Luverne.

And what will happen there is we're going to figure out how, as the wind tapers off, the combustion capacity can come on. And before very long, before this year is out, we'll have a pretty good handle on how to handle about 600 megawatts of peak during the year, which will be extremely lucrative to power producers because having 600 megawatts -- 600 hours, having a megawatt available on demand for 600 hours a year, your call utility, that's worth about six or seven thousand dollars a month, in addition to the energy, to have the capacity.

So we have the economic opportunity for this development to happen. And before two or three years are up, we'll be down on the shoulders of that peak. We'll be up to 14, 16, 1800 hours a year. And before this plant gets renewed, we're going to be swinging with a load duration curve just like Sherco 3 does. And then we're in business. (MS-D-3)

Comment: And as an afterthought, we go through the IRP, the Integrated Resource Planning process, to figure something out about conservation, because that's in the public good. Well, we're going to figure out at some point it is my fondest hope -- well, maybe second fondest -- that we figure out how to tie the financial health of the utility systems to what we all really want, which is the efficient use of resources, rather than the wasteful consumption.

And when we do that, we're going to find that we're wasting right now well over 50, 60, 70 percent of all of the kilowatt hours we consume. We don't need to if what we're focused on is how to get us the light that we want, or the refrigeration that we want, or the industrial drive that we want, rather than just selling bulk kilowatt hours.

So these are changes that are coming at you, NRC, in the time period that you're looking at for renewing this license. And I'm just really, I'm confused as to how you are going to evaluate that. (MS-D-5)

Comment: But when you consider alternatives, which you need to do, I would like to urge you to consider putting coal gasification that is slated to go elsewhere in Minnesota down here instead of nuclear. You preserve the jobs. You get rid of nuclear. You don't have to deal with those types of environmental issues, and I'll submit information in detail about that. (MS-G-1)

Comment: I am also concerned about alternatives. And again I live in Red Wing, which is right by Prairie Island, down river from Prairie Island, and also down river from this plant. So I would urge you to consider everything that Kristen particularly was talking about, and I will just give details on this later. But in alternatives, there are options being considered for Minnesota that would work really well here. This site is set up for it. It's time to consider some of those. (MS-G-3)

Comment: The "permanent" solution is transition to gasification, wind, solar roof panels, weather stripping, tighter windows a thousand improvements to improve our quality of life and also boost local employment. (MS-U-9)

Comment: No Action Alternative. Comment 1: EIS must consider current levels of load and generation in the region and state.

Comment 2: EIS must consider load and generation to evaluate impact of no action alternative:

MAPP 2004 Load and Capability Report

MAPP Form 3 (most recent version)

NERC 2004 Long-Term Reliability Assessment Report

CapX2020 Report

Rationale for Comments 1 and 2: The *Federal Register* notes that the "No Action" alternative will be considered. As a part of this alternative analysis, the NRC must consider the current levels of load and generation in the region and state to put the "No Action" alternative in context, including, but not limited to the MAPP 2004 Load and Capability Report and the MAPP Form 3 list of generation, the 2004 NERC Reliability Assessment Report, particularly the MAPP and MAIN sections, and the CapX2020 report claiming a "need" of 6,000 MW and the MISO queue with 16,712 MW in generation waiting in line. (MS-V-2)

Comment: Reasonable Alternative Energy Sources. Comment 3: The EIS must consider reasonable alternatives including natural gas fueled combined cycle plant as a reasonable alternative to Monticello.

Comment 4: The EIS must consider the Mesaba coal gasification plant as replacement, electrically and physically, for Monticello.

Comment 5: The EIS must consider the efficiencies and environmental benefits of utilizing pre-existing infrastructure and plant components in replacing Monticello with the Mesaba coal gasification generation balanced against continuation of Monticello nuclear generation and construction and operation of Mesaba elsewhere.

Comment 6: The EIS must consider system wide distributed, renewable generation as a reasonable alternative to Monticello.

Rationale for Comments 3, 4, 5 and 6: Rationale: Xcel claims it needs generation and that it should rely on coal and nuclear. The coal gasification option was mandated by the legislature, yet because of the market realities of high electrical availability, a power contract was also mandated. Because of these mandates, Mesaba should be analyzed as the first replacement option for nuclear power. Monticello relicensing is before us right now, and the Mesaba application to the EQB is imminent. (MS-V-3)

Comment: Comment 7: The NRC must evaluate, as reasonable alternatives, combinations of different intermittent generation, such as wind with gas and/or biomass, to give capacity equivalent to capacity percentages of "baseload" coal and nuclear.

Rationale for Comment 7: Xcel unreasonably relies exclusively on coal and nuclear when combinations of other fuel options could provide generation equal to, for example, the 70% or so availability of Monticello (40% wind plus just 30% gas = 70% capacity! See, that wasn't so hard.). (MS-V-4)

Comment: We would also suggest that alternatives to continued operations at the Monticello facility be properly evaluated, particularly part 5 titled "Systemwide Renewable, distributed generation" which could include the construction of wind farms, solar farms, or other renewable energy sources where the fuel is present locally and the method of generation not inherently dangerous. The # four option of "Wind and Gas" would also be a much more benign scenario to continued operations and infinitely long storage of nuclear waste on-site. (MS-X-3)

Comment: WHEREAS, replacement of the Monticello Nuclear Generating Plant would result in an electric rate increase and significantly increased emissions of carbon dioxide, nitrogen oxides, and sulfur dioxide. (MS-AA-4)

Comment: WHEREAS, replacement of the Monticello Nuclear Generating Plant would result in an electric rate increase and significant increased emissions of carbon dioxide, nitrogen oxides and sulfur dioxide... (MS-AC-4; MS-AD-5)

Response: *The comments are related to the environmental impacts of alternatives to license renewal at Monticello. The GEIS included a discussion of alternative energy sources. Environmental impacts associated with various reasonable alternatives to renewal of the Monticello operating license will be evaluated in Chapter 8 of the SEIS.*

Comment: The latest scientific evidence needs to be researched and referenced. The references of the generic EIS are testimony that the document is at the minimum 11 years old and largely outdated when it comes to renewable energy literature. The EIS needs to show, for example, that solar power holds tremendous promise in our region now, as there is increased PV efficiency, state governmental support, and PV panel costs continue to decline an average of 5% annually. The argument of land use and solar is incredibly exaggerated, as PV-panels in urban areas are readily mounted on existing buildings. Solar energy has one of the highest job intensities per unit of output of any energy technology, and thus has huge benefits to the local economies that adopt them. In addition to jobs from the contractors that install systems, the Minnesota economy is projected to benefit from an expanding solar energy manufacturing industry including growth in such areas as semiconductors, plastic films, electronic equipment, instrument measuring, switchgear and switchboard apparatus, wiring, storage batteries, sheet metal, and flat glass. (MS-Y-39)

Response: *The GEIS is subject to periodic review and update; in 2003, the NRC initiated an effort to update the GEIS. As new information becomes available, the NRC determines whether it is sufficiently significant to change a position. In Section 8.3 of the GEIS, the staff described the alternative energy technologies and evaluated the environmental impacts of supply and demand alternatives with the focus of "... the purpose and need of the proposed action [i.e., 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) decision makers]...." The staff focus is on the power generation capability of a baseload nuclear power plant. Alternative energy sources will be discussed in Chapter 8 of the SEIS.*

Comment: The EIS needs to be sensitive to the issue of CO_2 reduction. (MS-Y-40)

Response: *The comment raises issues related to alternative energy sources, which will be evaluated in Chapter 8 of the SEIS.*

Comment: The EIS needs to present a fair and accurate alternatives analysis.

The energy alternatives need to be discussed in an impartial manner. The generic EIS has a definite inherent pro-nuclear spin. Could it be because the nuclear power industry has been given more taxpayer dollars for research and development than any other energy sector? (MS-Y-38)

Response: *The comment is outside the scope of license renewal related environmental impacts. The NRC's regulations in 10 CFR Part 51 require the NRC to consider all reasonable alternatives to a proposed action as part of its NEPA review. The license renewal review evaluates a reasonable range of alternatives to supply baseload electric power generation. The analysis of alternatives to license renewal presented in the GEIS will be supplemented by a plant-specific alternatives analysis of license renewal at Monticello. The comment fails to provide any new and significant information, and will not be evaluated further.*

14. Comments Concerning Aging Management

Comment: The Monticello plant has also been well maintained over its lifetime. Approximately every two years we perform a refueling and maintenance outage, in which we typically carry out over 2,500 individual maintenance and inspection activities. This is in addition to the ongoing maintenance, inspection, and rigorous testing activities that are performed at the time the plant is operating on-line.

Over on the years, we have continued to invest in a wide range of equipment improvements to take advantage of technology and materials to ensure future reliable and safe operation. As computer training methods have evolved, we are able to broaden the training available. As we

move forward, we will continue to upgrade the equipment and technology at the station. (MS-A-4; MS-J-4)

Comment: And then we get to the aging issues for these reactors. Now, I understand, as I said in my opening remarks, I understand the commitment of the work force and the intent of the work force. But I also know that we have part of the fail-safe systems bolted to the packing crate at Monticello as well as at Duane Arnold for 35 years before it was discovered. Never took the bolts off.

So just because you're good and paying attention doesn't mean things can't happen. I know what happened at Davis Besse, where they were looking really hard, and they didn't find it because they weren't looking in the right place. I know it happened at Point Beach when the nuclear physicists forgot their high school chemistry and they caused an explosion in a cask. Damned near tipped the lid into the pool, which could have drained the pool; and then we would have some fire works. It didn't happen, fortunately.

But these are all examples; and there is many, many more. NRC knows them, so I won't bore you with them, but we're pushing the envelope with all of this stuff. You guys to got to do a better job of figuring out where to look when. You have to have more different ways of -- you have to find more diverse ways of looking at things. You've got to figure out not only where to look, but when to look. And you have to do that in a way that provides more assurance, than we have in the past, you're not overlooking things.

Things age. As things age, I mean it's the bathtub curve. Are you familiar with the bathtub curve concept? Things of life where in the early -- using a human example, there is a death mortality rate for infants which is higher than for juveniles and adults. And then it goes up again at the end, and in the long run we'll all be dead.

Well, the same with reactors or any other piece of equipment. It goes through a curve. And now that we're doing re-licensing, you see we're getting into the tail end of that curve, and that's why we look at aging things. But you're not looking at them good enough is the point. And the unfortunate point is that there is no way that you can look at it good enough because you can't always look everywhere. (MS-D-12)

Comment: Objectively, relicensing an old nuclear power plant beyond its expected peak performance is an accident waiting to happen. Picture a Bell Curve, problems with a complicated energy plant occur at the beginning and end of its production-time. Where is Monticello on that curve? Three Mile Island, Chernobyl the lesson will be repeated until it is learned. (MS-U-7)

Response: *The NRC's environmental review focuses on environmental impacts relevant to the extended period of operation requested by the applicant. Safety matters related to aging are outside the scope of this review. An NRC safety review for the license renewal period is conducted separately, and will be documented in an NRC staff Safety Evaluation Report. The*

comments provide no new information and will not be evaluated further in the context of the environmental review. However, the comments will be forwarded to the project manager for the license renewal safety review for consideration.

Comment: In addition, it has recently come to our attention that there are some age related component degradation (sic) issues the EIS needs to address. Specifically, the potential of mounting base plates, grout, and/or mounting hardware for pumps, heat exchangers, compressors, tanks, turbines and motors to fail due to age-related degradation needs to be examined.

Further, valve stem and pump shaft packing and gasket material, and other sealing materials required to prevent system leakage to the environment where shafts penetrate through a pump casings, valve body/bonnets, and other components needs to be analyzed for age-related degradation.

Further, consumables such as lubrication media including oils and greases must be analyzed from the perspective of age-related degradation.

Finally, valve internals flow isolation sealing subcomponents such as valve discs, plugs, and/or gates must be analyzed from an aging management program perspective. (MS-W-1)

Response: *The NRC's environmental review focuses on environmental impacts relevant to the extended period of operation requested by the applicant. Safety matters related to aging are outside the scope of this review. An NRC safety review for the license renewal period is conducted separately, and will be documented in an NRC staff Safety Evaluation Report. The safety review looks at the applicant's aging management programs for passive long-lived systems, structures and components. The comments provide no new information and will not be evaluated further in the context of the environmental review. However, the comments will be forwarded to the project manager for the license renewal safety review for consideration.*

Appendix B

Contributors to the Supplement

Appendix B: Contributors to the Supplement

The overall responsibility for the preparation of this supplement was assigned to the Office of Nuclear Reactor Regulation, U.S. Nuclear Regulatory Commission (NRC). The statement was prepared by members of the Office of Nuclear Reactor Regulation with assistance from other NRC organizations, the Lawrence Livermore National Laboratory, Argonne National Laboratory, Pacific Northwest National Laboratory, Energy Research Incorporated, and the Information Systems Laboratory.

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[a] Lawrence Livermore National Laboratory is operated for the U.S. Department of Energy by the University of California.
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Appendix C

Chronology of NRC Staff Environmental Review Correspondence Related to Nuclear Management Company, LLC's Application for License Renewal of Monticello Nuclear Generating Plant

Appendix C: Chronology of NRC Staff Environmental Review Correspondence Related to Nuclear Management Company, LLC's Application for License Renewal of Monticello Nuclear Generating Plant

This appendix contains a chronological listing of correspondence between the U.S. Nuclear Regulatory Commission (NRC) and Nuclear Management Company (NMC), and other correspondence related to the NRC staff's environmental review, under Title 10 of the *Code of Federal Regulations* (CFR) Part 51, of NMC's application for renewal of the Monticello operating license. All documents, with the exception of those containing proprietary information, have been placed in the Commission's Public Document Room, at One White Flint North, 11555 Rockville Pike (first floor), Rockville, MD, and are available electronically from the Public Electronic Reading Room found on the Internet at the following Web address: http://www.nrc.gov/reading-rm.html. From this site, the public can gain access to the NRC's Agencywide Documents Access and Management System (ADAMS), which provides text and image files of NRC's public documents in the Publicly Available Records (PARS) component of ADAMS. The ADAMS accession number for each document is included below.

March 16, 2005	Letter from Mr. Thomas J. Palmisano, NMC, to the NRC, submitting the application for renewal of the operating license for Monticello Nuclear Generating Plant (Accession No. ML050880241).
March 24, 2005	NRC press release announcing the availability of the license renewal application for Monticello Nuclear Generating Plant (Accession No. ML050830481).
March 31, 2005	NRC letter to Mr. Thomas J. Palmisano, NMC, Receipt and Availability of the License Renewal Application for Monticello Nuclear Generating Plant (Accession No. ML050900052).
May 5, 2005	NRC letter to Mr. Thomas J. Palmisano, NMC, forwarding the Determination of Acceptability and Sufficiency for Docketing, Proposed Review Schedule, and Opportunity for a Hearing Regarding the Application from Nuclear Management Company, LLC for Renewal of the Operating License for Monticello Nuclear Generating Plant (Accession No. ML051260029).

May 9, 2005	NRC letter to Ms. Margo Askin, Head Librarian Monticello Public Library regarding the maintenance of documents related to the Monticello Nuclear Generating Plant license renewal review (Accession No. ML051300167).
May 9, 2005	NRC letter to Ms. Amy Wittmann, Branch Librarian Buffalo Public Library regarding the maintenance of documents related to the Monticello Nuclear Generating Plant license renewal review (Accession No. ML051300195).
May 12, 2005	NRC press release announcing the opportunity for hearing on application to renew operating license for Monticello Nuclear Power Plant (Accession No. ML051320170).
May 12, 2005	*Federal Register* Notice of Acceptance for Docketing of the Application and Notice of Opportunity for Hearing Regarding the Renewal of Facility Operating License No. DPR-22 for an Additional 20-Year Period (70 FR 25117).
May 26, 2005	NRC letter to Mr. Thomas J. Palmisano, NMC, forwarding the *Federal Register* notice of intent to prepare an Environmental Impact Statement and conduct scoping process for license renewal for Monticello Nuclear Generating Plant (Accession No. ML051460549).
May 27, 2005	NRC letter to Mr. Don Klima, Director, Advisory Council on Historic Preservation, regarding the Monticello Nuclear Generating Plant license renewal review (Accession No. ML051470309).
May 27, 2005	NRC letter to Mr. Thomas J. Palmisano, NMC, requesting additional information regarding Severe Accident Mitigation Alternatives (SAMA) for Monticello Nuclear Generating Plant (Accession No. ML051470339).
May 27, 2005	NRC letter to the Fond Du Lac Reservation Tribal Council, inviting participation in the scoping process for the Monticello Nuclear Generating Plant license renewal review (Accession No. ML051520264).
May 27, 2005	NRC letter to the Flandreau Santee Sioux Executive Committee, inviting participation in the scoping process for the Monticello Nuclear Generating Plant license renewal review (Accession No. ML051520356).

May 27, 2005	NRC letter to the Turtle Mountain Band of Chippewa Tribal Council, inviting participation in the scoping process for the Monticello Nuclear Generating Plant license renewal review (Accession No. ML051520418).
May 27, 2005	NRC letter to the Upper Sioux Indian Community, inviting participation in the scoping process for the Monticello Nuclear Generating Plant license renewal review (Accession No. ML051520483).
May 27, 2005	NRC letter to the Bois Forte Reservation Tribal Council, inviting participation in the scoping process for the Monticello Nuclear Generating Plant license renewal review (Accession No. ML051520372).
May 27, 2005	NRC letter to the White Earth Tribal Council, inviting participation in the scoping process for the Monticello Nuclear Generating Plant license renewal review (Accession No. ML051520395).
May 27, 2005	NRC letter to the St. Croix Chippewa of Wisconsin, inviting participation in the scoping process for the Monticello Nuclear Generating Plant license renewal review (Accession No. ML051520525).
May 27, 2005	NRC letter to the Spirit Lake Tribe, inviting participation in the scoping process for the Monticello Nuclear Generating Plant license renewal review (Accession No. ML051520546).
May 27, 2005	NRC letter to the Sokaogon Chippewa Community, inviting participation in the scoping process for the Monticello Nuclear Generating Plant license renewal review (Accession No. ML051520568).
May 27, 2005	NRC letter to the Sisseton Wahpeton Oyate of the Lake Traverse Reservation, inviting participation in the scoping process for the Monticello Nuclear Generating Plant license renewal review (Accession No. ML051520578).
May 27, 2005	NRC letter to the Keweenaw Bay Tribal Council, inviting participation in the scoping process for the Monticello Nuclear Generating Plant license renewal review (Accession No. ML051530421).

May 27, 2005	NRC letter to the Lac Courte Orielles Governing Board, inviting participation in the scoping process for the Monticello Nuclear Generating Plant license renewal review (Accession No. ML051530539).
May 27, 2005	NRC letter to the Lac du Flambeau Band of Lake Superior Chippewa, inviting participation in the scoping process for the Monticello Nuclear Generating Plant license renewal review (Accession No. ML051540187).
May 27, 2005	NRC letter to the Lac Vieux Desert Band of Lake Superior Chippewa, inviting participation in the scoping process for the Monticello Nuclear Generating Plant license renewal review (Accession No. ML051540250).
May 27, 2005	NRC letter to the Leech Lake Band of Ojibwe, inviting participation in the scoping process for the Monticello Nuclear Generating Plant license renewal review (Accession No. ML051540294).
May 27, 2005	NRC letter to the Mille Lacs Band of Ojibwe, inviting participation in the scoping process for the Monticello Nuclear Generating Plant license renewal review (Accession No. ML051540402).
May 27, 2005	NRC letter to the Prairie Island Community Council, inviting participation in the scoping process for the Monticello Nuclear Generating Plant license renewal review (Accession No. ML051540436).
May 27, 2005	NRC letter to the Red Lake Tribal Council, inviting participation in the scoping process for the Monticello Nuclear Generating Plant license renewal review (Accession No. ML051540461).
May 27, 2005	NRC letter to the Santee Sioux Tribal Council, inviting participation in the scoping process for the Monticello Nuclear Generating Plant license renewal review (Accession No. ML051540473).
May 27, 2005	NRC letter to the Shakopee Dakota Community Council, inviting participation in the scoping process for the Monticello Nuclear Generating Plant (Accession No. ML051540487).
May 27, 2005	NRC letter to the Grand Portage Reservation Council, inviting participation in the scoping process for the Monticello Nuclear Generating Plant license renewal review (Accession No. ML051550002).

June 1, 2005	NRC letter to the Lower Sioux Indian Community of Minnesota Mdewakanton Sioux Indians, inviting participation in the scoping process for the Monticello Nuclear Generating Plant license renewal review (Accession No. ML051560007).
June 2, 2005	NRC letter to Dr. Nina M. Archabal, State Historic Preservation Officer for Minnesota, inviting participation in the scoping process relating to the Monticello Nuclear Generating Plant license renewal review (Accession No. ML01560004).
June 2, 2005	*Federal Register* Notice of Intent to Prepare an Environmental Impact Statement and Conduct Scoping Process of Facility Operating License No. DPR-22 (70 FR 32381).
June 3, 2005	NRC letter to Mr. Dan P. Stinnett, Field Supervisor, U.S. Fish and Wildlife Service, requesting list of protected species within the area under evaluation for the Monticello Nuclear Generating Plant license renewal review (Accession No. ML051560006).
June 3, 2005	NRC letter to the Red Cliff Band of Lake Superior Chippewa, inviting participation in the scoping process for the Monticello Nuclear Generating Plant license renewal review (Accession No. ML051560008).
June 3, 2005	NRC letter to the Bad River Band of Lake Superior Chippewa, inviting participation in the scoping process for the Monticello Nuclear Generating Plant license renewal review (Accession No. ML051560009).
June 6, 2005	NRC meeting notice informing public of scoping meeting to be held in Monticello, Minnesota, on June 30, 2005 (Accession No. ML051610403).
June 14, 2005	NRC letter to Monticello Nuclear Generating Plant summarizing the telecommunication to discuss the Severe Accident Mitigation Alternatives (SAMA) Requests for Additional Information (RAIs) (Accession No. ML051650157).
July 27, 2005	Letter from John T. Conway, NMC, to NRC providing the responses to Request for Additional Information Regarding Severe Accident Mitigation Alternatives for Monticello Nuclear Generating Plant (Accession No. ML052130197).

July 28, 2005	NRC letter to NMC, summarizing telephone conference concerning draft Request for Additional Information pertaining to the Monticello Nuclear Generating Plant license renewal application (Accession No. ML052100060).
July 28, 2005	NRC letter to NMC forwarding summary of public scoping meetings for Monticello Nuclear Generating Plant license renewal review (Accession No. ML052030005).
August 4, 2005	NRC letter summarizing the site audit regarding the Monticello Nuclear Generating Plant license renewal review (Accession No. ML052200039).
August 16, 2005	Letter from John T. Conway, NMC providing response to Request for Additional Information regarding Monticello Nuclear Generating Plant (Accession No. ML052340510).
September 1, 2005	NRC letter to NMC summarizing a telephone conference call held on August 10, 2005, to discuss follow-up items regarding the Severe Accident Mitigation Alternatives (SAMA) Request for Additional Information (RAI) for Monticello Nuclear Generating Plant (Accession No. ML052450030).
October 7, 2005	NRC letter to John T. Conway, NMC, forwarding the Environmental Scoping Summary Report regarding Monticello Nuclear Generating Plant license renewal review (Accession No. ML052800329).
December 22, 2005	NRC letter to Dan P. Stinnett, FWS, forwarding the Biological Assessment for Monticello Nuclear Generating Plant license renewal review (Accession No. ML053570019).

Appendix D

Organizations Contacted

Appendix D: Organizations Contacted

During the course of the staff's independent review of environmental impacts from operations during the renewal term, the following Federal, State, regional, local, and Native American tribal agencies were contacted:

Advisory Council on Historic Preservation, Washington, D.C.

Bad River Band of Lake Superior Chippewa, Odanah, Wisconsin

Bois Forte Reservation Tribal, Net Lake, Minnesota

City of Monticello, Administrator and Planning, Monticello, Minnesota

City of Monticello Economic Development, Monticello, Minnesota

City of Monticello Administrator, Monticello, Minnesota

Flandreau Santee Sioux Executive Committee, Flandreau, South Dakota

Fond Du Lac Reservation Tribal Council, Cloquet, Minnesota

Grand Portage Reservation Council, Grand Portage, Minnesota

Keweenaw Bay Tribal Council, Baraga, Michigan

Lac Courte Orielles Governing Board, Hayward, Wisconsin

Lac du Flambeau Band of Lake Superior Chippewa, Lac du Flambeau, Wisconsin

Lac Vieux Desert Band of Lake Superior Chippewa, Watersmeet, Wisconsin

Leech Lake Band of Ojibwe, Cass Lake, Minnesota

Lower Sioux Indian Community of Minnesota Mdewakanton Sioux Indians, Morton, Minnesota

Mille Lacs Band of Ojibwe, Onamia, Minnesota

Minnesota Department of Natural Resources, St. Paul, Minnesota

Minnesota State Historic Preservation Office, St. Paul, Minnesota

Monticello Area Chamber of Commerce, Minnesota

1 Wright County Assessor, Buffalo, Minnesota

2 Wright County Assessor, Auditor-Treasurer, Buffalo, Minnesota

3 Prairie Island Community Council, Welch, Minnesota

4 Red Lake Tribal Council, Red Lake, Minnesota

5 Red Cliff Band of Lake Superior Chippewa, Bayfield, Wisconsin

6 Santee Sioux Tribal Council, Niobrara, Nebraska

7 Shakopee Dakota Community Council, Prior Lake, Minnesota

8 Sherburne County, Auditor-Treasurer, Elk River, Minnesota

9 Sherburne County Department of Public Works, Elk River, Minnesota

10 Sherburne County Emergency Management, Elk River, Minnesota

11 Sisseton Wahpeton Oyate of the Lake Traverse Reservation, Sisseton, South Dakota

12 Sokaogon Chippewa Community, Crandon, Wisconsin

13 Spirit Lake Tribe, Fort Totten, North Dakota

14 St. Croix Chippewa of Wisconsin, Webster, Wisconsin

15 Turtle Mountain Band of Chippewa Tribal Council, Belcourt, North Dakota

16 United States Fish and Wildlife Service, Bloomington, Minnesota

17 Upper Sioux Indian Community, Granite Falls, Minnesota

18 White Earth Tribal Council, White Earth, Minnesota

19 Wright County Emergency Response Management (Civil Defense), Monticello, Minnesota

20 Wright County Treasury Department, Buffalo, Minnesota

Appendix E

Nuclear Management Company, LLC's Compliance Status and Consultation Correspondence

Appendix E: Nuclear Management Company, LLC's Compliance Status and Consultation Correspondence

Correspondence received during the process of evaluation of the application for renewal of the license for Monticello Nuclear Generating Plant is identified in Table E-1. Copies of the correspondence are included at the end of this appendix.

The licenses, permits, consultations, and other approvals obtained from Federal, State, regional, and local authorities for Monticello are listed in Table E-2.

Table E-1. Consultation Correspondence

Source	Recipient	Date of Letter
U.S. Nuclear Regulatory Commission	Advisory Council of Historic Preservation (D. Kilma)	May 27, 2005
U.S. Nuclear Regulatory Commission	Minnesota Historical Society, State Historic Preservation Officer (N. Archabal)	June 2, 2005
U.S. Nuclear Regulatory Commission	U.S. Fish and Wildlife Service (D. Stinnett)	June 3, 2005
U.S. Fish and Wildlife Service (D. Stinnett)	U.S. Nuclear Regulatory Commission	July 13, 2005
U.S. Nuclear Regulatory Commission	U.S. Fish and Wildlife Service (D. Stinnett)	December 22, 2005

Table E-2. Federal, State, Local, and Regional Licenses, Permits, Consultations, and Other Approvals for Monticello

Agency	Authority	Description	Number	Issue Date	Expiration Date	Remarks
NRC	10 CFR Part 50	Operating license, Monticello	DPR-22		09/8/10	Authorizes operation of Monticello Unit.
FWS	Migratory Bird Treaty Act (16 USC 703-712)	Permit	MB074020-0		03/31/06	Authorizes handling of injured and dead migratory birds.
DOT	49 CFR Part 107, Subpart G	Certificate of Registration for Transportation of Hazardous Materials	062504551041M		06/30/06	Authorization to transport hazardous materials.
ACOE	Section 10 of the Rivers and Harbors Act of 1988	General Permit	01-02982-GP-GAE		N/A[a]	Authorizes maintenance dredging, dewatering, and settling system discharge, and dredged material disposal.
MDNR	Minnesota Statutes Chapter 103G.271	Water Appropriations Permit	67-0083		N/A[a]	Authorizes groundwater withdrawals from well #1 and well #2.
MDNR	Minnesota Statutes Chapter 103G.271	Water Appropriations Permit	66-1172		N/A[a]	Authorizes surface water withdrawals from the Mississippi River.
MDNR	Minnesota Statutes Chapter 103G.315 Minnesota Rule Chapter 6115.0200	State Dredging Permit	67-0743 GP-100-MN		N/A[a]	Authorizes maintenance dredging, dewatering, and settling system discharge, and dredged material disposal.
MDNR	Minnesota Statutes Chapter 97A.401	Division of Fish and Wildlife Special Permit	12674		12/31/05	Authorizes collection of fish for biological evaluation.

[a]This permit does not expire.

Table E-2. (contd)

Agency	Authority	Description	Number	Issue Date	Expiration Date	Remarks
MDNR	Minnesota Statutes Chapter 97A.401	Division of Ecological Services Special Perrmit	12683		12/31/08	Authorizes collection of mussels for radioactive exposure analysis.
MPCA	Minnesota Statutes Chapters 115 and 116	NPDES permit	MN0000868		07/31/07	Authorizes discharge of wastewaters to waters of the state.
MPCA	Minnesota Statutes Chapters 115 and 116	General Stormwater Permit for Industrial Activity	MN G611000		10/31/02	Authorizes discharge of stormwater to waters of the state. (Permit renewal application submitted 4/16/02.)
MPCA	Minnesota Statutes Chapters 115 and 116	State Disposal System Permit	12915		N/A[(a)]	Authorized the construction and operation of a sanitary sewer extension.
MPCA	Minnesota Statutes Chapters 115 and 116	State Disposal System Permit	MN0058343		03/31/04	Authorizes maintenance dredging, dewatering, and settling system discharge, and dredged material disposal. (Permit renewal application submitted 9/24/03.)
MPCA	Minnesota Statutes Chapters 7045.0225	Hazardous Waste Generator License	MND000686139		06/30/06	Authorizes facility to operate as a hazardous waste generator.
MPCA	Minnesota Statutes Chapters 7007.0105	Air Emission Permit	17100019-003		08/16/05	Authorizes facility to operate air emission facility (oil- and gas-fired heating boiler, four emergency diesel generators, and an emergency fire pump diesel engine). (Permit renewal application submitted 2/17/05.)

[a]This permit does not expire.

Table E-2. (contd)

Agency	Authority	Description	Number	Issue Date	Expiration Date	Remarks
City of Monticello	Ordinance Title 14, Chapter 4	Sanitary Sewer Wastewater Discharge Agreement	001		N/A[(a)]	Authorizes discharge of domestic sanitary waste into the City of Monticello sanitary sewer collection system.
South Carolina Department of Health and Environmental Control	SC ADC 61-83	South Carolina radioactive waste transport permit	0026-22-04-X		12/31/05	Authorization to transport radioactive materials in South Carolina.
Tennessee Department of Environment and Conservation	TDEC 1200-2-10-30	Tennessee radioactive shipment license	T-MN002-L04		12/31/05	Authorization to ship radioactive material to a licensed disposal/ processing facility within Tennessee.

ACOE = U.S. Army Corps of Engineers
CFR = Code of Federal Regulations
DOT = U.S. Department of Transportation
FWS = U.S. Fish and Wildlife Service
MDNR = Minnesota Department of Natural Resources
MPCA = Minnesota Pollution Control Agency
NRC = Nuclear Regulatory Commission
SC = South Carolina
TDEC = Tennessee Department of Environment and Conservation
NPDES = National Pollutant Discharge Elimination System
NYSDEC = New York State Department of Environmental Conservation
USC = United States Code

[a]This permit does not expire.

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

May 27, 2005

Mr. Don Klima, Director
Office of Federal Agency Programs
Advisory Council on Historic Preservation
Old Post Office Building
1100 Pennsylvania Avenue, NW, Suite 809
Washington, DC 20004

SUBJECT: MONTICELLO NUCLEAR GENERATING PLANT LICENSE RENEWAL REVIEW (TAC NO. MC6441)

Dear Mr. Klima:

The U.S. Nuclear Regulatory Commission (NRC) staff is reviewing an application to renew the operating license for Monticello Nuclear Generating Plant (Monticello) which is located in the City of Monticello, Wright County, Minnesota, on the south bank of the Mississippi River. Monticello is operated by Nuclear Management Company, LLC (NMC). The application for renewal was submitted by NMC on March 24, 2005, pursuant to NRC requirements at Title 10 of the *Code of Federal Regulations* Part 54 (10 CFR Part 54). The NRC has established that, as part of the staff review of any nuclear power plant license renewal action, a site-specific Supplemental Environmental Impact Statement (SEIS) to its "Generic Environmental Impact Statement for License Renewal of Nuclear Plants" (GEIS), NUREG-1437, will be prepared under the provisions of 10 CFR Part 51, the NRC regulation that implements the National Environmental Policy Act of 1969 (NEPA). In accordance with 36 CFR 800.8, the SEIS will include analyses of potential impacts to historic and cultural resources. A draft SEIS is scheduled for publication in February of 2006, and will be provided to you for review and comment.

If you have any questions or require additional information, please contact the Environmental Project Manager, Ms. Jennifer Davis, at 301-415-3835 or JXD10@nrc.gov.

Sincerely,

Pao-Tsin Kuo, Program Director
License Renewal and Environmental Impacts Programs
Division of Regulatory Improvement Programs
Office of Nuclear Reactor Regulation

Docket No.: 50-263

cc: See next page

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

June 2, 2005

Dr. Nina M. Archabal
State Historic Preservation Officer
Minnesota Historical Society
State Historic Pres. Office
345 Kellogg Blvd West
St. Paul, MN 55102-1906

SUBJECT: MONTICELLO NUCLEAR GENERATING PLANT LICENSE RENEWAL REVIEW (TAC NO. MC6441) (SHPO Number: 2004-2193)

Dear Dr. Archabal:

The U.S. Nuclear Regulatory Commission (NRC) staff is reviewing an application to renew the operating license for Monticello Nuclear Generating Plant (Monticello), which is located in Wright County, Minnesota, on the southern bank of the Mississippi River. The nearest large city is St. Cloud, 22 miles to the northwest and upstream of the Monticello site. The Twin Cities area of Minneapolis, St. Paul, and their surrounding suburbs, is approximately 30 miles to the southeast of the site. Monticello is operated by Nuclear Management Company (NMC) and owned by Northern States Power Company, a wholly owned utility operating subsidiary of Xcel Energy, Inc. The application for renewal was submitted by NMC on March 24, 2005, pursuant to NRC requirements at Title 10 of the *Code of Federal Regulations* Part 54 (10 CFR Part 54). The NRC has established that, as part of the staff review of any nuclear power plant license renewal action, a site-specific Supplemental Environmental Impact Statement (SEIS) to its "Generic Environmental Impact Statement for License Renewal of Nuclear Plants" (GEIS), NUREG-1437, will be prepared under the provisions of 10 CFR Part 51, the NRC regulation that implements the National Environmental Policy Act of 1969 (NEPA). In accordance with 36 CFR 800.8, the SEIS will include analyses of potential impacts to historic and archaeological resources.

In the context of the National Historic Preservation Act of 1966, as amended, the NRC staff has determined that the area of potential effect (APE) for a license renewal action is the area at the power plant site and its immediate environs that may be impacted by post-license renewal land-disturbing operations or projected refurbishment activities associated with the proposed action. The APE may extend beyond the immediate environs in those instances where post-license renewal land-disturbing operations or projected refurbishment activities specifically related to license renewal may potentially have an effect on known or proposed historic sites. This determination is made irrespective of ownership or control of the lands of interest.

While preparing its application, NMC contacted your office by letter dated February 10, 2005. In that letter, NMC stated there are no plans to significantly alter current operations or engage in any land-disturbing activities during the license renewal period. NMC further stated that it is currently revising existing site procedures to incorporate guidance for the handling of items of

N. Archabal -2-

potential historic and archaeological significance, and cultural resources during any land-disturbing activities. Your office responded by letter dated March 30, 2005, stating that no historic properties listed on or eligible for listing on the National Register of Historic Places will be affected by the proposed action.

On June 30, 2005, the NRC will conduct two public NEPA scoping meetings at the Monticello Community Center, 505 Walnut Street in Monticello, Minnesota. You and your staff are invited to attend. Your office will receive a copy of the draft SEIS along with a request for comments. The anticipated publication date for the draft SEIS is February 2006. If you have any questions or require additional information, please contact Ms. Jennifer A. Davis, Project Manager, at 301-415-3835 or JXD10@nrc.gov.

Sincerely,

for Pao-Tsin Kuo, Program Director
License Renewal and Environmental Impacts
Division of Regulatory Improvement Programs
Office of Nuclear Reactor Regulation

Docket No.: 50-263

cc: See next page

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

June 3, 2005

Mr. Dan P. Stinnett
Field Supervisor
U.S. Fish and Wildlife Service
1 Federal Drive
BHW Federal Building
Fort Snelling, MN 55111-4056

SUBJECT: REQUEST FOR LIST OF PROTECTED SPECIES WITHIN THE AREA UNDER EVALUATION FOR THE MONTICELLO NUCLEAR GENERATING PLANT LICENSE RENEWAL (TAC NO. MC6441)

Dear Mr. Stinnett:

The U.S. Nuclear Regulatory Commission (NRC) is reviewing an application submitted by Nuclear Management Company, LLC (NMC) for the renewal of the operating license for Monticello Nuclear Generating Plant (Monticello). Monticello, a single nuclear unit plant, is located in the City of Monticello in Wright County, Minnesota, on the south bank of the Mississippi River. As part of its review of the license renewal application, the NRC is preparing a Supplemental Environmental Impact Statement (SEIS) under the provisions of the National Environmental Policy Act (NEPA) of 1969, as amended, which includes an analysis of pertinent environmental issues, including endangered or threatened species and impacts to fish and wildlife. This letter is being submitted under the provisions of the Endangered Species Act of 1973, as amended and the Fish and Wildlife Coordination Act of 1934, as amended.

If the license is renewed, the unit that would operate under the renewed license would use existing plant facilities and transmission lines and would not require additional construction or disturbance of new areas. Any maintenance activities would be limited to previously disturbed areas. The site consists of approximately 2,150 acres with roughly two miles of frontage on both 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 acres on the northern side of the River. Approximately 50 acres are occupied by the plant and its supporting facilities. The remaining acres are undeveloped with approximately 174 acres leased by local farmers and 144 acres are under lease for recreational use.

The circulating water system utilizes both open and closed cycle operating modes, as well as a combination of the two. Cooling water is drawn and discharged to the Mississippi River through an approach channel and discharge canal. Monticello is also equipped with two mechanical draft cooling towers enabling complete or partial recirculation of cooling water when required by special permit (NPDES) conditions. The circulating water system components include the intake structure, circulating water pumps, main condenser, discharge structure, cooling tower pumps, two induced-draft cooling towers, and discharge canal.

Currently, there are seven transmission lines emanating from the Monticello Substation. The transmission lines in the scope of the environmental review for license renewal are those that were constructed for the specific purpose of connecting the plant to the transmission system. Transmission lines installed as a result of the construction and operation of Monticello are the Monticello-Coon Creek 345kV line and the Monticello-Parkers Lake 345kV line totaling about 60

D. Stinnett -2-

miles of rights-of way. Xcel Energy controls these corridors through permanent easements purchased from land owners at the time of construction. These easements prohibit the use of property that could adversely affect the safe and reliable operation of the transmission lines. These transmission line corridors traverse Sherburne, Anoka, Wright, and Hennepin Counties. The transmission lines and site boundary are identified in Enclosures 1 and 2.

To support the environmental impact statement preparation process and to ensure compliance with Section 7 of the Endangered Species Act, the NRC requests a list of species and information on protected, proposed, and candidate species and critical habitat that may be in the vicinity of Monticello and its associated transmission line rights-of-way. In addition, please provide any information you consider appropriate under the provisions of the Fish and Wildlife Coordination Act.

On June 28 through 29, 2005, we plan to conduct an environmental site audit at the Monticello site. We will hold two public NEPA scoping meetings on June 30, 2005, at the Monticello Community Center in Monticello, Minnesota. You and your staff are invited to attend both the site audit and the public meetings. Your office will receive a copy of the draft SEIS along with a request for comments. The anticipated publication date for the draft SEIS is February 2006. If you have any questions concerning Monticello, the license renewal application, or other aspects of this project, please contact Jennifer A. Davis, Environmental Project Manager, at 301-415-3835 or by e-mail at JXD10@nrc.gov.

Sincerely,

for Pao-Tsin Kuo, Program Director
License Renewal and Environmental Impacts Program
Division of Regulatory Improvement Programs
Office of Nuclear Reactor Regulation

Docket No.: 50-263

Enclosures: As stated

cc w/encl.: See next page

FIGURE 3.1-2
MONTICELLO 345-KV TRANSMISSION CORRIDORS

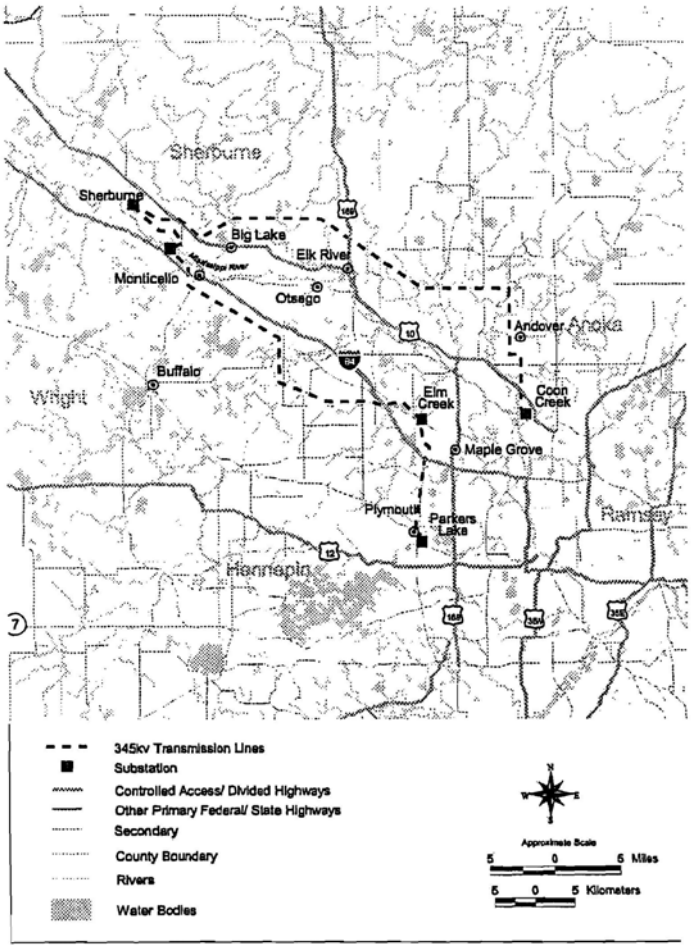
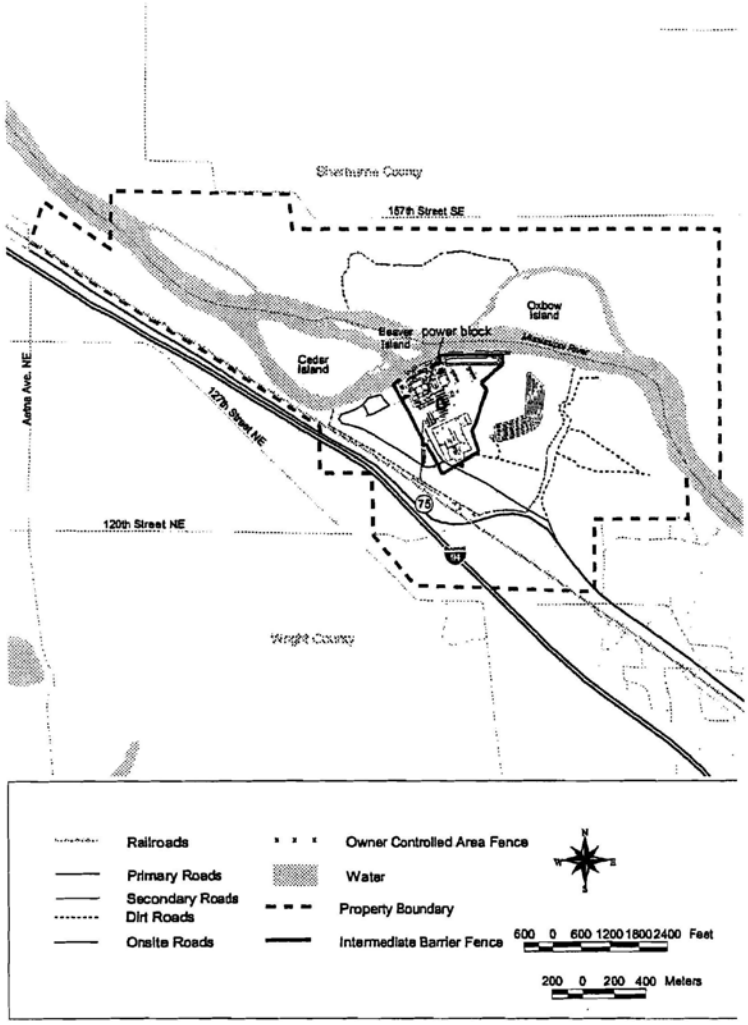


FIGURE 2.1-3
SITE BOUNDARY



United States Department of the Interior

FISH AND WILDLIFE SERVICE
Twin Cities Field Office
4101 East 80th Street
Bloomington, Minnesota 55425-1665

JUL 13 2005

Mr. Pao-Tsin Kuo
Program Director
License Renewal and Environmental Impacts Program
Division of Regulatory Improvement Programs
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

Dear Mr. Kuo:

This responds to your June 3, 2005, letter, requesting a list of federally threatened or endangered species and information on proposed and candidate species and critical habitat that may be in the vicinity of the Monticello Nuclear Generating Plant. The project site is located on the right descending bank of the Mississippi River just upriver of Monticello in the NE1/4 of the SE1/4 of Section 32, T122N, R25W, Wright County, Minnesota. The U.S. Nuclear Regulatory Commission (NRC) is currently reviewing an application submitted by Nuclear Management Company, LLC (NMC) for the renewal of the operating license for the Monticello plant. NMC has applied for a 20 year extension on its current operating license, which expires in 2010.

In addition to the nuclear generating plant, the project also consists of two transmission lines. The Coon Creek line extends from the facility across the Mississippi River to Sherburne County and then east to Anoka County and south to the city of Coon Creek. The Parkers Lake line extends from the facility southeast through Wright County to Hennepin County and then south to Parkers Lake in the city of Plymouth. As part of the license renewal application, the NRC is preparing a Supplemental Environmental Impact Statement under the provisions of the National Environmental Policy Act of 1969, as amended.

The Endangered Species Act (Act) of 1973, as amended, requires Federal agencies to consult with the Fish and Wildlife Service (Service) on proposed actions that may affect federally-listed threatened and endangered species and listed critical habitat. The following listed species may be present in the action area:

Common Name	Scientific Name	Status	Counties
Bald eagle	*Haliaeetus leucocephalus*	threatened	Anoka, Hennepin Sherburne, Wright
Gray wolf	*Canis lupus*	threatened	Sherburne
Higgins' eye pearlymussel	*Lampsilis higginsii*	endangered	Hennepin

As the lead Federal agency for the proposed action, the NRC is responsible for reviewing the proposed action and determining whether the action may affect any of the above listed species. If the NRC determines that the proposed action may adversely affect any federally listed species then it must notify the Service and initiate consultation under section 7(a)(2) of the Act.

If you have questions regarding our comments, please call Mr. R. Nicholas Rowse of my staff at (612) 725-3548, extension 210 or by email at *nick_rowse@fws.gov*.

Sincerely,

Dan P. Stinnett
Field Supervisor

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

December 22, 2005

Mr. Dan P. Stinnett, Field Supervisor
U.S. Fish and Wildlife Service
1 Federal Drive
BHW Federal Building
Fort Snelling, MN 55111-4056

SUBJECT: BIOLOGICAL ASSESSMENT FOR MONTICELLO NUCLEAR GENERATING PLANT LICENSE RENEWAL REVIEW (TAC NO. MC6441)

Dear Mr. Stinnett:

The U.S. Nuclear Regulatory Commission (NRC) has prepared the enclosed biological assessment (BA) (Enclosure 1) to evaluate whether the proposed renewal of the Monticello Nuclear Generating Plant (Monticello) operating license, for a period of an additional 20 years, would have adverse effects on listed species. The proposed action (license renewal) is not a major construction activity. Monticello, a single nuclear unit plant, is located in the City of Monticello in Wright County, Minnesota, on the south bank of the Mississippi River, 30 miles northwest of the Twin Cities metropolitan area.

By letter dated June 3, 2005, the NRC requested that the U.S. Fish and Wildlife Service (FWS) provide lists of Federally listed endangered or threatened species, and information on protected, proposed, and candidate species, as well as any designated critical habitat, that may be in the vicinity of Monticello and its associated transmission line rights-of-way. The FWS responded to the NRC request on July 13, 2005, and indicated that two threatened species, the bald eagle *(Haliaeetus leucocephalus)* and the gray wolf (*Canis lupus*), and one endangered species, the Higgins' eye pearlymussel (*Lampsilis higginsii*), be considered for potential impacts of license renewal and operation.

This BA provides an evaluation of the potential impact of renewing the Monticello operating license for an additional 20 years of operation on two Federally listed threatened species and one Federally listed endangered species with the potential to occur within the vicinity of the Monticello site or along its associated transmission line corridors.

The NRC staff has determined the license renewal for Monticello may affect, but is not likely to adversely affect, the bald eagle; it will have no effect on the gray wolf or the Higgins' eye pearlymussel.

D. Stinnett -2-

We are requesting your concurrence with our determination. In reaching our conclusion, the NRC staff relied on information provided by the applicant, on research performed by the NRC staff, and on information from FWS (including current listings of endangered species provided by the FWS). If you have any questions regarding this BA or the staff's request, please contact Ms. Jennifer Davis, Environmental Project Manager, at 301-415-3835 or by e-mail at jxd10@nrc.gov.

Sincerely,

Rani Franovich, Branch Chief
Environmental Branch B
Division of License Renewal
Office of Nuclear Reactor Regulation

Docket No.: 50-263

Enclosure: As stated

cc w/encl.: See next page

Biological Assessment

Monticello Nuclear Plant
License Renewal Review
Docket Number
50-263

December 2005

U.S. Nuclear Regulatory Commission
Rockville, MD

1.0 Introduction

The U.S. Nuclear Regulatory Commission (NRC) issues operating licenses for domestic nuclear power plants in accordance with the provisions of the Atomic Energy Act of 1954 (AEC 1954), as amended, and NRC implementing regulations. The purpose and need for the proposed action (that is, renewal of an operating license) is to provide an option that allows electric power generation to continue beyond the term of the current nuclear power plant operating license, so future generating needs can be met if the operator and State regulatory agencies pursue that option.

Northern States Power Company (NSP), which is a wholly owned utility operating subsidiary of Xcel Energy Inc. (Xcel Energy), has exclusive right to the energy generated by Monticello Nuclear Generating Plant (Monticello). Nuclear Management Company, LLC (NMC) operates and maintains Monticello on behalf of NSP. NMC is the licensee for the purposes of its current operating license (OL) and an applicant for the renewal of the OL. NMC has prepared an environmental report (ER) in conjunction with its application for renewal of the Monticello operating license, as provided for by the following NRC regulations:

- Title 10, *Energy*, Code of Federal Regulations (CFR) Part 54, "Requirements for Renewal of Operating Licenses for Nuclear Power Plants," Section 54.23, "Contents of Application — Environmental Information" (10 CFR 54.23).

- Title 10, *Energy*, CFR Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions," Section 51.53, "Postconstruction Environmental Reports," Subsection 51.53(c), "Operating License Renewal Stage" [10 CFR 51.53(c)].

The NRC is reviewing an application submitted by NMC (the applicant) for the renewal of the operating license for Monticello for a period of an additional 20 years. There will be no major construction, refurbishment, or replacement activities associated with this action. This biological assessment examines the potential effects of the continued operation of Monticello on three Federally-listed species that could occur within the Monticello site, near the site, or along its associated transmission line rights-of-way (ROWs) pursuant to Section 7(a)(2) of the Endangered Species Act.

In a letter dated June 3, 2005 (NRC 2005a), the NRC requested that the U.S. Fish and Wildlife Service (FWS) provide lists of Federally listed endangered or threatened species, and information on protected, proposed, and candidate species, as well as any designated critical habitat, that may be in the vicinity of Monticello and its associated transmission line ROWs. The FWS responded (FWS 2005a) to the NRC request on July 13, 2005, and indicated that the Federally threatened bald eagle *(Haliaeetus leucocephalus)* and gray wolf (*Canis lupus*) and the endangered Higgin's eye pearlymussel (*Lampsilis higginsii*) be considered for potential impacts of license renewal and operation.

2.0 Proposed Action

The proposed action is the renewal of the operating license for Monticello. Monticello is located in southeastern Minnesota on the southern bank of the Mississippi River, approximately 22 mi southeast of St. Cloud, Minnesota, and 30 mi northwest of Minneapolis-St. Paul, Minnesota. The area within 6 mi of Monticello, Minnesota (see Figure 1), includes portions of Wright and Sherburne counties which are primarily agricultural (NMC 2005). The current operating license for Monticello expires September 8, 2010. NMC has submitted an application to the NRC to renew this operating license for an additional 20 years of operation (until September 8, 2030). The renewed license, if issued, would be effective from the date of issuance until 20 years after the expiration date of the current operating license.

3.0 Environmental Setting

3.1 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 cooling-system discharge canal and Mississippi River. The transmission lines that are within scope of the license renewal review for Monticello cross several streams and rivers. The Monticello-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.

The Monticello plant facilities are located on the southern bank of the Mississippi River in Wright County at Mississippi River Mile (RM) 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/sec (NMC 2005). 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).

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 (RM 854) near the Twin Cities. Since there are no locks on these headwater dams, the river is not used for commercial navigation above the Twin Cities (NMC 2005). The Mississippi River in Minnesota is used for a variety of purposes, including drinking water, industrial use, irrigation, recreation, tourism, and conservation.

6-MILE SITE VICINITY

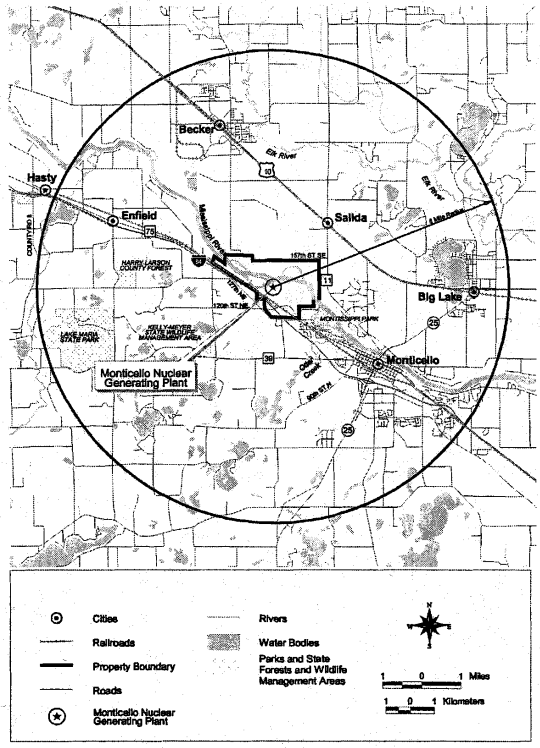


Figure 1. Location of Monticello

Despite the modifications and multiple competing uses of the Upper Mississippi River, the overall fish biodiversity has been persistent and resilient (USGS 1999). Impacts to the river include urban, industrial, and agricultural contaminants; steam modification; water diversions; land use changes; dredging; shoreline modifications; and wetland deliniations and modifications (Weitzell et al. 2003; Genet and Chirhart 2004). 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 within the Monticello site vicinity since sampling began during pre-operational years (NSP 2004). The fish community in the Monticello area has remained about the same since before the plant became operational, with only minor variations occurring between areas upstream and downstream from the Monticello

discharge (NSP 2004). Among the 27 species collected by electroshocking, the major species include the shorthead redhorse (*Moxostoma macrolepidotum*), silver redhorse (*M. anisurum*), common carp (*Cyprinus carpio*), smallmouth bass *(Micropterus dolomieu*), northern hog sucker (*Hypentelium nigricans*), white sucker *(Catostomus commersoni*), channel catfish (*Ictalurus punctatus*), and walleye (*Sander vitreus*) (NSP 2004). Forty-four species have been collected in seining samples since 1970. The major species collected include the sand shiner (*Notropis stramineus*), spotfin shiner (*Cyprinella spiloptera*), bluntnose minnow (*Pimephales notatus*), and bigmouth shiner (*N. dorsalis*) (NSP 2004).

The spotfin and sand shiners are the major forage fish species in the area (NSP 2004). Common game species included the 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). A commercial fishery does not occur near Monticello (Amish et al. 1978).

The major primary producers within the Monticello area are periphyton, which contribute an estimated 60 to 82% of the primary production in the Monticello area (Amish et al. 1978). Peak periphyton production occurs in summer. Phytoplankton in the Upper Mississippi River is dominated by diatoms and green algae, and contributes 18 to 40% of the primary productivity in the Monticello area (Amish et al. 1978). The macrophytes found in the immediate area near Monticello include the American pondweed (*Potamogeton nodosus*), sago pondweed (*Stuckenia pectinatus*), and antifever fontinalis moss *(Fontinalis antipyretica)*. The macroscopic green alga (*Cladophora glomerata)* also occurs in the area. Overall, a low abundance of macrophytes occurs in the Monticello area due to high currents and shifting sand and gravel substrates (Amish et al. 1978).

Near Monticello, the zooplankton community is comprised of protozoans, rotifers, cladocerans, and copepods (Afzal et al. 1975; Amish et al. 1978).

The most abundant groups of benthic macroinvertebrates near Monticello include 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 benthic macroinvertebrate species than the main channel area (USGS 1999). This was also noted near Monticello where 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 (i.e., 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 zebra mussel (*Dreissena polymorpha*) (USGS 1999; Weitzell et al. 2003).

The range of some mussel species has been expanding above St. Anthony Falls (located at RM 854, 46 mi downstream of Monticello), as fish (hosts for mussel glochidia [the parasitic larvae of native freshwater mussels]) can now circumnavigate the two navigation locks at this location (Kelner and Davis 2002). About 13 mussel species currently occur upstream of St. Anthony Falls (MNDNR 2003a). Only six species were recently collected above Coon Rapids Dam (RM 866): white heelsplitter (*Lasmigona complanata*), giant floater (*Pyganodon grandis*), plain pocketbook (*Lampsilis cardium*), fatmucket (*L. 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 2001b). To date, known populations of the zebra mussel within the Mississippi River have not been found above the Twin Cities area (St. Anthony Falls Lock and Dam) (MNDNR 2005). They were not present 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). Similarly, the Asiatic clam (*Corbicula fluminea*), another invasive mollusc species that has caused condenser tube clogging problems at power plants, has not been found above the Twin Cities area of the Mississippi River (MNDNR 2003a).

3.2 Terrestrial Resources

The Monticello site is approximately 2150 acres, and has roughly 2 mi of shoreline on the north and south banks of the Mississippi River in Wright and Sherburne Counties (NMC 2005). The Monticello site is located in a region dominated by rivers, streams, and lakes (NMC 2005). 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 patches are restricted mostly to larger river islands and small isolated pockets along the river banks (AEC 1972).

The Upper Mississippi River near the Monticello site supports a variety of plant and animal species that are typical of free-flowing, upper Midwestern rivers (NMC 2005). 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 predominantly 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 (*Acer saccharinum*), cottonwood (*Populus deltoides*), and black willow (*Salix nigra*) (MCBS 1998).

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.), plains pocket gopher (*Geomys bursarius*), white-tailed jackrabbit (*Lepus townsendii*), beaver (*Castor canadensis*), muskrat (*Ondatra zibethicus*), gray fox (*Urocyon cinereoargenteus*), coyote (*Canis latrans*), eastern fox squirrel (*Sciurus niger*), eastern chipmunk (*Tamias striatus*), American mink (*Mustela vison*), weasels (*Mustela frenata, M. erminea,* and *M. nivalis*), and striped skunk (*Mephitis mephitis*) (AEC 1972; NMC 2005).

Furthermore, the Sherco Environmental Monitoring and Ecological Studies Program (NMC 2005) 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 2005). 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 2005).

In its Environmental Report, the applicant identified seven transmission lines that emanate from the Monticello site. The two transmission lines installed as a direct result of initial construction and operation of the Monticello site (and are, therefore, within the scope of the license renewal environmental report) are the Monticello-Coon Creek 345-kV line and the Monticello-Parkers Lake 345-kV line (AEC 1972), and are pertinent to this analysis (see Figure 2 and Table 1). These transmission lines are expected to remain a permanent part of the regional transmission system even after the decommissioning of Monticello.

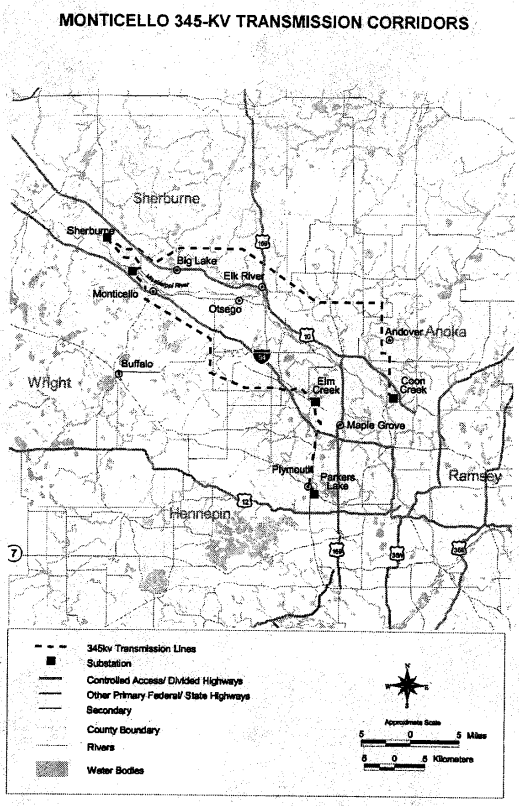


Figure 2. Monticello Transmission Lines

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Table 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	43.1	Monticello-Coon Creek	Varies from 125 to 240	749.7
Elm Creek	1	345	37.1	Monticello-Parkers Lake	Varies from 165 to 240	957

Source: Xcel 2005

Xcel Energy is responsible for maintenance on transmission line ROWs for Monticello's owner (NSP) and operator (NMC). Xcel Energy implements specific programs for ensuring continued operation of its transmission lines, continued compatibility of land uses on the transmission corridors, and environmentally sound maintenance of the corridors (NMC 2005). 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 (NMC 2005). Xcel Energy's vegetation management in ROWs is focused on reducing risk to transmission lines by keeping corridors free of tall-growing vegetation. Low-growing trees, shrubs, and grasses are encouraged by selectively removing tall-growing trees and brush. Qualified line-clearance tree trimmers manually cut and prune using approved mechanical equipment, such as hydro-axes, and selective application of approved herbicides (NMC 2005). Approved herbicides are applied in strict compliance with all Federal, state, and local laws and regulations. Similarly, tall trees typically located just off the right-of-way that have a high probability of failure and sufficient height to make contact with the conductors and/or structures are pruned or cut as appropriate. Vegetation control cycles vary based on line voltage and vegetation conditions, but typically occur on intervals from 2 to 8 years.

4.0 Assessment of Federally Listed Species and Critical Habitat

Three Federally listed species are evaluated in this biological assessment because of their proximity to Monticello or its associated transmission lines (Table 2). No Federally designated candidate species, nor critical habitat for any threatened or endangered species, exist at the Monticello site or along the associated transmission corridors (NMC 2005; FWS 2005a).

Table 2. Terrestrial and Aquatic Species Listed as Endangered or Threatened by the U.S. Fish and Wildlife Service and that Occur or Potentially Occur Within the Monticello Site or the Associated Transmission Line Rights-of-Way

Scientific Name	Type	Common Name	Federal Status	Counties
Lampsilis higginsii	Invertebrate	Higgins' eye pearlymussel	Endangered	Hennepin
Haliaeetus leucocephalus	Bird	bald eagle	Threatened	Anoka, Hennepin, Sherburne, Wright
Canis lupus	Mammal	gray wolf	Threatened	Sherburne

Source: FWS 2005a

Higgins' Eye Pearlymussel (*Lampsilis higginsii*)

The Federally listed endangered Higgins' eye pearlymussel is only found in the Mississippi River, St. Croix River in Wisconsin, the Wisconsin River, and the Rock River in Illinois. It may be present within Hennepin County over 45 river miles (RM) downstream of the Monticello site (FWS 2005a). It has not been reported from Sherburne or Wright counties where Monticello is located. The Higgins' eye pearlymussel spawns in late summer, but larvae are retained in the marsupia until they are released during the following spring or summer (FWS 2003). The Higgins' eye pearlymussel most frequently occurs in medium to large rivers with current velocities of about 0.5 to 1.5 ft/sec and in depths of 3 to 20 ft, with firm, coarse sand or mud-gravel substrates (FWS 2000, 2001a).

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) (FWS 1998). No EHAs occur within the Mississippi River drainage close to Monticello. The most upstream EHA is at Whiskey Rock, Iowa, at Mississippi RM 656, which is downstream from Lock and Dam 8. Monticello is located some 240 RM upstream. The closest EHA for the Higgins' eye pearlymussel occur in the St. Croix River (Hornbach 2004), which flows into the Mississippi River at RM 811 about 89 mi downstream from Monticello.

Suitable fish hosts for the glochidia (larvae) 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*) (FWS 2003).

In 2000-2001, an empty Higgins' eye pearlymussel shell was found in Upper Pool 3 of the Mississippi River (the area below Lock and Dam 3 in the area where the St. Croix River enters the Mississippi River at RM 811 (Kelner and Davis 2002). In 2000, 200 specimens of Higgins'

eye pearlymussel were relocated from Pool 14 of the Mississippi River to Upper Pool 2 and 3 (Kelner and Davis 2002). The transplanted mussels are over 50 RM downstream of Monticello. Reintroductions of the Higgins' eye pearlymussel into the rivers from which it has been extirpated have been conducted since 2000, but it is too early to determine the success of these reintroductions (FWS 2003).

The FWS (FWS 2000) has determined that the continuation of the current operation and maintenance activities of the 9-ft navigation channel in the Mississippi River for another 50 years would jeopardize the continued existence of the Higgins' eye pearlymussel. Two of the EHAs for the Higgins' eye pearlymussel, both located in Wisconsin, are located within the navigation channel (FWS 2000). However, the major adverse effect would be associated with continuing upstream transport of zebra mussels by barge traffic. Currently, there are no effective ways to control established populations of zebra mussels at the scale required to eliminate their threat to the Higgins' eye pearlymussel (FWS 2003).

Coon Rapids Dam, located over 5 mi downstream of where Rum River enters the Mississippi River relative to the plant, serves as a faunal barrier to upstream migration of mussels via their host fish (Kelner and Davis 2002).

The Higgins' eye pearlymussel is not known to occur further upstream than Pool 2 of the Mississippi River, which is mostly located downstream from the Twin Cities area (Kelner and Davis 2002; Hornbach 2004) over 50 RM downstream of Monticello. 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 National Pollutant Discharge Elimination System (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. Additionally, there are no plans to conduct refurbishment or construction at Monticello.

On the basis of the negligible anticipated impacts of the cooling-water intake and discharge on the Higgins' eye pearlymussel and its current distribution, the NRC staff concludes that continued operation of Monticello over the 20-year license renewal project will have no effect on the Higgins' eye pearlymussel.

Bald Eagle (*Haliaeetus leucocephalus*)

One active bald eagle nest is known from the Monticello site. The nest is located on Beaver Island in the Mississippi River north-northwest of the Monticello power block. Beaver Island is wholly within the Monticello site. During the June 2005 site audit, the NRC staff observed an eagle perched next to the nest. Subsequent discussions with the NMC biologist confirm that this is an active nest (NRC 2005b).

During the June 2005 site audit, the NRC staff also observed an additional nest on a transmission tower located on the Monticello-Coon Creek 345 kV line. Again, discussions with the NMC biologist also confirm that this also is an active nest (NRC 2005b).

NMC has adopted the Minnesota Department of Natural Resources Management Guidelines for Bald Eagle Breeding Areas, and the U.S. Fish and Wildlife Service (FWS) Northern States Bald Eagle Recovery Plan (MNDNR 2003b) recommendations for protecting individual occupied and active nest sites. Additionally, on April 19, 2002, Xcel Energy entered into a memorandum of understanding (MOU) which establishes procedures and policies to avoid avian injuries or fatalities on company property (Xcel Energy et al. 2002).

The nest on Beaver Island is located approximately 1000 feet north-northwest from the Monticello power block in which the majority of site activity occurs. Activities that might affect nesting success, such as landscape alterations and construction, would be outside both the Primary and Secondary Protective Zones as defined by the MNDNR management guidelines. The licensee does not engage in any burning or forest maintenance activities within these zones and physical security requirements ban unauthorized human entry and low flying aircraft over company property on both sides of the Mississippi River. Additionally, the island properties located within the river system (e.g. Beaver Island) are posted against trespassing. There is no vehicular access to these areas except by boat; however, unauthorized access by boat would result in action by the site security force.

The majority of adverse human activities would also be restricted throughout the year in the Tertiary zone (660 feet to 1/4 mile from the nest), with restrictions on landscape alterations and burning. The fact that the station predates the construction of the nest, and that the station has been in almost continuous operation during past nesting activity, strongly suggests that the activities associated with Monticello operation are not likely to adversely affect bald eagles using the nest. In fact, the limitations on unauthorized access, the relatively pristine nature of the majority of the 2,150 acre site, the roughly two miles of undeveloped shoreline on the north and south banks of the river (with the exception of the area of the plant), and the warm water discharge that attracts and concentrates fish for foraging, particularly during the winter, suggests that the Monticello site could be considered beneficial to the species.

The nest located on the transmission tower along the Monticello-Coon Creek 345kV line is located in an area of limited public access. Periodic line maintenance for vegetative control is performed, on average, every 4 years and consists of the removal of danger trees on either side of the ROW and the clearing of vegetative growth under the lines that could come within close proximity of the conductors (NMC 2005). Such line maintenance is achieved by selective tree removal along the edges of the transmission corridor that could pose a danger if toppled into the line and selectively removing potentially tall-growing trees and brush in the actual ROW. The area where the Monticello-Coon Creek line nest is located is relatively open and poses little line risk due to danger trees; therefore, future removal of large trees along the margins of the transmission lines is unlikely. Additionally, because of the eagle nest, selective vegetative clearing activities within the ROW is restricted to summer, which is outside the critical period of 10 February to 1 May, as defined in the MNDNR management guidelines.

The remoteness of the Monticello-Coon Creek nest site, and the timing of infrequent vegetative maintenance leads the staff to conclude that continued plant operation is not likely to adversely affect the bald eagle nest site on the Monticello-Coon Creek transmission line.

Lehman (2001) summarized the literature regarding raptor electrocutions on power lines, and emphasized that nearly all electrocutions in the United States occur on comparatively low-voltage distribution lines supplying individual users and businesses, not transmission lines. The spacing of conductors on transmission towers is typically greater than the wingspan of raptors, and therefore, electrocutions are highly unlikely.

There are no known reports of bald eagle collisions with the Monticello transmission lines or other Monticello structures. Xcel Energy has a program in place to install flight diverters on its transmission lines to reduce potential for avian collisions and has entered into a MOU with the FWS and MNDNR to develop and implement an avian protection plan (Xcel Energy et al. 2002). The MOU requires that any injuries or mortalities to bald eagles associated with transmission line collisions would be reported to the MNDNR. The requirement to report all onsite raptor mortalities and any bald eagle injuries or mortalities to MNDNR is part of NMC's procedures.

Based on the location of the onsite nest relative to the power block, the remoteness of the nest on the Monticello-Coon Creek transmission line, NMC's commitment to follow the MNDNR Management Guidelines for Bald Eagle Breeding Areas and the FWS Northern States Bald Eagle Recovery Plan, the actual potential for disturbance during nesting/breeding, either from the Monticello site activities or from ROW maintenance, is highly unlikely. The potential for bald eagle electrocutions and collisions is also highly unlikely. Consequently, the NRC staff has determined that renewal of the Monticello operating license for an additional 20 years is not likely to adversely affect the bald eagle at the Monticello site or the associated transmission lines.

Gray Wolf (*Canis lupus*)

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 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 2005b). 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 2005b). Potential impacts to the Federally-threatened gray wolf include direct destruction of the habitat from land-disturbing activities on site, and routine vegetation maintenance practices on site and along the transmission corridors. However, NMC has not identified any land-disturbing activities that would be undertaken for license renewal (NMC 2005). As gray wolf populations recover, it is likely that they may traverse the transmission corridors of interest to the license renewal of Monticello. Gray wolves have not been sighted in the Monticello area or on the Monticello site to date. It is possible that if the population of gray wolves continues to increase, the species may use the Monticello site sometime in the future. However, activities associated with future plant operations would not be detrimental to the species.

Vegetation management may improve habitat quality for prey items important to the gray wolf. In fact, the maintenance of a large tract of undeveloped property associated with the site, closed to the public, with no hunting pressure, may in fact be beneficial to the species. However, continued high density development around the plant site will likely preclude the species from the area.

For these reasons, the NRC staff has determined that continued operation of Monticello over the 20-year license renewal period will have no effect on the gray wolf.

5.0 Conclusions

The NRC staff has evaluated the potential impacts of an additional 20 years of continued Monticello operation on two Federally listed threatened species and one Federally listed endangered species with the potential to occur within the vicinity of the Monticello site or along its associated transmission line corridors. Although the Federally protected bald eagle is known to use the Monticello site and associated transmission corridors, NMC and Xcel Energy have developed and implemented procedures to protect the species and important habitat.

The NRC staff has determined that license renewal for Monticello may affect, but is not likely to adversely affect, the bald eagle; and will have no effect on the gray wolf or the Higgins' eye pearlymussel.

6.0 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."

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Appendix F

GEIS Environmental Issues Not Applicable to Monticello

Appendix F: GEIS Environmental Issues Not Applicable to Monticello Nuclear Generating Plant

Table F-1 lists those environmental issues listed in the *Generic Environmental Impact Statement for License Renewal of Nuclear Plant*s (GEIS), NUREG-1437, Volumes 1 and 2 (NRC 1996, 1999)[(a)] and 10 CFR Part 51, Subpart A, Appendix B, Table B-1, that are not applicable to Monticello because of plant or site characteristics.

Table F-1. GEIS Environmental Issues Not Applicable to Monticello

ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1	Category	GEIS Sections	Comment
SURFACE WATER QUALITY, HYDROLOGY, AND USE (FOR ALL PLANTS)			
Altered salinity gradients	1	4.2.1.2.2; 4.4.2.2	Monticello cooling system does not discharge to an estuary.
Altered thermal stratification of lakes	1	4.2.1.2.2; 4.4.2.2	Monticello cooling system does not discharge into a lake.
GROUNDWATER USE AND QUALITY			
Groundwater use conflicts (potable and service water, and dewatering; plants that use >100 gpm)	2	4.8.1.1; 4.8.1.2	Monticello does not use more than 100 gpm groundwater.
Groundwater-use conflicts (Ranney wells)	2	4.8.1.4	Monticello does not have or use Ranney wells.
Groundwater quality degradation (Ranney wells)	1	4.8.2.2	Monticello does not have or use Ranney wells.
Groundwater quality degradation (saltwater intrusion)	1	4.8.2.1	Monticello does not discharge to saltwater.
Groundwater quality degradation (cooling ponds in salt marshes)	1	4.8.3	Monticello does not have or use cooling ponds.
Groundwater quality degradation (cooling ponds at inland sites)	2	4.4.4	Monticello does not have or use cooling ponds.
TERRESTRIAL RESOURCES			
Cooling pond impacts on terrestrial resources	1	4.4.4	Monticello does not have or use cooling ponds.

[(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.

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Appendix G

NRC Staff Evaluation of Severe Accident Mitigation Alternatives (SAMAs) for Monticello Nuclear Generating Plant

Appendix G: NRC Staff Evaluation of Severe Accident Mitigation Alternatives (SAMAs) for Monticello Nuclear Generating Plant

G.1 Introduction

Nuclear Management Company, LLC (NMC) submitted an assessment of severe accident mitigation alternatives (SAMAs) for Monticello Nuclear Generating Plant (Monticello) as part of the environmental report (ER) (NMC 2005a). This assessment was based on the most recent Monticello probabilistic safety assessment (PSA) available at that time, a plant-specific offsite consequence analysis performed using the MELCOR Accident Consequence Code System 2 (MACCS2) computer code, and insights from the Monticello individual plant examination (IPE) (NSP 1992) and individual plant examination of external events (IPEEE) (NSP 1995a,b). In identifying and evaluating potential SAMAs, NMC considered SAMAs that addressed the major contributors to core damage frequency (CDF) and population dose at Monticello, as well as SAMA candidates for other operating plants which have submitted license renewal applications. NMC identified 40 potential SAMA candidates. This list was reduced to 16 unique SAMA candidates by eliminating SAMAs that: are not applicable to Monticello due to design differences, are of low benefit in boiling water reactors, have already been implemented at Monticello or whose benefit has been achieved at Monticello using other means, or have estimated costs that would exceed the dollar value associated with completely eliminating all severe accident risk at Monticello. NMC assessed the costs and benefits associated with each of the potential SAMAs and concluded in the ER that several of the candidate SAMAs evaluated may be cost-beneficial and warrant further review for potential implementation.

Based on a review of the SAMA assessment, the U.S. Nuclear Regulatory Commission (NRC) issued a request for additional information (RAI) to NMC by letter dated May 27, 2005 (NRC 2005). Key questions concerned: changes to the Level 2 PSA model and source terms since the IPE; MACCS2 input data (core inventory, releases, meteorology data, and offsite economic costs); further information on several specific candidate SAMAs; additional information/clarification regarding SAMAs related to external events; and the rationale used by NMC to arrive at a set of "recommended" SAMAs for further evaluation. NMC submitted additional information by letter dated July 27, 2005 (NMC 2005b). In the response, NMC provided: a description of the current Level 2 model and dominant risk scenarios for each accident consequence bin; results of sensitivity studies related to radionuclide inventories, release heights and thermal content of the plume; rationale for seemingly larger offsite economic cost risk at Monticello; specific requested information for SAMAs related to external events; and the rationale used to arrive at the set of "recommended" SAMAs. NMC's responses addressed the staff's concerns.

An assessment of SAMAs for Monticello is presented below.

G.2 Estimate of Risk for Monticello Nuclear Generating Plant

NMC's estimates of offsite risk at the Monticello are summarized in Section G.2.1. The summary is followed by the staff's review of NMC's risk estimates in Section G.2.2.

G.2.1 Nuclear Management Company, LLC's Risk Estimates

Two distinct analyses are combined to form the basis for the risk estimates used in the SAMA analysis: (1) the Monticello Level 1 and 2 PSA model, which is an updated version of the IPE (NSP 1992), and (2) a supplemental analysis of offsite consequences and economic impacts (essentially a Level 3 PSA model) developed specifically for the SAMA analysis. The SAMA analysis is based on a slight modification of the 2003 Monticello Level 1 and 2 PSA model, referred to as the SAMA model. The scope of the Monticello PSA does not include external events.

The baseline CDF for the purpose of the SAMA evaluation is approximately 4.5×10^{-5} per year. The CDF is based on the risk assessment for internally-initiated events at extended power uprate conditions. NMC did not include the contribution from external events within the Monticello risk estimates; however, it did account for the potential risk reduction benefits associated with external events by doubling the estimated benefits for internal events. This is discussed further in Section G.6.2.

The breakdown of CDF by initiating event is provided in Table G-1. As shown in this table, events initiated by internal floods are the dominant contributors to CDF. Station blackout (SBO) sequences contribute 1.52×10^{-6} per year (about 3 percent of the total internal events CDF), while anticipated transient without scram sequences are insignificant contributors to CDF ($8.24\ 10^{-8}$ per year). NMC defined SBO as loss of offsite power and both emergency diesel generators. This definition excludes the SBO-like conditions resulting from flooding-induced loss of electrical buses which are large contributors to the internal flooding CDF. When the contribution from flooding events is also included, events resulting in SBO-like conditions account for the majority of the CDF.

Table G-1. Monticello Core Damage Frequency

Initiating Event	CDF (per year)	% Contribution to CDF
Fire protection system 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 east	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 residual heat removal (RHR) B room	8.9×10^{-7}	2
SW line break 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 (from internal events)	**4.5×10^{-5}**	**100**

The Level 2 Monticello PSA model that forms the basis for the SAMA evaluation represents an adaptation and updating of the IPE Level 2 model. The IPE Level 2 model involved the development of containment event trees that describe the response of the containment to the severe accident phenomena for each of the Level 1 accident classes. The current Level 2 model retains the IPE containment event tree logic and is directly linked with the Level 1 model via the linked fault tree process. In addition, the SAMA model incorporates several modeling changes to better reflect an improved understanding of Level 2 PSA issues as suggested by an independent peer review, most notably, drywell shell failure due to contact with core debris, several items related to radionuclide release states, and net positive suction head (NPSH) limits following containment venting.

The result of the Level 2 PSA is a set of release categories with their respective frequency and release characteristics. The results of this analysis for Monticello are provided in Table F.2-4 of the ER. The frequency of each release category was obtained from the quantification of the linked Level 1 - Level 2 models. The release characteristics were obtained from the results of modular accident analysis program (MAAP) analyses that were determined to bound the release fraction for the sequences in each release category.

The offsite consequences and economic impact analyses use the MACCS2 code to determine the offsite risk impacts on the surrounding environment and public. Inputs for these analyses include plant-specific and site-specific input values for core radionuclide inventory, source term and release characteristics, site meteorological data, projected population distribution (within an 80-kilometer (50-mile) radius) for the year 2030, emergency response evacuation modeling, and economic data. The core radionuclide inventory is based on the generic boiling water reactor (BWR) inventory provided in the MACCS2 manual, adjusted to represent the Monticello uprated power level of 1,775 megawatt thermals [(MW(t)]. The magnitude of the onsite impacts (in terms of clean-up and decontamination costs and occupational dose) is based on information provided in NUREG/BR-0184 (NRC 1997b).

In the ER, NMC estimated the dose to the population within 80 kilometers (50 miles) of the Monticello site to be approximately 0.38 person-sievert (Sv) (38 person-rem) per year. The breakdown of the total population dose by containment release mode is summarized in Table G-2. Containment failures within the late time frame (greater than 6 hours following declaration of a general emergency) and within the early time frame (less than 6 hours following declaration of a general emergency) provide similar contributions to the population dose risk at Monticello.

Table G-2. 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	**38.0**	**100**

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

G.2.2 Review of Nuclear Management Company, LLC's Risk Estimates

NMC's determination of offsite risk at Monticello is based on the following three major elements of analysis:

- The Level 1 and 2 risk models of the 1992 IPE submittals (NSP 1992) and the external events analyses of the 1995 IPEEE submittals (NSP 1995a,b),

- The major modifications to the IPE models that have been incorporated in the Monticello PSA models used to support the SAMA analyses, and

- The MACCS2 analyses performed to translate fission product release frequencies from the Level 2 PSA model into offsite consequence measures.

Each of these analyses was reviewed to determine the acceptability of NMC's risk estimates for the SAMA analysis, as summarized below.

The staff's review of the Monticello IPE is described in an NRC report dated May 26, 1994 (NRC 1994). Based on a review of the original IPE submittal and subsequent supplements and revisions, the staff concluded that the IPE submittal met the intent of Generic Letter (GL) 88-20; that is, the IPE was of adequate quality to be used to look for design or operational vulnerabilities. The IPE did not identify any severe accident vulnerabilities associated with either core damage or poor containment performance.

Although no vulnerabilities were identified, a number of modifications to the plant, procedures and training were identified that had either been implemented, were to be implemented, or were being considered at the time of the completion of the IPE process. The outstanding items have subsequently been implemented, further evaluated and found not to be sufficiently beneficial to be considered further, or have been included as a SAMA in the current evaluation (NMC 2005a,b).

There have been numerous revisions to the IPE model since its submittal. A comparison of internal events CDF between the IPE and the SAMA PSA models indicates an increase of approximately 1.9×10^{-5} per year in the total CDF (from 2.6×10^{-5} per year to 4.47×10^{-5} per year). The increase is mainly attributed to modeling and hardware changes that have been implemented since the IPE was submitted. There has been a significant increase in internal flooding CDF from 6.8×10^{-6} per year to 4.15×10^{-5} per year and a sizeable reduction in the loss of offsite power contribution from 1.3×10^{-5} per year to 1.8×10^{-6} per year due to hardware and modeling changes. A summary listing of those changes that resulted in the greatest impact on the internal events CDF was provided in the ER (NMC 2005a) and are summarized in Table G-3.

The IPE CDF value for Monticello is close to the average of the CDF values reported in the IPEs for BWR 3/4 plants. Figure 11.2 of NUREG-1560 shows that the IPE-based total internal events CDF for BWR 3/4 plants ranges from 9×10^{-8} to 8×10^{-5} per year, with an average CDF for the group of 2×10^{-5} per year (NRC 1997a). It is recognized that other plants have updated the values for CDF subsequent to the IPE submittals to reflect modeling and hardware changes. The current internal events CDF results for Monticello are comparable to other plants of similar vintage and characteristics.

Table G-3. Monticello PSA Historical Summary

PSA Version	Summary of Changes from Prior Model	CDF
1992	IPE Submittal	2.6×10^{-5}
1995	• Added non-safety diesel generator to supply battery chargers • Added hard pipe containment vent • Improved safety/relief valve (SRV) pneumatics • Added cross-tie for diesel fire pump for low-pressure makeup • Replaced instrument air compressor with one not dependent on service water • Established more realistic success criteria for service water pumps	1.37×10^{-5}
1999	• Incorporated effects of extended power uprate	1.44×10^{-5}
2003	• Updated failure rate data • Revised operator error structure to explicitly model dependencies • Credited manual alignment of low pressure safety systems when control power not available • Incorporated new findings on two significant flood scenarios • Modified recovery modeling for offsite power and emergency diesel generators • Credited control rod drive injection under certain conditions	4.43×10^{-5}
SAMA	• Small number of event failure probability changes resulting from data update tasks • Lowered truncation limit to 1×10^{-11}	4.47×10^{-5}

The staff considered the peer reviews performed for the Monticello PSA, and the potential impact of the review findings on the SAMA evaluation. In the ER, NMC described the previous peer reviews, the most significant of which was the Boiling Water Reactor Owners Group (BWROG) Peer Review of the 1995 PSA model conducted in 1997. The BWROG review concluded that the Monticello PSA can be effectively used to support applications involving relative risk significance. NMC stated that all peer review comments, or the evolutions of those peer review comments, are captured by the 2003 model, and that no outstanding model issues exist outside the normal PSA maintenance program and that none of the PSA maintenance tasks are known to have the potential to impact the SAMA conclusions.

Given that the Monticello internal events PSA model has been peer-reviewed and the peer review findings were either addressed or judged to have no adverse impact on the SAMA evaluation, and that NMC satisfactorily addressed staff questions regarding the PSA, the staff

concludes that the internal events Level 1 PSA model is of sufficient quality to support the SAMA evaluation. Further consideration of the Level 2 PSA model is provided below.

As indicated above, the current Monticello PSA does not include external events. In the absence of such an analysis, NMC used the Monticello IPEEE to identify the highest risk accident sequences and the potential means of reducing the risk of posed by those sequences, as discussed below.

The Monticello IPEEE was submitted in March 1995 (NSP 1995a), in response to Supplement 4 of Generic Letter 88-20. A revision to the IPEEE was submitted in November 1995 (NSP 1995b). Northern States Power did not identify any fundamental weaknesses or vulnerabilities to severe accident risk in regard to the external events related to seismic, fire, or other external events. In a letter dated April 14, 2000, the staff concluded that the submittals met the intent of Supplement 4 to Generic Letter 88-20, and that the licensee's IPEEE process is capable of identifying the most likely severe accidents and severe accident vulnerabilities (NRC 2000).

The Monticello IPEEE uses a focused scope Electric Power Research Institute (EPRI) seismic margins analysis. This method is qualitative and does not provide numerical estimates of the CDF contributions from seismic initiators. The seismic IPEEE identified a number of outliers of items within the scope of the Unresolved Safety Issue (USI) A-46 program. Resolution of these outliers was accomplished in the context of USI A-46. Given the satisfactory resolution of these outliers, Monticello found that none of the plant's high confidence in low probability of failure values were less than the 0.3g review level earthquake used in the IPEEE. The NRC review and closure of USI A-46 for Monticello are documented in a letter dated November 12, 1998 (NRC 1998).

Notwithstanding the conclusions of the IPEEE as part of the SAMA evaluation, NMC reviewed the seismic analysis results and history to determine whether there were any unresolved issues that could impact the seismic risk at Monticello, particularly, any unfinished plant enhancements that were needed to ensure equipment on the safe shutdown list would be capable of withstanding the review level earthquake, or any additional plant enhancements that were identified as means of reducing seismic risk but were discarded due to cost considerations. Based on their review, NMC concluded that there were no outstanding issues that could impact the SAMA results.

Based on the licensee's IPEEE efforts to identify and address seismic outliers and the expected cost associated with further seismic risk analysis and potential plant modifications, the staff concludes that the opportunity for seismic-related SAMAs has been adequately explored and that there are no cost-beneficial, seismic-related SAMA candidates.

The Monticello IPEEE fire analysis employed a combination of a probabilistic risk analysis (PRA) and EPRI's fire-induced vulnerability evaluation (FIVE) methodology. An initial screening phase was performed for fire areas outside of the main reactor/turbine building complex. Fire

boundaries were then developed considering spread of fire across area boundaries using the FIVE methodology. PRA techniques were then utilized to progressively analyze the various fire accident sequences that could lead to core damage. This involved using the IPE model of internal events to quantify the CDF resulting from a fire-initiating event. The CDF for each zone was obtained by multiplying the frequency of a fire in a given fire zone by the conditional core damage probability associated with that fire zone including, where appropriate, the impact of fire suppression and fire propagation. The potential impact on containment performance and isolation was evaluated following the core damage evaluation.

The total fire CDF was estimated as 7.81 x 10^{-6} per year (NSP 1995b). The following seven fire areas (room/burn sequences) are considered to be the dominant contributors and comprise more than 80 percent of the total fire CDF:

Fire Area	Area Description	CDF
VIII/9	Control room	1.5 x 10^{-6}
XII/BS5	Turbine building 931-ft elevation	1.3 x 10^{-6}
IX/BS4	Feedwater pump area	1.2 x 10^{-6}
VI/8	Cable spreading room	9.0 x 10^{-7}
II/BS2	Reactor building 935/962-ft elevation west	5.6 x 10^{-7}
IX/12A	Lower 4kV switchgear room	5.1 x 10^{-7}
XXII/BS6	Div. II area of the emergency filtration train building	4.1 x 10^{-7}

The fire CDF is approximately 17 percent of the current internal events CDF. In the ER, NMC described each of the fire areas listed above and identified candidate SAMAs to potentially reduce the associated fire risk. As a result, NMC identified potential enhancements which it further considered as SAMAs. These include:

- Permanently posting an operator at the alternate shutdown system (ASDS) panel
- Modifying the ASDS panel to include additional system controls, and
- Adding an emergency level control system to the hotwell.

The staff inquired about the status of several insights/potential improvements that were identified by NMC in the IPEEE and Revision 1 to the IPEEE. NMC indicated that two of three improvements identified in the original IPEEE submittal were actually PSA modeling changes that would better reflect actual risk (NMC 2005b). These improvements involve a revision to the service water pump success criteria and the elimination of the SRV dependence on alternating

current (ac) power for depressurization to be consistent with a previous plant change. Both enhancements have been incorporated into the current SAMA PSA model. The third improvement, taking credit for control rod drive (CRD) injection after bypassing the load shed logic, has been incorporated into emergency operating procedures and credited in the current PSA model.

Revision 1 of the IPEEE identified two additional modeling improvements (NSP 1995b). These two improvements involve crediting manual fire suppression in areas other than the control room, and crediting CRD injection and the main condenser as a heat sink for fires that do not cause their failure. These improvements have not been credited in the Monticello fire analysis but would tend to reduce the analyzed risk and the potential for cost-beneficial SAMAs; their omission is therefore conservative.

The IPEEE analysis of high winds, floods and other external events followed the screening specified in Supplement 4 to GL 88-20 (NRC 1991) and did not identify any significant sequences or vulnerabilities (NSP 1995a). The Monticello ER qualitatively discusses the risks from high winds, external flooding and probable maximum precipitation, and transportation and nearby facility accidents. NMC considered the potential for SAMAs to reduce these risks, but concluded that no further modifications would be cost-beneficial. It is noted that the risks from aircraft were explicitly excluded since this was being considered in other forums along with other sources of sabotage.

Due to the relatively low contribution to CDF from fire and other external events, NMC doubled the benefit which was derived from the internal events model to account for the contribution from external events. This doubling was not applied to those SAMAs that specifically addressed fire risk (i.e., SAMAs 38 through 40), since these SAMAs are specific to fire risks and would not have a corresponding risk reduction in internal events. The fire risk analysis is described in the IPEEE and in the environmental report as producing conservative CDF results. While conservative assumptions were used for the majority of fire areas, other aspects of the analysis were considered to be optimistic (NRC 2000). Thus, the degree of conservatism in the result is not clear. Notwithstanding the above, the staff agrees with the applicant's conclusion that the risks posed by external events is less than that due to internal events. Therefore, the staff concludes that the applicant's use of a multiplier of two to account for external events is reasonable for the purposes of the SAMA evaluation.

The staff reviewed the general process used by NMC to translate the results of the Level 1 PSA into containment releases, as well as the results of this Level 2 analysis. NMC characterized the releases for the spectrum of possible radionuclide release scenarios using a set of seven release categories, defined based on the timing and magnitude of the release. The frequency of each release category was obtained from the quantification of a linked Level 1 - Level 2 model which effectively evaluates a containment event tree for each Level 1 accident sequence. Four containment event trees were utilized that differentiated between intact or failed containment at the time of reactor vessel failure and events with and without SBO. The release

characteristics for each release category were obtained from the results of MAAP 4.0.5 analyses of conservatively determined representative sequences for each category. The process for assigning accident sequences to the various release categories and selecting a representative accident sequence for each release category is described in the ER and in response to RAIs (NMC 2005a,b). The release categories and their frequencies are presented in Tables F.2-2, F.2-3, and F.2-4 of the ER (NMC 2005a). All releases were modeled as occurring at ground level and with a thermal content the same as ambient. The staff concludes that the process used for determining the release category frequencies and source terms is reasonable and appropriate for the purposes of the SAMA analysis.

The total frequency of releases resulting from the Level 2 analysis is slightly greater than the CDF. In the ER and in response to an RAI, NMC stated that the difference is due to the inclusion of some non-minimal cutsets for scenarios that have higher releases than the corresponding minimal cutsets for the scenarios assessed for the CDF (NMC 2005a,b). The frequency of these non-minimal cutsets should have been subtracted from the frequency of the lower release categories. Therefore, this introduces a slight conservatism in the SAMA analysis.

The staff's review of the Level 2 IPE (NRC 1994) concluded that it addressed the most important severe accident phenomena normally associated with the Mark I containment type, and identified no significant problems or errors.

The Level 2 PSA model was independently reviewed in 2004 by an NMC contractor who concluded that the model was adequate to support the SAMA analysis subject to the resolution of three issues. These issues are:

- Updating the drywell shell failure probabilities due to debris contact

- Addressing items related to radionuclide release states (including shell failure timing and application of drywell spray for the prevention of shell failure, matching order of events in accident sequences to emergency procedure instructions, and how accident scenarios are represented in MAAP)

- Including established NPSH limits for low pressure coolant injection/containment spray operation following containment venting in the MAAP analysis.

These items were resolved in the Level 2 model used for the SAMA analysis. The staff notes that the above issues could be important to accident progression. Therefore, the decision to incorporate updates in these areas appears reasonable.

Based on the staff's review of the Level 2 methodology, and the fact that the Level 2 model was reviewed in more detail as part of the BWROG peer review and a more recent independent

contractor review and updated to address the review findings, the staff concludes that the Level 2 PSA provides an acceptable basis for evaluating the benefits associated with various SAMAs.

As mentioned previously, the reactor core radionuclide inventory used in the consequence analysis is based on the generic BWR inventory provided in the MACCS2 manual, adjusted to represent the Monticello power level of 1775 MWt. In response to an RAI concerning the impact of current and future fuel management practices, NMC performed an additional Monticello-specific MACCS2 sensitivity calculation assuming a 65 percent increase in the inventories for Sr-90, Cs-134, and Cs-137. This level of increase was based on a prior calculation for Nine Mile Point in which the end-of-cycle activity levels for a bounding case of 1400 effective full power days were compared to the reference BWR inventories. Use of this increased inventory results in an approximately 29 percent increase in the total costs associated with a severe accident at Monticello. Using realistic mid-life or average conditions would result in a smaller increase. NMC assessed the impact that this change might have on the SAMA screening process and determined that one SAMA (SAMA 39) could become marginally cost-beneficial. However, this SAMA was already identified as potentially cost-beneficial when using a 3 percent real discount rate and when 95th percentile values are used, as discussed in Section G.6.2. Based on this limited impact, the staff concludes that the scaling based on the plant-specific power level yields sufficiently accurate and reasonable results for the dose assessment.

The staff reviewed the process used by NMC to extend the containment performance (Level 2) portion of the PSA to an assessment of offsite consequences (essentially a Level 3 PRA). This included consideration of the source terms used to characterize fission product releases for the applicable containment release category and the major input assumptions used in the offsite consequence analyses. The MACCS2 code was utilized to estimate offsite consequences. Plant-specific input to the code includes the source terms for each release category and the reactor core radionuclide inventory (both discussed above), site-specific meteorological data, projected population distribution within an 80-kilometer (50-mile) radius for the year 2030, emergency evacuation modeling, and economic data. This information is provided in Appendix F of the ER (NMC 2005a).

NMC used site-specific meteorological data for the 2000 calendar year as input to the MACCS2 code. The data were collected from the onsite meteorological tower. In response to an RAI, NMC stated that it considered the year 2000 data to be representative of 5-year meteorological data previously tabulated for the alternate source term project. Small data voids were filled using interpolation between data points. Larger data voids were filled using data from the previous, or following, week for the same time of day. The staff notes that previous SAMA analyses results have shown little sensitivity to year-to-year differences in meteorological data and concludes that the use of the 2000 meteorological data in the SAMA analysis is reasonable.

The population distribution the applicant used as input to the MACCS2 analysis was estimated for the year 2030, using SECPOP2000 (NRC 2003), U.S. Census block-group level population

data, and population growth rate estimates (USCB 2000a). The 1990 and 2000 census data were used to estimate a regional annual average population growth rate (USCB 2000b). This annual average population growth rate was applied uniformly to all sectors to calculate the year 2030 population distribution, which NMC has determined is conservative relative to the population projections based on the county-specific growth rates. The staff concludes that the methods and assumptions for estimating population are reasonable and acceptable for purposes of the SAMA evaluation.

The emergency evacuation model was modeled as a single evacuation zone extending out 10 miles from the plant. It was assumed that 95 percent of the population would move at an average speed of approximately 2.5 miles per hour with a delayed start time of 30 minutes (NMC 2005a). This assumption is conservative relative to the NUREG-1150 study (NRC 1990), which assumed evacuation of 99.5 percent of the population within the emergency planning zone. The staff concludes that the evacuation assumptions and analysis are reasonable and acceptable for the purposes of the SAMA evaluation.

Much of the site-specific economic data was provided from SECPOP2000 (NRC 2003) by specifying the data for each of the counties surrounding the plant, to a distance of 50 miles. SECPOP2000 utilizes economic data from the 1997 Census of Agriculture (USDA 1998). In addition, generic economic data that applied to the region as a whole were revised from the MACCS2 sample problem input when better information was available. These included the value of farm and non-farm wealth and the fraction of farm wealth from improvements (e.g., buildings, equipment). Information on the duration of growing seasons for the remaining crops (pasture, green leafy vegetables, roots/tubers and other food crops) were the same as those used in all five NUREG-1150 sites (NRC 1990). NMC compared these data against the information that was available for Minnesota and judged them to be reasonable.

The staff noted that the offsite economic cost risk at Monticello is larger than that estimated at other sites having similar core damage frequency and population doses. In response to the staff's RAI, NMC stated that the economic value parameters used as input to the Monticello MACCS2 analyses are consistent with industry guidance, and produced results that are considered to be appropriate for the Monticello site. Upon further review by the staff, the differences in offsite economic cost risk between sites appear to be due to the differences in the site-specific 50-mile population distributions.

The staff concludes that the methodology used by NMC to estimate the offsite consequences for Monticello provides an acceptable basis from which to proceed with an assessment of risk reduction potential for candidate SAMAs. Accordingly, the staff based its assessment of offsite risk on the CDF and offsite doses reported by NMC.

G.3 Potential Plant Improvements

The process for identifying potential plant improvements, an evaluation of that process, and the improvements evaluated in detail by NMC are discussed in this section.

G.3.1 Process for Identifying Potential Plant Improvements

NMC's process for identifying potential plant improvements (SAMAs) consisted of the following elements: review of the most significant basic events from the Levels 1 and 2 PSA,

- Review of Phase II SAMAs from license renewal applications for seven other U.S. nuclear sites,
- Review of potential plant improvements identified in the Monticello IPE and IPEEE, and
- Review of seven dominant room/burn areas, and SAMAs that could potentially reduce the associated fire risk.

Based on this process, an initial set of 40 candidate SAMAs, referred to as Phase I SAMAs, was identified. In Phase I of the evaluation, NMC performed a qualitative screening of the initial list of SAMAs and eliminated SAMAs from further consideration using the following criteria:

- The SAMA is not applicable at Monticello due to design differences,
- The SAMA is of low benefit in boiling water reactors,
- The SAMA has already been implemented at Monticello or its benefit has been achieved at Monticello using other means, or
- The SAMA costs more than $8.6 million to implement (the modified maximum averted cost-risk (MMACR), which represents the dollar value associated with completely eliminating all internal and external event severe accident risk at Monticello).

Based on this screening, 24 SAMAs were eliminated leaving 16 for further evaluation. The remaining SAMAs, referred to as Phase II SAMAs, are listed in Table F.5-4 of the ER (NMC 2005a).

During Phase II of the evaluation, NMC screened out one additional SAMA because its benefit was small compared to its relevant importance ranking. A detailed evaluation was performed for each of the 15 remaining SAMA candidates, as described in Sections G.4 and G.6 below. To account for the potential impact of external events, the estimated benefits based on internal events were multiplied by a factor of two (except for those SAMAs specific to fire risks, since those SAMAs would not have a corresponding benefit on the risk from internal events.)

NMC also assessed the impact on the initial screening if the MMACR were based on a 3 percent discount rate rather than 7 percent, or if the MMACR were increased by a factor of 2.5 to reflect the potential impact of uncertainties. As a result, three additional SAMAs would have been retained for the Phase II analysis. Theses SAMAs are discussed further in Section G.6.2.

G.3.2 Review of Nuclear Management Company, LLC's Process

NMC's efforts to identify potential SAMAs focused primarily on areas associated with internal initiating events and internal fires. The initial list of SAMAs generally addressed the accident sequences considered to be important to CDF from functional, initiating event, and risk reduction worth perspectives at Monticello, and included selected SAMAs from prior SAMA analyses for other plants.

The preliminary review of NMC's SAMA identification process raised some concerns regarding the completeness of the set of SAMAs identified. The staff requested information on certain improvements that were identified during the IPE but that did not appear to be addressed by a candidate SAMA (NRC 2005). In response to the RAI, NMC explained that one of the improvements (assure faster operation of the condensate demineralizer bypass valve on loss of air) should have been considered as a SAMA but was not. Upon further review by NMC, the potential benefit for the modification would be less than $2000, which is significantly less than the cost, and therefore, would not be justified (NMC 2005b). NMC stated that a second modification (operator training on recovery of the failed RHR) is addressed by SAMA 26, operator training on a failed main condenser. For the remaining modification in question (testing of the boron injection hose), NMC stated that the alternate boron injection has a very small impact on CDF, and that the associated recommendation was subsumed by SAMA 13 (NMC 2005b).

The staff also questioned the ability of two SAMAs to accomplish their intended objectives, i.e., SAMA 7, rupture disk bypass line, and SAMA 36, divert water from TB931 East. SAMA 7 was subsumed by SAMA 16, passive overpressure relief. The staff noted that SAMA 16 does not address the same failure modes that are relevant to SAMA 7 (NMC 2005a). NMC stated that SAMA 16 does not directly address rupture disk failure; however, SAMA 16 was chosen as the best method to address containment vent reliability (NMC 2005b). With regard to SAMA 36, the staff noted that in Table F.5-1 of the ER, basic event IEF_FS-TB931W, which is a flood in the turbine building at the 931-foot elevation west, is indicated to be addressed by SAMA 36 (NMC 2005a). NMC clarified that this SAMA is only applicable to the east region of the turbine building but was included in the importance list as part of the recommended flood mitigation package (NMC 2005b).

Lastly, the staff questioned the applicant about two basic events that have a risk reduction worth of 1.005, but for which no candidate SAMAs were considered. In response to the staff's question, NMC stated that the components involved are a manual bypass switch and a manual disconnect switch that support operation of an instrument ac panel. This particular instrument

panel is important because its failure precludes operation of all three containment vent paths, fails division II containment heat removal, trips the mechanical vacuum pump, and fails high pressure coolant injection. NMC argued that manual switches are extremely reliable (i.e., have a very low failure probability); therefore, only an inexpensive modification that could mitigate the consequence would be cost-beneficial (NMC 2005b). The staff agrees that there would be no cost-beneficial SAMAs to address these basic events.

Based on this additional information as described above, the staff concludes that the set of SAMAs evaluated in the ER addresses the major contributors to CDF and offsite dose.

NMC identified Monticello-specific candidate SAMAs for fire events using a combination of the Monticello PSA model and the IPEEE. The fire risk at Monticello is dominated by seven room/burn sequences, the largest contributor being the control room. As a result, three fire-related SAMAs were identified and retained for the Phase II evaluation. Potential plant enhancements for other external events (high winds, external floods, and transportation and nearby facility accidents) were determined to be too costly or bounded by existing scenarios. The staff concludes that the applicant's rationale for eliminating these enhancements from further consideration is reasonable.

The staff notes that the set of SAMAs submitted is not all inclusive, since additional, possibly even less expensive, design alternatives can always be postulated. However, the staff concludes that the benefits of any additional modifications are unlikely to exceed the benefits of the modifications evaluated and that the alternative improvements would not likely cost less than the least expensive alternatives evaluated, when the subsidiary costs associated with maintenance, procedures, and training are considered.

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. This search included reviewing insights from the plant-specific risk studies, reviewing plant improvements considered in previous SAMA analyses, and using the knowledge and experience of its PSA personnel.

G.4 Risk Reduction Potential of Plant Improvements

NMC evaluated the risk-reduction potential of the 15 remaining SAMAs that were applicable to Monticello. The changes made to the model to quantify the impact of the SAMAs are detailed in Section F.6 of Appendix F to the ER (NMC 2005a). The SAMA evaluations were performed using realistic assumptions with some conservatism.

NMC used model re-quantification to determine the potential benefits. The CDF and population dose reductions were estimated using the SAMA model version of the Monticello PSA. Table G-4 lists the assumptions considered to estimate the risk reduction for each of the

evaluated SAMAs, the estimated risk reduction in terms of percent reduction in CDF and population dose, and the estimated total benefit (present value) of the averted risk. The determination of the benefits for the various SAMAs is further discussed in Section G.6.

For those SAMAs that specifically address fire events (i.e., SAMAs 38 through 40), the reduction in CDF and population dose was not directly calculated. For these SAMAs, a bounding estimate of the impact of the SAMA was made based on general assumptions regarding the approximate contribution to total risk from external events (relative to that from internal events), the fraction of the external event risk attributable to fire events, and the fraction of the fire risk affected by the SAMA and associated with each fire compartment (based on information from the IPEEE.) For example, it is assumed that the contribution to risk from external events is approximately equal to that from internal events, and that internal fires contribute 85 percent of the external events risk. The IPEEE fire analysis was then used to identify the fraction of the fire risk that could be eliminated by potential enhancements in various fire rooms/burn sequences. A similar process was applied to the proposed fire enhancements for each fire room/burn sequence considered.

The staff has 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.

G.5 Cost Impacts of Candidate Plant Improvements

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 cost estimates provided in the ER did not generally account for inflation. When using costs estimates prior to 1995, NMC applied a 2.75 percent per year inflation rate to arrive at year 2004 estimated costs (e.g., SAMA 39).

The staff reviewed the bases for the applicant's cost estimates (presented in Section F.6 of Appendix F to the ER). 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 reviewed the costs and found them to be consistent with estimates provided in support of other plants' analyses.

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

Table G-4. SAMA Cost-Benefit Screening Analysis for Monticello

SAMA	Assumptions	% Risk Reduction CDF	% Risk Reduction Population Dose	Total Benefit Using 7% Discount Rate ($)	Total Benefit Using 3% Discount Rate ($)	Cost ($)
2—Enhance direct current (dc) power availability by providing a direct connection from DG-13, the security diesel, or another source to the 250-volt (V) battery chargers or other required loads.	Additional credit given for alignment and operation of direct feed line to battery chargers from DG-13. Failure probability of modification is 1E-02	<1	1	79,000	109,000	75,000
4—Install a direct drive diesel injection pump as additional high pressure injection system.	Failure probability of 1E-02 for alignment and operation of this system with no dependencies on other plant systems and not subject to flooding failures. Added to all high-pressure injection failure gates.	98	8	460,000	11,520,000	2,000,000
6—Install additional fan and louver pair for emergency diesel generator (EDG) heating, ventilation, and air conditioning.	Additional credit given for modification in case of failure of both trains of existing EDG room cooling. Failure probability of modification is 1E-02.	2	1	103,000	137,000	100,000
8—Improve EDG-emergency service water (ESW) pumping capability by utilizing the fire service water (FSW) system as a back up for EDG cooling.	Failure probability of 1E-02 for actuation and operation of system. Added to all gates for failure of both divisions of EDG-ESW.	1.8	2.4	211,000	290,000	2,000,000
10—Install drywell igniters or passive hydrogen ignition system.	Additional credit given to new system to prevent hydrogen deflagration with failure probability of 1E-02 for new system.	0	3.5	272,000	380,000	760,000
11—Enhance alternate injection reliability by including the residual heat removal service water and FSW cross-tie valves in the maintenance program.	Assumed valve testing every 5 years leading to a factor of 10 reduction in valve failure probability.	<1	9	687,000	959,999	50,000

SAMA	Assumptions	% Risk Reduction CDF	% Risk Reduction Population Dose	Total Benefit Using 7% Discount Rate ($)	Total Benefit Using 3% Discount Rate ($)	Cost ($)
12—Proceduralize use of fire pumper truck to pressurize the FSW system.	Replaced existing failure of fire pump that credits a fire pumper truck, with a failure probability of 1E-02, and reduced diesel fire pump failure probability by a factor of 10 based on plant experience.	<1	34	2,12,000	3,684,000	50,000
13—Enhance, test and train on alternate boron injection with the control rod drive system.	Additional credit given by revising the failure probability for boron injection via the reactor water clean up system to 1E-03 with complete dependence on operator action to inject boron via the standby liquid control.	<1	0	3500	4200	50,000
16—Provide passive overpressure relief by changing the containment vent valves to fail open and improving the strength of the rupture disk.	All hard pipe vent failures replaced with effective rupture disk failure probability of 1E-03.	2.5	3.5	279,000	383,000	200,000
28—Develop procedure to refill condensate storage tank (CST) with FSW system.	Insufficient CST volume failure ANDed with 1E-02 failure probability to refill CST.	0	~0	1300	1900	50,000
36—Install interlock to open 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.	Failure probability of door to open and divert water to "safe zone" set to 1E-03.	13	23	1,900,000	2,614,000	100,000
37—Develop guidance to allow local, manual control for reactor core isolation cooling (RCIC) operation.	Failure probability of manual operation of RCIC is set to 1E-02 and credit for RCIC injection given following heat removal failure and containment vent success. Dependence on electric power removed for operator success in late injection.	16	-82[a]	-5,581,000	-7,850,000	100,000

SAMA	Assumptions	% Risk Reduction CDF	% Risk Reduction Population Dose	Total Benefit Using 7% Discount Rate ($)	Total Benefit Using 3% Discount Rate ($)	Cost ($)
38—Post an operator at the ASDS panel full time.	Eliminate all risk for Class 1A sequences due to fires that require control room evacuation.	Not estimated		331,000	450,000	10,000,000
39—Enhance the ASDS panel to include additional system controls for opposite division.	Eliminate all risk for Class 1D sequences due to fires that require control room evacuation.	Not estimated		753,000	1,025,000	787,000
40—Add an emergency level control system to the hotwell.	Eliminate all risk for Class 2 sequences due to fires that require operator-based hotwell makeup.	Not estimated		178,000	243,000	230,000

[a]Implementation of this SAMA is estimated to result in an 82-percent increase in dose-risk due to the timing of core damage relative to containment failure.

G.6 Cost-Benefit Comparison

NMC's cost-benefit analysis and the staff's review are described in the following sections.

G.6.1 Nuclear Management Company, LLC's Evaluation

The methodology used by NMC was based primarily on NRC's guidance for performing cost-benefit analysis, i.e., NUREG/BR-0184, *Regulatory Analysis Technical Evaluation Handbook* (NRC 1997b). The guidance involves determining the net value for each SAMA according to the following formula:

Net Value = (APE + AOC + AOE + AOSC) - COE where, APE = present value of averted public exposure ($)

AOC = present value of averted offsite property damage costs ($)

AOE = present value of averted occupational exposure costs ($)

AOSC = present value of averted onsite costs ($)

COE = cost of enhancement ($).

If the net value of a SAMA is negative, the cost of implementing the SAMA is larger than the benefit associated with the SAMA and it is not considered cost-beneficial. NMC's derivation of each of the associated costs is summarized below.

NUREG/BR-0058 has recently been revised to reflect the agency's policy on discount rates. Revision 4 of NUREG/BR-0058 states that two sets of estimates should be developed one at 3 percent and one at 7 percent (NRC 2004). NMC provided both sets of estimates (NMC 2005a).

- **Averted Public Exposure (APE) Costs**

The APE costs were calculated using the following formula:

APE = Annual reduction in public exposure (person-rem/year)

x monetary equivalent of unit dose ($2000 per person-rem)

x present value conversion factor (10.76 based on a 20-year period with a 7 percent discount rate).

As stated in NUREG/BR-0184 (NRC 1997b), it is important to note that the monetary value of the public health risk after discounting does not represent the expected reduction in public health risk due to a single accident. Rather, it is the present value of a stream of potential losses extending over the remaining lifetime (in this case, the renewal period) of the facility. Thus, it reflects the expected annual loss due to a single accident, the possibility that such an accident could occur at any time over the renewal period, and the effect of discounting these potential future losses to present value. For the purposes of initial screening, which assumes elimination of all severe accidents, NMC calculated an APE of approximately $817,000 for the 20-year license renewal period.

- **Averted Offsite Property Damage Costs (AOC)**

The AOCs were calculated using the following formula:

AOC = Annual CDF reduction

x offsite economic costs associated with a severe accident (on a per-event basis)

x present value conversion factor.

For the purposes of initial screening which assumes all severe accidents are eliminated, NMC calculated an annual offsite economic risk of about $253,600 based on the Level 3 risk analysis. This results in a discounted value of approximately $2,730,000 for the 20-year license renewal period.

- **Averted Occupational Exposure (AOE) Costs**

The AOE costs were calculated using the following formula:

AOE = Annual CDF reduction

x occupational exposure per core damage event

x monetary equivalent of unit dose

x present value conversion factor.

NMC derived the values for averted occupational exposure from information provided in Section 5.7.3 of the regulatory analysis handbook (NRC 1997b). Best estimate values provided for immediate occupational dose (3300 person-rem) and long-term occupational dose (20,000 person-rem over a 10-year cleanup period) were used. The present value of these doses was calculated using the equations provided in the handbook in conjunction with a monetary equivalent of unit dose of $2000 per person-rem, a real discount rate of 7 percent,

and a time period of 20 years to represent the license renewal period. For the purposes of initial screening, which assumes all severe accidents are eliminated, NMC calculated an AOE of approximately $17,000 for the 20-year license renewal period.

- **Averted Onsite Costs**

Averted onsite costs (AOSC) include averted cleanup and decontamination costs and averted power replacement costs. Repair and refurbishment costs are considered for recoverable accidents only and not for severe accidents. NMC derived the values for AOSC based on information provided in Section 5.7.6 of NUREG/BR-0184, the regulatory analysis handbook (NRC 1997b).

NMC divided this cost element into two parts the onsite cleanup and decontamination cost, also commonly referred to as averted cleanup and decontamination costs, and the replacement power cost.

Averted cleanup and decontamination costs (ACC) were calculated using the following formula:

ACC = Annual CDF reduction

x present value of cleanup costs per core damage event

x present value conversion factor.

The total cost of cleanup and decontamination subsequent to a severe accident is estimated in NUREG/BR-0184 to be $1.1 x 109 (discounted over a 10-year cleanup period). This value integrated over the term of the proposed license extension. For the purposes of initial screening, which assumes all severe accidents are eliminated, NMC calculated an ACC of approximately $529,000 for the 20-year license renewal period.

Long-term replacement power costs (RPC) were calculated using the following formula:

RPC = Annual CDF reduction

x present value of replacement power for a single event

x factor to account for remaining service years for which replacement power is required

x reactor power scaling factor

NMC based its calculations on the value of 587 megawatt electrics (MWe), which is the current electrical output for Monticello (after the extended power uprate). Therefore, NMC applied

power scaling factors of 587 MWe/910 MWe to determine the replacement power costs. For the purposes of initial screening, which assumes all severe accidents are eliminated, NMC calculated the AOSC to be approximately $227,500 for the 20-year license renewal period.

Using the above equations, NMC estimated the total present dollar value equivalent associated with completely eliminating severe accidents at Monticello to be about $4,320,000. To account for additional risk reduction in external events, NMC doubled this value (to $8,642,000), to provide the MMACR, which represents the dollar value associated with completely eliminating all internal and external event severe accident risk at Monticello.

For each of the SAMAs remaining after the initial screening, the averted costs associated with the SAMA were estimated using the above equations in conjunction with the CDF and population dose reductions for the SAMA.

- **NMC's Results**

If the implementation costs for a candidate SAMA were greater than the MMACR of $8,642,000, then the SAMA was screened from further consideration. A more refined look at the costs and benefits was performed for the remaining SAMAs. If the implementation costs for a candidate SAMA exceeded the calculated benefit, the SAMA was considered not to be cost-beneficial. In the baseline analysis contained in the ER (using a 7-percent discount rate), NMC identified seven potentially cost-beneficial SAMAs. Based on an analysis using a 3-percent real discount rate, as recommended in NUREG/BR-0058 (NRC 2004), two additional SAMA candidates were determined to be potentially cost-beneficial. The potentially cost-beneficial SAMAs are:

- 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 EDG heating, ventilation, and air condition.

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

- SAMA 12—proceduralize the use of a fire pumper truck to pressurize the FSW 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.

- SAMA 39—upgrade the ASDS panel to include additional system controls for opposite division (cost-beneficial at 3 percent discount rate).

- SAMA 40—add emergency level control sensor and control valve to the hotwell (cost-beneficial at 3 percent discount rate).

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 candidate (beyond those identified in the 3 percent discount rate case) was determined to be potentially cost-beneficial. The potentially cost-beneficial SAMAs, and NMC's plans for further evaluation of these SAMAs are discussed in more detail in Section G.6.2.

G.6.2 Review of Nuclear Management Company, LLC's Cost-Benefit Evaluation

The cost-benefit analysis performed by NMC was based primarily on NUREG/BR-0184 (NRC 1997b) and was executed consistent with this guidance.

In order to account for external events, NMC multiplied the internal event benefits by a factor of two for each SAMA, except those SAMAs that specifically address fire risk (SAMAs 38 through 40). Doubling the benefit for these SAMAs is not appropriate since these SAMAs are specific to fire risks and would not have a corresponding risk reduction in internal events. Given that the CDF from internal fires and other external events as reported by NMC is less than the CDF for internal events, the staff agrees that the factor of two multiplier for external events is reasonable.

NMC considered the impact that possible increases in benefits from analysis uncertainties would have on the results of the SAMA assessment. Currently, an uncertainty distribution is not available for the SAMA PSA model. Therefore, NMC reviewed the point estimate and 95th percentile CDFs for several SAMA submittals. The factor by which the 95th percentile CDFs exceed the point estimate CDFs ranged from 2.35 to 2.45 (NMC 2005a). NMC re-examined the initial set of SAMAs to determine if any additional Phase I SAMAs would be retained for further analysis if the benefits (and MMACR) were increased by a factor of 2.5. Three such SAMAs were identified, specifically, SAMAs 1, 9, and 14. However, based on further consideration of costs and limited effectiveness, NMC concluded that SAMAs 1 and 14 could not be

cost-beneficial even if the systems were 100 percent reliable. NMC also considered the impact on the Phase II screening if the estimated benefits were increased by a factor of 2.5 (in addition to the factor of two multiplier already included in the baseline benefit estimates to account for

external events). One additional SAMA (SAMA 9 dedicated alternate low-pressure injection/drywell spray system) became potentially cost-beneficial in NMC's analysis.

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. NMC identified the following six low-cost SAMAs as a "recommended" combination of SAMAs that substantially reduces risk at Monticello for a relatively low cost of implementation. They are:

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

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

- SAMA 28—develop a procedure to refill the CST with FSW system.

- 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.

- SAMA 37—develop guidance to allow local, manual control for RCIC operation.

To assess the impact of the implementation of the recommended SAMAs, NMC made the same modeling changes to the PSA as used previously to represent to the implementation of the SAMAs individually. The combined implementation cost of the set was assumed to be the sum of the individual SAMA implementation costs, without consideration given to the timing or manner in which the SAMAs are implemented. Implementation of the recommended SAMAs was estimated to result in an 86-percent reduction in CDF and an 80 percent reduction in dose, yielding a total benefit of almost $7 million. The combined implementation cost for the set is estimated to be $425,000.

The staff noted that two of the SAMAs in the set (SAMAs 28 and 37) were not previously identified as cost-beneficial, and that one of the two SAMAs (SAMA 37, manual RCIC operation) was actually estimated to result in an 82-percent increase in dose risk if implemented individually. The staff questioned how the implementation of SAMA 37, in combination with several other SAMAs, results in a large (approximately 80-percent) net decrease in risk (NRC 2005). In response to the staff's question, NMC stated that for a prolonged SBO, RCIC alone does not represent a success path, i.e., SAMA 37 would not create a success path (NMC 2005b). During SBO, containment heat removal and containment venting are both unavailable.

Containment failure due to overpressure would preclude the operators from occupying the RCIC room to support manual operation of the RCIC. Even with manual operation, the RCIC will eventually fail due to lack of water in the CST or overheating if taking suction from the suppression pool. Manual operation of RCIC (i.e., SAMA 37), therefore, delays the core damage while the containment pressurizes due to lack of heat removal. Core damage and vessel melt through in a pressurized containment results in a greater chance of containment failure than if they occur in an unpressurized containment.

When SAMA 37 is implemented in combination with other SAMAs, particularly SAMAs 12 and 28, a new success path is created. SAMA 12 provides a source of containment spray and CST makeup independent of electric power, while SAMA 28 provides for refilling the CST so that RCIC can continue to function; i.e., SAMA 37 (manual operation of RCIC) is successful due to the refill of the CST. SAMA 2 provides power to solenoid valves allowing containment venting for prolonged SBO scenarios, and SAMA 36 delays or prevents loss of dc so that time is available for manual operation of RCIC. The net result is a significantly reduced CDF and risk when these SAMAs are implemented as a group.

Since the ER was submitted, NMC has implemented the six "recommended" SAMAs (SAMAs 2, 11, 12, 28, 36, and 37), and has reassessed the value of the remaining SAMAs. Implementation of the recommended SAMAs reduces the benefit of the remaining Phase II SAMAs (including SAMA 9, which was identified as a result of the uncertainty analysis) such that only one SAMA remains potentially cost-beneficial. SAMA 16 (passive overpressure relief for containment) becomes even more cost-beneficial (to approximately $1 million) 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 did not identify SAMA 16 as a modification planned for further consideration in the ER. However, in response to an RAI (NRC 2005), NMC stated that after re-evaluating SAMA 16, the value of modifying the hard pipe vent design was found to still be significant, and 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.

G.7 Conclusions

NMC compiled a list of 40 SAMAs based on a review of: the most significant basic events from the plant-specific PSA, Phase II SAMAs from license renewal applications for other plants, and insights from the plant-specific IPE and IPEEE. A qualitative screening removed SAMA candidates that (1) were not applicable at Monticello due to design differences, (2) were of low benefit in BWRs, (3) had already been implemented at Monticello, (4) had been achieved at Monticello using other means, or (5) exceeded $8.6 million to implement (the modified maximum averted cost-risk). Twenty-four SAMAs were eliminated leaving 16 for evaluation. Another screening removed one additional SAMA leaving 15 SAMAs for further evaluation.

For the remaining SAMA candidates, a more detailed design and cost estimate were developed as shown in Table G-4. The cost-benefit analyses showed that seven of the SAMA candidates were potentially cost-beneficial in the baseline analysis. NMC performed additional analyses to evaluate the impact of parameter choices and uncertainties on the results of the SAMA assessment. As a result, several additional SAMAs were identified as potentially cost-beneficial. NMC evaluated the impact of implementing a selected set of six "recommended" low-cost SAMAs. The evaluation indicated that the remaining SAMAs, with the exception of one SAMA, would no longer be cost-beneficial. Since the ER was submitted, NMC stated that it has implemented all six of the "recommended" SAMAs (SAMAs 2, 11, 12, 28, 36, and 37). NMC is in the process of further evaluating the one remaining cost-beneficial SAMA (SAMA 16).

The staff reviewed the NMC analysis and concludes that the methods used and the implementation of those methods was 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: inclusion of several candidate SAMAs related to dominant fire events, improvements that have been realized as a result of the IPEEE process, and inclusion of a multiplier to account for external events.

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 all or a subset of the identified, potentially cost-beneficial SAMAs. The staff agrees that the implementation of the "recommended" SAMAs by NMC is beneficial, and that after implementing the recommended SAMAs, only one additional SAMA remains potentially cost-beneficial. However, this 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 Title 10 of the *Code of Federal Regulations*, Part 54.

G.8 References

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