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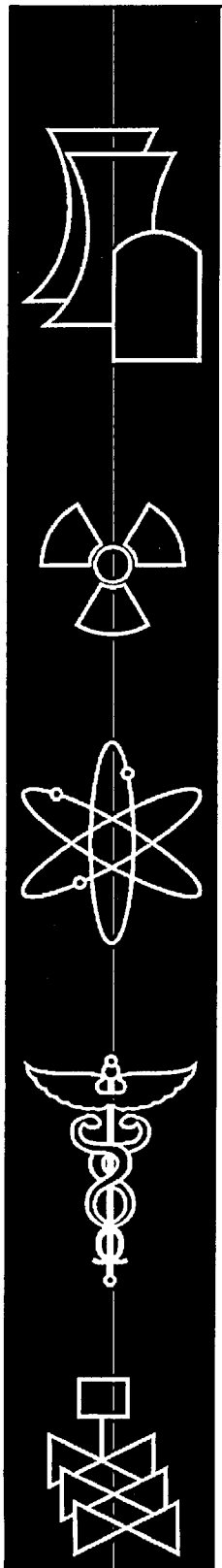

Generic Environmental Impact Statement for License Renewal of Nuclear Plants

Supplement 27

Regarding
Palisades Nuclear Plant

Draft Report for Comment

U.S. Nuclear Regulatory Commission
Office of Nuclear Reactor Regulation
Washington, DC 20555-0001

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NUREG-1437
Supplement 27

Generic Environmental Impact Statement for License Renewal of Nuclear Plants

Supplement 27

Regarding Palisades Nuclear Plant

Draft Report for Comment

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U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

COMMENTS ON DRAFT REPORT

Any interested party may submit comments on this report for consideration by the NRC staff. Comments may be accompanied by additional relevant information or supporting data. Please specify the report number NUREG-1437, Supplement 27, draft, in your comments, and send them by May 18, 2006, to the following address:

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Electronic comments may be submitted to the NRC by the Internet at PalisadesEIS@nrc.gov.

For any questions about the material in this report, please contact:

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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 Part 51 of Title 10 of the *Code of Federal Regulations* (10 CFR Part 51). In the GEIS (and its Addendum 1), the NRC 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 the Nuclear Management Company, LLC (NMC) to renew the OL for Palisades Nuclear Plant (Palisades) 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 NRC staff's preliminary recommendation regarding the proposed action.

Regarding the 69 issues for which the GEIS reached generic conclusions, neither NMC nor the NRC staff has identified information that is both new and significant for any issue that applies to Palisades. In addition, the NRC staff determined that information provided during the scoping process did not call into question the conclusions in the GEIS. Therefore, the NRC staff concludes that the impacts of renewing the Palisades OL would not be greater than the impacts identified for these issues in the GEIS. For each of these issues, the NRC 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 Palisades are addressed in this draft SEIS. For each applicable issue, the NRC staff concludes that the significance of the potential environmental impacts of renewal of the OL would be SMALL, except for historic and archaeological resources for which the potential impact would likely be SMALL, but could be MODERATE. The NRC staff determined that information provided during the scoping process did not identify any new issue that has a significant environmental impact.

(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 Palisades are not so great that preserving the option of license renewal for energy-planning decision makers 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 NRC staff's own independent review; and (5) the NRC staff's consideration of public comments received during the scoping process.

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Executive Summary

By letter dated March 22, 2005, Nuclear Management Company, LLC (NMC) submitted an application to the U.S. Nuclear Regulatory Commission (NRC) to renew the operating license (OL) for Palisades Nuclear Plant (Palisades) 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 at or before the expiration date of the current OL, which is March 24, 2011.

The NRC has implemented Section 102 of the National Environmental Policy Act (NEPA), Title 42, Section 4321, of the *United States Code* (42 USC 4321) in Part 51 of Title 10 of the *Code of Federal Regulations* (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 staff 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 NRC staff visited the Palisades site in July 2005 and held public scoping meetings on July 28, 2005, in South Haven, Michigan. During the preparation of this draft Supplemental Environmental Impact Statement (SEIS) for Palisades, the NRC staff reviewed the NMC Environmental Report (ER) and compared it with the GEIS, consulted with other agencies, conducted an independent review of the issues following the guidance set forth in NUREG-1555, Supplement 1, *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 draft SEIS.

The NRC staff intends to hold two public meetings in South Haven, Michigan, in April 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 draft SEIS. When the comment period ends, the NRC 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.

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 NRC staff's preliminary recommendation regarding the proposed action.

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) decision makers.

The evaluation criterion for the NRC staff's environmental review, as defined in 10 CFR 51.950(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 decision makers 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 NRC 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 NRC staff's consideration of all 92 environmental issues identified in the GEIS. The NRC 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 Palisades) and alternative methods of power generation. Based on projections made by the U.S. Department of Energy's Energy Information Administration, gas- and coal-fired generation appear to be the most likely power-generation alternatives if the power from the plant is replaced. These alternatives are evaluated assuming that the replacement power generation plant is located at either the Palisades site or some other unspecified alternate location.

NMC and the NRC 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 NRC 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, the NRC staff did not identify, during the scoping process, any new issue applicable to Palisades that had a significant environmental impact. Therefore, the NRC staff relies upon the conclusions of the GEIS for all of the Category 1 issues that are applicable to Palisades.

NMC's license renewal application presents an analysis of the Category 2 issues. The NRC 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. Nine Category 2 issues are not applicable because they are related to plant design features or site characteristics not found at Palisades. 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 Palisades 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 the Operation of Palisades Nuclear Generating Plant, Consumers Power Company.*

Eight 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. Four 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 eight of the Category 2

issues and environmental justice, the NRC staff concludes that the potential environmental effects would be of SMALL significance in the context of the standards set forth in the GEIS. In addition, the NRC 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 NRC 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 SAMA. Given the potential for cost-beneficial risk reduction, the NRC staff agrees that further evaluation of these SAMAs by NMC is warranted. However, none of the potentially cost-beneficial SAMAs directly relate to adequately managing the effects of aging during the period of extended operation. Therefore, they need not be implemented as part of the license renewal pursuant to 10 CFR Part 54.

Cumulative impacts of past, present, and reasonably foreseeable future actions were considered, regardless of any other action undertaken by agencies or persons. For purposes of this analysis, the overall conclusion of the NRC staff is that these impacts would not result in significant cumulative impacts on potentially affected resources.

If the Palisades OL is not renewed and the plant ceases operation on or before the expiration of its current OL, then the adverse impacts of likely alternatives will not be smaller than those associated with continued operation of Palisades. 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 Palisades are not so great that preserving the option of license renewal for energy planning decision makers 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 NRC staff's own independent review; and (5) the NRC staff's consideration of public comments received during the scoping process.

Abbreviations/Acronyms

°	degree
µCi	microcurie(s)
µg	microgram(s)
ac	acre(s)
ADAMS	Agencywide Documents Access and Management System
AEC	U.S. Atomic Energy Commission
AEP	American Electric Power
AFW	Auxiliary Feedwater
ALARA	As Low as Reasonably Achievable
AQCR	Air Quality Control Region
Btu	British thermal unit(s)
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
Ci	curie(s)
cm^3	cubic centimeter(s)
CO	carbon monoxide
CWS	Circulating Water System
CZMA	Coastal Zone Management Act
DAW	dry active waste
DBA	design-basis accident
DFO	Department of Fisheries and Oceans Canada
DMR	Discharge Monitoring Report
DSM	Demand Side Management
DOC	U.S. Department of Commerce
DOE	U.S. Department of Energy
DOI	U.S. Department of the Interior
DOL	U.S. Department of Labor
DOT	U.S. Department of Transportation
EDG	Emergency Diesel Generator
EIA	Energy Information Administration
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

F	Fahrenheit
FAA	Federal Aviation Administration
FES	Final Environmental Statement
FSAR	Final Safety Analysis Report
ft	foot (feet)
ft^3	cubic foot (feet)
FWS	U.S. Fish and Wildlife Service
gal	gallon(s)
GEIS	Generic Environmental Impact Statement for License Renewal of Nuclear Plants, NUREG-1437
GLSC	Great Lakes Science Center
GLSGN	Great Lakes Sea Grant Network
gpd	gallon(s) per day
gpm	gallon(s) per minute
HEPA	high-efficiency particulate air
HLW	high-level waste
hr	hour(s)
Hz	hertz
I-196	Interstate-196
IDNR	Indiana Department of Natural Resources
IEEE	Institute of Electrical and Electronic Engineers
in.	inch(es)
INEEL	Idaho National Engineering and Environmental Laboratory
kV	kilovolt(s)
kWe	kilowatt(s) electrical
kWh	kilowatt hour(s)
L	liter(s)
lb	pound(s)
m	meter(s)
m^2	square meter(s)
mA	milliampere(s)
MDCH	Michigan Department of Community Health
MDEQ	Michigan Department of Environmental Quality
MDNR	Michigan Department of Natural Resources
MEDC	Michigan Economic Developrnent Corporation

MEI	maximally exposed individual
METC	Michigan Electric Transmission Company, LLC
mg	milligram(s)
mi	mile(s)
mi^2	square mile(s)
mi^3	cubic mile(s)
min	minute(s)
MNFI	Michigan Natural Features Inventory
mph	mile(s) per hour
MRCC	Midwestern Regional Climate Center
mrem	millirem(s)
MSL	mean sea level
MW	megawatt(s)
MWh	megawatt hour(s)
MW(e)	megawatt(s) electric
MW(t)	megawatt(s) thermal
NCES	National Center for Educational Statistics
NEPA	National Environmental Policy Act
NREL	National Renewable Energy Laboratory
NESC	National Electric Safety Code
ng/J	nanogram(s) per Joule
NHPA	National Historic Preservation Act
NIEHS	National Institute of Environmental Health Sciences
NMC	Nuclear Management Company, LLC
NOAA	National Oceanic and Atmospheric Administration
NO_x	nitrogen oxide(s)
NPDES	National Pollutant Discharge Elimination System
NPS	National Park Service
NRC	U.S. Nuclear Regulatory Commission
ODCM	Offsite Dose Calculation Manual
OL	operating license
PCB	polychlorinated biphenyl
PCS	Primary Coolant System
PG&E	PG&E Corporation
PM_{10}	particulate matter with an aerodynamic diameter of 10 μm or less
PNL	Pacific Northwest National Laboratory
PSD	prevention of significant deterioration
psi	pounds per square inch

RCP	Reactor Coolant Pump
REMP	radiological environmental monitoring program
s	second(s)
SAMA	severe accident mitigation alternative
SAR	Safety Analysis Report
SCR	selective catalytic reduction
SECA	Solid State Energy Conservation Alliance
SEIS	Supplemental Environmental Impact Statement
SER	Safety Evaluation Report
SHPO	State Historic Preservation Office
SO_2	sulfur dioxide
SO_x	sulfur oxide(s)
STS	STS Consultants, Inc.
SWPPP	Storm Water Pollution Prevention Plan
SWS	Service Water System
TEDE	total effective dose equivalent
TLAA	time-limited aging analysis
TRO	total residual oxidant
TSS	total suspended solids
TWh	terawatt-hour(s)
U.S.	United States
USC	United States Code
USDA	U.S. Department of Agriculture
UWSGI	University of Wisconsin Sea Grant Institute
W	watt(s)
yd	yard(s)

1.0 Introduction

Under the U.S. Nuclear Regulatory Commission's (NRC's) environmental protection regulations in Part 51 of Title 10 of the *Code of Federal Regulations* (10 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 NRC 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 must 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 Palisades Nuclear Plant (Palisades) in southwestern Michigan under OL DPR-20, which was issued by the NRC. This OL will expire in March 2011. On March 22, 2005, NMC submitted an application to the NRC to renew the Palisades OL for an additional 20 years under 10 CFR Part 54. NMC is a licensee for the purposes of its current OL and an applicant for the renewal of the OL. 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 impacts.

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

(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.

1.1 Report Contents

The following sections of this introduction (1) describe the background for the preparation of this draft SEIS, including the development of the GEIS and the process used by the NRC staff to assess the environmental impacts associated with license renewal; (2) describe the proposed Federal action to renew the Palisades 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 NRC 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 draft SEIS,
- The organizations contacted during the development of this draft 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 Palisades, and
- 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 support 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 impact for both beneficial and adverse impacts, (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, and 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 draft 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 NRC staff assessed 92 environmental issues and determined that 69 qualified as Category 1 issues, 21 qualified as Category 2 issues, and 2 issues were not categorized. The two uncategorized issues are environmental justice and chronic effects of electromagnetic fields. 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), and
- 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); and
- 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 Palisades 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 Palisades 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 Palisades 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 Palisades. 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 *Standard Review Plans for Environmental Reviews for Nuclear Power Plants, Supplement 1: Operating License Renewal,* NUREG-1555, Supplement 1 (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 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 Palisades. 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 issues are 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 NRC 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 and opportunity for a hearing in the *Federal Register* (Volume 70, page 33533 (70 FR 33533)) (NRC 2005a) on June 8, 2005. On June 27, 2005, the NRC staff published a Notice of Intent to prepare an EIS and conduct scoping (70 FR 36967) (NRC 2005b). Two public scoping meetings were held on July 28, 2005, in South Haven, Michigan. Comments received during the scoping period were summarized in the *Environmental Impact Statement*

Scoping Process: Summary Report – Palisades Nuclear Plant, Van Buren County, Michigan (NRC 2005c).

Comments that are applicable to this environmental review are presented in Part 1 of Appendix A.

The NRC staff followed the review guidance contained in NUREG-1555, Supplement 1 (NRC 2000). The NRC staff and contractors retained to assist the NRC visited the Palisades site on July 26 and 27, 2005, to gather information and to become familiar with the site and its environs. The NRC 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 Palisades were reviewed and are referenced in this draft SEIS.

This draft SEIS presents the NRC staff's analysis that considers and weighs the environmental impacts of the proposed renewal of the OL for Palisades, the environmental impacts of alternatives to license renewal, and mitigation measures available for avoiding adverse environmental impacts. Chapter 9, "Summary and Conclusions," provides the NRC staff's preliminary 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 decision makers 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, an afternoon session and an evening session, will be planned for April 2006 in South Haven, Michigan. During these meetings, the NRC staff intends to 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 Palisades. Palisades is located in Covert Township, Van Buren County, Michigan, on the southeastern shoreline of Lake Michigan. The site is located 4.5 mi south of the South Haven city limits. Kalamazoo and Portage, Michigan, and Elkhart and South Bend, Indiana, are located inland 30 to 50 mi from Palisades. Smaller cities in the region include South Haven, Benton Harbor, and St. Joseph, Michigan. The site location is approximately 75 mi northeast of downtown Chicago, Illinois.

The plant has a single pressurized light-water reactor. Combustion Engineering, Inc. designed the Nuclear Steam Supply System, which includes the primary system (e.g., reactor vessel,

steam generators, pressurizer, and pumps), reactor auxiliary system components, nuclear and certain process instrumentation, and the Reactor Protective System. Bechtel Corporation and its affiliate, Bechtel Company, designed and supplied the balance of the plant equipment, systems, and structures (NMC 2003).

The maximum authorized power level of the reactor is 2565 megawatts thermal (MW(t)) (NMC 2003). The current net summer capacity of Palisades is 786 megawatts electric (MW(e)), which is equivalent to the power needs of approximately 775,000 residences (NMC 2005a). Palisades uses a circulating water cooling system to conduct waste heat from the main condenser to two mechanical draft cooling towers where heat is removed by evaporation. The current OL for Palisades expires on March 24, 2011. By letter dated March 22, 2005, NMC submitted an application to the NRC (NMC 2005b) to renew this OL for an additional 20 years of operation (i.e., until March 24, 2031).

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) decision makers.

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 2005a), 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 Palisades license renewal. Authorizations and consultations relevant to the proposed OL renewal action are included in Appendix E.

The NRC 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 (NMC 2005a) states that NMC is in compliance with applicable environmental standards and requirements for Palisades. The NRC 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.

National Environmental Policy Act of 1969 (NEPA), as amended. 42 USC 4321, et seq.

Nuclear Management Company, LLC (NMC). 2003. *Final Safety Analysis Report (FSAR) – Palisades Nuclear Plant.* Rev. 24, Covert, Michigan (October 2003).

Nuclear Management Company, LLC (NMC). 2005a. *Applicant's Environmental Report – Operating License Renewal Stage, Palisades Nuclear Power Plant.* Docket No. 50-255, Covert, Michigan (March 2005).

Nuclear Management Company (NMC). 2005b. *Palisades Nuclear Plant. Application for Renewed Operating License.* Covert, Michigan (March 22, 2005).

U.S. Nuclear Regulatory Commission (NRC). 1996. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants.* NUREG-1437, Vols. 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, Vol. 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 Hearing Regarding Renewal of Facility Operating License No. DPR-20 for an Additional 20-Year Period." *Federal Register*, Vol. 70, No. 109, pp. 33533–33535, Washington, D.C. (June 8, 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. 122, pp. 36967–36968, Washington, D.C. (June 27, 2005).

U.S. Nuclear Regulatory Commission (NRC). 2005c. *Environmental Impact Statement Scoping Process: Summary Report – Palisades Nuclear Plant, Van Buren County, Michigan.* Rockville, Maryland. (December 14, 2005).

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

Palisades Nuclear Plant (Palisades) is owned by Consumers Energy Company (Consumers Energy), a subsidiary of CMS Energy Corporation. Nuclear Management Company, LLC (NMC) operates Palisades on behalf of Consumers Energy. With respect to the Palisades operating license (OL), Consumers Energy is the owner licensee, and NMC is the licensed operator of the facility (NMC 2005a). Palisades is located in Covert Township, Van Buren County, Michigan, on the southeastern shoreline of Lake Michigan. The plant consists of a pressurized light-water reactor that produces steam that turns turbines to generate electricity.

The Palisades facilities and infrastructure include the power block area, two independent spent fuel storage installations for dry storage, mechanical draft cooling towers, main parking lot, main access road, switchyard (Palisades Substation), and power transmission facilities and corridors, which extend eastward from the power block to the eastern site boundary at the Blue Star Memorial Highway. Other development on the site consists of waste storage and support facilities, including a radioactive waste storage building, an interim steam generator storage building for storage of old steam generators that were replaced in the early 1990s, a warehouse, an outage/training facility, and spent fuel services building. The plant and its environment 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

Palisades is located on approximately 432 ac of land, and is bordered by Lake Michigan on the west and the Blue Star Memorial Highway and adjacent Interstate-196 (I-196) on the east in Covert Township, Van Buren County, Michigan. The nearest town is South Haven, Michigan, which is approximately 4.5 mi north of the plant, and has a population of about 5000 people. The major towns within a 50-mi radius of the plant are Kalamazoo and Portage, Michigan, and Elkhart, Mishawaka, and South Bend, Indiana. Figures 2-1 and 2-2 show the site location and features within 50 mi and 6 mi, respectively (NMC 2005a).

Based on 2000 U.S. Census Bureau data, approximately 1.3 million people live within 50 mi of the site (NMC 2005a). The population density of 293 persons/mi^2 is considered a high population area based on the criteria described in the Generic Environmental Impact Statement

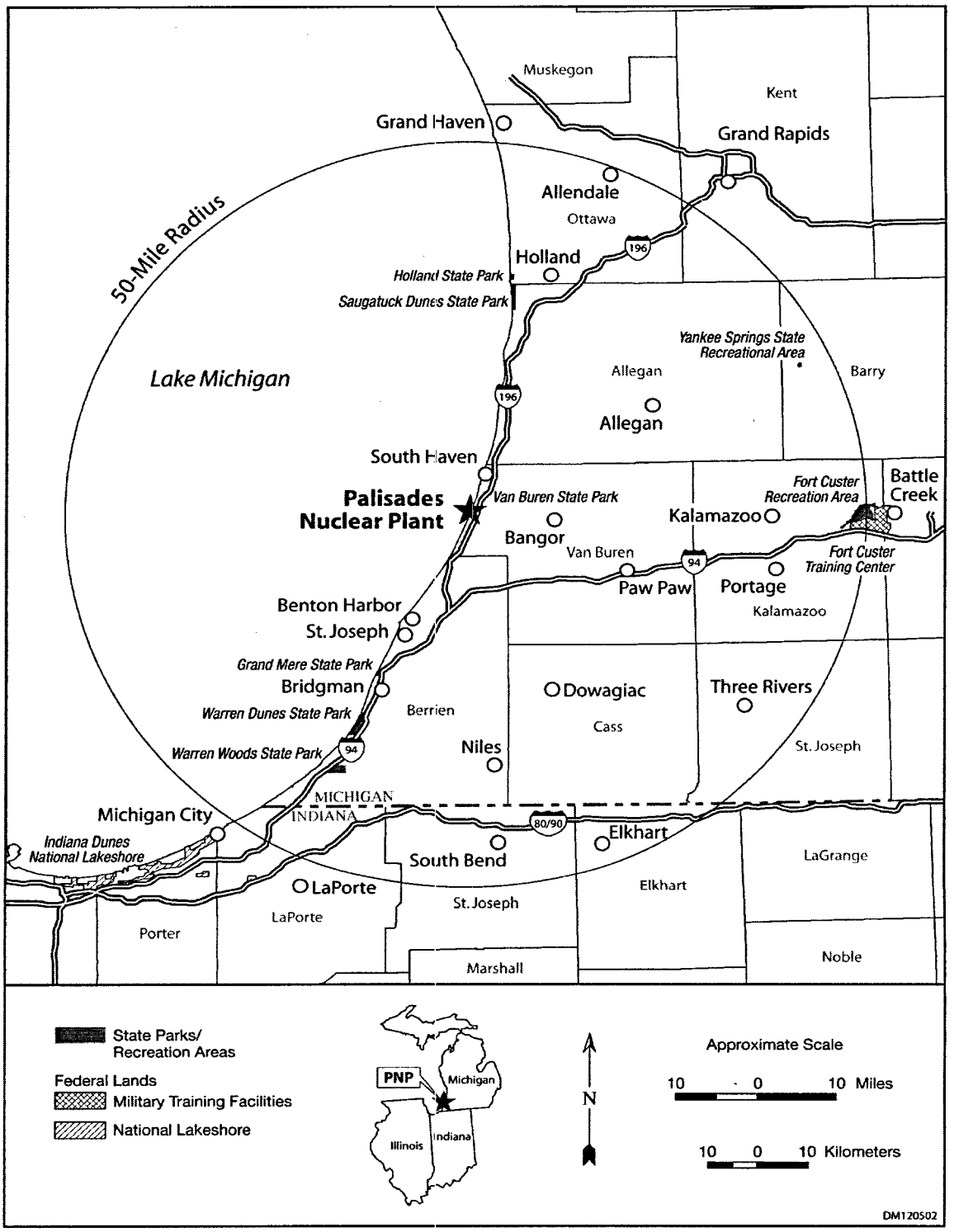

Figure 2-1. Location of Palisades, 50-mi Region

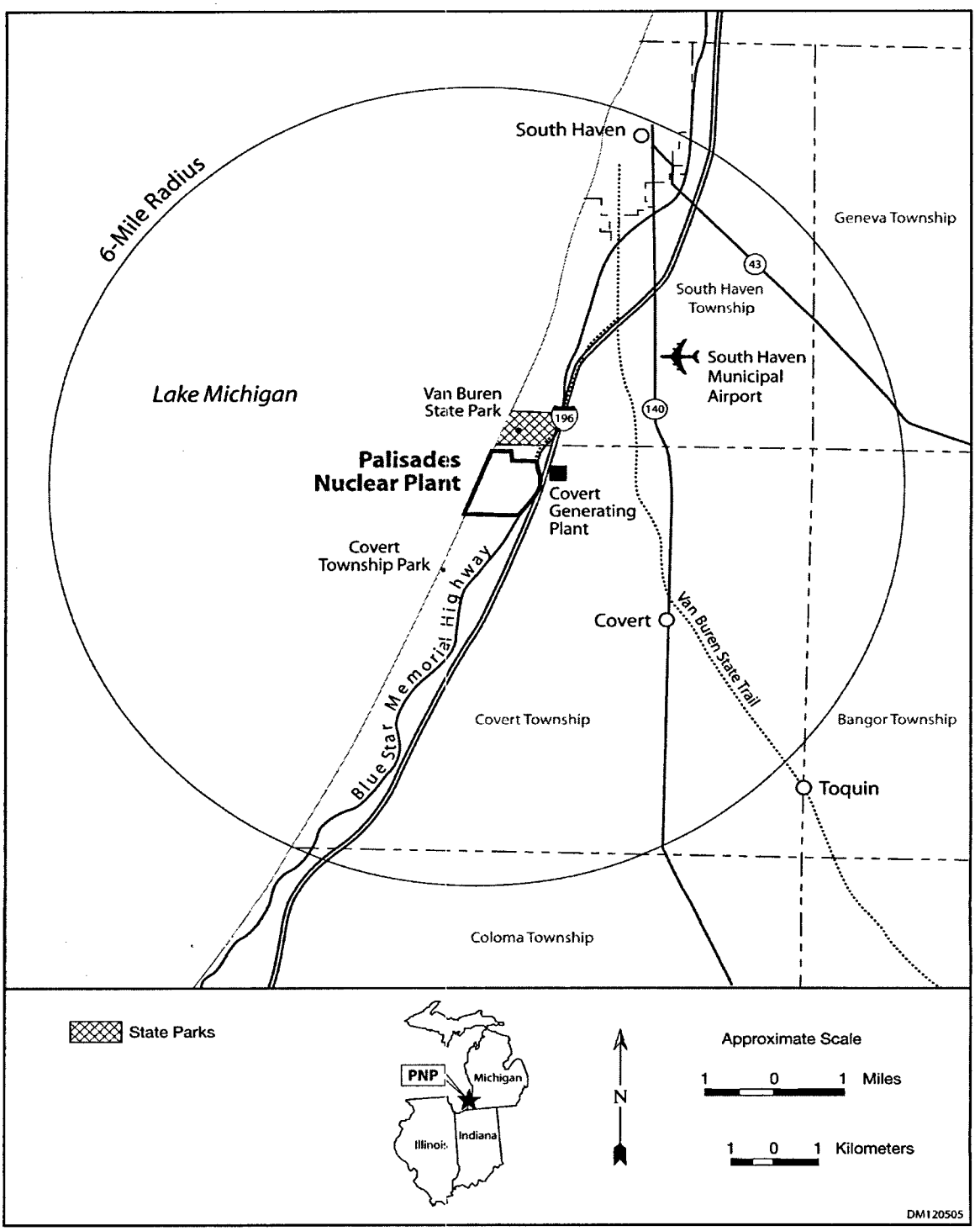

Figure 2-2. Location of Palisades, 6-mi Region

for License Renewal of Nuclear Plants (GEIS), NUREG-1437, Volumes 1 and 2 (NRC 1996, 1999).[a]

NMC employs a permanent workforce of approximately 530 employees and 110 contractors. The reactor is refueled on an 18-month refueling cycle. During refueling outages, site employment increases by approximately 380 workers assigned for temporary (30 to 40 days) duty (NMC 2005a). Upon the initiation of the renewed OL, the permanent workforce is expected to increase by approximately 60 employees to perform the license renewal surveillance, online monitoring, inspections, testing, trending, and record keeping activities (NMC 2005a).

2.1.1 External Appearance and Setting

Palisades property includes approximately 1 mi of lake frontage and extends about 1 mi eastward from Lake Michigan. The local terrain consists of a gentle upward sloping beach at an elevation of about 580 ft above mean sea level (MSL) that rises sharply into sand dunes at an elevation of approximately 780 ft MSL and then drops off abruptly to about 610 ft MSL at the eastern site boundary. The area surrounding the plant property is largely rural, characterized by agriculture and heavily wooded, rugged sand dunes along the lakeshore (NMC 2005a). As indicated in Figure 2-2, there are few urban areas and little industrial development within the 6-mi radius of the plant. The only major industrial facility in the immediate vicinity of the site is the Covert Generating Plant, on the east side of I-196. The Covert Generating Plant consists of three natural-gas-fired combined-cycle electric generating units. It generates 1100 MW of electricity when all three units are operating. The electricity from the plant is connected to the grid at the Palisades Substation.

The developed area on the Palisades site, which includes power production and support facilities, roads, parking lots, and the transmission line rights-of way up to the site boundary, is approximately 80 ac. No residences exist on the site. The main access to the site is the Blue Star Memorial Highway.

Numerous public recreational areas and summer vacation properties exist within 50 mi of the Palisades site. The area is particularly popular with tourists during the summer months. There are no Federal facilities, but State-owned facilities include eight parks, two recreational areas, seven game areas, one fish and wildlife area, and seven wilderness and natural areas (NMC 2005a). There are also a large number (more than 200) of municipal and privately owned parks and recreational areas. The site is bordered by Van Buren State Park on the north and a privately owned residential and lakefront recreational community, Palisades Park

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

and Country Club, on the south. The 40-ac Van Buren State Park has a 1-mi shoreline on Lake Michigan and contains campgrounds and picnic and beach facilities. Two of the State Parks in the region are linear walking and riding trails. The Van Buren Trail State Park is a dirt and gravel multiuse trail between South Haven and Hartford, Michigan. The Kal-Haven Trail State Park is a 34-mi crushed limestone path between South Haven and Kalamazoo, Michigan. Both trails are located on abandoned railroad paths (NMC 2005a). Many of the State-owned and private recreational areas within 50 mi of the site offer facilities for camping, picnicking, boating, hunting, fishing, swimming, hiking, horseback riding, and winter sports (NMC 2005a).

The 432-ac site is owned by Consumers Energy. Consumers Energy has granted easements to the Michigan Electric Transmission Company, LLC (METC), which owns the transmission lines leaving the Palisades Substation on the site. The immediate plant area is fenced, with a locked gate under the control of plant personnel. Access to the site is controlled both from the land and the lake.

2.1.2 Reactor Systems

The Nuclear Steam Supply System for Palisades is a pressurized water reactor consisting of a reactor Primary Coolant System (PCS) and associated auxiliary systems (NMC 2003b). The PCS design features two closed loops in which reactor coolant is circulated, each of which includes two primary coolant pumps and a steam generator. The reactor coolant, demineralized water to which chemicals are added to control corrosion and moderate the nuclear reaction, circulates under high pressure through the reactor vessel and the tube side of the two steam generators in these closed loops. Heat from the reactor is transferred to conditioned, demineralized water in the shell side of the steam generators to produce high-pressure steam that is routed through the steam turbine, condensed back to water in the main condenser, and pumped back to the steam generators, thus comprising an isolated secondary cooling loop (i.e., the secondary system) (NMC 2003b). The steam turbine is a tandem-compound unit and is connected directly to the generator. The maximum calculated capacity of the turbine generator is 865 megawatts-electric (MW(e)) gross. Heat transfer from the main condenser is accomplished by a third cooling loop, the Circulating Water System (CWS).

The nuclear fuel is low-enriched uranium dioxide with enrichments below 5 percent by weight (NMC 2005a). The fuel is contained in long fuel rods that are assembled into fuel bundles consisting of 225 rods in 15 × 15 arrays. The collection of fuel bundles with associated instrument tubes, control rods, and structural elements make up the reactor core. The nuclear energy contained in the fuel is converted to thermal energy through fissioning of the uranium atoms in the fuel, and the thermal energy is transferred to the circulating water in the primary cooling system as described above.

The reactor, steam generators, and related systems are enclosed in a Containment Building that is designed to prevent leakage of radioactivity to the environment in the improbable event of a rupture of the reactor coolant piping. The Containment Building is a reinforced concrete cylinder with a slab base and an arching dome. A 0.25-in. welded steel liner is attached to the inside face of the concrete shell to ensure a high degree of leak-tightness. In addition, the 3.5-ft-thick concrete walls serve as a radiation shield for both normal and accident conditions.

The Containment Building is ventilated to maintain pressure and temperatures within acceptable limits. The containment ventilation system also can purge the containment prior to entry. Exhaust from the ventilation system is monitored for radioactivity before being released to the plant vent, which is located just above the top of the containment outside wall. High-efficiency particulate air (HEPA) filters are used when needed to filter the air before releasing it.

In addition to the Containment Building, the major structures within the power block on the Palisades site include the Turbine Building, which houses the turbines, the electrical generator, condenser, feedwater heaters, and feedwater and condensate pumps; the Auxiliary Building and the attached Radioactive Waste Building, which contain the spent fuel pool, radioactive waste management equipment, heating and ventilation system components, the emergency diesel generators, switchgear, laboratories, offices, and the control room; the Condensate and Makeup Demineralizer Building, which houses the equipment and facilities used to treat the makeup water for the CWS; the Cooling Tower Pump House; and the Intake Structure, which houses the service water and fire protection pumps.

As shown in Figure 2-3, the other prominent structures outside of the power block area on the Palisades side include two independent spent fuel storage installations for dry storage, cooling towers, the Palisades Substation (the switchyard), power transmission lines extending from the Palisades Substation to the eastern site boundary, a Warehouse Building, a meteorological tower, and various storage areas, roads, and parking lots.

2.1.3 Cooling and Auxiliary Water Systems

Palisades relies on two sources of water: raw water from Lake Michigan and potable water from the South Haven Municipal Water Authority (Consumers Energy 2003; NMC 2003b). The water from Lake Michigan is used primarily for waste heat removal in the plant's Service Water System (SWS) and CWS. The withdrawal rate is approximately 98,000 gpm during normal full power operation. Of this flow, evaporative loss due to evaporation from the two CWS cooling towers may range as high as 12,000 gpm during the summer, while the remaining 86,000 gpm is returned to Lake Michigan (Consumers Energy 2003; NMC 2003b).

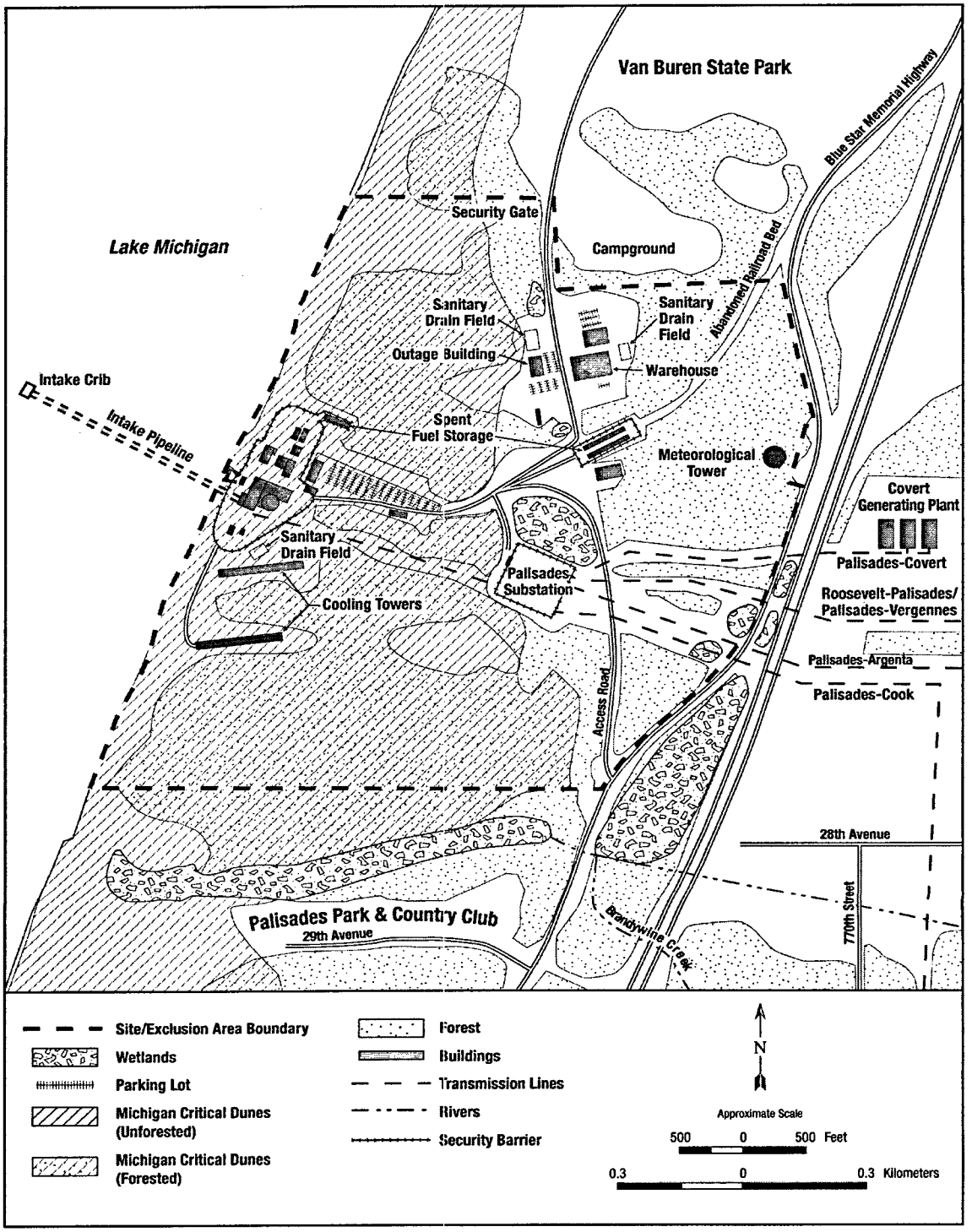

Figure 2-3. Palisades Site Layout

The water for the SWS and CWS is withdrawn from Lake Michigan via pipeline from a submerged intake crib structure located 3300 ft offshore in water about 35 ft deep (Consumers Energy and NMC 2001). The crib is a box structure measuring 57 ft wide, 57 ft long, and 13 ft high. Two-thirds of its top surface consist of steel plates, and one-third is comprised of bar racks. Water enters the crib through the bar racks and on each of the crib's four sides, which are constructed of 2-in. vertical steel bars spaced at 10-in. intervals (Consumers Energy and NMC 2001).

Originally, the crib was designed for a once-through cooling-water flow rate of approximately 400,000 gpm. However, subsequent conversion to a closed-cycle cooling system reduced intake flow to approximately 98,000 gpm, resulting in low approach velocities of approximately 0.1 foot per second at the face of the structure (Consumers Energy and NMC 2001). Water flows from the intake crib through an 11-ft-diameter pipe to the onshore intake structure where it passes through trash racks constructed of steeply sloped bars to prevent entry of coarse debris. Debris accumulated on the trash racks is removed by a mechanical rake or scoop (AEC 1972). The water then flows through vertical 0.375-in. mesh traveling screens for removal of finer debris (Consumers Energy and NMC 2001). The traveling screens are cleaned by rotating and backwashing the screens as needed (in automatic or manual operation) and sluicing the debris to a collection basket (AEC 1972; Consumers Energy and NMC 2001). The accumulated debris is disposed of in accordance with the Palisades National Pollutant Discharge Elimination System (NPDES) permit (MDEQ 2004).

Three 8000-gpm service water pumps, one of which is normally on standby, are located in the onshore intake structure and provide water to the SWS (NMC 2003b). The purpose of the service water is to remove waste heat from the nuclear plant and steam plant auxiliary systems. After flowing through coolers, heat exchangers, and other plant components, this service water is discharged to the makeup basin, which is open to the suction basins for the CWS cooling tower pumps (NMC 2003b). A small fraction of water in the SWS is used as feedwater for production of demineralized water for use in the primary and secondary cooling loops.

The CWS removes waste heat from the main condenser by recirculating water from the hot side of the condenser through the facility's two mechanical draft cooling towers (NMC 2003b). In these towers, cooling takes place through evaporation. Water circulation in this system is accomplished by two 164,000-gpm pumps located in the cooling-tower pump building. Evaporation in the cooling towers ranges from 4500 gpm in winter to 6000 gpm in summer for each of the two towers.

Evaporation and other losses (e.g., cooling-tower blowdown) from the CWS are replaced by makeup water withdrawn from the onshore intake structure by two 40,000-gpm dilution water pumps. Makeup water surplus is directed to the makeup basin where it combines with the SWS

cooling water. Excess cooling water in the makeup basin flows over weirs to the mixing basin for discharge to the lake.

The cool lake water provided by the dilution water pumps increases the generation efficiency of the plant and reduces the temperature of the water discharged to the lake (NMC 2003b). Cooling water mixes with low-volume waste sources, which meet the criteria described in Section 2.2.3, from plant operations in the mixing basin and flows through openings in the outer wall of the mixing basin to Lake Michigan via Outfall 001, which is the shoreline discharge structure (NMC 2003b). The outfall is a pile structure that widens from 37 ft at the mixing basin outlet wall to 100 ft at its terminus, 108 ft from the outlet wall (AEC 1972). The discharge (monitoring point 001A) is monitored for both radiological and nonradiological parameters in accordance with the NPDES permit (MDEQ 2004). Associated limits include a maximum allowable discharge flow of 135.2 million gpd, a daily maximum heat addition limit of 2.1×10^9 Btu/hr, and limits for release of total residual oxidants (TROs) used for biofouling control (MDEQ 2004).

2.1.4 Radioactive Waste Management Systems and Effluent Control Systems

Radioactive wastes resulting from plant operations are classified as liquid, gaseous, and solid wastes. Palisades uses liquid, gaseous, and solid radioactive waste management systems to collect and process these wastes before they are released to the environment or shipped to offsite commercial waste processing or disposal facilities. The waste disposal system meets the design objectives and release limits as set forth in Title 10 of the *Code of Federal Regulations*, Part 20 (10 CFR Part 20) and Part 50 (10 CFR Part 50), Appendix I ("Numerical Guide for Design Objectives and Limiting Conditions for Operation to Meet the Criterion 'As Low As is Reasonably Achievable' for Radiological Material in Light-Water-Cooled Nuclear Power Reactor Effluents"), and controls the processing, disposal, and release of radioactive liquid, gaseous, and solid wastes. Unless otherwise noted, the description of the radioactive waste management systems and effluent control systems for liquid, gaseous, and solid wastes presented here (Sections 2.1.4.1, 2.1.4.2, and 2.1.4.3, respectively) is based on information provided in the *Palisades Final Safety Analysis Report* (FSAR; NMC 2003b) and as confirmed during the U.S. Nuclear Regulatory Commission (NRC) staff site visit on July 26 and July 27, 2005.

The waste disposal system collects and processes all potentially radioactive reactor plant wastes for removal from the plant site within limitations established by applicable governmental regulations. In addition, the system is capable of liquid waste segregation and reuse. All planned releases of liquid and gaseous effluents may be either batch or continuous. Before a batch may be released, the tank is sampled and the sample analyzed in the laboratory. A gas release is made only if the release can be made without exceeding Federal standards, and lack

of reserve holdup capacity requires such a release. Radiation monitors are provided to maintain surveillance over the release operation, and a permanent record of activity released is provided by radiochemical analysis of known quantities of waste (NMC 2003b).

Radioactive fission products build up within the fuel as a consequence of the fission process. These fission products are contained in the sealed fuel rods; however, as a result of fuel cladding failure and corrosion, small quantities escape from the fuel rods and contaminate the reactor coolant. Neutron activation of the primary coolant system is also responsible for coolant contamination. Nonfuel solid wastes result from treating and separating radionuclides from gases and liquids and from removing contaminated material from various reactor areas. Solid wastes also consist of reactor components, equipment, and tools removed from service as well as contaminated protective clothing, paper, rags, and other trash generated from plant operations during design modification and during routine maintenance activities. The solid waste disposal system is designed to package solid wastes for removal to offsite treatment or disposal facilities. Some solid waste is temporarily stored onsite.

Fuel assemblies that have exhausted a certain percentage of their fuel and that are removed from the reactor core for disposal are called spent fuel. Palisades currently operates on an 18-month refueling cycle. Spent fuel is temporarily stored onsite in a spent fuel pool and in two dry-storage areas.

The Offsite Dose Calculation Manual (ODCM) for Palisades (NMC 2004a), which is included in the *Palisades Annual Radioactive Effluent Release and Waste Disposal Reports* (e.g., NMC 2005b), describes the methods and parameters used for calculating radioactivity concentrations in the environment and the estimated potential offsite doses associated with liquid and gaseous effluents from the plant. The ODCM also specifies controls for release of liquid and gaseous effluents from Palisades to ensure compliance with NRC regulations.

2.1.4.1 Liquid Waste Processing Systems and Effluent Controls

A small fraction of the water circulating in the primary coolant system is routinely withdrawn by the chemical and volume control system within the plant, processed, and then reinjected into the primary coolant system to control the composition and volume of the primary coolant. The processing equipment removes any radionuclides that either escape from the fuel rods or are produced in the coolant due to activation with neutrons to prevent their buildup in the primary coolant.

Any leaks from piping, valves, pump seals, and storage tanks throughout the plant are routinely collected via catch basins, building drains, or sumps. At times equipment changes, repairs, or cleanup operations also generate liquids that contain small concentrations of radioactive elements. All such liquids, including those generated by the chemical and volume control

system, are handled by the Liquid Radioactive Waste System. They are collected, monitored, and processed by a combination of mechanisms, including holdup (permitting radioactive decay), filtration, demineralization, and ion-exchange treatment (removal of insoluble particulates and soluble contaminants), degassing (removal of dissolved gases), and evaporation (volume reduction). After processing, most of the liquids are recycled back into the primary coolant system or other liquid systems within the plant and reused. The wet residues or certain concentrates are solidified and sent offsite for disposal (see Section 2.1.4.3). Liquid streams that are not needed in the plant and meet the release criteria established in 10 CFR Part 50, Appendix I, are discharged to Lake Michigan after dilution with CWS discharge. This flow is via low-velocity surface discharge at the shoreline. The releases to the lake are in batches and are strictly monitored to make sure that the release criteria are met. Any liquids that do not meet the criteria are reprocessed until they meet the criteria, or they are sent offsite for disposal after appropriate solidification and packaging.

Some of the radionuclides in the recycled primary coolant are noble gases dissolved in the water. These radionuclides are degassed during the processing of the bleed-off stream by the chemical and volume control system and sent to the gaseous radioactive waste processing system for further processing (see Section 2.1.4.2).

Prior to 1989, another source of liquid waste was the laundry facility that was used to clean contaminated clothing. Although the equipment used for laundry is still in place, the facility is no longer being used. Laundry is sent offsite to be cleaned by a contractor, and clean laundry is returned to the site.

During the 5-year period from 2000 through 2004 (the most recent year for which data were available), an average of four liquid batch releases occurred annually from Palisades. During this 5-year period, there were no unplanned or uncontrolled liquid releases to the environment. Liquid effluents were reported in the *Palisades Annual Radioactive Effluent Release and Waste Disposal Reports* for the years 2000 through 2004 (NMC 2001, 2002, 2003a, 2004b, 2005b). Over this period, liquid effluents containing fission and activation products[(a)] and tritium were released into Lake Michigan. An annual average of 1.18×10^{-3} Ci of fission and activation products and 202 Ci of tritium were discharged with an average diluted concentration of 8.78×10^{-15} Ci/L for fission and activation products and 1.58×10^{-9} Ci/L for tritium (NMC 2001, 2002, 2003a, 2004b, 2005b). The maximum amount released in any one year during the 5-year period was 2.12×10^{-3} Ci for fission and activation products and 342 Ci for tritium. The releases and the average diluted concentrations were well below NRC regulatory limits. NMC does not anticipate any significant increases in liquid waste released annually during the

(a) Exclusive of tritium activity (which is given separately), activity of dissolved and entrained gases (which is generally below levels of detection), and gross alpha radioactivity (which is negligibly small).

renewal period. See Section 2.2.7 for a discussion of the theoretical doses to the maximally exposed individual (MEI) as a result of these releases.

NMC is planning to modify the liquid radioactive waste processing system at Palisades in the near future. The current system relies heavily on the evaporation of liquids containing radioactivity and management of evaporator bottoms as solid waste. This type of a system results in relatively low liquid releases to the environment; however, it is hard to maintain and is no longer used at many of the nuclear power plants in the United States. The system NMC plans to install relies on cleaning of the contaminated liquid streams through a process known as ion exchange. In this method, specially formulated resins are used to capture the contaminants from the liquid streams. Once saturated, the resins are removed from the system and are treated as solid waste. New resins are placed in the system and the cycle is repeated.

The equipment NMC plans to install is commonly used in other nuclear power plants in the United States, including the Donald C. Cook Nuclear Plant in Michigan and Nine Mile Point in New York. On the basis of experience in those plants and preliminary analyses conducted by NMC staff, it is expected that Palisades will continue to comply with all regulatory standards and will maintain the existing ODCM release limits and set points.

2.1.4.2 Gaseous Waste Processing Systems and Effluent Controls

During plant operations, gaseous wastes originate from degassing reactor coolant discharged to the chemical and volume control system, displacement of cover gases as liquids accumulate in various tanks, miscellaneous equipment vents and relief valves, and sampling operations and automatic gas analysis for hydrogen and oxygen in cover gases.

The Gaseous Radioactive Waste System in Palisades is designed to maintain gaseous effluents within limits specified in 10 CFR Part 20, Appendix B, Table 2, and to ALARA (as low as reasonably achievable). The system is divided into two sections: (1) the gas collection header, which collects low-activity gases from liquids that have been previously degassed and/or vented in other waste handling steps, and (2) the waste gas processing system, which collects gases from potentially high-activity sources. Gases collected by the gas collection header are passed through a HEPA filter to the suction side of the main vent exhaust fans, diluted by ventilation exhaust air, and discharged through a ventilation stack to the atmosphere.

The waste gas processing system collects all potentially high-activity gaseous waste. The waste gas surge tank collects and absorbs surges from the demineralizer vents, quench tank vent, primary system drain tank vent, volume control tank vent, vacuum degassifier vent, equipment drain tank, and evaporator vents. The same tank also collects vent gas from relief valves on various waste collection tanks. The waste gas surge tank discharges to one of three compressors that compress the gas for storage and decay in one or more of six waste decay

tanks. If the activities are less than or equal to 1×10^{-5} μCi/cm^3 (xenon-133), the waste gas surge tank can be discharged through a HEPA filter directly to the ventilation stack.

Gases collected in decay tanks are held in the tanks until the radioactivity is low enough for them to be discharged to the atmosphere. Gaseous effluents entering the plant's ventilation stack are continuously monitored and flow-controlled so that the previously established limits are not exceeded. The discharge is then immediately diluted by mixing airflow from one of the two continuously operating ventilation fans that transport 75,000 ft^3/min of air up the stack. If at any time a high radiation condition is detected, the flow of radioactive gases through the stack is stopped and the control room operators are alerted of the condition.

Gaseous effluents for the years 2000 through 2004 (the most recent year for which data were available) were reported in the *Palisades Annual Radioactive Effluent Release and Waste Disposal Reports* (NMC 2001, 2002, 2003a, 2004b, 2005b). During this 5-year period, there were no unplanned or uncontrolled gaseous releases to the environment; Palisades did, however, release measurable concentrations of fission and activation gases, radioiodine, particulate radioactivity, and tritium in gaseous effluents to the atmosphere. The average annual effluent releases over this 5-year period were 28.9 Ci of fission and activation gases, 1.93×10^{-3} Ci of iodine-131, 2.65×10^{-4} Ci of particulates, and 37.7 Ci of tritium. The maximum amount released in any one year during this 5-year period was 65 Ci for fission and activation gases, 3.49×10^{-3} Ci for iodine-131, 9.62×10^{-4} for particulates, and 99.2 Ci for tritium. NMC does not anticipate any significant increases in the radioactive gaseous releases during the renewal period. As discussed in Section 2.2.7, the estimated doses to the MEI as a result of these releases is a small fraction of applicable dose limits.

2.1.4.3 Solid Waste Processing

Solid wastes from Palisades include filter sludge, spent resin, radioactive tools and equipment, and miscellaneous trash from plant operations and laboratory, maintenance, and cleanup operations. The solid wastes are collected, processed, and temporarily stored onsite before being shipped offsite for disposal or further processing and disposal by an authorized third party. Radiation levels of shipped containers are maintained within the standards set forth by the NRC and the U.S. Department of Transportation (DOT) (NMC 2003b).

The Solid Radioactive Waste System consists of those systems and components that are used to process and package wet and dry solid waste so that the waste is suitable for transport and disposal. The system is not used for spent fuel storage and shipment. The spent fuel from the plant is currently stored in the spent fuel storage pool and two dry storage areas onsite. High-activity reactor wastes other than the spent fuel are stored in the fuel storage pool to allow radioactive decay, then packaged and transferred in approved shipping containers for offsite burial. Maintenance waste, such as contaminated clothing and tools, is packed in suitable

DOT-approved containers and may be stored prior to shipment. Process waste, such as filter sludges and spent resins, is collected in tanks, processed, and stored prior to shipment.

Dry active waste (DAW), generated as a result of operation and maintenance activities, is collected throughout the radiologically controlled areas of the facility. Typical DAW includes air filters, cleaning rags, protective tape, paper and plastic coverings, discarded contaminated clothing, tools, equipment parts, and solid laboratory wastes. Most DAW has relatively low radioactive content and may be handled manually. The DAW is normally stored in various work areas and then moved to the process area.

Liquid radwaste concentrates (evaporator bottoms) are volume reduced to a dry powder, mixed with a binding agent, and discharged directly into a burial container. Wet solid radioactive waste results from the processing of spent demineralizer resins (both bead and powdered) and spent filter material from the equipment drain, floor drain subsystems, and water cleanup systems. The wet waste is solidified, dried, or dewatered for acceptability for a disposal site. If storage is required for any of these types of waste, the containers of waste may be temporarily stored onsite.

Transportation and disposal of solid radioactive wastes are performed in accordance with the applicable requirements of 10 CFR Part 71 and 10 CFR Part 61, respectively. No releases to the environment occur from solid radioactive wastes generated at Palisades. During the period 2000 through 2004, Palisades made an average of 16 shipments of solid radioactive waste each year, with an average volume for spent resins, filter sludges, evaporator bottoms, contaminated equipment, and other sources of 1561 ft^3, and an average activity of 1740 Ci (NMC 2001, 2002, 2003a, 2004b, 2005b; NMC 2005e).

The maximum volume of waste shipped offsite in any one year during this 5-year period was 2285 ft^3 in 2001. In terms of activity, the maximum amount shipped in any one year was 8554 Ci in 2000. The planned modification to the liquid waste processing system at Palisades (see Section 2.1.4.1) is not expected to significantly change the generation of solid waste and offsite shipments of such waste from the plant.

2.1.5 Nonradioactive Waste Systems

The principal nonradioactive effluents from Palisades consist of chemical and biocide wastes, lubrication oil waste, resin regeneration waste, Freon™ filters, and sanitary waste. Palisades stopped using chlorinated solvents and oils several years ago. The chemistry laboratory may generate small quantities of expired chemicals. Other wastes could include laboratory packs and mercury switches. Spent batteries and discarded fluorescent lights are recycled. Sanitary waste is sent to two onsite septic tanks. The tanks are sampled twice a year and emptied quarterly. Thus far, no radioactive contamination has been detected in the tanks. Depending

on the usage and the number of workers onsite during outages, they may be emptied more frequently. The sewage removed from the tanks is taken to a local sewage treatment plant and treated there, along with regular city sewage.

2.1.6 Plant Operation and Maintenance

Routine maintenance performed on plant systems and components is necessary for the safe and reliable operation of a nuclear power plant. Maintenance activities conducted at Palisades include inspection, testing, and surveillance to maintain the current licensing basis of the plant and to ensure compliance with environmental and safety requirements. Certain activities can be performed while the reactor is operating. Others require that the plant be shut down. Long-term outages are scheduled for refueling and for certain types of repairs or maintenance, such as the replacement of a major component. Palisades is refueled on an 18-month schedule.

As part of the License Renewal Application (Application), NMC conducted an aging management review to manage the impacts of aging on systems, structures, and components in accordance with 10 CFR Part 54. Appendix A of the Application provides the information to be submitted in a FSAR Supplement as required by 10 CFR 54.21(d) for Palisades. The Application contains the technical information required by 10 CFR Part 54. Section 4 of the Application documents the evaluations of time-limited aging analyses (TLAAs) for the period of extended operation. Appendix B of the Application provides descriptions of the programs and activities that will manage the impacts of aging for the period of extended operation. These summary descriptions of aging management program activities and TLAAs will be incorporated into the FSAR for Palisades following the issuance of the renewed OL. NMC expects to conduct the activities related to the management of aging impacts during plant operation or normal refueling and other outages, but does not plan any outages specifically for the purpose of refurbishment.

2.1.7 Power Transmission System

Transmission corridors considered in scope for license renewal are those constructed specifically to connect the facility to the transmission system (10 CFR 51.53(c)(3)(ii)(H)). The Final Environmental Statement (FES) for Palisades (AEC 1972) described two transmission lines that connected Palisades with the transmission system. Both lines were constructed in 1969 and have steel lattice support structures anchored to concrete footings (AEC 1972). The initial 0.6-mi long Palisades-Cook 345-kV transmission line (referred to as the Palisades-West Olive line in the FES (AEC 1972)) connects to the American Electric Power (AEP) system, while the 40-mi-long Palisades-Argenta 345-kV transmission line connects to the METC system and the Michigan Power Pool (NMC 2005a). The Palisades-Argenta line extends eastward to the

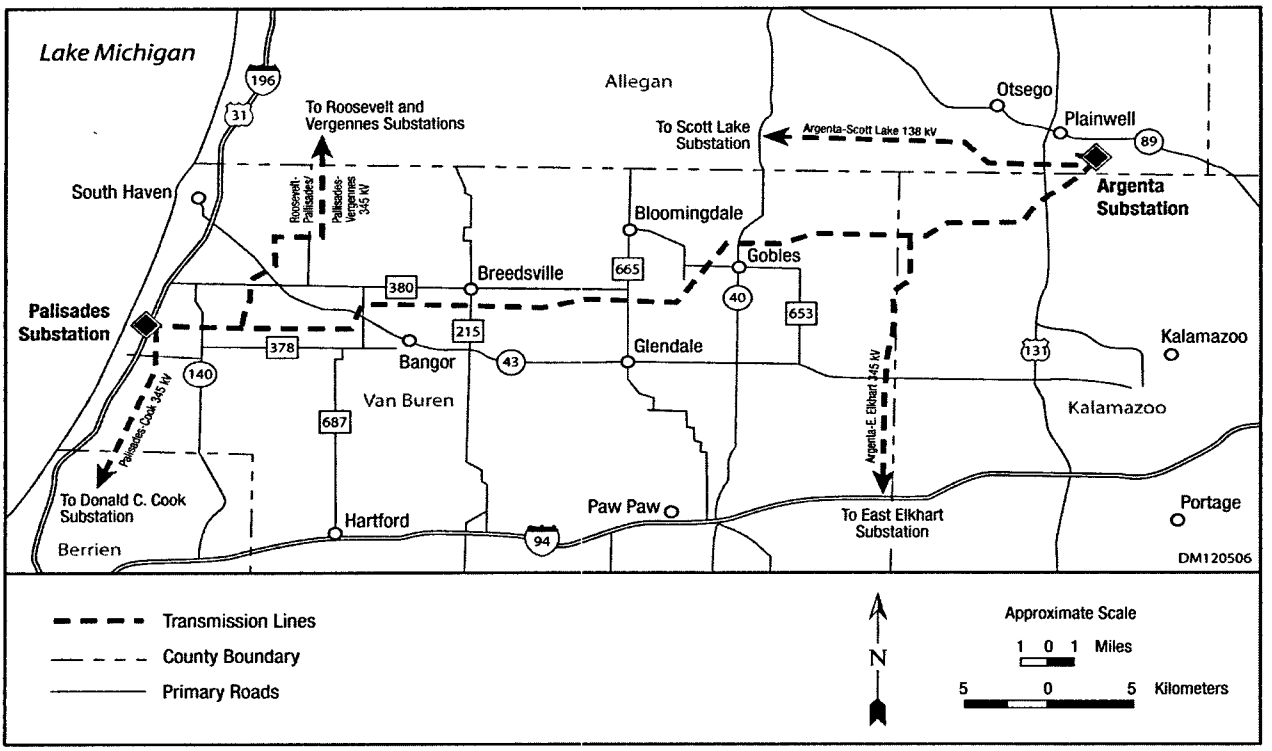

Figure 2-4. Transmission Lines

Argenta Substation near Plainwell, north of Kalamazoo (Figure 2-4). Both transmission lines have been owned by the METC since 2002, while Consumers Energy owns the land on which the transmission lines are located (NMC 2005a).

The Palisades Substation, which operates at 345-kV, is the interconnection between Palisades and the power grid system. The applicant's ER (NMC 2005a) describes changes in the way that Palisades is connected to the transmission system that have been made since the FES was published. Currently seven 345-kV circuits on four double-circuit, steel lattice support structure transmission lines extend from the Palisades Substation (Figure 2-3): Palisades-Cook #1 and #2 (Circuits 310B and 310A); Palisades-Argenta #1 and #2 (Circuits 309A and 309B); Palisades-Vergennes and Roosevelt-Palisades (Circuits 306A and 306B); and Palisades-Covert Plant (Circuit 306J) (NMC 2005a). However, only the 0.6-mi-long Palisades-Cook line and the 40-mi-long Palisades-Argenta line are considered in scope for license renewal.

Both transmission lines associated with Palisades were constructed in accordance with the National Electrical Safety Code (NESC) (IEEE 2002) and industry guidance in effect at that time. The transmission facilities are maintained to ensure continued compliance with current standards.

The 0.6-mi-long Palisades-Cook transmission line occurs on land similar to that of the Palisades site. Its construction involved the clearing of a 150-ft-wide right-of-way totaling 10.9 ac over sand dunes (AEC 1972). The Palisades-Argenta transmission line right-of-way is 1320 ft wide for the first 4.5 mi, 350 ft wide for the next 34 mi, and 471 ft wide for the final 1.5 mi, totaling 2250 ac. This line occurs mostly on flat to gently rolling terrain crossing land used primarily for agriculture, with scattered orchards and residential and commercial properties (AEC 1972).

In general, the corridors are in remote, sparsely populated areas. Where the Palisades-Argenta line crosses agricultural lands, the land typically continues to be used for agricultural purposes. Both transmission lines cross Blue Star Memorial Highway and I-196, which occur just east of Palisades. The Palisades-Argenta line also crosses a number of other State and U.S. highways. The transmission lines are near the Van Buren State Park, and the Palisades-Argenta transmission line crosses the Kal-Haven and Van Buren State Trails (NMC 2005a). The Palisades-Argenta line crosses the Kalamazoo River and several other streams (see Section 2.2.5), while the 0.6-mi-long Palisades-Cook line does not cross any streams or rivers.

The METC recognizes that transmission line rights-of-way provide ancillary compatible uses, including agriculture, wildlife habitat, recreation, and aesthetics. The METC practices a vegetation-management program that utilizes physical, chemical, and biological treatments to promote stable, diverse, low-growing plant communities in a way that promotes wildlife habitat and/or maintains current usage of the rights-of-way and reduces environmental impacts.

Semiannual visual helicopter patrols and biennial infrared inspections of the transmission lines are conducted to check for anomalies in the conductors, insulators, and support structures, as well as for encroachments into the rights-of-way (e.g., trees, buildings, or other obstructions) (NMC 2005a). Walking inspections are also conducted about every 2 years to assess the condition of trees and other vegetation. Contractors conduct vegetation maintenance about every 4 years in accordance with METC-approved maintenance plans. Right-of-way maintenance involves both selective cutting and herbicide application. Herbicide use during right-of-way maintenance is restricted to treatment of tree species, with a basal application applied to individual stems or root crowns. Such applications are normally made at 5- to 6-year intervals (METC 2001). Only those herbicides approved by the U.S. Environmental Protection Agency (EPA) are used. They are applied by a licensed contractor in accordance with label instructions (NMC 2005a). Danger trees are generally removed whenever identified, except at critical areas where they are trimmed (METC 2001).

Border and wire zone vegetation management is employed for right-of-way maintenance. The wire zone (the area beneath the conductors) is managed to promote a mix of herbaceous plants, whereas the border area is managed to promote low-growing shrubs and other

compatible vegetation. Low-growing trees and shrubs that do not interfere with the function of the transmission lines are left undisturbed. Trees that have the potential to interfere with the transmission lines, including danger trees that are outside of the 150-ft-wide right-of-way, are removed (NMC 2005a). Special consideration is given to areas where threatened and endangered species could occur in areas where maintenance activities are planned. Practices to mitigate adverse impacts on these species are reviewed and approved by the METC before maintenance activities are conducted (NMC 2005a).

2.2 Plant Interaction with the Environment

Sections 2.2.1 through 2.2.8 provide general descriptions of the environment near Palisades 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 Palisades site is located in Covert Township, Van Buren County, Michigan, on the southeastern shoreline of Lake Michigan, about 4.5 mi from South Haven, Michigan. The Palisades site is approximately 432 ac and extends approximately 1 mi inland between Lake Michigan and the Blue Star Memorial Highway and adjacent I-196. The nearest population center is the township of Covert, which is approximately 2.5 mi southeast of the Palisades site. Van Buren State Park is located immediately to the north of the Palisades site, and Van Buren Trail State Park is located northeast of the site.

The Palisades site lies on the southwest flank of the Michigan Basin within the Central Lowland physiographic province (NMC 2003b). Covert Ridge, a glacial moraine, bounds the area to the east of the site. The ridge serves as a drainage divide; the water table gradient is nearly flat with a slow westward flow toward the lake. The western part of the site is covered by large, coalescing sand dunes more than 200 ft high, while the eastern portion is characterized by scattered lower dunes with broad intervening basins, some of which contain shallow ponds. The dunes are relatively stable topographic features with occasional blowout caused by wind action. The majority of the land area is heavily wooded, with occasional wetlands.

The plant facilities are located about 2500 ft from both the northern and southern boundaries of the site. A number of buildings and other permanent structures occupy approximately 80 ac of the Palisades site. These include the power generation and administration area (20 ac), transmission corridors and switchyard (30 ac), warehouse area (7 ac), cooling towers (4 ac), and other supporting buildings and waste storage (7 ac) (DeCamp 2005).

A fence, with a locked gate under the control of plant security personnel, surrounds the plant area, and the site boundary is posted (NMC 2005a). As a result of events on September 11, 2001, NMC implemented actions to limit and/or monitor the entire beach area along the lakefront portion of the site. These actions include vehicle barriers and no trespassing signs at the north and south site boundaries. The U.S. Coast Guard has established a security zone extending along the lakeshore frontage of the site 1000 yds out into Lake Michigan, effectively prohibiting access without prior authorization (NMC 2005a).

In addition, Section 307(c)(3)(A) of the Coastal Zone Management Act (CZMA) (Section 1456(c)(3)(A) of Title 16 to the *United States Code*, (16 USC 1456(c)(3)(A))) requires that applicants for Federal licenses certify that the proposed coastal zone activity is consistent with the enforceable policies of the State's coastal management program (NRC 2004). A copy of the certification is also to be provided to the State. The State is to notify the Federal agency whether the State concurs with or objects to the applicant's certification. This notification is to occur within 6 months of the State's receipt of the certification. Palisades is within Michigan's coastal zone for purposes of the Act. Following submission of the NMC certification of consistency, the Michigan Department of Environmental Quality (MDEQ) determined that renewal of the OLs for Palisades would be consistent with the Michigan Coastal Management Program (NMC 2005a; Attachment D).

2.2.2 Water Use

Palisades lies on the southeastern shore of Lake Michigan, the only Great Lake that lies entirely within the boundaries of the United States. Lake Michigan is the second largest of the Great Lakes by volume at 1.3×10^{15} gal and third largest by area at 22,300 mi^2. It drains an area of 45,600 mi^2 (Fuller, Shear, and Witting 1995). Major tributaries of Lake Michigan include the Fox-Wolf, Grand, St. Joseph, Menominee, and Kalamazoo rivers. Lake Michigan is joined to Lake Huron at the Straits of Mackinac; thus, the two basins are hydrologically connected.

The northern part of the Lake Michigan watershed is forested and sparsely populated, except for the Fox River Valley, which drains into Green Bay. The southern part of Lake Michigan is among the most urbanized areas in the Great Lakes region, containing both the Milwaukee and Chicago metropolitan areas.

Lake Michigan provides safe drinking water for 10 million people, wildlife habitat, food production and processing, an active sport and sustenance fishery, and other valuable commercial and recreational activities (EPA 2000). However, threats to the ecosystem of the lake and its basin persist.

As described in Section 2.1.3, water usage at Palisades includes Lake Michigan water by the SWS and the CWS. In addition, the facility receives municipal water from the South Haven Municipal Water Authority. Average water use by the Palisades Domestic Water Distribution System is approximately 18,000 gpd (Consumers Energy 2003). This system provides Palisades with water for potable, sanitary, emergency showers, eyewash stations, and other uses. Average daily plant usage represents 1.1 percent of the South Haven Municipal Water Authority's average daily demand and 0.45 percent of its permitted capacity (NMC 2005a). NMC does not expect any significant change in water usage during the license renewal term. The South Haven Water Authority has an excess capacity of 0.77 million gpd.

A water intake was constructed in 2002 offshore from Van Buren State Park, approximately 1 mi north of the Palisades facility. The purpose of this intake is to provide water to the Covert Generating Plant, a 1170-MW, combined-cycle, natural-gas-fired power plant that shares a transmission line with Palisades (Mulcahy 2002). The Covert plant is located about 1 mi east of Palisades (Figure 2-2). Water usage from the Covert plant has been approximately 8 million gpd (Prein & Newhof 2004). The intake is designed as infiltration beds, comprised of slotted pipe on the lake bottom, and surrounded by gravel and sand that allow infiltration while keeping lake sand out of the pipes (Prein & Newhof 2004). Each infiltration bed has a capacity of 10 million gpd (Prein & Newhof 2004), and the system may be expanded.[a]

From the inception of the water intake structure as a source of water for the gas plant's cooling needs, planners realized its potential as a possible future supply point for municipal water (PG&E 2001; City of South Haven 2005; Mulcahy 2002).

South Haven's water needs are anticipated to outgrow its capacity (City of South Haven 2005). South Haven's water system has been operating at 80 to 90 percent of its capacity, and additional development is anticipated, according to a water filtration plant representative.[a] The district engineer for the MDEQ estimates that in 3 to 5 years, a water treatment plant will be completed, relying on the intake for use in an expanded municipal water system.[b] The water treatment plant would be built on land provided by the Covert Generating Plant (City of South Haven 2005).[b] As with the existing South Haven water supply system, sampling and monitoring of an additional intake and treatment plant would be regulated by the State of Michigan.

(a) Personal communication from R. Packard, South Haven Michigan Water Filtration Plant, to J. Quinn, Argonne National Laboratory, Argonne, Illinois. Subject: "Municipal Water System." (September 16, 2005).

(b) Personal communication from W. Chooi, District Engineer, Michigan Department of Environmental Quality, to J. Quinn, Argonne National Laboratory, Argonne, Illinois. Subject: "Lake Michigan Water Intake at Covert." (September 16, 2005).

Most of the domestic water is disposed of as sanitary wastewater, which is collected by the Palisades septic system. This system collects the raw sanitary wastewater in holding tanks where solids settle out. Effluent from the tanks flows to three sanitary drain fields, one located between the north cooling tower and the power block, one located east of Warehouse No. 2, and one located north of the Outage Building (Figure 2-3). Wastewater is treated and disposed of by infiltration at the drain fields; solids are periodically removed from the holding tanks and disposed of at a licensed wastewater treatment facility by a commercial vendor (Consumers Energy 1998).

Palisades has three operating groundwater wells to supply water for grounds maintenance and other miscellaneous uses. Their combined pumping capacity is 24 gpm.

2.2.3 Water Quality

The water quality of Lake Michigan has been degraded by industrial, municipal, agricultural, navigational, and recreational water users for more than 150 years. Water quality is diminished near urban areas, mostly due to sewer overflows, direct storm water runoff, and industrial discharges. Sources of pollutants throughout the basin include atmospheric deposition, release from contaminated groundwater and sediments, point source discharges, and nonpoint source runoff.

The health of aquatic organisms is continually affected by the presence of toxic pollutants (e.g., mercury and polychlorinated biphenyls [PCBs]). Fish consumption advisories and beach closings adversely affect the beneficial uses of the lake. Non-native species continue to disrupt native plant and animal communities. Purple loosestrife (*Lythrum salicaria*) is still largely uncontrolled despite numerous eradication attempts (EPA 2000). Algal species abundance and type can vary greatly within the lake and can be altered by excessive predation by uncontrolled exotic species and competition with nonindigenous algae (EPA 2000). Increased salinity and other environmental changes may also support adaptation of non-native species.

The United States and Canada, in consultation with State and Provincial governments, are working to "...restore and maintain the chemical, physical, and biological integrity of the water of the Great Lakes Basin Ecosystem" under the provisions of the Great Lakes Water Quality Agreement, signed in 1972 and amended in 1987 (EPA 2000).

As part of this effort, the Lake Michigan Technical Committee developed a Lake Michigan Lakewide Management Plan (EPA 2000) that describes the current state of lake habitats (e.g., open waters, wetlands, and tributary streams), identifies areas of concern, and recommends future steps that should be taken to protect and restore Lake Michigan ecosystems. These recommendations range from controls on ballast water to remediation of

contaminated sediment sites, to implementation of Total Maximum Daily Load strategies for tributary streams. The Lake Michigan Lakewide Management Plan lists a number of areas in which improvements have been made (e.g., reduction of point-source pollutants entering the basin and protection and restoration of wetlands) but notes other areas still needing improvement (e.g., deposition of toxic air pollutants in the watershed and nonpoint-source pollutants).

Consumers Energy Company's Palisades Nuclear Plant is authorized to discharge water to Lake Michigan under an NPDES permit administered by the MDEQ. As described in the current NPDES permit (MDEQ 2004), Palisades has one outfall, Outfall 001, and three monitoring points: 001A, 001D, and 001F.

At monitoring point 001A, the discharge is a combination of noncontact cooling water, cooling-tower blowdown, and the miscellaneous treated low-volume wastewaters from monitoring points 001D and 001F, which may include steam generator blowdown, demineralization backwash, regeneration waste, reverse osmosis filter backwash, turbine sump drainage, floor drainage, laboratory waste, and radwaste wastewater. Water from the three monitoring points discharges to Lake Michigan through five pipes at Outfall 001. The NPDES permit for Palisades (MDEQ 2004) describes the limits for discharges at monitoring point 001A. The daily limit for TRO is 38 µg/L for continuous discharge (greater than 160 min/day) and 200 µg/L for intermittent discharge (less than or equal to 160 min/day). During bromine use, the discharge must be less than or equal to 120 min/day, and the TRO daily limit is 50 µg/L. The heat addition limit is 2.1×10^9 Btu/hr. The pH should range between 6.5 and 9.0. Flow and TRO discharge time are to be recorded daily, and outfall observations are to be made 5 times per day.

Monitoring point 001D is radwaste wastewater, up to 0.1 million gpd. The flow and total suspended solids (TSS) are monitored at this point, with a grab sample for TSS analysis for each batch of wastewater. TSS limits are 30 mg/L monthly and 100 mg/L daily. As discussed in Section 2.1.4.1, this radwaste wastewater must meet criteria prior to discharge at monitoring point 001D. Monitoring point 001F is turbine sump water, also up to 0.1 million gpd. The flow and oil and grease content are monitored, with two grab samples per month for oil and grease analysis. Oil and grease limits are 15 mg/L monthly and 20 mg/L daily. Discharges from monitoring points 001D and 001F are monitored prior to discharge to the mixing basin, where the discharge comingles with other wastewater.

Palisades applies treatments to control microbiological organisms and the zebra mussel (*Dreissena polymorpha*) in the SWS and CWS. NMC uses approved biocides in these systems to control biofouling problems in accordance with use and discharge requirements, including provisions of the NPDES permit and special MDEQ approvals required for discharge of water treatment additives (MDEQ 2004). NMC currently is permitted by MDEQ to use chlorination,

bromination, and application of a quaternary amine formulation for biofouling control (MDEQ 2004; Consumers Energy 2003). Compliance with NPDES permit limits for discharge of these biocides and associated residuals is confirmed by monitoring.

Discharge Monitoring Reports (DMRs) include daily data on TRO discharge time, oxidants, Betz Clam-Trol CT-2 and CT-4, flow, pH, visual inspection, and dechlorination agent, all at monitoring point 001A. Oxidants and Clam-Trol are noted as "not used" on many monthly reports. Temperature data collection at monitoring point 001A began in 2005 in accordance with the new NPDES permit. The actual temperature data are not logged on the DMRs, but rather the Btu/hr data are presented, as a function of temperature and flow data. The permitted maximum for heat addition is 2.1×10^9 Btu/hr (MDEQ 2004).

Several violations of NPDES permitting requirements have been issued by the MDEQ in the last 5 years. One was a minor oily sheen and discharge to Lake Michigan on April 6, 2001. The sheen was within 2 to 5 ft of the lakeshore and was remediated with an oil boom. Another was a septic lift station pump failure on February 12, 2002, during which about 300 gal of liquid sewage (no solids) overflowed into storm drains, which drained onto beach sands (Consumers Energy 2002). According to a notification submitted to the MDEQ, the incident did not cause adverse impact to the environment or the public (Consumers Energy 2002).

EPA Region 5 manages a Web site of quarterly listings of facilities in noncompliance (EPA 2005a). In the second quarter of 2001, violations such as "report overdue," and "compliance schedule overdue" are posted for the Palisades plant, and "incomplete/deficient report" is listed for each compliance parameter. In subsequent quarters, "continuing noncompliance" notices are listed for the compliance parameters. The initial violations stem from a delinquent annual review of the Storm Water Pollution Prevention Plan (SWPPP) (NMC 2001b). The MDEQ (MDEQ 2005c) has documented that the noncompliance notices on the online database are erroneous, and the facility is in compliance.

Seven field surveys conducted from August 2000 to June 2003 provide information on the thermal characteristics of the cooling water discharged to Lake Michigan and the resulting thermal plume in the lake. The surveys include temperature measurements while the plant was operating at near-maximum power levels at a discharge flow rate of 92,500 gpm. Results of the surveys indicate that the thermal plume is much smaller than it was when Palisades had its initial once-through cooling system and that the plume is generally at the surface. The area of the plume (the 3°F isotherm) ranged seasonally from 40 to 286 ac at the lake surface and from 0 to 19 ac at a depth of 3 ft. The 3°F isotherm was seldom noted to extend at or below a depth of 5 ft. The temperature of the plant cooling-water discharge during the surveys ranged from 77 to 98°F, corresponding to approximately 25 to 34°F above the ambient lake temperature in all seasons except winter. During the winter survey, conducted March 19, 2001, the ambient lake temperature was 34°F, the discharge temperature was approximately 78°F, or 44°F above

ambient, and the plume area at the surface was approximately 76 ac. According to the NPDES permit, Palisades must make gradual changes to thermal inputs to the lake to avoid fish mortality due to cold shock during the winter months (MDEQ 2004).

The applicant monitors the septic sludge twice per year. A 1-L dip sample is taken at each sampling event, and it is analyzed through a gamma scan. Septic waste is hauled to the Benton Harbor wastewater treatment plant. Septic field effluent is not monitored.

The Palisades Storm Water Pollution Protection Plan (SWPPP) notes that the septic system has the potential to overflow and reach storm water outflow SW-4 by way of a catch basin (Consumers Energy 2003). To prevent this, an alarm system, structural curb, and backup pump have been installed. The SWPPP also notes that storm water outflow SW-6, which discharges to monitoring point 001A, includes floor drains in the Turbine Building. Therefore, the building has sediment bags or socks to collect debris and sediment, and an oil boom is installed across the mixing basin.

2.2.4 Air Quality

The Palisades site is located in the Moist Continental Climate zone, characterized by the dominance of tropical air masses in summer and polar air masses in winter and by the presence of deciduous forest that covers the Great Lakes region of the United States and Canada. Seasonal changes between summer and winter are very large, with an average seasonal temperature change of 46°F. Daily temperatures also change often. Abundant precipitation falls throughout the year but increases in the spring and summer seasons due to invading tropical air masses. Cold winters are caused by polar and arctic air masses moving south. Local precipitation occurs throughout the year, with a typical increase in rainfall in summer. Meteorological records for southwestern Michigan (i.e., the South Haven area) are generally representative of the Palisades site. The data from this area indicate that the lowest precipitation amounts for the year generally last for about a month or two, typically in February. Mean or normal monthly temperatures for southwestern Michigan range from 13.4 to 35.3°F in January to 65.5 to 77.6°F in July and August (MRCC 2005). The mean annual precipitation for the region is 35.8 in. Normal monthly precipitation ranges from 1.7 to 2.5 in. in the dry season (January to March) to 3.6 to 4.1 in. in the wet season (July to September) (NOAA 2002).

Onsite meteorological conditions at Palisades are monitored at three levels: 10, 30, and 100 m from the main meteorological tower. The tower winds (speed and direction) and temperature are measured at two levels, 10 and 30 m, including horizontal wind direction variations. Atmospheric stability is calculated from temperature differences taken from readings between the 30- and 10-m levels. Hourly data from readings recorded from both levels and annual summaries, including wind roses, can be found in the Palisades meteorological monitoring semiannual report (Consumers Energy 2005). Winds during the winter season tend to be

stronger, with mean winds at the 100-m level exceeding 9 mph, and are predominately out of the southwest. During the summer, winds are more often from the southwest and are from the north-northwest more than 20 percent of the time; in the fall, they are from the southeast to south-southeast about 19 percent of the time (Consumers Energy 2005).

Over the past 55 years, severe thunderstorms with winds exceeding 58 mph or with resulting property damage occurred on average about once per year (NOAA 2005). During the period from the middle of March to the middle of November, the daily occurrence of thunderstorms and high winds is less than once every 2 months, with a total of 103 thunderstorm and wind damage reports filed for Van Buren County from January 1, 1950, to May 31, 2005. Through the last half of the last century to the present, 1950 to 2005, a total of 16 tornadoes touched down in Van Buren County (NOAA 2005). The majority of these (13 strikes) produced slight or moderate property damage, less than $25,000 and less than $250,000, respectively. These storm events were categorized in the low-to-moderate intensity range of the Fujita Tornado Scale, that is, F-0, F-1, and F-2 category tornados.[a] Three F-3 tornado strikes, two that occurred on March 3, 1956, and one on May 13, 1980, caused a total of 21 injures and produced major property damage totaling approximately $2.5 million for each storm (NOAA 2005). On the basis of statistics for the 30 years from 1954 through 1983 (NRC 2005), the probability of a tornado striking a point in a 1 degree latitude-longitude square at the site is expected to be about 7 to 8 $\times$ 10^{-4} per year.

Wind resources are expressed in terms of wind power classes, ranging from Class 1 to Class 7 (Elliott et al. 1986). Each class represents a range of mean wind power density or approximate mean wind speed at specified heights above the ground. The wind energy resource for most of the Lake Michigan shoreline region in the State of Michigan, including Van Buren County, has good wind power potential The annual average wind power for this part of the State is rated Class 4 (Elliot et al. 1986). Areas designated Class 3 or greater are suitable for most wind energy applications, whereas Class 2 areas are marginal, and Class 1 areas are generally not wind power suitable.[b]

Air quality in a given area is a function of the air pollutant emissions (type of pollutant; rate, frequency, and duration; and exit conditions and location of release), atmospheric conditions (climate and meteorology), the area itself (size of airshed and topography of the area), and the pollutants transported from outside the area. Air quality within a 31-mi radius of Palisades is

(a) Tornado wind speeds for the F-0 to F-4 categories are in the following ranges: F-0: 40 to 72 mph; F-1: 73 to 110 mph; F-2: 111 to 157 mph; F-3: 158 to 206 mph; and F-4: 207 to 260 mph (Fujita 1987).

(b) Wind power densities ranging from 0 to 100 W/m^2 at 10 m (above ground) and 0 to 200 W/m^2 at 50 m (NREL 2005).

generally considered good, with the exception of areas within 16 mi of designated ozone nonattainment areas (EPA 2005b). Localized sources of emissions include man-made sources of commercial, residential, and transportation-related emissions. Natural sources of windblown dust contribute to temporary increases in air pollution.

The MDEQ is responsible for air quality in six Air Quality Control Regions (AQCRs) within the State of Michigan. Palisades is located in Van Buren County, Michigan, and is within AQCR 82 located in the southwestern corner of the State. AQCR 82 includes two other counties, Berrien and Cass, just south of Van Buren. This region, with the exception of the 8-hour ozone standard, is designated as being in attainment or unclassifiable for all criteria pollutants (40 CFR 81.333). The AQCR 82 is designated as the Kalamazoo-Battle Creek Sub-Part 1 (of the Clean Air Act) 8-hour nonattainment area for ozone. No Prevention of Significant Deterioration Class I areas are located within 62 mi of Palisades.

Two emergency diesel generators serve the Palisades plant. The two small generators are identical and are rated at a nominal capacity of approximately 2350 kilowatts electric (kW(e)). The diesels are used for emergency backup power and provide a standby source of electric power for equipment required for mitigation of the consequences of an accident, for safe shutdown, and for maintenance of the station in a safe condition under postulated event and accident scenarios (NMC 2005d). The diesel generators are tested once a month for 1,- 2-, 3-, and 4-hour test burn durations. Maintenance tests for each generator (e.g., to replace pumps and test for leaks) last 24 hours and are run as needed. Twenty-four hour endurance runs are performed on a staggered test schedule, once every 18 months.

Under the air pollution rules and regulations of the MDEQ, Part 2, R 336.1212, insignificant activities exemptions, emergency diesel generators meeting certain operating criteria are exempt from State operating permit requirements. The rules define emergency power generating units as stationary internal combustion engines that operate as a mechanical or electrical power source only when the usual supply of power is unavailable. These sources are provided a permit exemption if their annual emissions are less than significance levels as defined in R 336.1119. This would apply to operations during emergency situations, routine maintenance, and routine exercising (e.g., test firing the engine for 1 hour a week to ensure reliability). Since all of the emergency diesel generators at Palisades operate for a small number of test hours per year, emissions from these sources are not regulated under Michigan's Permit Operating Program. In addition to the emergency diesel generators, Palisades has three No. 2 diesel oil-fired boilers that are used for evaporator heating, plant space heating, and feedwater purification. Two units are rated at 6.8 MW/hr and the third at 7.4 MW/hr. All three units are permitted to operate under Michigan's Air Pollution Control Rule 336.1210(1) (MDEQ 2003).

There are no mandatory Federal Class 1 areas within 100 mi of the Palisades site in which visibility is an important value as designated in 40 CFR Part 81.

2.2.5 Aquatic Resources

Palisades is located on the southeastern shoreline of Lake Michigan, which is the source and receiving body for the plant's cooling system. The 40-mi-long Palisades-Argenta 345-kV transmission line associated with Palisades crosses several streams, including the South Branch of the Black River, Extension Drain, Veley Drain (a Clear Lake tributary), Pine Creek (a tributary to the Kalamazoo River), and the Kalamazoo River (NMC 2005a). No streams are crossed by the 0.6-mi-long Palisades-Cook transmission line. Transmission line right-of-way maintenance activities in the vicinity of stream and river crossings include procedures to minimize erosion and shoreline disturbance while encouraging vegetative cover. In addition, aerial application of herbicides is restricted from riparian areas (NRC 1978).

Water depths in the southeastern portion of Lake Michigan are up to 10 ft within 500 ft of the shore and up to 50 ft at 1 mi offshore. Lake substrates range from coarse and very coarse sand in the surf zone, medium sand at the 5-ft-depth zone, and fine sand in deeper waters (NMC 2005a). Open-lake temperatures range from 35°F in January and February to about 75°F in mid-August. Temperatures near the Palisades intake range from a monthly minimum of about 34°F in January to a monthly maximum of about 70°F in August, with a daily minimum and maximum of about 33°F and 80°F, respectively (NMC 2005a). In the Palisades area, the lake is thermally stratified in summer but is generally isothermic in early winter and early spring. Inshore waters may be substantially warmer than offshore waters in early winter, while being colder in early spring. These conditions limit mixing of inshore and offshore waters during these periods. Intermittent ice cover extends 1 to 2 mi offshore during winter (NMC 2005a; AEC 1972).

Lake Michigan is used for a variety of purposes, including navigation, recreation, tourism, and conservation. The major changes and modifications that have had the greatest impact on aquatic resources of Lake Michigan include (1) industrial, urban, and residential developments on the lakefront; (2) water quality impairment from industrial, municipal, agricultural, navigational, and recreational water uses; (3) overfishing; and (4) invasion of exotic species (EPA 2004). Overall, the status of Lake Michigan habitats, including open water, wetlands, coastal shore, and tributaries, is considered "mixed" to "deteriorating" (EPA 2004). Dams, agricultural and urban development activities, drainage and filling of wetlands, and invasive species have adversely affected the aquatic resources of the tributary streams to Lake Michigan (e.g., the Kalamazoo River) (Wesley 2005).

Contamination is emerging as an important concern in fish in Lake Michigan and its tributary streams (EPA 2004). Some fish cannot be sold commercially because of high levels of PCBs, mercury, or other substances (Fuller, Shear, and Witting 1995). The State of Michigan has published advisories governing the consumption of fish from these water bodies. Within the southeastern portion of Lake Michigan, there are advisories for brown trout (*Salmo trutta*), lake trout (*Salvelinus namaycush*), rainbow trout (*Oncorhynchus mykiss*), chinook salmon (*O. tshawytscha*), coho salmon (*O. kisutch*), common carp (*Cyprinus carpio*), channel catfish (*Ictalurus punctatus*), rainbow smelt (*Osmerus mordax*), lake sturgeon (*Acipenser fulvescens*), walleye (*Sander vitreus*), lake whitefish (*Coregonus clupeaformis*), and yellow perch (*Perca flavescens*). PCB advisories have also been issued for common carp, northern pike (*Esox lucius*), and white sucker (*Catostomus commersoni*) in the Black River, and for all fish species for some portions of the Kalamazoo River (MDCH 2003).

Despite the modifications and multiple competing uses of Lake Michigan, the overall fish community is fairly diverse. Almost 100 species of fish occur in Lake Michigan (UWSGI 2001a). Lake Michigan supports commercial, recreational, and Tribal fishing. Commercial and Tribal production totals more than 14.6 million lb of fish annually (EPA 2004). Lake whitefish is the primary commercial species, while both lake whitefish and lake trout comprise the Tribal fisheries (Stein et al. 2003). Some commercial fishing also targets bloater (*Coregonus hoyi*) and rainbow smelt (Madenjian et al. 2004). Sport fishing within the southeastern portion of Lake Michigan is for lake trout, rainbow trout or steelhead (the migratory form of rainbow trout), brown trout, coho salmon, chinook salmon, northern pike, smallmouth bass (*Micropterus dolomieu*), various sunfish (e.g., bluegill (*Lepomis macrochirus*), pumpkinseed (*L. gibbosus*), and rock bass (*Ambloplites rupestris*)), yellow perch, and walleye (MDNR 2005d; IDNR 2005). Important forage species in Lake Michigan include alewife (*Alosa pseudoharengus*), bloater, rainbow smelt, and deepwater sculpin (*Myoxocephalus thompsoni*) (Madenjian et al. 2002, 2005).

Top-level predators in Lake Michigan are dominated by the introduced trout and salmon, while the native burbot (*Lota lota*) and lake trout (the original top predators in the lake) (Madenjian et al. 2004) are recovering. The lake trout is recovering mostly through stocking rather than natural reproduction. About 2.4 million yearling lake trout are stocked annually into Lake Michigan (Bronte and Schuette 2002). Reasons that self-sustaining populations of lake trout have yet to be reestablished in Lake Michigan may include loss of suitable spawning habitat, environmental contamination, predation on larval lake trout by alewife, thiamine deficiency from a diet of alewife, and a loss of genetically distinct strains (EPA 2004). About 70 percent of the Great Lakes trout and salmon fishery is dependent upon fish stocking (MDNR 2004).

Forty fish species were collected during preoperational and early years of operation at Palisades. The dominant species included alewife (the major component of the catch), rainbow

smelt, yellow perch (the most numerous garne species), spottail shiner (*Notropis hudsonius*, the most abundant minnow species), slimy sculpin (*Cottus cognatus*, which inhabits the rip-rap around the intake crib), trout-perch (*Percopsis omiscomaycus*), longnose dace (*Rhinichthys cataractae*), longnose sucker (*Catostomus catostomus*), and white sucker (NMC 2005a; NRC 1978; AEC 1972). Coho and chinook salmon, steelhead, and lake and brown trout were also collected during preoperational studies (NMC 2005a).

At least 160 species have been introduced into the Great Lakes since the early 1800s through the canal system interconnection with the Atlantic Ocean (e.g., sea lamprey (*Petromyzon marinus*), alewife, and white perch (*Morone americana*)), ship ballast (e.g., Asiatic clam (*Corbicula fluminea*), zebra mussel (*Dreissena polymorpha*), spiny water flea (*Bythotrephes cederstroemi*), and round goby (*Neogobius melanostomus*)), or as intentionally introduced species (e.g., common carp, rainbow smelt, and various salmonids) (EPA 2004; Peeters 1998). The non-native salmonids that were introduced to the Great Lakes between 1870 and 1960 include Atlantic species (Atlantic salmon (*Salmo salar*) and brown trout); Pacific species (chinook salmon, coho salmon, rainbow trout, kokanee (*Oncorhynchus nerka*), chum salmon (*O. keta*), cutthroat trout (*O. clarkii*), masu salmon (*O. masou*), and pink salmon (*O. gorbuscha*)); and Arctic species (Arctic charr (*Salvelinus alpinus*)) (Crawford 2001).

Since the mid-1970s, salmonid stocking in Lake Michigan has included the brook trout, brown trout, lake trout, rainbow trout/steelhead, chinook salmon, coho salmon, and splake (hybrid between lake trout and brook trout). Nearly 14.5 million trout and salmon are stocked annually in Lake Michigan. Atlantic salmon have not been stocked in the lake since 1989 (Bronte and Schuette 2002). Currently, the only major objective for salmonid stocking is the development and maintenance of recreational fisheries (Crawford 2001). The stocking of salmonids may have resulted in the introduction of some non-native fish diseases and parasites to the Great Lakes and caused genetic alteration of native salmonids through hybridization and introgression and/or through declines in the abundance of native salmonids. Also, stocked salmonids may present a direct threat to native and non-native forage fish and invertebrates, while placing competitive pressure upon native fish species for food and habitat resources (Crawford 2001).

The native fish species of Lake Michigan have been affected by introduced aquatic species, most notably the sea lamprey and alewife. Both species have adversely affected native fish species, including commercially and/or recreationally important species such as the cisco (*Coregonus artedi*), lake whitefish, burbot, and lake trout (Madenjian et al. 2002). Combined with overfishing, the introduction of the sea lamprey led to the extirpation of the longjaw cisco (*C. alpanae*), deepwater cisco (C. *johannae*), and blackfin cisco (*C. nigripinnis*) from Lake Michigan (Fuller and Nico 2000). Sea lamprey abundance remains higher than desired in Lake Michigan. This limits rehabilitation efforts for lake trout, despite the stocking program previously mentioned (Stein et al. 2003). Other impediments to sustainable reproduction of lake trout in Lake Michigan relate to the following: (1) the lakewide population is too low,

(2) spawning aggregations are too diffuse and in inappropriate locations, and (3) there is poor survival of early life stages (Bronte et al. 2003).

The alewife was first reported from Lake Michigan in 1949, and by 1967 it made up about 85 percent of the fish biomass of the lake (Peeters 1998). Its increase was aided by the decrease in its main predators (lake trout and burbot) caused by the sea lamprey. The population explosion of alewives led to the decline of native planktivorous fishes such as the emerald shiner (*Notropis atherinoides*), lake whitefish, cisco, and a number of coregonine species (Peeters 1998; Fuller and Nico 2000). The alewife is the most important prey species for salmonids in Lake Michigan. The alewife's estimated lakewide biomass decreased from 42,876 metric tons in 2003 to 13,721 metric tons in 2004 (Madenjian et al. 2005). Currently, there is no commercial fishery for alewives in Lake Michigan (Madenjian et al. 2004).

Alewives are easily stressed, and during peak population levels, stress can result in large die-offs in the spring. They are affected by both osmotic stress associated with life in freshwater and exposure to fluctuating water temperatures when they move to inshore waters (e.g., exposure to colder waters during an upwelling event can cause the fish to die; UWSGI 2002). Susceptibility to cold is related to inadequate fat reserves (Eshenroder et al. 1995). In spring, alewives are also in a weakened condition because of a lack of forage in the winter and by stress related to spawning (UWSGI 2001b). Adult alewives feed little, if at all, during their spawning migration (DFO 2004). Large numbers of spawning alewives can occur in nearshore waters as a result of strong year classes produced in the prior 3 or more years. Fish that become weak or die during rapid temperature change can be blown into windrows close to shore or can wash onto beaches (UWSGI 2002). Adult mortality following spawning may be as high as 40 to 60 percent (DFO 2004). Therefore, potentially large numbers of both moribund and dead alewives can be found in inshore waters during the spawning season. The alewife spawning season generally occurs from late May to early August, peaking in June and July, in the southeastern portion of the lake (Jude 1995).

The white perch preys on eggs of walleye and other species (including its own), zooplankton, macroinvertebrates, and minnows. It may compete with yellow perch, emerald shiner, and spottail shiner for food resources (Fuller 2003).

The round goby first appeared in southern Lake Michigan in 1994 (Fuller and Benson 2003). It feeds on the eggs and young of other bottom-dwelling fish species, zebra mussels, snails, soft-shelled crayfish, aquatic insects, and zooplankton. The round goby inhabits a wide variety of habitats but prefers rock, cobble, or rip-rap (Manz 1998). This is the type of habitat found around the Palisades intake. The round goby has a long spawning season (it may spawn up to six times during the breeding season) and aggressively defends its spawning area. It displaces native sculpins and darters and impacts recreationally important centrarchids (sunfish and bass) and lake trout (GLSC 2003; Marsden and Chotkowski 1995; Manz 1998; Ray and

Corkum 1997). However, to date, no lakewide changes in the abundance of any Lake Michigan species have been ascribed to the round goby invasion (Madenjian et al. 2002).

The ruffe (*Gymnocephalus cernuus*), native to Europe and Asia, was introduced to the Great Lakes in ship ballast. This species also has the potential to disrupt fish community structure within the lake through competition or modification of plankton and macroinvertebrate populations (Jude 1995).

The plankton community of Lake Michigan may be changing as a result of the presence of contaminants and nutrients in the water and sediment as well as the presence of exotic species such as the zebra mussel and spiny water flea (EPA 2004). Phytoplankton abundance and production in nearshore areas have decreased since 1970, probably due to a reduction in phosphorus loading (Madenjian et al. 2002). Phytoplankton in southeastern Lake Michigan is dominated by diatoms, while green algae and blue-green algae were not found to be abundant near Palisades (AEC 1972; NRC 1978). Periphyton (attached algae) and rooted aquatic plant growth is limited in the Palisades area because of shifting sandy-gravel substrates (NRC 1978; NMC 2005a). The water intake structure and other underwater components provide artificial habitats for periphyton.

The zooplankton community in Lake Michigan near Palisades is abundant and fairly diverse. Copepods and cladocerans dominated the zooplankton community near Palisades (NRC 1978). Predation by the spiny water flea has caused a significant decline in three offshore *Daphnia* spp. that are a prey source for young-of-year fish (Lehman 1991). The spiny water flea population grows rapidly, partly due to its parthenogenic asexual reproduction. Its rapid population growth allows it to monopolize the zooplankton food supply, which can be detrimental to fishes such as the bloater (GLSGN 1991).

The benthic macroinvertebrate community near Palisades was dominated by *Diporeia* spp. (formerly known as *Pontoporeia* spp., an amphipod), chironomids (midges), aquatic worms, and fingernail clams (NRC 1978; NMC 2005a). Nearshore benthic macroinvertebrate communities have been altered dramatically since the 1960s because of a reduction in phosphorus and other nutrient loads and the establishment of the zebra mussel (Madenjian et al. 2002).

The zebra mussel was first discovered in Lake Michigan in 1988. Its impacts fall into three main categories: (1) biofouling, (2) filter feeding, and (3) nutrient dynamics (Garton 2002). The zebra mussel has impacted aquatic communities by consuming zooplankton and phytoplankton (fundamentally altering the foodchain) and by displacing native mussels (Garton 2002; Madenjian et al. 2002). Zebra mussels have eliminated native mussels from some areas of the Great Lakes and can exclude gastropods (snails) and net-spinning caddisflies from hard substrates through competition for food and space (Stewart et al. 1998a). However, they consistently cause increases in the total macroinvertebrate biomass and densities of

hydrozoans, flatworms, and amphipods on hard benthic substrates because their shells enhance surface area, substrate heterogeneity, and accumulation of benthic organic matter (Horvath et al. 1999; Stewart et al. 1998a).

It is suspected that the lakewide population decline of *Diporeia* spp. is linked to the introduction of the zebra mussel, which has severely limited the food available to *Diporeia* spp. (EPA 2004). Declines of *Diporeia* spp. might be the cause of decline in the abundance of lake whitefish and slimy sculpin (Madenjian et al. 2004; Stein et al. 2003) and decline in alewife condition (Madenjian et al. 2002). Reduced biomass of phytoplankton, zooplankton, and *Diporeia* spp. caused by zebra mussels may adversely affect rainbow smelt and young salmonids, which in turn would affect predators of these fishes. However, freshwater drum (*Aplodinotus grunniens*), rock bass, yellow perch, and other benthivorous fish species consume large numbers of gammarid amphipods, crayfish, zebra mussels, and other benthic macroinvertebrates that have increased in abundance (Stewart et al. 1998a, 1998b).

The zebra mussel is cold-tolerant and is considered a potential serious biofouling problem at power plants. Zebra mussels can accumulate on the inside of intake tunnels; intake cribs; and screenhouse walls, floors, and trash racks. Large piles of zebra mussels that slough off from other areas can accumulate on screenhouse floors in areas of low flow and against out-of-service traveling screens. Approved biocides are used, in accordance with NPDES permit requirements (MDEQ 2004), to control zebra mussels (Consumers Energy 2003; NMC 2005a).

The amphipod *Echinogammarus ischnus* and the quagga mussel (*Dreissena bugensis*), a species similar to the zebra mussel, have recently been reported in Lake Michigan. Both species will likely contribute to further food-web modifications in the lake. The quagga mussel may further decrease the abundance of *Diporeia* spp. in offshore areas, while *E. ischnus* may become an important food item for many fish species (Nalepa et al. 2001).

No Federally listed threatened, endangered, proposed, or candidate aquatic species occur in Lake Michigan in the vicinity of Palisades. In addition, no Federally listed aquatic species are listed for Allegan, Kalamazoo, and Van Buren Counties within which the Palisades-Argenta transmission line occurs (FWS 2005a; MNFI 2005a,b). Also, no designated critical habitat for aquatic species occurs in the site vicinity. State-listed aquatic species that have the potential to occur in the vicinity of Palisades and its associated transmission lines are presented in Table 2-1.

2.2.6 Terrestrial Resources

The Palisades site is located in the glacial plain of Lake Michigan, where sand dunes up to 200 ft high occur in a band along the lakeshore, and generally flat to gently rolling glacial

features occur eastward (NMC 2005a). Forests dominated by American beech (*Fagus grandifolia*), sugar maple (*Acer saccharum*), and eastern hemlock (*Tsuga canadensis*) made up much of the original vegetation of the region (MNFI 2005c); however, timber harvest, sand mining, and drainage of wetlands have greatly altered the landscape (NMC 2005c). Most of the land in the region is now devoted to agriculture, including blueberry farming on poorly drained sites and orchards and vineyards on better drained soils (NMC 2005a).

The entire Palisades site is protected under the CZMA and Michigan's Coastal Zone Management Program (MDEQ 2005a). About 80,000 ac of Lake Michigan sand dunes in Michigan, including those within the Palisades site, are classified and protected as Critical Dune Areas under authority of Michigan's Natural Resources and Environmental Protection Act, Part 353 (MDEQ 2005b). Development activities in designated critical dune areas, including those on the site, require an environmental impact assessment and permit from MDEQ (MDEQ 2005b).

Table 2-1. State-Listed Aquatic Species Potentially Occurring in the Vicinity of Palisades and Associated Transmission Lines

Scientific Name	Common Name	Michigan Status[a]	County[a]	Habitat
Plants				
Lemna valdiviana	pale duckweed	X	K, V	Ponds, marshes
Insects				
Stenelmis douglasensis	Douglas stenelmis riffle beetle	SC	K	On wood in lakes, streams, and rivers
Mussels and Snails				
Alasmidonta viridis	slippershell mussel	SC	A	Small to medium lakes; small tributaries to large rivers
Cyclonaias tuberculata	purple wartyback	SC	A	Moderate gradient of medium to large rivers
Funtigens nickliniana	watercress snail	SC	K	Ponds, small lakes, small streams
Fish				
Acipenser fulvescens	lake sturgeon	T	A	Large rivers and shallow water of large lakes
Lepisosteus oculatus	spotted gar	SC	A, K	Nearshore areas of medium to large lakes; medium to large rivers
Coregonus artedi	lake herring	T	A, K	Nearshore areas of medium to large lakes; large rivers
Hiodon tergisus	mooneye	T	A	Nearshore areas of medium to large lakes; large rivers
Erimyzon oblongus	creek chubsucker	E	A, K	Low-gradient creeks
Notropis anogenus	pugnose shiner	SC	K, V	Small to medium lakes; small tributaries to medium rivers
Notropis texanus	weed shiner	X	A, K	Sand-bottomed creeks; sloughs and large rivers

(a) A = Allegan County, E = endangered, K = Kalamazoo County, SC = special concern, T = threatened, V = Van Buren County, X = probably extirpated.

Sources: Brown 1976; Carman 2002a,b; Cummings and Mayer 1992; Eagle et al. 2005; FWS 2003; MNFI 2005a,b; Page and Burr 1991; NatureServe 2005; Scott and Crossman 1973; Smith 1979.

Developed or maintained areas occupy about 80 ac of the 432-ac Palisades site. Most (about 68 percent) of the undeveloped portions of the Palisades site are dominated by forest. The most extensive forest community type is a red oak (*Quercus rubra*), sassafras (*Sassafras albidium*), sugar maple, and American beech association. This forest is typical of many rear-dune areas along the Lake Michigan shoreline and appears to have a well-balanced, all-age structure (NMC 2005a). A portion of this community near the southern site boundary is recognized as important habitat by the Michigan Natural Features Inventory (MNFI) (Higman and Goff 1991; Goff 1992). Most of the remaining forest on the site is a second-growth community dominated by red oak, white ash (*Fraxinus americana*), sassafras, and sugar maple.

Early successional plant communities on the Palisades site include old-field and upland scrub-shrub, which occupy portions of transmission line rights-of-way, abandoned railroad bed, disturbed sites around buildings, forest openings, borders of forested areas, and dune blowouts (NMC 2005a). These communities occupy about 10 percent of the site.

Portions of steep dunes and flats at the base of dunes that are on or adjacent to developed areas have been stabilized with plantings of beach grass (*Ammophila breviligulata*) and dune grass (*Calamovilfa longifolia*) or are stabilized by natural colonization of these species (NMC 2005a). These areas occupy about 10 percent of the site. Sand dune blowouts (4 percent of the site) occur where wind action has disturbed established vegetation and resulted in dune destabilization. About 3 percent of the site is open sand (beach and other unvegetated flat areas).

Wetland communities occupy a total of about 9 ac (2 percent of the site area) but are generally small and widely scattered (NMC 2005a). The largest wetland on site is located just north of the Palisades Substation and is a seasonally inundated wetland dominated by black gum (*Nyssa sylvatica*), willow (*Salix* spp.), and reedgrass (*Calamogrostis* spp.). Similar small wetlands occur in the transmission right-of-way on the eastern border of the site, and a small forested wetland dominated by black gum is located north of the Outage Building sanitary waste drainfield.

Approximately 5 ac of vegetation (1 percent of the site) on dune ridges adjacent to and southeast of the cooling towers have been affected by condensate plumes and drift (NMC 2005a). Drift from operation of the two mechanical draft cooling towers has resulted in the replacement of the original mature trees with an early succession dense scrub-shrub community. Some standing dead trees remain from the original forest. Rochow (1978a) described the sequence of vegetation change in drift-impacted areas at Palisades. Three to four months after cooling tower start-up, white pines began to show signs of chemically induced injury in areas up to 295 ft from the towers. Deciduous trees began showing visible signs of injury during the second summer of operation. High deposition rates of sulfate were considered responsible for this damage (Rochow 1978a and 1978b). Severe icing of vegetation in the

winter of 1976 to 1977 resulted in extensive damage of trees, and by the third summer of operations, the forest canopy had been nearly eliminated in the most severely impacted areas.

Site surveys have documented a variety of terrestrial vertebrates on the site, including 4 amphibian, 3 reptile, 113 bird, and 14 mammal species. Amphibians include northern leopard frog (*Rana pipiens*), spring peeper (*Pseudacris crucifer*), American toad (*Bufo americanus*), and red-backed salamander (*Plethodon cinereus*). Reptiles on the site include the eastern box turtle (*Terrapene carolina*), eastern hognose snake (*Heterodon platyrhinos*), and blue racer (*Coluber constrictor*). Birds on the site include killdeer (*Charadrius vociferus*), ring-billed gull (*Larus delawarensis*), northern flicker (*Colaptes auratus*), blue jay (*Cyanocitta cristata*), black-capped chickadee (*Poecile atricapillus*), gray catbird (*Dumetella carolinensis*), American robin (*Turdus migratorius*), red-winged blackbird (*Agelaius phoeniceus*), American goldfinch (*Carduelis tristis*), and eastern towhee (*Pipilo erythrophthalmus*). Mammals on the site include white-tailed deer (*Odocoileus virginianus*), eastern cottontail (*Sylvilagus floridanus*), raccoon (*Procyon lotor*), red fox (*Vulpes vulpes*), white-footed mouse (*Peromyscus leucopus*), eastern chipmunk (*Tamias striatus*), and thirteen-lined ground squirrel (*Spermophilus tridecemlineatus*).

The landscape crossed by the Palisades-Cook transmission line and the western portion of the Palisades-Argenta line is similar to that of the Palisades site; however, the eastern portion of the Palisades-Argenta transmission line in Van Buren County crosses an area with moderate to steep slopes and scattered kettle depressions that are poorly drained (NMC 2005a). Most of the original vegetation of this portion of the project area was forest dominated by American beech, sugar maple, and white oak (*Quercus alba*). However, swamp hardwoods, tamarack (*Larix laricina*), wetland shrubs, and bogs occurred in kettle depressions, and wet prairie and emergent marsh were found in other poorly drained sites (MNFI 2005c; NMC 2005a). Most of the area is now used for agriculture. In Kalamazoo County, the Palisades-Argenta line traverses a glacial outwash plain with flat to gently sloping terrain. Prior to settlement, tallgrass prairie, oak savannas, wet prairies, marshes, and extensive wet meadows were present (MNFI 2005c; NMC 2005a). Most uplands and large areas of wetland in this region have been converted to agriculture. Although prairie fens remain common in the region, tallgrass prairie, wet prairie, and oak savanna are now quite rare (NMC 2005a).

Approximately 38 percent of the land within transmission line rights-of-way associated with Palisades is classified as active agricultural land (NMC 2005a). Approximately 28 percent and 25 percent of the rights-of-way are forest (mostly hardwoods) and rangeland (mostly shrubland), respectively, and about 7 percent of the area traversed consists of urban and developed areas such as roadways.

The percent of area within Palisades rights-of-way occupied by wetland communities was estimated by the applicant as 2 percent (primarily scrub-shrub) by using State land-use data but as 18 percent by using the U.S. Fish and Wildlife Service (FWS) National Wetland Inventory

(NMC 2005a). Nearly all of these wetlands are seasonally or temporarily flooded palustrine emergent and, to a lesser extent, seasonally flooded palustrine scrub-shrub habitat. Wetlands within the corridors are generally associated with unnamed streams in the Brandywine Creek, South Branch Black River, Paw Paw River, and Kalamazoo River watersheds.

Areas of natural vegetation traversed by the lines are maintained to ensure compatibility with the line by using a vegetation-management protocol that involves periodic selective removal of woody vegetation to promote and maintain herbaceous plant communities beneath the conductors and low-growing shrubs and other compatible vegetation in the border zones. Vegetation maintenance beyond the border zone is limited to selective removal of trees that could come into contact with the line (NMC 2005a). Right-of-way maintenance activities are on an approximate 4- to 6-year schedule; although mowing is occasionally used for vegetation maintenance, selective application of registered herbicides is the preferred method of vegetation control. Compatible land uses (e.g., cropland, pastureland) are allowed to continue on the right-of-way. No access road exists along the right-of-way, and access is gained on foot and with the use of all-terrain vehicles.

Federally listed and State-listed, proposed, or candidate terrestrial species found in Allegan, Kalamazoo, and Van Buren Counties and, therefore, possibly present on the Palisades site or the transmission line rights-of-way associated with Palisades are included in Table 2-2. No designated critical habitat occurs on the Palisades site or vicinity, or on the associated transmission line rights-of-way.

The NRC contacted the FWS and requested information on Federally listed and proposed threatened and endangered species, candidate species, and critical habitat on and near the Palisades site (NRC 2005b). In its response, the FWS stated that four Federally listed species and one Federal candidate for listing could occur in the project area (FWS 2005c). These include the Pitcher's thistle (*Cirsium pitcheri*; threatened), Karner blue butterfly (*Lycaeides melissa samuelis*; endangered), Mitchell's satyr butterfly (*Neonympha mitchelli mitchelli*; endangered), Indiana bat (*Myotis sodalis*; endangered), and eastern massasauga rattlesnake (*Sistrurus catenatus catenatus*; candidate).

Pitcher's thistle is the only Federally listed species known to exist on the Palisades site (NMC 2005a). It occurs on the site in open habitats on the dunes, including dune blowouts. The species is a perennial, herbaceous plant that is endemic to the nonforested dunes of the western Great Lakes and requires active dune processes to maintain early successional habitat (FWS 2005c). In Michigan, Pitcher's thistle is most common in the dunes of the northern and northeastern shores of Lake Michigan and exists in scattered populations along the perimeter of southeastern Lake Michigan (MNFI 2005c).

Table 2-2. Federally Listed and State-Listed Terrestrial Species Potentially Occurring on or in the Vicinity of Palisades and Associated Transmission Lines

Scientific Name	Common Name	Federal Status[a]	Michigan Status[a]	Habitat and Location in Project Area[b]
Plants				
Agalinis gattingeri	Gattinger's gerardia	–	E	Sandy, rocky, or clayey slopes; open woods; barrens; Kalamazoo County
Aristida tuberculosa	beach three-awned grass	–	T	Sandy barrens; Van Buren County
Aristolochia serpentaria	Virginia snakeroot	–	T	Southern floodplain forests, rich dry-mesic forests; Van Buren County
Aster sericeus	western silvery aster	–	T	Prairies, dry banks, fields; Kalamazoo County
Astragalus canadensis	Canadian milk-vetch	–	T	Oak barrens, moist openings, wet ground, sandy lake shores; Kalamazoo County
Baptisia leucophaea	cream wild indigo	–	E	Openings of dry to dry-mesic forest; Kalamazoo County
Bartonia paniculata	panicled screw-stem	–	T	Coastal plain marsh; Allegan and Van Buren Counties
Berula erecta	cut-leaved water-parsnip	–	T	Cold spring-fed drainages; recorded within 1 mi of Palisades-Argenta line (1940s); Allegan, Kalamazoo, and Van Buren Counties
Besseya bullii	kitten-tails	–	T	Oak savanna remnants on steep hillsides; Kalamazoo and Van Buren Counties
Calamagrostis stricta	narrow-leaved reedgrass	–	T	Streams, marshes, fens, mudflats; Kalamazoo County
Carex albolutescens	greenish-white sedge	–	T	Intermittent wetlands, lake margins, wet prairies; Allegan and Kalamazoo Counties
Carex lupuliformis	false hop sedge	–	T	Deciduous and mixed swamps in southern Michigan; Kalamazoo County

Table 2-2. (contd)

Scientific Name	Common Name	Federal Status[a]	Michigan Status[a]	Habitat and Location in Project Area[b]
Carex platyphylla	broad-leaved sedge	–	T	Mesic forests formed on dunes; Van Buren County
Carex oligocarpa	eastern few-fruited sedge	–	T	Rich deciduous woods; Kalamazoo County
Carex seorsa	sedge	–	T	Swamps and buttonbush depressions; recorded (1985) within 1 mi of Palisades site; Kalamazoo and Van Buren Counties
Carex straminea	straw sedge	–	E	Low ground, marshes, and swamps; Kalamazoo County
Castanea dentata	American chestnut	–	E	Upland forest; Kalamazoo County
Cirsium pitcheri	Pitcher's thistle	T	T	Great Lakes shorelines and sand dunes; found in dune blowouts and other open dune habitats on the site; more than 100 individual plants found onsite in July 2005 in the northwestern portion of the site near Van Buren State Park (Dawson 2005); Allegan and Van Buren Counties
Coreopsis palmata	prairie coreopsis	–	T	Mesic prairies along railroad rights-of-way; Kalamazoo and Van Buren Counties
Corydalis flavula	yellow fumewort	–	T	Oak savannas and floodplain forests; Kalamazoo County
Cypripedium candidum	white lady-slipper	–	T	Alkaline wetlands; Kalamazoo and Van Buren Counties
Diarrhena americana	beak grass	–	T	Floodplain forests; Kalamazoo County
Draba reptans	creeping whitlow-grass	–	T	Oak savanna and prairie; Kalamazoo County

Table 2-2. (contd)

Scientific Name	Common Name	Federal Status[a]	Michigan Status[a]	Habitat and Location in Project Area[b]
Dryopteris celsa	log fern	–	T	Acidic, humus-rich soils in hardwood swamps and floodplain forests; Kalamazoo and Van Buren Counties
Echinodorus tenellus	dwarf burhead	–	E	Intermittent, seasonally inundated wetlands within oak barrens; Allegan County
Eleocharis compressa	flattened spike-rush	–	T	Limestone pavement and grassland; Kalamazoo County
Eleocharis microcarpa	small-fruited spike-rush	–	E	Intermittent, seasonal wetlands; Allegan County
Eleocharis tricostata	three-ribbed spike-rush	–	T	Wetlands with a fluctuating water table; Allegan County
Eryngium yuccifolium	rattlesnake-master	–	T	Sedge and grass-dominated portions of prairie fens; Kalamazoo and Van Buren Counties
Eupatorium sessilifolium	upland boneset	–	T	Slopes of oak savannas; Kalamazoo County
Euphorbia commutata	tinted spurge	–	T	Sandy areas of riparian hillsides and open woods; Allegan County
Filipendula rubra	queen-of-the-prairie	–	T	Prairie fen; Kalamazoo County
Fuirena squarrosa	umbrella-grass	–	T	Coastal plain marshes, sandy lake edges, dune swales, seepages, and sandy marshes; Kalamazoo and Van Buren Counties
Galearis spectabilis	showy orchis	–	T	Rich deciduous woods, often near temporary spring ponds; Kalamazoo and Van Buren Counties
Gentiana flavida	white gentian	–	E	Dry or moist prairies and oak woodlands; Kalamazoo County

Table 2-2. (contd)

Scientific Name	Common Name	Federal Status[a]	Michigan Status[a]	Habitat and Location in Project Area[b]
Gentiana puberulenta	downy gentian	–	E	Edges of coastal plain marshes in oak barrens; Allegan County
Gentianella quinquefolia	stiff gentian	–	T	Wet meadows; Kalamazoo County
Geum triflorum	prairie-smoke	–	T	Lower slopes of dry sand prairie; Allegan County
Gillenia trifoliata	Bowman's root	–	T	Oak barrens; Kalamazoo County
Helianthus mollis	downy sunflower	–	T	Prairie remnants and oak barrens; Kalamazoo County
Hydrastis canadensis	goldenseal	–	T	Southern hardwood forests and moist ravines and portions of riparian forests; Allegan, Kalamazoo, and Van Buren Counties
Isoetes engelmannii	Appalachian quillwort	–	E	Intermittent wetlands; Allegan County
Isotria verticillata	whorled pogonia	–	T	Successional oak and red maple forest; Kalamazoo and Van Buren Counties
Juncus brachycarpus	short-fruited rush	–	T	Coastal plain marshes, sandy lake edges, dune swales, seepages, and sandy marshes; Allegan County
Juncus scirpoides	scirpus-like rush	–	T	Coastal plain marshes, sandy lake edges, dune swales, seepages, and sandy marshes; recorded within 1 mi of Palisades-Argenta line (1983); Allegan, Kalamazoo, and Van Buren Counties
Juncus vaseyi	Vasey's rush	–	T	Wet prairies, moist sandy barrens, and open marshy flats or swales; Allegan County

Table 2-2. (contd)

Scientific Name	Common Name	Federal Status[a]	Michigan Status[a]	Habitat and Location in Project Area[b]
Lechea pulchella	Leggett's pinweed	–	T	Seasonally inundated intermittent wetlands; Allegan and Kalamazoo Counties
Linum virginianum	Virginia flax	–	T	Open oak forests, upland woods, and lakeside and riparian forests; Kalamazoo and Van Buren Counties
Ludwigia sphaerocarpa	globe-fruited seedbox	–	T	Muddy shores of lakes, marshes, and streams; Allegan and Van Buren Counties
Lygodium palmatum	climbing fern	–	E	Moist thickets and woods; Kalamazoo County
Morus rubra	red mulberry	–	T	Southern floodplain forest; Kalamazoo County
Muhlenbergia richardsonis	mat muhly	–	T	Limestone pavement communities; Kalamazoo County
Nelumbo lutea	American lotus	–	T	Marshes and large rivers; Kalamazoo County
Panax quinquefolius	ginseng	–	T	Rich shaded forests; Allegan, Kalamazoo, and Van Buren Counties
Panicum leibergii	Leiberg's panic-grass	–	T	Dry prairies and open areas in savannas; Kalamazoo and Van Buren Counties
Panicum longifolium	long-leaved panic-grass	–	T	Seasonally flooded wetlands in shallow depressions; Allegan County
Panicum verrucosum	warty panic-grass	–	T	Coastal plain marshes, sandy lake edges, dune swales, seepages, and sandy marshes; Van Buren County
Platanthera ciliaris	orange or yellow fringed orchid	–	T	Acid swamps; Allegan, Kalamazoo, and Van Buren Counties

Table 2-2. (contd)

Scientific Name	Common Name	Federal Status[a]	Michigan Status[a]	Habitat and Location in Project Area[b]
Poa paludigena	bog bluegrass	–	T	Bogs, swamps, and wet woods; Kalamazoo County
Polygonum careyi	Carey's smartweed	–	T	Coastal plain marshes and intermittent wetlands; Allegan and Van Buren Counties
Populus heterophylla	swamp or black cottonwood	–	E	Swamp forest; Kalamazoo County
Potamogeton bicupulatus	waterthread pondweed	–	T	Coastal plain marshes and intermittent wetlands; Allegan and Van Buren Counties
Psilocarya scirpoides	bald-rush	–	T	Coastal plain marshes, sandy lake edges, dune swales, seepages, and sandy marshes; Allegan, Kalamazoo, and Van Buren Counties
Rhynchospora globularis	globe beak-rush	–	E	Coastal plain marshes, sandy lake edges, dune swales, seepages, and sandy marshes; Allegan County
Sabatia angularis	rose-pink	–	T	Moist sandy shores, depressions in dunes, marshy ground and edges of lakes; Kalamazoo and Van Buren Counties
Schoenoplectus hallii	Hall's bulrush	–	T	Intermittent wetlands within oak barrens; Allegan County
Scleria pauciflora	few-flowered nut-rush	–	E	Sandy edges of intermittent wetlands; Van Buren County
Scleria reticularis	netted nut-rush	–	T	Seasonally flooded wetlands in glacial lakeplain landscapes; Allegan and Van Buren Counties
Silene stellata	starry campion	–	T	Dry, open woodlands on sandy soils; Kalamazoo County
Silphium integrifolium	rosinweed	–	T	Mesic prairie; Kalamazoo and Van Buren Counties

Table 2-2. (contd)

Scientific Name	Common Name	Federal Status[a]	Michigan Status[a]	Habitat and Location in Project Area[b]
Silphium laciniatum	compass-plant	–	T	Mesic prairies; Kalamazoo County
Silphium perfoliatum	cup-plant	–	T	Openings in floodplain forests; Kalamazoo County
Sisyrinchium atlanticum	Atlantic blue-eyed-grass	–	T	Moist sandy shores; Allegan County
Solidago missouriensis	Missouri goldenrod	–	T	Dry sand prairie; Kalamazoo County
Spiranthes ovalis	lesser ladies'-tresses	–	T	Open, sandy soil, old roads, and open fields; Kalamazoo County
Stellaria crassifolia	fleshy stitchwort	–	T	Cold springs and seeps along rivers; Kalamazoo County
Trichostema dichotomum	bastard pennyroyal	–	T	Oak savannas; Allegan, Kalamazoo, and Van Buren Counties
Trillium sessile	toadshade	–	T	Floodplains and mesic forests; recorded within 1 mi of Palisades-Argenta line (1981); Kalamazoo and Van Buren Counties
Triphora trianthophora	three-birds orchid	–	T	Rich oak-hickory forests; Allegan, Kalamazoo, and Van Buren Counties
Valerianella chenopodiifolia	goosefoot corn-salad	–	T	Wet sites in forested floodplains; Kalamazoo County
Viola pedatifida	prairie birdfoot violet	–	T	Mesic prairie; Kalamazoo County
Utricularia subulata	zigzag bladderwort	–	T	Damp sand at the margins of interdunal wetlands; Allegan County
Zizania aquatica var. *aquatica*	wild-rice	–	T	Rivers, streams, lakes, and ponds; Kalamazoo County

Table 2-2. (contd)

Scientific Name	Common Name	Federal Status[a]	Michigan Status[a]	Habitat and Location in Project Area[b]
Insects				
Erynnis persius persius	Persius duskywing	–	T	Oak savannas and pine barrens (Shepard et al. 2005); Allegan and Kalamazoo Counties
Hesperia ottoe	Ottoe skipper	–	T	Remnant dry sand prairies and open oak barrens with native warm season grasses; Allegan County
Incisalia irus	frosted elfin	–	T	Oak savannas and pine barrens (Shepard et al. 2005); Allegan and Kalamazoo Counties
Lepyronia gibbosa	great plains spittlebug	–	T	Prairies; Van Buren County
Lycaeides melissa samuelis	Karner blue butterfly	E	T	Oak or oak-pine savanna, openings, old fields, and rights-of-way surrounded by close-canopied oak forest; Allegan County
Neonympha mitchellii mitchellii	Mitchell's satyr butterfly	E	E	Calcareous wetlands; Kalamazoo and Van Buren Counties
Nicrophorus americanus	American burying beetle	E	E	Wide variety of habitats with significant humus and topsoil suitable for burying of carrion (FWS 1989); Kalamazoo County, last observation 1961; no recent State sightings (MDNR 2005a).
Speyeria idalia	regal fritillary	–	E	Tall-grass prairie, meadows, marshes, and pastures (Shepard et al. 2005); Kalamazoo County

Table 2-2. (contd)

Scientific Name	Common Name	Federal Status[a]	Michigan Status[a]	Habitat and Location in Project Area[b]
Amphibians				
Ambystoma opacum	marbled salamander	–	T	Sandy, upland deciduous forests most of the year; lowland forest in the fall to breed (MDNR 2005b); Allegan and Van Buren Counties
Reptiles				
Clemmys guttata	spotted turtle	–	T	Shallow wetlands; recorded within 1 mi of Palisades-Argenta line (2002); Allegan, Kalamazoo, and Van Buren Counties
Clonophis kirtlandii	Kirtland's snake	–	E	Damp meadows, vacant lots, and open swampy woodlands (MDNR 2005c); Kalamazoo and Van Buren Counties
Sistrurus catenatus catenatus	eastern massasauga rattlesnake	C	–	Wetlands, including bogs, fens, shrub swamps, wet meadows, marshes, moist grasslands, wet prairies, and floodplain forests; recorded within 1 mi of Palisades-Argenta line (1995); Allegan, Kalamazoo, and Van Buren Counties
Birds				
Buteo lineatus	red-shouldered hawk	–	T	Mature, forested floodplains and upland forest; Allegan County
Dendroica discolor	prairie warbler	–	E	Upland scrub-shrub; recorded within 1 mi of Palisades-Argenta line (1997); Allegan and Van Buren Counties

Table 2-2. (contd)

Scientific Name	Common Name	Federal Status[a]	Michigan Status[a]	Habitat and Location in Project Area[b]
Lanius ludovicianus migrans	migrant loggerhead shrike	–	E	Grasslands and open, agricultural areas characterized by short vegetation and scattered trees, shrubs, or hedgerows; Allegan County
Rallus elegans	king rail	–	E	Freshwater marshes; Allegan and Van Buren Counties
Mammals				
Cryptotis parva	least shrew	–	T	Grassy, weedy, or brushy fields; Allegan, Kalamazoo, and Van Buren Counties
Microtus ochrogaster	prairie vole	–	E	Open prairie and savanna; recorded on Palisades site (1978); Kalamazoo and Van Buren Counties
Myotis sodalis	Indiana bat	E	E	Riparian, bottomland, and upland forest habitats; Allegan, Kalamazoo, and Van Buren Counties (FWS 2005)

(a) C = candidate for listing; E = listed as endangered, T = listed as threatened, – = no listing.
(b) Habitat information from MNFI 2005b,c or NMC 2005a unless otherwise noted. Location on Palisades site or near transmission lines from NMC 2005a. County occurrence from MNFI 2005d unless otherwise noted.

The Pitcher's thistle has been found in dune blowouts and in semistabilized, but dynamic, full-sun dune habitats throughout the Palisades site (Dawson 2005). The species' distribution on the site can change over time in response to changes in habitat suitability and the location of seed sources offsite. From the early 1980s until the late 1990s, the Pitcher's thistle was found onsite in suitable habitat near the cooling towers. No Pitcher's thistle were found near the cooling towers during the NRC staff's site audit in July 2005. A survey on July 28, 2005, found no Pitcher's thistle in suitable habitat south or north of Palisades site; however, a population comprised of 113 individuals (9 mature plants and 104 first-year plants) were found in the beach grass stabilized dune community and flats located on the north end of the site adjacent to Van Buren State Park (Dawson 2005).

On the basis of county distributions published in FWS (2005), the Karner blue butterfly occurs in Allegan County and the Mitchell's satyr butterfly occurs in Kalamazoo and Van Buren Counties. However, Czarnecki (FWS 2005c) stated that the Karner blue butterfly may occur near the Argenta-E. Elkhart transmission line in eastern Van Buren County, and the Mitchell's satyr butterfly may be found near the Palisades-Cook transmission line in Berrien County. It should be noted that neither the Argenta-E. Elkhart transmission line nor the portion of the Palisades-Cook transmission line in Berrien County were part of the original licensing of the plant and, therefore, are not considered in this draft SEIS. Neither species was observed during field surveys of the Palisades site and transmission line corridors conducted in 1979 (Asplundh 1979) and 1991 (Higman and Goff 1991; Goff 1992).

The Karner blue butterfly is dependent on its only known larval food plant, wild lupine (*Lupinus perennis*), grasses, and a variety of nectar plants (FWS 2005a). These plants and the butterfly's habitat occur in areas of sandy soil in oak and oak-pine savanna habitat, as well as other locations such as highway and transmission line rights-of-way, especially those surrounded by close-canopied oak forest (FWS 2005c; MNFI 2005b). The Mitchell's satyr butterfly is closely affiliated with wetlands that are dominated by sedges, especially *Carex stricta*, with scattered deciduous or coniferous trees such as tamarack and red cedar (*Juniperus virginiana*) (FWS 2005c; MNFI 2005b).

There is a possibility that the Indiana bat occurs within suitable habitat on or near the Palisades site or transmission lines associated with the plant (FWS 2005c). The summer range of this species includes the southern half of Michigan and most of the western coastal counties of the Lower Peninsula. Although the MNFI does not have records of occurrence in the three counties in the project area (MNFI 2005d), the FWS lists the Indiana bat as occurring in all three of the counties associated with the proposed action (FWS 2005). Suitable habitat for the Indiana bat consists of riparian, bottomland, and upland forest habitats with trees that have crevices or exfoliating bark that can be used as roosting sites.

The eastern massasauga rattlesnake is known from Allegan, Kalamazoo, and Van Buren Counties and could occur on the Palisades site and within the rights-of-way of its associated transmission lines (FWS 2005c; FWS 2005). Four records of eastern massasauga occur within 1 mi of the Palisades-Argenta transmission line within Van Buren County. Across the species' range, Michigan has the most recent recordings, and the State may represent the massasauga's last stronghold (MNFI 2005b). Recent sightings have been clustered in several portions of the Lower Peninsula, including Allegan and Kalamazoo Counties of the project area (MNFI 2005b). Eastern massasauga habitat includes a variety of wetland habitats, including bogs, fens, shrub swamps, wet meadows, marshes, moist grasslands, wet prairies, and floodplain forests (MNFI 2005b). In southern Michigan, populations are typically associated with open wetlands, particularly prairie fens. In the summer, snakes migrate from wetlands to drier, upland sites that include forest openings, old fields, agricultural lands, and prairies.

Preferred sites have the following characteristics: (1) open, sunny areas intermixed with shaded areas, presumably for thermoregulation; (2) a water table near the surface for hibernation; and (3) variable elevations between adjoining lowland and upland habitats (MNFI 2005b).

2.2.7 Radiological Impacts

NMC has conducted a radiological environmental monitoring program (REMP) around the Palisades site since 1971. Through this program, radiological impacts on workers, the public, and the environment are monitored, documented, and compared with the appropriate standards. The objectives of the REMP are the following:

- Identify and measure radiation and radioactivity in the plant environs for the calculation of potential dose to the population.
- Verify the effectiveness of in-plant measures used for controlling the release of radioactive materials.
- Provide reasonable assurance that the predicted doses, based on effluent data, have not been substantially underestimated and are consistent with applicable standards.
- Comply with regulatory requirements and plant technical specifications and provide records to document compliance.

Each year, radiological releases are summarized in two annual reports: the *Palisades Annual Radiological Environmental Operating Report* (e.g., NMC 2005c) and the *Palisades Annual Radioactive Effluent Release and Waste Disposal Report* (e.g., NMC 2005b). The limits for all radiological releases are specified in the ODCM (NMC 2004a), and these limits are designed to meet Federal standards and requirements. The primary radiological standards applicable to Palisades are contained in 10 CFR Part 20, 40 CFR Part 190, and 10 CFR Part 50, Appendix I. The REMP includes monitoring of the waterborne environment (groundwater, surface water, and sediments), ingestion pathways (milk, fish, and vegetation), direct radiation (gamma dose on thermoluminescent dosimeter locations), and atmospheric environment (airborne radioiodine, particulates, gross beta, and gamma).

NMC performed an assessment of radiation dose to the general public from radioactive effluents. For the period 2000 through 2004, dose estimates were calculated on the basis of actual liquid and gaseous effluent release data (NMC 2001, 2002, 2003a, 2004b, 2005b). Calculations were performed by using the plant effluent release data, onsite meteorological data, and appropriate pathways identified in the ODCM (NMC 2004a).

For the 5-year period 2000 through 2004, the annual total effective dose equivalent (TEDE) calculated each year for the MEI was well within the annual limit of 25 mrem for members of the public as specified in the ODCM (TEDE is the sum total of the external dose and the sum of the weighted internal dose) (NMC 2001, 2002, 2003a, 2004b, 2005b). Over this 5-year period, the maximum annual TEDE for the MEI was estimated to be 7.53×10^{-3} mrem with an annual average TEDE of 3.73×10^{-3} mrem (NMC 2001, 2002, 2003a, 2004b, 2005b). These doses represent approximately 0.03 percent and 0.015 percent of the 25-mrem limit, respectively. The TEDE estimates include exposure from liquid and gaseous effluents and direct radiation. These results confirm that Palisades is operating in compliance with 10 CFR Part 50, Appendix I, 10 CFR Part 20, and 40 CFR Part 190.

Because of the planned modification to the Liquid Radioactive Waste System discussed in Section 2.1.4.1, there may be a slight increase in the TEDEs given above. However, these doses are still expected to be much lower than the applicable standards.

2.2.8 Socioeconomic Factors

The NRC staff reviewed the NMC ER (NMC 2005a) and information obtained from county, city, school district, and local economic development staff. The following sections describe the housing market, community infrastructure, population, and economy in the region surrounding the Palisades site.

2.2.8.1 Housing

The majority of plant employees live in Van Buren County (44 percent) and in Berrien County (33 percent), and most of the remaining employees are located in Ottawa, Allegan, and Kalamazoo Counties (Table 2-3). Given the residential location of Palisades employees, the most significant impacts of plant operations are likely to occur in Van Buren and Berrien Counties. The analysis in this draft SEIS focuses on the impacts of Palisades operations in these two counties.

NMC refuels Palisades every 18 months. During refueling, approximately an additional 380 workers are employed for a 30- to 40-day period (NMC 2005a). The majority of these workers reside in the same communities as the permanent employees at the plant (NMC 2005b).

The number of housing units and housing vacancies in Van Buren and Berrien Counties are shown in Table 2-4. In Van Buren County, the total number of housing units grew at an annual rate of 0.7 percent over the period 1990 to 2000, while the number of occupied units grew at an average annual rate of 0.9 percent over the same period. With an annual average population growth rate of almost 1 percent during this period, there was a slight decline in the annual rate

of growth in the number of vacant units. In Berrien County, total and occupied housing over the period 1990 to 2000 grew at an average annual rate of approximately 0.5 percent, exceeding the growth rate in population during this period, leading to a 1.5 percent annual growth in vacant housing units.

Table 2-3. Palisades Permanent Employee Residence Information by County and City

County and City[a]	Number of Employees	Percent of Total
VAN BUREN COUNTY		
South Haven	156	30
Bangor	14	3
Grand Junction	13	2
Paw Paw	12	2
Hartford	8	2
Others	30	6
Total Van Buren County	233	44
BERRIEN COUNTY		
St. Joseph	73	14
Coloma	24	5
Benton Harbor	23	4
Stevensville	21	4
Watervliet	14	3
Others	17	3
Total Berrien County	172	33
Other counties	119	23
Grand total	524	100

(a) Addresses are for both unincorporated (counties) and incorporated (cities and towns) areas.
Source: NMC 2004c.

2.2.8.2 Public Services

Water Supply

Water supplies in Van Buren and Berrien Counties come from both surface and groundwater sources, although surface water (especially Lake Michigan) is the main source (NMC 2005a). While Lake Michigan water meets the water quality standards set by the State, water from the

lake is under localized threat of degradation from surface runoff, construction, and industrial activity.

Currently, Van Buren County has 28 water suppliers, although these suppliers currently only provide 28 percent of capacity and water supply (NMC 2005a). Residents in Van Buren County not served by municipal systems receive water from individual onsite wells or through wells

Table 2-4. Housing Units and Housing Units Vacant (Available) by County During 1990 and 2000

	1990	2000	Percentage Change 1990 to 2000
VAN BUREN COUNTY			
Housing units	31,530	33,975	7.8
Occupied units	25,402	27,982	10.2
Vacant units	6,128	5,993	-2.2
BERRIEN COUNTY			
Housing units	69,532	73,445	5.6
Occupied units	61,025	63,569	4.2
Vacant units	8,507	9,876	16.1

Source: U.S. Census Bureau 2000b.

accessed by small private providers. In Berrien County, 50 suppliers provide 57 percent of water supplies, with the majority of capacity and water supply in the county provided by municipal systems located in St. Joseph, Benton Harbor, Niles, and Lake Charter. Access to water by using individual onsite wells or through private supply systems is less important as a source of water supply in Berrien County. Table 2-5 shows the largest water supply systems in both counties.

According to estimates, excess water capacity in both Van Buren and Berrien Counties is high, and existing water suppliers would be able to satisfy new residential, commercial, and industrial demands (NMC 2005a).

South Haven Municipal Water Authority provides potable water to Palisades at an average daily rate of 18,000 gpd (Section 2.2.3). Fire protection for the plant is provided by the Covert Township Fire Department.

Education

Palisades is located in the Covert Public School District, which has a current enrollment of 739 students (Standard and Poors 2005). Fifty-four teachers are currently employed in the district (MEDC 2005), and current expenditures are $6222 per student (Standard and Poors 2005). Enrollment has declined slightly in recent years, together with expenditures per student, while the number of teachers in the district has remained stable over the same period (MEDC 2005; Standard and Poors 2005; greatschools.net 2005).

Table 2-5. Major Public Water Supply Systems in Van Buren and Berrien Counties in 2004

Water System	Source	Average Daily Use (million gpd)	Maximum Capacity (million gpd)
	VAN BUREN COUNTY		
South Haven	Surface water	1.7	4.0
Lawton	Groundwater	1.3	3.9
Mattawan	Groundwater	0.8	1.6
	BERRIEN COUNTY		
Benton Harbor	Surface water	4.9	12.0
St. Joseph	Surface water	5.2	16.0
Niles	Groundwater	1.7	9.5
Lake Charter Township	Surface water	1.6	5.0
Buchanan	Groundwater	0.5	2.2

Source: NMC 2005a.

Including the Covert Public School District, there are 12 public school districts in Van Buren County, with a current total enrollment of 17,696 students (Standard and Poors 2005). Average expenditure per student in the public school districts in the county is $5013, compared with $8653 for Michigan as a whole in 2002 (Standard and Poors 2005). There were an additional six private schools in the county in 2004 with a total enrollment of 550 students (NCES 2005).

Berrien County has 15 public school districts, which had a total enrollment of 27,012 students in 2002. Average expenditure per student in the county was $4841. There are also 30 private/parochial schools with a current total enrollment of 4030 students, and two public school academies (Berrien County 2005).

Transportation

Access to Palisades is via Blue Star Memorial Highway, approximately 1 mi east of the plant. Blue Star Memorial Highway runs parallel to I-196 and US 31. Most employees traveling from Benton Harbor and St. Joseph from the south, and South Haven to the north use these roads.

Moderate increases in traffic have occurred on many of the roads in the vicinity of the plant; in particular, I-196, which has seen large increases in commercial traffic. Four segments of I-196 for which traffic counts are available, were assessed in the NMC ER (NMC 2005a). These segments are located both north and south of the plant. Traffic conditions on this stretch of roadway vary between medium density, stable flow, to high-capacity traffic where congestion is likely. Blue Star Memorial Highway also experiences relatively high daily traffic flow (NMC 2005a).

2.2.8.3 Offsite Land Use

Land use in Van Buren County (623 mi^2) is primarily agricultural (47 percent of total land area) and residential (44 percent), with a smaller land area occupied by industrial (2 percent) and commercial (2 percent) land uses (Table 2.6). Berrien County (583 mi^2) is also rural in character, with approximately 84 percent of the land area used for agriculture or classified as unused. About 9 percent of county land is residential and 3 percent is devoted to manufacturing, commercial, and sand and gravel mining activities (NMC 2003b). Fruit production, particularly berries, apples, and cherries, and food processing are an important part of the agricultural economy in both counties. Tourism also provides a significant source of employment and income in both counties. The Lake Michigan lakefront, parks, and recreational areas are strong attractions for summer and fall visitors and seasonal residents, even though less than 4 percent of the land is devoted to public and semipublic uses in both counties.

Although Van Buren County's population has grown relatively slowly over the past 30 years, it has experienced moderate residential, industrial, and commercial growth during that period. Residential development has moved away from the urban cores, notably the Kalamazoo area (NMC 2005a), and through the development of lakefront locations for summer and retirement homes, notably in the South Haven area. As a result of these developments, both the Lake Michigan lakefront and prime farmland in the county are confronting growth pressure. In an attempt to manage new development, the county has developed an overall land-use decision-making strategy that encourages the implementation of a "smart growth" methodology by municipalities within the county. To conform with the strategy, each municipality has attempted to create development and planning tools that are compatible with local

Table 2-6. Land Use in Van Buren County, 2005[a]

Land Use	Percent of Total
Residential	44
Commercial	2
Industrial	2
Agriculture	47
Other	5
Total	100

(a) Interview with K. Getman and M. Thomas, Michigan Economic Development Corporation (July 2005).

infrastructure, encourage clustering of new mixed use developments to foster the preservation of open space, farmland, natural beauty, and critical environmental areas.[a]

2.2.8.4 Visual Aesthetics and Noise

Palisades is located on the southeastern shoreline of Lake Michigan. The Lake Michigan shoreline in Van Buren County serves as a strong draw to summer tourists and seasonal residents who enjoy the recreational and environmental attractions of the area.

The Palisades site covers 432 ac of beach and high-wooded sand dunes. Plant buildings include a rectangular turbine building (90 ft high); a cylindrical, domed-top reactor containment building (92 ft high); a rectangular auxiliary building (74 ft high); and a rectangular cooling tower building (70 ft high) that houses two cooling towers. All of the plant's structures and the reactor dome are equal to or below the height of the surrounding sand dunes. While the plant is readily visible from Lake Michigan and the shoreline, the distance from the north and south property lines, and the property's dominating sand dunes and trees obscure buildings from view of adjacent properties and I-196. The transmission lines can be seen from both the interstate highway and Blue Star Memorial Highway.

Noise measurements are not available for the Palisades site. However, noise generated by Palisades operations is mitigated at the site boundary because the plant is located approximately 2500 ft from the northern and southern boundaries of the site and is surrounded by sand dunes and vegetation, and most equipment is located within the plant buildings. In

(a) Interview with K. Getman and M. Thomas, Michigan Economic Development Corporation (July 2005).

addition, I-196 encloses the eastern portion of the site and reduces the conspicuousness of any noise generated by Palisades operations.

2.2.8.5 Demography

In 2000, 118,667 people were living within 20-mi of Palisades, for a density of 238 persons/mi^2. This density translates to Category 4 (least sparse), using the GEIS measure of sparseness (NMC 2005a). At the same time, there were 1,287,558 persons living within 50 mi of the plant, for a density of 283 persons/mi^2. The NRC sparseness and proximity matrix assigns a Category 4 rating (high density) for this measure as well. There are currently no mandatory growth controls that would limit housing development in this area (NMC 2005a).

Table 2-7 shows population trends for the two counties where the majority of Palisades employees live. Annual average growth rates in Van Buren County show moderate growth

Table 2-7. Population Growth in Van Buren and Berrien Counties, 1970 to 2020

	Van Buren County		Berrien County	
Year	Population	Annual Growth Percent[a]	Population	Annual Growth Percent
1970	56,173	–[b]	163,875	–
1980	66,814	1.7	171,276	0.5
1990	70,060	0.5	161,378	-0.6
2000	76,263	0.9	162,453	0.1
2010	87,100	1.3	160,800	-0.1
2020	95,800	1.0	158,900	-0.1

(a) Annual percent growth rate is calculated over the previous decade.
(b) – indicates no data available.
Sources: NMC 2005a; U.S. Census Bureau 2000a.

during the 1970s, followed by slight increases during the 1980s and 1990s. The annual average growth rate in Michigan over this period was 0.4 percent.

Growth is forecasted to continue at moderate levels over the period 2000 to 2020. In Berrien County, relatively slow growth in population in the 1970s was followed by declining population in the 1980s and slight increases in the 1990s. Population is forecasted to decline in both decades between 2000 and 2020.

Transient Population

The transient population in the vicinity of Palisades consists primarily of tourists visiting South Haven, St. Joseph, Benton Harbor, and various recreational facilities (NMC 2005a). It is estimated that peak visitation levels reach almost 10,000 associated with campgrounds and beaches in the area (NMC 2005a). People visiting summer homes and attendance at local colleges in the area also represent a substantial source of transient population in the area.

Migrant Farm Labor

Although seasonal or migrant workers are employed during the summer and fall months in many of the counties around the plant, the majority of agricultural laborers reside in the area (NMC 2005a). Only a small number of seasonal migrant agricultural workers reside in Van Buren and Berrien Counties, where agriculture is less important to the county economy than it is in adjacent counties (USDA 2002).

2.2.8.6 Economy

Employment and Income

Total employment in Van Buren County was 16,977 in 2002 (U.S. Census Bureau 2000b). Service industries dominate employment in the county with more than 39 percent of total employment (27,488 people employed). The largest employer in the county is Consumers Energy, with 484 employees (Table 2-8). Manufacturing also plays an important part in the local economy, with more than 29 percent of local employment (4934 people); a number of manufacturing firms have a large local labor force, including Double J Moulding and Pullman Industries. Wholesale and retail trade employs 18 percent (2974 people) of the county workforce.

Of the 61,028 employed in Berrien County in 2002, almost 48 percent of employment (29,214 people) is in the various service sectors (U.S. Census Bureau 2000b). Manufacturing has a relatively small share of county employment (24 percent), with 14,435 people employed. Wholesale and retail trade has more than 16 percent of the county workforce, with 9,836 people.

Personal income in Berrien County was $2.0 billion in 2002 (in 2004 dollars), with a per capita income of $25,514 (2004 dollars) (DOC 2002). In Berrien County, total personal income was $4.7 billion, with a per capita income of $29,081.

Table 2-8. Major Employment Facilities Within 16 km (10 mi) of Palisades

Firm	Number of Employees
Consumers Energy	484
Double J Moulding	240
Pullman Industries	240
Wal-Mart	230
South Haven Community Hospital	160
De Grandchamp Blueberry Farms	154
Wyckoff Chemical	140
South Haven Public Schools	126
Bangor Industries	110

Source: MEDC 2005.

Unemployment

Unemployment in Van Buren County was moderately high at 7.2 percent in December 2004. The rate for Michigan as a whole for the same month was 7.1 percent. In Berrien County, the rate for December 2004 was lower, at 4.2 percent (DOL 2004).

Taxes

Palisades pays property taxes to Covert School District, Covert Township, Van Buren Intermediate School District, Van Buren County, the District Library, and the South Haven Community Hospital District. Because Palisades is located in Covert Township, the township collects sufficient tax revenues from the plant to cover local expenditures and forwards the balance to the other jurisdictions. Revenues are used to fund local and county emergency management programs, public safety, local public schools, local government operations, local road maintenance, and the local library system.

The plant is a significant source of tax revenue for local and county government. Over the period 2002 to 2004, 56 percent (about $1 million in 2004 dollars) of tax revenues spent in Covert Township came from Palisades property taxes, and 29 percent ($2.7 million) of revenues raised by Covert School District came from the plant (Table 2-9). Roughly 4 percent (about $0.8 million in 2004 dollars) of Van Buren County tax revenues over the period 2002 to 2004 came from Palisades.

Utility restructuring legislation has been in place in Michigan since 2000. However, the long-term impact of the restructuring of the electric power industry in the State and its impact on Palisades are not yet known. Any changes in assessed valuation of plant property and equipment that may potentially occur could affect property tax payments to the township, county, and local school districts. However, any impacts on tax revenues as a result of restructuring would not occur as a direct result of license renewal.

Table 2-9. Contribution of Palisades to County Property Tax Revenues and Total Operating Revenues

Year	Total Covert School District Property Tax Revenues (millions $ 2004)	Property Tax Paid to Covert School District for Palisades (millions $ 2004)	Percent of Total Property Taxes
	COVERT SCHOOL DISTRICT		
2002	7.4	2.8	37
2003	8.7	2.7	31
2004	9.2	2.7	29
Year	**Total Covert Township Property Tax Revenues (millions $ 2004)**	**Property Tax Paid to Covert Township for Palisades (millions $ 2004)**	**Percent of Total Property Taxes**
	COVERT TOWNSHIP		
2002	1.6	0.9	58
2003	1.5	0.9	60
2004	1.6	0.9	56
Year	**Total Van Buren County Property Tax Revenues (millions $ 2004)**	**Property Tax Paid to Van Buren County for Palisades (millions $ 2004)**	**Percent of Total Property Taxes**
	VAN BUREN COUNTY		
2002	17.6	0.9	5
2003	18.7	0.9	5
2004	19.7	0.8	4
Year	**Total Van Buren Intermediate School District Property Tax Revenues (millions $ 2004)**	**Property Tax Paid to Van Buren Intermediate School District for Palisades (millions $ 2004)**	**Percent of Total Property Taxes**
	VAN BUREN INTERMEDIATE SCHOOL DISTRICT		
2002	26.3	0.9	3
2003	26.9	0.8	3
2004	28.4	0.8	3

Source: VerBermones 2005.

2.2.9 Historic and Archaeological Resources

This section discusses the cultural background and the known historic and archaeological resources at the Palisades site and in the surrounding area.

2.2.9.1 Cultural Background

Evidence of human occupation within the region is found in archaeological sites dated according to the following chronological sequence that reflects cultural change through time: Paleo-Indian Period (10,000 BC to 8000 BC); Archaic Period (8000 BC to 1000 BC); Woodland Period (1000 BC to AD 1050); and Upper Mississippian Period (1050 to 1600). The Paleo-Indian Period marks the beginning of human occupation within the region. These were highly mobile bands of hunters and gatherers, with a heavy reliance on late Pleistocene animals for food, clothing, and shelter. Archaeological sites tend to be found in upland areas along ancient lakebeds and may consist of a single projectile point or other stone tool of a style characteristic of the period (Mason 1981).

During the Archaic Period, human populations adapted to the postglacial environment by adopting a more sedentary way of life based upon hunting, fishing, and gathering, and a heavy dependence upon waterways for travel, transport, and settlement (Funk 1978; Quimby 1960). Archaeological sites from this period are larger, more numerous, and richer in occupation debris than previous periods, reflecting larger, denser populations and a more abundant and reliable subsistence base. New types of raw material were used for tool production as the techniques of pecking, grinding, and polishing stone gained importance (Mason 1981).

In the Woodland Period, earthenware pottery appears in archaeological sites. Burials are characteristically earthen mounds and contain an abundance of grave offerings. The beginnings of undisputed plant domestication and agriculture also mark this period (Mason 1981). Widespread exchange networks existed and there is evidence of a dramatic increase in the frequency and scale of warfare (Fitting 1978; Mason 1981). The Upper Mississippian Period in southwestern Michigan is characterized by mostly Late Woodland cultural traits with the addition of shell- and grit-tempered cord-marked and plain ceramics (Brose 1978).

The historic period begins in the late 1600s with the arrival of French explorers, missionaries, and fur traders. Fort Miami (in present-day St. Joseph) and Fort St. Joseph (in present-day Niles) were the first European settlements in the area. Native American groups that inhabited the area during the historic period were predominantly the Potawatomi, Mascouten, Miami, and Ottawa. During the early historic period, their villages were situated on the edge of forested land, adjacent to prairies and convenient to streams and the lakeside; temporary winter camps

were established in sheltered areas. By the beginning of the nineteenth century, the Potawatomi had established 11 known villages in southern Michigan. Most were near the shorelines of Lake Michigan and Lake Erie, generally along the streams that flow into their waters (Clifton 1978; Goddard 1978; Callender 1978; Feest and Feest 1978).

After 1783, the official beginning of the American period, Indian lands were rapidly absorbed by expanding American settlements: by 1821, most of these lands were ceded by treaty or purchase (Feest and Feest 1978). In the 1830s, lumbering was an important regional industry and drew many settlers (Brennan 2004). One of the earliest settlements in the Palisades area was Paulville, a logging town established in 1857, and several logging operations were established in the area between 1866 and 1880. While the 1840s and 1850s was a period of agricultural settlement of much of southern lower Michigan (Great Lakes Research 2000), the dune formations present at the Palisades site rendered this area unsuitable for agriculture. As late as 1927, only six structures were located in the Palisades vicinity and they were south of the site along Brandywine Creek (Weir, et al.1980).

Five historic properties within Van Buren County are listed on the National Register of Historic Places (NRHP; NPS 2005a); there are no National Historic Landmarks listed for the county (NPS 2005b). Properties listed on the NRHP that are closest to the Palisades site (Liberty Hyde Bailey Birthplace in South Haven and the Navigation Structures at South Haven Harbor) are located approximately 6 mi to the north. In addition, one property in Allegan County (the James Noble Sherwood House in Plainwell) is located approximately 0.5 mi from the Palisades-Argenta transmission line right-of-way (NPS 2005a). The Michigan State Historic Preservation Office's (SHPO's) inventory of historic properties for Van Buren County lists 29 properties. Those nearest the Palisades site are Ward School, Hartman School, and Haven Peaches Informational Designation, all in South Haven, and the First Congregational Church in Covert (State of Michigan 2005).

The Southwest Michigan Underwater Preserve stretches along the Lake Michigan shoreline from just north of Holland to just north of the Indiana border, including the 1-mi stretch of the lakeshore that lies within the Palisades site boundaries. Seventeen sites are documented in and near the preserve that include shipwrecks, geologic features, and historic structures: most lie offshore from South Haven. The closest to the Palisades site is the shipwreck site of the *City of Greenbay*, which sank in 1887. It lies at a depth of 10 ft (Michigan Underwater Preserve Council 2004), approximately 0.5 mi north of the Palisades site.

At least seven previous archaeological surveys came within 1 mi of the Palisades site and transmission line rights-of-way. These surveys resulted in the recordation of 15 archaeological sites within 1 mi of the Palisades site and transmission line rights-of-way. These 15 sites consist of prehistoric lithic scatters and camp sites, one dating to the Archaic Period; isolated prehistoric artifacts, including two Paleo-Indian Period fluted points; one prehistoric village site,

Pell Village; two prehistoric sites of undeterrnined function; and one historic trading post site. One of the prehistoric sites of unknown type, 20-VA-28, is located about 0.3 mi south of the Palisades site and the other, 20-VA-4, is recorded just outside the Palisades site's eastern boundary (Weir et al. 1980).

2.2.9.2 Historic and Archaeological Resources at the Palisades Site

The Palisades site encompasses approximately 432 ac of land, including about 1 mi of Lake Michigan shoreline. The site consists primarily of sand dunes, mostly forested, that extend from the shoreline inland approximately 1 mi. Approximately 110 ac of the site are developed or maintained. The developed or maintained areas include power production and support facilities, roads, and related infrastructure. Most of these facilities are located along the north access road that leads to the north security gate. Also within this area are the power corridor from the main station transformer to the Palisades Substation, and transmission rights-of-way from the substation extending offsite. Service and circulating water are withdrawn from Lake Michigan via pipeline from a submerged intake crib structure located 3300 ft offshore (NMC 2005a; Dawson and Comstock 2005). In addition to the land disturbance caused by these developments, more than 4 ac of additional land in the northern portion of the Palisades site have been disturbed by former use of the land for sand quarrying operations. Intact archaeological sites could be present within the remaining undeveloped areas as well as in soils below the depth of ground disturbance in most areas of the site. As discussed in Section 2.2.9.1, Native American villages are known to have been situated within physiographic settings similar to portions of the Palisades site: on the shorelines of Lake Michigan and on the edge of forested land, adjacent to prairies and convenient to streams and the lakeside.

A file search conducted on July 27, 2005, at the Michigan SHPO indicates that one cultural resources assessment (Weir et al. 1980) was undertaken at the Palisades site but that no archaeological field surveys have been conducted either at the Palisades site or for original transmission line construction or maintenance. The cultural resource assessment, which was undertaken in 1979, concluded that without accurate knowledge of the cultural resources present at the Palisades site, it must be assumed that power plant construction has the potential to adversely impact significant resources that may exist on the plant site. The report recommends that an intensive survey be undertaken of the undisturbed portions of the site.

In addition to the assessment report on file at the Michigan SHPO, Consumers Energy files contain a second report that documents a brief cultural resource field visit to the Palisades site by archaeologists in 1982. The purpose of the field visit was to determine the likelihood of the existence of archaeological sites at the locations of three proposed facilities: a drainage pond, a parking lot, and a warehouse (CAI 1982). The report concluded that the likelihood of encountering archaeological sites at the three locations was minimal because of the generally steep terrain and distance from the Lake Michigan shore.

Agency consultation undertaken by the U.S. Atomic Energy Commission (AEC) in 1972 for issuance of an OL for Palisades operation generated comment letters from the U.S. Department of the Interior and from the Michigan State Liaison Officer for Historic Preservation (AEC 1972). The Department of the Interior letter states that it does not appear that the existing plant should directly affect any site eligible for registration as a National Historic Landmark (DOI 1972). The Michigan State Liaison Officer's letter concludes that as far as could be determined at that time, Palisades would not adversely affect known historical or archaeological resources of the State of Michigan (Milstein 1972).

Consumers Energy and NMC corresponded with the Michigan SHPO in early 2005 regarding the current license permit renewal application (Malone and Wawro 2005). The Consumers Energy and NMC letter to the SHPO states that NMC, Consumers, and the Palisades Environmental Review Team conclude the operation of Palisades through the license renewal term will not have an adverse effect on any historic or cultural property in the region and, therefore, a survey of the project area is not necessary. Their conclusion was based upon the small extent of potential land-disturbing activities, the absence of known historic properties in the vicinity of Palisades, and the existence of adequate environmental controls to ensure protection of cultural resources. A response letter from the SHPO dated March 15, 2005, concurred with these conclusions (Conway 2005).

Correspondence between the Michigan SHPO and the NRC, dated June 30, 2005, is provided in Appendix E.

Government to Government consultation with appropriate Federally recognized Native American Tribes has been initiated. Copies of the consultation letters are provided in Appendix E. To date, no known sites of significance to Native Americans have been identified at Palisades.

2.2.10 Related Federal Project Activities and Consultations

The NRC staff reviewed the possibility that activities of other Federal agencies might impact the renewal of the OL for Palisades. 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 draft SEIS.

The NRC staff has determined that there are no Federal project activities that would make it desirable for another Federal agency to become a cooperating agency for preparing this draft SEIS. There are no known Federal facilities or land or Native American land within 50 mi of Palisades. The D.C. Cook Nuclear Plant, owned by the Indiana and Michigan Power Company, is located approximately 28 mi south-southwest of Palisades.

The NRC is required under Section 102(c) of the National Environmental Policy Act of 1969 as amended (NEPA) 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; the consultation is described in Sections 2.2.6 and 4.6, and correspondence is included in Appendix E.

2.3 References

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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."

10 CFR Part 71. *Code of Federal Regulations*, Title 10, *Energy*, Part 71, "Packaging and Transportation of Radioactive Material."

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

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 draft 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.

(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
GROUNDWATER USE AND QUALITY	
Impacts of refurbishment on groundwater 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

Category 1 and Category 2 issues related to refurbishment that are not applicable to the Palisades Nuclear Plant (Palisades) because they are related to plant design features or site characteristics not found at Palisades are listed in Appendix F.

The potential environmental impacts of refurbishment actions would be identified, and the analysis would be summarized within this section, if such actions were planned. Nuclear Management Company, LLC (NMC) indicated that it has performed an evaluation of structures and components pursuant to Section 54.21 of Title 10, of the *Code of Federal Regulations* (10 CFR 54.21) to identify activities that are necessary to continue operation of Palisades 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).

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 archaeological 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 applicant's environmental report and the U.S. Nuclear Regulatory Commission staff's environmental impact statement.

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 for Palisades (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 Palisades beyond the end of the existing operating license. Therefore, refurbishment is not considered in this draft SEIS.

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."

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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, Vol. 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 off-site 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 Part 51 of Title 10 of the *Code of Federal Regulations* (CFR Part 51), Subpart A, Appendix B, and are applicable to the Palisades Nuclear Plant (Palisades). Section 4.1 addresses issues applicable to the Palisades 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

(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.

information that was raised during the scoping period, and Section 4.8 discusses cumulative impacts. The results of the evaluation of environmental issues related to operation during the renewal term are summarized in Section 4.9. Finally, Section 4.10 lists the references for Chapter 4. Category 1 and Category 2 issues that are not applicable to Palisades because they are related to plant design features or site characteristics not found at Palisades 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 Palisades cooling system operation during the renewal term are listed in Table 4-1. Nuclear Management Company, LLC (NMC) stated in its Environmental Report (ER; NMC 2005a) that it is not aware of any new and significant information associated with the license renewal and continued operation of Palisades. The NRC staff has not identified any new and significant information during its independent review of the NMC ER (NMC 2005a), the site visit, the scoping process, or the evaluation of other available information. Therefore, the NRC staff concludes that there would be no impacts related to these issues beyond those discussed in the GEIS. For all of the issues, the NRC staff concluded in the GEIS that the impacts are SMALL, and additional plant-specific mitigation measures are not likely to be sufficiently beneficial to be warranted.

A brief description of the NRC 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 NRC staff has not identified any new and significant information during its independent review of the NMC ER, the site visit, the scoping process, or the evaluation of other available information. Therefore, the NRC staff concludes that there would be no impacts of altered current patterns at intake and discharge structures during the renewal term beyond those discussed in the GEIS.

Table 4-1. Category 1 Issues Applicable to the Operation of the Palisades 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	
Altered current patterns at intake and discharge structures	4.2.1.2.1
Altered thermal stratification of lakes	4.2.1.2.2
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
AQUATIC ECOLOGY	
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
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 (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

- Altered thermal stratification of lakes. Based on information in the GEIS, the Commission found that

  > Generally, lake stratification 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 NRC staff has not identified any new and significant information during its independent review of the NMC ER, the site visit, the scoping process, the review of monitoring programs, or the evaluation of other available information. Therefore, the NRC staff concludes that there would be no impacts of altered thermal stratification of lakes 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.

  The NRC staff has not identified any new and significant information during its independent review of the NMC ER, the site visit, the scoping process, or the evaluation of other available information. Therefore, the NRC staff concludes that there would be 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 NRC staff has not identified any new and significant information during its independent review of the NMC ER, the site visit, the scoping process, the review of monitoring programs, or the evaluation of other available information. Therefore, the NRC staff concludes that there would be 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 NRC staff has not identified any new and significant information during its independent review of the NMC ER, the site visit, the scoping process, the review of monitoring programs, or the evaluation of other available information, including plant monitoring data and technical reports. Therefore, the NRC staff concludes that there would be no impacts of eutrophication 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 NRC staff has not identified any new and significant information during its independent review of the NMC ER, the site visit, the scoping process, or the evaluation of other available information, including the National Pollutant Discharge Elimination System (NPDES) permit for Palisades and discussion with the Michigan Department of Environmental Quality (MDEQ) compliance office. Therefore, the NRC staff concludes that there would be 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 the NPDES permit, and periodic modifications, if needed, and are not expected to be a problem during the license renewal term.

  The NRC staff has not identified any new and significant information during its independent review of the NMC ER, the site visit, the scoping process, or the evaluation of other available information, including the NPDES permit for Palisades and discussion with the MDEQ compliance office. Therefore, the NRC staff concludes that there would be 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 NRC staff has not identified any new and significant information during its independent review of the NMC ER, the site visit, the scoping process, or the evaluation of other available information, including the NPDES permit for Palisades and discussion with the MDEQ compliance offices. Therefore, the NRC staff concludes that there would be no impacts of discharges of other metals in wastewater 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 NRC staff has not identified any new and significant information during its independent review of the NMC ER, the site visit, the scoping process, or the evaluation of available information. Therefore, the NRC staff concludes that there would be 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 NRC staff has not identified any new and significant information during its independent review of the NMC ER, the site visit, the scoping process, the review of monitoring programs, or the evaluation of other available information. Therefore, the NRC staff concludes that there would be 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 NRC staff has not identified any new and significant information during its independent review of the NMC ER, the site visit, the scoping process, or the evaluation of other available information. Therefore, the NRC staff concludes that there would be 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 NRC staff has not identified any new and significant information during its independent review of the NMC ER, the site visit, the scoping process, or the evaluation of other available information. Therefore, the NRC staff concludes that there would be no impacts of thermal plume barriers on 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 affect the larger geographical distribution of aquatic organisms.

The NRC staff has not identified any new and significant information during its independent review of the NMC ER, the site visit, the scoping process, the review of monitoring programs, or the evaluation of other available information. Therefore, the NRC staff concludes that there would be 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 NRC staff has not identified any new and significant information during its independent review of the NMC ER, the site visit, the scoping process, or the evaluation of other available information. Therefore, the NRC staff concludes that there would be 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 NRC staff has not identified any new and significant information during its independent review of the NMC ER, the site visit, the scoping process, or the evaluation of other available information. Therefore, the NRC staff concludes that there would be 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 NRC staff has not identified any new and significant information during its independent review of the NMC ER, the site visit, the scoping process, the review of monitoring programs, or the evaluation of other available information. Therefore, the NRC staff concludes that there would be 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 NRC staff has not identified any new and significant information during its independent review of the NMC ER, the site visit, the scoping process, or the evaluation of other available information. Therefore, the NRC staff concludes that there would be 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 NRC staff has not identified any new and significant information during its independent review of the NMC ER, the site visit, the scoping process, or the evaluation of other available information. Therefore, the NRC staff concludes that there would be 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 heat dissipation). 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 NRC staff has not identified any new and significant information during its independent review of the NMC ER, the site visit, the scoping process, or the evaluation of other available information. Therefore, the NRC staff concludes that there would be 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 heat dissipation). 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 NRC staff has not identified any new and significant information during its independent review of the NMC ER, the site visit, the scoping process, or the evaluation of other available information. Therefore, the NRC staff concludes that there would be 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 heat dissipation). 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 NRC staff has not identified any new and significant information during its independent review of the NMC ER, the site visit, the scoping process, or the evaluation of other available information. Therefore, the NRC staff concludes that there would be 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 renewal term.

The NRC staff has not identified any new and significant information during its independent review of the NMC ER, the site visit, the scoping process, or the evaluation of other available information. Therefore, the NRC staff concludes that there would be 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 NRC staff has not identified any new and significant information during its independent review of the NMC ER, the site visit, the scoping process, or the evaluation of other available information. Therefore, the NRC staff concludes that there would be 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 NRC staff has not identified any new and significant information during its independent review of the NMC ER, the site visit, the scoping process, or the evaluation of other available information. Therefore, the NRC staff concludes that there would be 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 NRC staff has not identified any new and significant information during its independent review of the NMC ER, the site visit, the scoping process, or the evaluation of other available information. Therefore, the NRC staff concludes that there would be 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 NRC staff has not identified any new and significant information during its independent review of the NMC ER, the site visit, the scoping process, or the evaluation of other available information. Therefore, the NRC staff concludes that there would be no impacts of noise during the renewal term beyond those discussed in the GEIS.

No Category 2 issues related to cooling system operation during the renewal term are applicable to Palisades.

4.2 Transmission Lines

The Final Environmental Statement (FES) for Palisades (AEC 1972) describes two transmission lines that connect Palisades with the transmission system. The transmission lines, as well as their ownership and responsibilities for their maintenance, are described in Section 2.1.7 of this Supplemental Environmental Impact Statement (SEIS). The 0.6-mi-long Palisades-Cook 345-kV transmission line connects to the American Electric Power (AEP) system, while the 40-mi-long Palisades-Argenta 345-kV transmission line connects to the Michigan Electric Transmission Company, LLC (METC) system and the Michigan Power Pool (NMC 2005a).

The Palisades-Cook transmission line is situated on land similar to that of the Palisades site. Its construction involved the clearing of a 150-ft-wide right-of-way totaling 10.9 ac over sand dunes (AEC 1972). The Palisades-Argenta transmission line right-of-way is 1320 ft wide for the first 4.5 mi, 350 ft wide for the next 34 mi, and 471 ft wide for the final 1.5 mi, totaling 2250 ac. This line crosses mostly flat to gently rolling terrain used primarily for agriculture (AEC 1972).

Vegetation control along Palisades transmission lines is accomplished through the use of herbicides, mowing, and cutting, or pruning of tall-growing tree species that are considered danger trees. Danger trees are typically outside the cleared right-of-way but could cause a line outage from windfall of healthy or diseased trees. Procedures are in place to ensure that vegetation management along rights-of-way is carried out in a manner to protect local water bodies and aquatic organisms that could be adversely impacted from herbicide application in the immediate vicinity of stream and river crossings. Herbicides that are used comply with Federal and State regulations and are applied by licensed applicators.

Category 1 issues in 10 CFR Part 51, Subpart A, Appendix B, Table B-1 that are applicable to Palisades transmission lines are listed in Table 4-2. NMC stated in its ER that it is not aware of any new and significant information associated with the renewal of the Palisades operating license (OL) (NMC 2005a). The NRC staff has not identified any new and significant information during its independent review of the NMC ER, the site visit, the scoping process, or the evaluation of other available information. Therefore, the NRC staff concludes that there would be no impacts related to these issues beyond those discussed in the GEIS (NRC 1999). For all of those issues, the NRC staff concluded in the GEIS that the impacts are SMALL, and

additional plant-specific mitigation measures are not likely to be sufficiently beneficial to be warranted.

A brief description of the NRC staff's review and 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 NRC staff has not identified any new and significant information during its independent review of the NMC ER, the site visit, the scoping process, consultation with the U.S. Fish and Wildlife Service (FWS) and the Michigan Department of Natural Resources (MDNR), or the evaluation of other information. Therefore, the NRC staff concludes that there would be no impacts of power line right-of-way maintenance during the renewal term beyond those discussed in the GEIS.

Table 4-2. Category 1 Issues Applicable to the Palisades 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
Floodplains 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

- 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 NRC staff has not identified any new and significant information during its independent review of the NMC ER, the site visit, the scoping process, consultation with the FWS and MDNR, or the evaluation of other information. Therefore, the NRC staff concludes that there would be 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 NRC staff has not identified any new and significant information during its independent review of the NMC ER, the site visit, the scoping process, or the evaluation of other information. Therefore, the NRC staff concludes that there would be no impacts of electromagnetic fields on flora and fauna during the renewal term beyond those discussed in the GEIS.

- Floodplains and wetlands on power line rights-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 NRC staff has not identified any new and significant information during its independent review of the NMC ER, the site visit, the scoping process, consultation with the FWS and MDNR, or the evaluation of other information. Therefore, the NRC staff concludes that there would be no impacts of power line rights-of-way on floodplains and wetlands during the renewal term beyond those discussed in the GEIS.

- Air quality effects of transmission lines. Based on the 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 NRC staff has not identified any new and significant information during its independent review of the NMC ER, the site visit, the scoping process, or the evaluation of other information. Therefore, the NRC staff concludes that there would be 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 NRC staff has not identified any new and significant information during its independent review of the NMC ER, the site visit, the scoping process, or the evaluation of other information. Therefore, the NRC staff concludes that there would be 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-way would continue with no change in restrictions. The effects of these restrictions are of small significance.

  The NRC staff has not identified any new and significant information during its independent review of the NMC ER, the site visit, the scoping process, or the evaluation of other information. Therefore, the NRC staff concludes that there would be no impacts of power line rights-of-way 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 being treated as a Category 2 issue. These issues are listed in Table 4-3 and are discussed in Sections 4.2.1 and 4.2.2.

Table 4-3. Category 2 and Uncategorized Issues Applicable to the Palisades Transmission Lines 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
HUMAN HEALTH			
Electromagnetic fields, acute effects (electric shock)	4.5.4.1	H	4.2.1
Electromagnetic fields, chronic effects	4.5.4.2	NA	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 draft SEIS.

In the GEIS (NRC 1996), the NRC staff found that without a review of the conformance of each nuclear plant transmission line with National Electrical Safety Code (NESC) (IEEE 2002) criteria, 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 plants. For other 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.

Both transmission lines associated with Palisades were constructed in accordance with NESC and industry guidance in effect at that time. The transmission facilities are maintained to ensure continued compliance with current standards. Since the lines were constructed, a new criterion has been added to the NESC for power lines with voltages exceeding 98 kV. This criterion states that the minimum clearance for a line must limit induced currents due to static effects to 5 mA.

NMC (2005a) has reviewed the power lines for compliance with this criterion. Spans where the potential for induced current would be the greatest were identified. The electric field strengths and potential induced currents for these spans were calculated by using Version 2.5 of the ENVIRO computer code (EPRI 1996). Input to the code included line sag at a 120°F conductor temperature, maximum operating voltage during normal load conditions, and a large tractor-trailer parked under the line in a position to maximize the induced current. The calculated induced currents for both Palisades 345-kV lines at six locations ranged from 1.6 to 4.9 mA, all below the NESC 5-mA criterion (NMC 2005a).

The NRC staff has reviewed the available information, including the applicant's evaluation and computational results. Based on this information, the NRC staff has evaluated the potential impacts for electric shock resulting from operation of Palisades and its associated transmission

lines. The NRC staff concludes that the impacts of electric shock during the renewal period would be SMALL, and that no further mitigation measures would be warranted.

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 Category 1 or 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 (DOE). The report by 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 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 noncancer health outcomes provide sufficient evidence of a risk to currently warrant concern.

This statement is not sufficient to cause the NRC staff to change its position with respect to the chronic effects of electromagnetic fields. The NRC staff considers the GEIS finding of "Not Applicable" 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 Palisades in regard to radiological impacts are listed in Table 4-4. NMC stated in its ER (NMC 2005a) that it is not aware of any new and significant information associated with the renewal of the Palisades OL. The NRC staff has not identified any new and significant information during its independent review of the NMC ER, the site visit, the scoping process, or the evaluation of other available information. Therefore, the NRC staff concludes that there are no impacts related to these issues beyond those discussed in the GEIS. For these issues, the NRC 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 4-4. *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 NRC 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 NRC staff has not identified any new and significant information during its independent review of the NMC ER, the site visit, the scoping process, or the evaluation of other available information. Therefore, the NRC staff concludes that there would be 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 NRC staff has not identified any new and significant information during its independent review of the NMC ER, the site visit, the scoping process, or the evaluation of other available information. Therefore, the NRC staff concludes that there would be 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 Period

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 4-5. NMC stated in its ER (NMC 2005a) that it is not aware of any new and significant information associated with the renewal of the Palisades OL. The NRC staff has not identified any new and significant information during its independent review of the NMC ER, the site visit, the scoping process, or the evaluation of other available information. Therefore, the NRC staff concludes that there are no impacts related to these issues beyond those discussed in the GEIS (NRC 1996). For these issues, the NRC 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 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 NRC 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 on public safety, social services, and tourism and recreation are expected to be of SMALL significance at all sites.

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

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

  No significant impacts are expected during the license renewal term.

  The NRC staff has not identified any new and significant information during its independent review of the NMC ER, the site visit, the scoping process, or the evaluation of other available information. Therefore, the NRC staff concludes that there would be 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 NRC staff has not identified any new and significant information during its independent review of the NMC ER, the site visit, the scoping process, or the evaluation of other available information. Therefore, the NRC staff concludes that there would be no aesthetic impacts of transmission lines during the renewal term beyond those discussed in the GEIS.

Table 4-6 lists the Category 2 socioeconomic issues, which require plant-specific analysis, and environmental justice, which was not addressed in the GEIS.

Table 4-6. 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 Sections	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, transportation	4.7.3.2	J	4.4.4
Historic and archaeological 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 NRC 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), and a matrix is used to rank the population category as low, medium, or high (GEIS Figure C.1).

In 2000, 118,667 people were living within 20 mi of the Palisades site. Based on the GEIS measure of sparseness, the area within 20 mi has a density of 238 persons/mi^2, placing it in the least sparse (high-density) category, Category 4 (NMC 2005a; U.S. Census Bureau 2004). In 2000, 1,287,558 persons lived within 50 mi of the plant, giving the area a density of 283 persons/mi^2. According to the NRC sparseness and proximity matrix, the area falls into Category 4 for both measures, meaning that the area is classified as a high-density area.

Part 51 of 10 CFR, Subpart A, Appendix B, Table B-1 states that impacts on housing availability are expected to be of small significance at plants located in a high-population area where growth-control measures are not in effect. The Palisades site is located in a high-population area, and Van Buren County is not subject to growth-control measures that would limit housing development. Based on the NRC criteria, NMC anticipates that housing impacts would be SMALL during continued operation of Palisades (NMC 2005a).

SMALL impacts result when no discernible change in housing availability occurs, changes in rental rates and housing values are similar to those occurring statewide, and no housing construction or conversion is required to meet new demand (NRC 1996). The NMC ER (NMC 2005a) assumes that a small number of additional workers might be needed during the license renewal period to perform routine maintenance and other activities.

The housing vacancy rate in 2000 was 17.6 percent in Van Buren County and 13.4 percent in Berrien County. If these vacancy rates continue, small increases in the number of workers required at the plant would not require any new housing construction.

The NRC staff reviewed the available information relative to housing impacts and NMC's conclusions. Based on this review, the NRC staff concludes that the impact on housing during the license renewal period would be SMALL, and additional mitigation is 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 both plant demand and plant-related population growth. Section 2.2.2 describes the Palisades permitted withdrawal rate and actual use of water.

The NRC staff has reviewed the available information, including permitted and actual water use rates at Palisades, and water use and water supply capacities for the major water supply systems in Van Buren County. Based on this information, the NRC staff concludes that the potential impacts of Palisades operation during the license renewal period would be SMALL. During the course of its evaluation, the NRC staff considered mitigation measures for continued operation of Palisades. Based on this evaluation, the NRC staff expects that mitigation measures in place at Palisades are appropriate, and that no additional 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.

NMC expects to use existing employees, possibly adding a maximum of two employees, to support Palisades operations during the license renewal term. In Section 3.7.5 of the GEIS (NRC 1996), the NRC staff stated that if plant-related population growth is less than 5 percent of the study area's total population, offsite land-use changes would be SMALL, especially if the study area has established patterns of residential and commercial development, a population density of at least 60 persons/mi^2, and at least one urban area with a population of 100,000 or more within a 50-mi radius. In this case, population growth would be 0 percent of the total 2000 population of 1,287,558 within the 50-mi radius. The area has established patterns of residential and commercial development, a population density of 283 persons/mi^2, and at least one urban area (Kalamazoo-Battle Creek Metropolitan Statistical Area) with a population of 100,000 or more within the 50-mi radius. Consequently, the NRC staff concludes that population changes resulting from renewal of the Palisades OL would likely result in SMALL impacts on offsite land use.

Tax revenue can affect land use because it enables local jurisdictions to provide the public services (e.g., transportation and utilities) necessary to support development. In Section 4.7.4.1 of the GEIS, the NRC staff 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.

Covert Township and Covert School District receive significant tax payments from Consumers Energy property tax payments. As discussed in Section 2.2.8.6 and shown in Table 2-10, Consumers Energy paid an average of $0.9 million annually in property taxes to the township over the 3-year period from 2002 through 2004, or approximately 56 percent of the township's revenues. The Covert School District received an average of $2.6 million annually from taxes paid by Consumers Energy over the 3-year period (2002 through 2004). These payments represent a substantial, positive impact on the fiscal condition of the township and the school district. In addition to the Covert School District, Covert Township forwards the balance of the property tax revenues to the Van Buren Intermediate School District and Van Buren County. Both the Van Buren Intermediate School District and Van Buren County received an average of $0.8 million annually in property tax payments over the 3-year period (2002 through 2004), or 3 to 4 percent of revenues in each jurisdiction.

Because no refurbishment or new construction activities are associated with the license renewal, no additional sources of plant-related tax payments are expected that could influence land use in the township or the county. The continued collection of property taxes from Consumers Energy for Palisades will result in moderate indirect tax-driven land-use impacts through sewer and water system improvements and expansion, lower property taxes, and improved educational services and facilities. This source of revenue allows the township, school district, and county to keep tax rates below the levels they would otherwise have in order to fund the higher levels of public infrastructure and services, schools, and government services.

Van Buren County's population growth rates over the last 30 years have been both moderate and stable (Table 2-8). NMC projects the addition of one or two additional employees to support the Palisades operations during the license renewal term; thus, land-use changes from Palisades population-related growth would be negligible. While the county has experienced significant residential, industrial, and commercial growth during this 30-year period, Van Buren County has developed an overall land-use decision-making strategy that encourages

municipalities to implement a "smart growth" methodology that relies on a mix of development and planning tools.[a]

NMC projects that annual property taxes from Palisades to Covert Township, Covert School District, Van Buren County Intermediate School District, and Van Buren County will remain relatively constant throughout the license renewal period. However, the Michigan Public Service Commission is currently implementing the electric utility restructuring legislation that was enacted in June 2000, and the impacts are not fully known at this time. Any changes to tax rates for the Palisades property due to the restructuring would be independent of license renewal (NMC 2005a).

No adverse impacts on offsite land use would occur because of license renewal. Consequently, the NRC staff concludes that offsite land-use impacts would likely be SMALL, and additional mitigation is not warranted.

4.4.4 Public Services: Transportation Impacts During Operations

On October 4, 1999, 10 CFR 51.53(c)(3)(ii)(J) and 10 CFR Part 51, Subpart A, Appendix B, Table B-1 were revised to clearly state that "Public Services: Transportation Impacts During Operations" is a Category 2 issue (see NRC 1999 for more discussion of this clarification). The issue is treated as such in this draft SEIS.

Given the small number of additional workers required during the renewal period, there would be no additional impacts on the transportation network in the vicinity of the Palisades site. Therefore, the NRC staff concludes that during the license renewal period, transportation impacts during operation would likely be SMALL. Additional mitigation is not warranted.

4.4.5 Historic and Archaeological Resources

The National Historic Preservation Act of 1966 (NHPA), as amended through 2000, requires Federal agencies to take into account the potential effects of their undertakings on historic properties. The historic-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. The renewal of an OL for a nuclear power plant is an undertaking that could potentially affect either known or potential historic properties that may be located at the plant's site. In accordance with the provisions of the NHPA, the NRC is required to make a reasonable effort to identify historic properties in the potentially affected areas and notify the State Historic Preservation Office

(a) Interview with K. Getman and M. Thomas, Michigan Economic Development Corporation (July 2005).

(SHPO) before proceeding. If historic properties are determined to be present, an assessment is required to resolve any possible adverse effects of the undertaking.

At Palisades, the potential exists that presently unknown significant archaeological resources may be present on or below the ground surface at the site and along the transmission line corridors. Any such resources could be inadvertently disturbed or destroyed by construction or other ground-disturbing activities. The applicant has indicated that no major refurbishment or replacement activities at Palisades or along the transmission line corridors are associated with its license renewal request (NMC 2005a). However, routine operations and maintenance activities that will take place during the renewal period could potentially affect presently unknown archaeological resources. The applicant states that it has procedures in place to protect any resources from such inadvertent disturbance or destruction from these activities.

The NRC staff reviewed the applicant's environmental review procedures for Palisades during the site audit. The applicant has stated that these procedures are in place to ensure that any archaeological resources that may be present receive consideration and protection. The procedures require that an archaeological survey be undertaken for any construction and modification activities that involve all ground-disturbing activities in the owner-controlled area of NMC operated nuclear facilities and to those activities including, but not limited to the construction or expansion of buildings, facilities, substations, parking lots, roads, or overhead or underground utility lines. In the event that items of potential historic significance are discovered during surveys, NMC and Consumers Energy would consult with the SHPO prior to proceeding. The NRC staff's independent review of records on file at the SHPO office did not locate records related to project-specific archaeological surveys conducted at Palisades for ground-disturbing activities. However, Consumers Energy did locate in its records one such report that documented a cultural resource field visit to the Palisades site by archaeologists in 1982 for three proposed projects (CAI 1982).

During the site audit, the NRC staff also reviewed the applicant's excavation and trenching control procedures, which require that any planned excavation activities that occur at a depth greater than 6 in. within previously undisturbed land be reviewed by the NMC Environmental Coordinator. The Environmental Coordinator's responsibilities (as defined in NMC's Archaeological, Cultural & Historic Resources procedures) include reviewing excavation and trenching plans to determine if any known archaeological resources are located within the proposed ground disturbance area, assessing the potential importance of any archaeological resources discovered during construction, and coordinating with the SHPO when potentially culturally important resource discoveries are made. The procedures also include a list of the types of archaeological materials that could be encountered during construction. During the site audit, the NRC staff expressed concerns about the NMC procedures not requiring a qualified archaeologist to survey the proposed ground disturbance area for archaeological resources prior to construction. In addition, the NRC staff noted that the procedure did not

specify the training, experience, or credential requirements for the site's Environmental Coordinator to recognize archaeological materials or assess the potential significance of historic or archaeological resources. Subsequent to the NRC staff's comments, the applicant revised and implemented its procedures in January 2006 (NMC 2006) to reflect these concerns.

Based on the NRC staff's review of agency files, published literature, and information provided by the applicant, the NRC staff concludes that potential impacts on historic and archaeological resources would be SMALL. This conclusion is based on the fact that (1) o major refurbishment or replacement activities would occur during the renewal period; and (2) the applicant has environmental review procedures in place to ensure that any archaeological resources that may be present receive consideration and protection.

4.4.6 Environmental Justice

Environmental justice refers to a Federal policy that requires that Federal agencies identify and address, as appropriate, disproportionately high and adverse human health or environmental impacts of its actions on minority[(a)] or low-income populations. The memorandum accompanying Executive Order 12898 (59 FR 7629) directs Federal executive agencies to consider environmental justice under the National Environmental Policy Act (NEPA). The Council on Environmental Quality (CEQ) has provided guidance for addressing environmental justice (CEQ 1997). 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.

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

The NRC staff looks for minority and low-income populations within the 50-mi radius of the site. For the NRC staff's review, a minority population exists in a census block group[(a)] if the percentage of each minority and aggregated minority category within the census block group exceeds the 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 percentage points, or if the corresponding percentage of low-income population within a census block group is at least 50 percent.

For the Palisades review, the NRC staff examined the geographic distribution of minority and low-income populations within 50-mi of the site, employing data from the 2000 census for low-income populations and for minority populations (NMC 2005a). The analysis was supplemented by discussions with the planning department and social service agencies in Van Buren County.

Figures 4-1 and 4-2 show the geographic distribution of minority and low-income groups within 50 mi of the plant. A number of tracts within Van Buren County exceed the NRC thresholds defining low-income; these are located in Covert. Other tracts within the 50-mi region are located in Kalamazoo to the east of Palisades and South Bend to the southeast. Census block groups with a minority population within the 50-mi region in Michigan are located in Covert and Keeler in Van Buren County, and in Berrien, Cass, Van Buren, and Allegan Counties. In Indiana, minority populations are located in South Bend, Mishawaka, and Elkhart.

With the locations of minority and low-income populations identified, the NRC staff proceeded to evaluate whether any of the environmental impacts of the proposed action could affect these populations in a disproportionately high and adverse manner. Based on NRC staff guidance (NRC 2004a), air, land, and water resources within about 50-mi of the Palisades 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.

(a) A census block group is a combination of census blocks, which are statistical subdivisions of a census tract. A census block is the smallest geographic entity for which the U.S. Census Bureau 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 U.S. Census Bureau guidelines for the purpose of collecting and presenting decennial census data. Census block groups are subsets of census tracts (U.S. Census Bureau 2004).

1

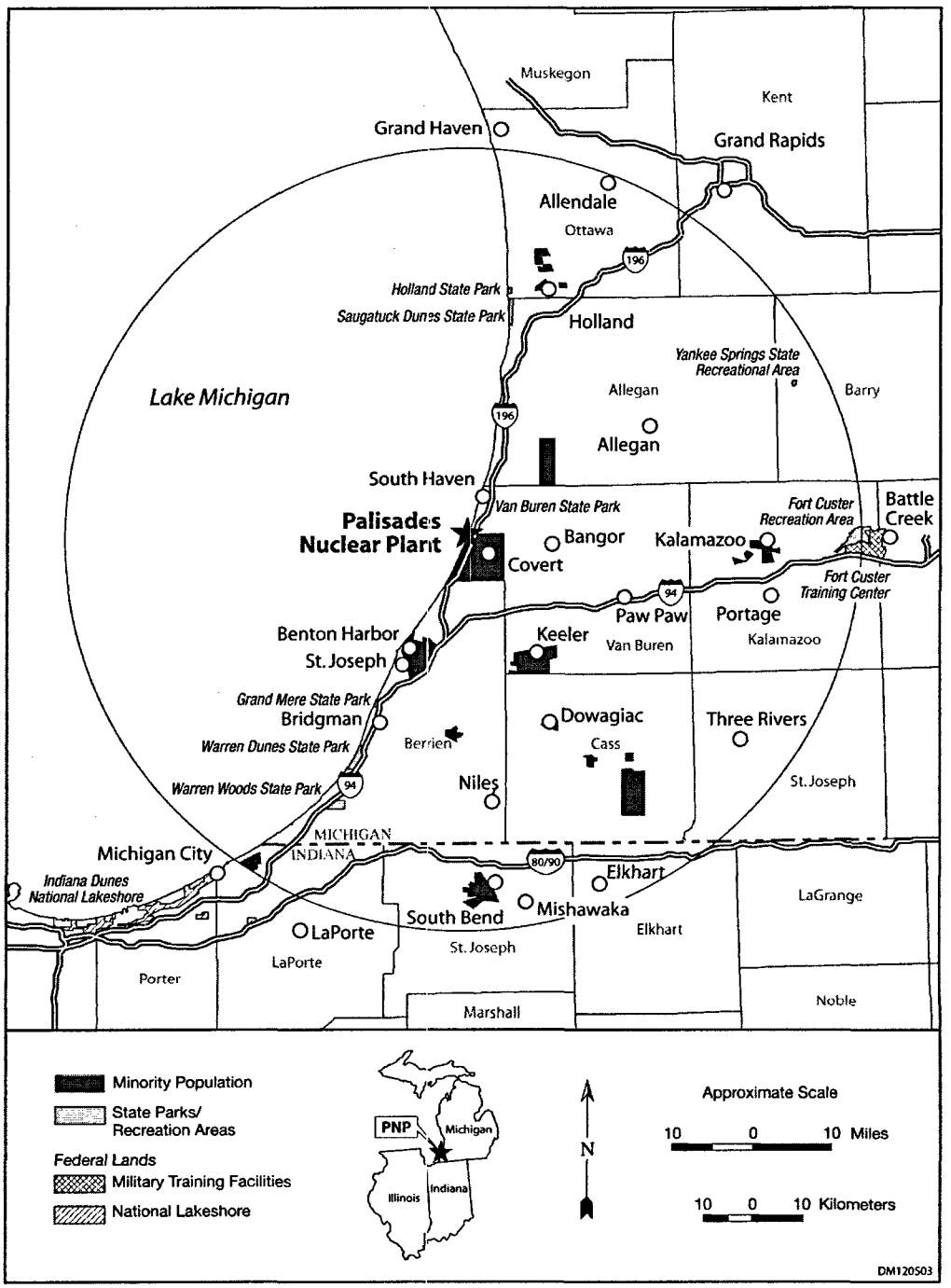

Figure 4-1. Geographic Distribution of Minority Populations (shown in shaded areas) Within 50 mi of Palisades Based on Census Block Group Data

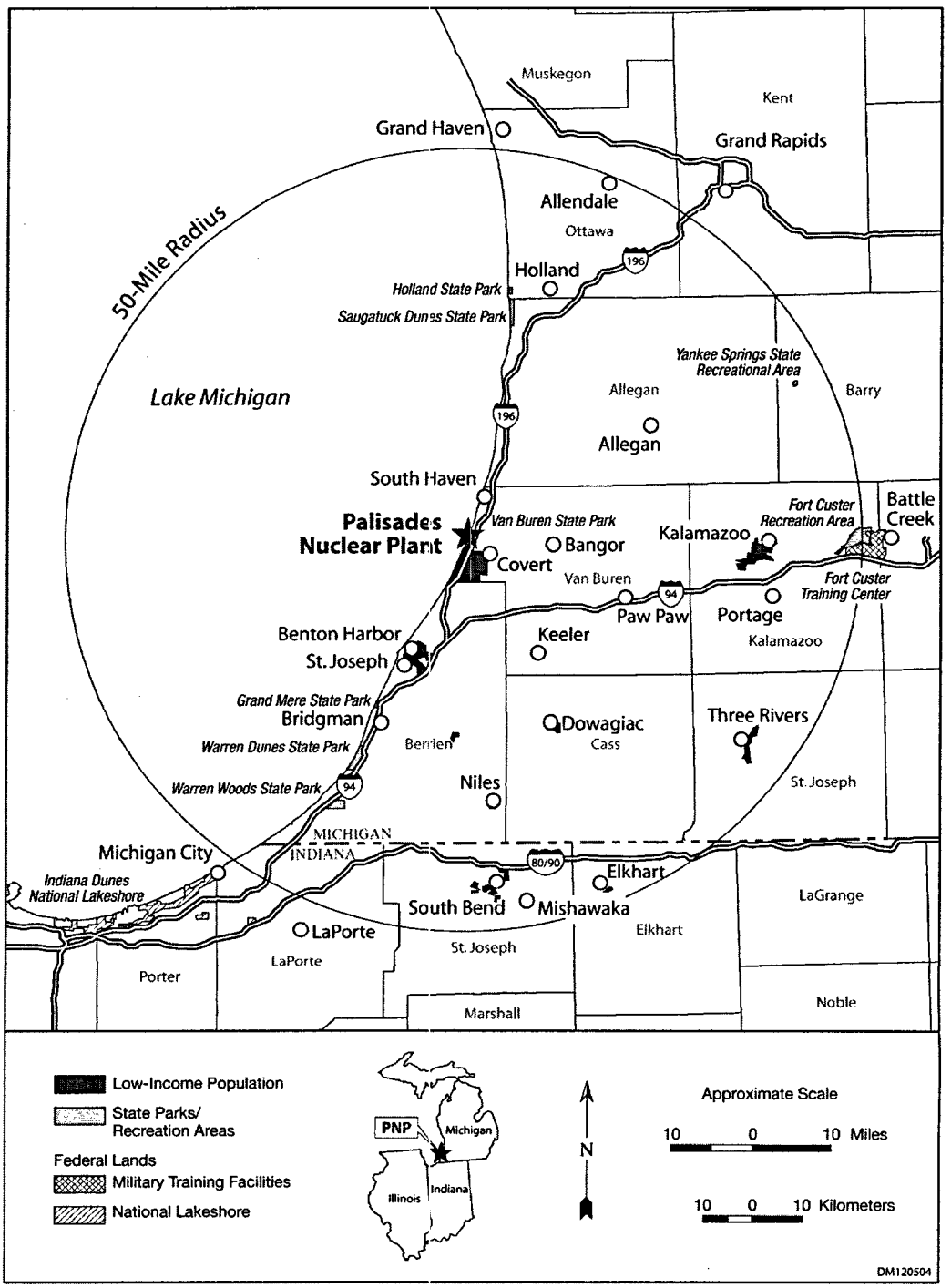

Figure 4-2. Geographic Distribution of Low-Income Populations (shown in Shaded areas) Within 50 mi of Palisades Based on Census Block Group Data

The pathways through which the environmental impacts associated with Palisades license renewal can affect human populations are discussed throughout this draft SEIS. The NRC staff evaluated whether minority and low-income populations could be disproportionately affected by these impacts. The NRC staff found no unusual resource dependencies or practices, such as subsistence agriculture, hunting, or fishing, through which the populations could be disproportionately high and adversely affected. In addition, the NRC staff did not identify any location-dependent disproportionately high and adverse impacts affecting these minority and low-income populations. The NRC staff concludes that offsite impacts from Palisades on minority and low-income populations would be SMALL, and no special mitigation actions are warranted.

4.5 Groundwater Use and Quality

Of the Category 1 issues related to groundwater use and quality that are identified in 10 CFR Part 51, Subpart A, Appendix B, Table B-1, only one is applicable to Palisades and it is listed in Table 4-7.

Table 4-7. 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
GROUNDWATER USE AND QUALITY	
Groundwater use conflicts (potable and service water; plants that use <100 gpm).	4.8.1.1

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

- Groundwater 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 groundwater use conflicts.

As discussed in Section 2.2.2, Palisades has three operable groundwater production wells for grounds maintenance or other miscellaneous uses. Their combined pumping rate is 24 gpm, which is below the 100-gpm threshold.

The NRC staff has not identified any new and significant information during its independent review of the NMC ER, the site visit, the scoping process, or the evaluation of other available information. Therefore, the NRC staff concludes that there would be no impacts related to this issue beyond those 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.

4.6 Threatened or Endangered Species

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 4-8.

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 Federally listed threatened or endangered species in the vicinity of the Palisades site and its associated transmission lines is discussed in Sections 2.2.5 and 2.2.6.

Table 4-8. Category 2 Issue Applicable to Threatened or Endangered Species 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
THREATENED OR ENDANGERED SPECIES (FOR ALL PLANTS)			
Threatened or endangered species	4.1	E	4.6

On June 30, 2005, the NRC contacted the FWS to request information on Federally listed threatened and endangered species and the impacts of relicensing (NRC 2005). In response, on July 29, 2005, the FWS provided information regarding Federally listed species that could occur in the vicinity of Palisades or along the transmission line rights-of-way (FWS 2005b).

4.6.1 Aquatic Species

The NRC staff has reviewed the information provided by the applicant and public information and has contacted the FWS and the MDNR. No Federally listed threatened or endangered aquatic species occur in Lake Michigan in the vicinity of the Palisades site, and no Federally listed threatened or endangered species occur in the streams crossed by the Palisades-Argenta transmission line. Therefore, license renewal would have no effect on any Federally listed aquatic species.

4.6.2 Terrestrial Species

The FWS identified four Federally listed and one candidate terrestrial species that they believe could occur on the Palisades site or along the associated transmission line rights-of-way: Pitcher's thistle (*Cirsium pitcheri*; threatened), Karner blue butterfly (*Lycaeides melissa samuelis*; endangered), Mitchell's satyr butterfly (*Neonympha mitchelli mitchelli*; endangered), Indiana bat (*Myotis sodalis*; endangered), and eastern massasauga rattlesnake (*Sistrurus catenatus catenatus*; candidate) (FWS 2005b). These species, their preferred habitat, and county distributions are described in Section 2.2.6.

Pitcher's thistle is the only Federally listed species known to exist on the Palisades site, where it occurs in open dune habitats (NMC 2005a).[(a)] License renewal and continued operation of Palisades are not likely to adversely affect the Pitcher's thistle for several reasons. No refurbishment is considered necessary during the license renewal period at the Palisades site (NMC 2005a), and, therefore, significant land disturbance during that period is not considered likely. However, any activities during the renewal period that could result in land disturbance would undergo a predisturbance evaluation and consideration of impacts to threatened and endangered species (NMC 2005a). In addition, all dune areas on the site where the Pitcher's thistle is most likely to occur are protected under authority of Michigan's Natural Resources and Environmental Protection Act, Part 353, and any action that would disturb dune habitats would require a permit from the State (MDEQ 2005). The Pitcher's thistle does not occur in areas affected by current operations, including those areas affected by cooling-tower drift. On the basis of these considerations, continued operation of Palisades during the license renewal period would not be expected to adversely affect the Pitcher's thistle.

Of the counties in the project area, the Karner blue butterfly is known only from Allegan County (MNFI 2005; FWS 2005), which is crossed by a very short length of the Palisades-Argenta line (NMC 2005a). However, Czarnecki (FWS 2005b) suggests that the species could also occur near the Argenta-E. Elkhart line in the eastern portion of Van Buren County. This species was not observed during field surveys of the Palisades site and transmission line corridors conducted in 1979 (Asplundh 1979) and 1991 (Higman and Goff 1991; Goff 1992). The applicant's vegetation-management practices that maintain habitat within transmission line rights-of-way in early successional stages (NMC 2005a) are consistent with protecting habitats occupied by this species, and continued maintenance over the license renewal period is not expected to adversely affect this species or its habitat. The owner of Palisades is partnering with the MDNR, the Nature Conservancy, and others to develop a habitat conservation plan for the Karner blue butterfly (NMC 2005a).

(a) Interview with G. Dawson, Consumers Energy Company, Environmental and Laboratory Services (July 26, 2005).

The Mitchell's satyr butterfly may occur in wetland areas along portions of the transmission lines in Kalamazoo and Van Buren Counties (FWS 2005; MNFI 2005); however, this species was not observed during field surveys conducted in 1979 (Asplundh 1979) and 1991 (Higman and Goff 1991; Goff 1992). License renewal and continued operations of Palisades are not likely to adversely affect the Mitchell's satyr butterfly for several reasons. Preferred habitat for this species (calcareous wetlands) is not known to occur within or adjacent to transmission line rights-of-way associated with Palisades (NMC 2005a). The applicant's vegetation-management practices that maintain habitat within transmission line rights-of-way as herbaceous or low-growing shrub communities (NMC 2005a) are consistent with protecting habitats occupied by this species. Therefore, continued maintenance of rights-of-way over the license renewal period would not be expected to adversely affect this species or its habitat.

The Indiana bat is not known to occur at the Palisades site or along associated transmission lines, but potential habitat occurs within the project area (FWS 2005b). It should be noted, however, that this species is difficult to detect without conducting specialized surveys, and such surveys of the site have not been conducted. The Indiana bat is reported to occur in suitable habitat during the summer months in all counties crossed by the Palisades transmission line (FWS 2005). Tree species, such as the shagbark hickory (*Carya ovata*), red oak (*Quercus rubra*), and bur oak (*Quercus macrocarpa*), often have loose or decaying bark that provide nursery habitat for females with young. License renewal and continued operations of Palisades are not likely to adversely affect the Indiana bat for several reasons. No refurbishment is considered necessary during the license renewal period at the Palisades site (NMC 2005a), and, therefore, significant land disturbance during that period is not considered likely. However, any activities during the renewal period that could result in land disturbance would undergo a predisturbance evaluation and consideration of impacts on threatened and endangered species (NMC 2005a). Vegetation management within the transmission line rights-of-way prevents the establishment of large trees within the rights-of-way that could be used by the Indiana bat. Only danger trees in the border zone of the rights-of-way are removed during routine vegetation management (NMC 2005a). This greatly limits the likelihood that a tree used by Indiana bats for roosting or nursery habitat would be affected. On the basis of these considerations, continued operation of Palisades during the license renewal period would not be expected to adversely affect the Indiana bat.

The eastern massasauga rattlesnake, a Federal candidate for listing, could occur in wetland areas such as bogs, ponds, or swamps, and prefers open canopy with a sedge or grass ground cover (FWS 2005b). It is unlikely that the eastern massasauga would be adversely affected by continued operation of Palisades during the license renewal period because no land-disturbing refurbishment activities are planned at the Palisades site, and vegetation maintenance procedures for Palisades transmission line rights-of-way (NMC 2005a) maintain the open habitats preferred by this species.

Based on the NRC staff's review of the applicant's environmental report and the NRC staff's independent analysis, the NRC staff has concluded that continued operation of Palisades during the license renewal term would not likely adversely affect any species that are Federally listed, proposed for listing, or candidates for listing as endangered or threatened within the immediate vicinity of the Palisades site and its associated transmission lines. The applicant currently plans no power plant refurbishment activities. The NRC staff anticipates that best management practices for protecting Federally listed species and their habitats, while carrying out vegetation-management activities, will be implemented by the applicant and its contractors. Therefore, it is the NRC staff's finding that the impact on threatened or endangered species of an additional 20 years of operation of Palisades and associated transmission lines would be SMALL, and further mitigation is not warranted.

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

The NRC 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 NRC staff also determined that information provided during the public comment period did not identify any new issue that requires site-specific assessment. The NRC 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 of Operations During the Renewal Term

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 Palisades cooling system is primarily the southeastern portion of Lake Michigan, particularly that portion bounded by South Haven to the north and Hagar Shore to the south and extending to about 1.9 mi from shore (i.e., the location of the thermal bar separating the inshore and offshore water masses during spring (Thurber and Jude 1985)). As discussed in Section 4.1, the NRC staff found no new and significant information that would indicate that the conclusions regarding any of the cooling-system-related Category 1 issues related to Palisades are inconsistent with the conclusions in the GEIS (NRC 1996). Because

Palisades has a closed-cycle cooling system, impacts from Category 2 plant cooling system issues (i.e., entrainment, impingement, and heat shock) that would have an impact on local water quality and aquatic resources are not addressed in Section 4.1. Nevertheless, entrainment, impingement, and heat shock have not been found to have greater than a minimal impact on aquatic biota (Consumers Energy and NMC 2001; NRC 1978). Therefore, operation of the Palisades cooling system would not contribute significantly to the cumulative impacts that would impact water quality and aquatic resources of southeastern Lake Michigan.

The cumulative impacts of past actions have resulted in the existing conditions of local water quality and aquatic resources. Section 2.2.5 discusses the major changes and modifications within Lake Michigan that have had the greatest impacts on aquatic resources. These include physical and chemical stresses, lakefront developments, overfishing, and introduction of non-native species. Physical and chemical stresses that have impacted Lake Michigan and its tributaries include urban, industrial, and agricultural contaminants (e.g., nutrients, toxic chemicals, and sediments); stream modifications (e.g., dams); land-use changes (e.g., residential, recreational, agricultural, and industrial development); dredging; shoreline modifications; wetland elimination and modification; water diversions (e.g., canals); impingement and entrainment in water-intake structures; thermal loading from cooling water; ice control for navigation; and major degradative incidents or catastrophes (Francis et al. 1979; Fuller et al. 1995). These in turn can affect fish, benthos, 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 (Eshenroder et al. 1995).

The dramatic changes that have occurred in the fish communities due to habitat modification and development, overfishing, and non-native species introductions have been reviewed for the period from the 1800s to 1970 (Wells and McLain 1973) and from 1970 to 2000 (Madenjian et al. 2002). Disruptions in the native fish community (primarily caused by introduction of the sea lamprey (*Petromyzon marinus*) and alewife [*Alosa pseudoharengus*]), coupled with habitat alterations and degradation, contributed to the decline of important commercial and sport fisheries by the end of the 1950s (IDNR 2004). In the 1960s, programs to extend control of sea lamprey and stock trout and salmon species began to rehabilitate the Lake Michigan fish community, control alewife numbers, and provide recreational fisheries (Eshenroder et al. 1995).

Future contributions to cumulative impacts on aquatic resources within Lake Michigan would generally occur from those actions that currently cause impacts (e.g., human habitation, urban and industrial development, agriculture, commercial and recreational fisheries, and spread of non-native species). Primary management challenges will be to keep the salmonid community in balance with an available forage base, while keeping alewife levels suppressed at a level that does not threaten native species (Eshenroder et al. 1995). Remaining problems include inadequate natural reproduction of salmonids, low abundance or complete loss of many native

fish stocks, continued problems with exotic species, continued difficulties in suppressing sea lampreys, and continued unacceptable levels of pollution and toxic chemicals (Eshenroder et al. 1995).

Large oil or chemical spills could potentially severely impact aquatic resources within Lake Michigan; the probability of such spills, however, is relatively small. The probability of smaller spills is higher, but the impacts from such spills would probably be small, temporary, and additive and unlikely to severely affect aquatic resources, especially if spill response activities are undertaken when such events occur.

The potential exists for the expansion of non-native species, which has already begun to occur in Lake Michigan, and for additional non-native species to become established within the lake (Ricciardi and MacIsaac 2000; Ricciardi and Rasmussen 1998). Any future ecological changes that may be associated with global climate change would occur much more slowly than those induced by invasions of non-native species (Madenjian et al. 2002).

The lake water supply is adequate to meet the needs of the facility for cooling purposes under all conditions. The NRC staff, while preparing this assessment, assumed that other industrial, commercial, or public installations could be located in the general vicinity of the Palisades site prior to the end of plant operations. The discharge of water to Lake Michigan from these facilities would be regulated by the MDEQ. The discharge limits are set considering the overall or cumulative impact of all other regulated activities in the area. Compliance with the Clean Water Act and Palisade's NPDES permits minimizes cumulative impacts on aquatic resources. Continued operation of Palisades would require renewed discharge permits from the MDEQ, which will address changing requirements so that cumulative water quality objectives are served.

The NRC staff concludes that the SMALL impacts of the Palisades cooling system operations, including entrainment and impingement of fish and shellfish, heat shock, or any of the cooling system-related Category 1 issues, are not contributing to an overall decline in water quality or the status of the fishery or other aquatic resources. Therefore, the NRC staff concludes that the potential cumulative impacts of operation of the cooling system of Palisades would be SMALL, and that no further mitigation measures would be warranted.

4.8.2 Cumulative Impacts Resulting from Continued Operation of the Transmission Lines

Continued operation of the electrical transmission facilities associated with license renewal for Palisades 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 on 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 Michigan counties that contain the transmission lines associated with Palisades (Allegan, Kalamazoo, and Van Buren Counties).

As described in Section 4.2, the NRC staff found no new and significant information indicating that the conclusions regarding any of the transmission-line-related Category 1 issues as related to Palisades are inconsistent with the conclusions within the GEIS. The applicant uses vegetation-management procedures over all of its rights-of-way that are protective of wildlife and habitat resources (NMC 2005a). These vegetation-management practices are not expected to change during the license renewal period and are therefore not expected to result in any changes to current levels of cumulative impacts. None of the management procedures alter wetland or floodplain hydrology or adversely affect vegetation characteristics of these habitats or other habitats. Vegetation-maintenance procedures within rights-of-way ensure minimal disturbance to ecological systems and species. In addition, these procedures maintain habitats that are beneficial to some of the Federally listed threatened and endangered species that could occur within them. Continued operation and maintenance of these rights-of-way are not likely to contribute to a regional decline in wildlife and habitat resources.

As discussed in Section 2.2.6, four Federally listed threatened or endangered species are known to occur or could occur within this area. These species include the Pitcher's thistle, Karner blue butterfly, Mitchell's satyr butterfly, and Indiana bat. The eastern massasauga rattlesnake, a candidate for Federal listing, could also occur in habitats traversed by Palisades transmission lines. No critical habitat, as designated in the Endangered Species Act occurs in the area affected by Palisades or its associated transmission lines. The NRC staff's findings, presented in Section 4.6, are that continued operation of Palisades during the license renewal period would not likely adversely affect listed, proposed, or candidate species, and, therefore, the impact on these species would be SMALL. Consequently, the continued operation of Palisades during the renewal term would not contribute to cumulative impacts on these species. Therefore the cumulative impacts on these species would be SMALL, and additional mitigation measures would not be warranted.

Based on these considerations, the NRC staff has determined that the cumulative impacts of the continued operation of the Palisades transmission lines would be SMALL, and that no additional mitigation is warranted.

4.8.3 Cumulative Radiological Impacts

The radiological dose limits for protection of the public and workers have been developed by the U.S. Environmental Protection Agency and the 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 Palisades site was included. As stated in Section 2.2.7, NMC has conducted a radiological environmental monitoring program (REMP) around the Palisades site since 1971, with the results presented annually in the Palisades Annual Radiological Environmental Operating Report (NMC 2001, 2002, 2003a, 2004, 2005b). The REMP measures radiation and radioactive materials from all sources, including Palisades, as well as the Indiana and Michigan Power Company's Donald C. Cook Nuclear Plant Units 1 and 2 that are located approximately 28 mi south-southwest of Palisades on the shore of Lake Michigan. Monitoring results for the 5-year period 2000 to 2004 were reviewed as part of the cumulative impacts assessment. In addition, in Sections 2.2.7 and 4.3, the NRC staff concluded that impacts of radiation exposure on the public and workers (occupational) from operation of Palisades during the renewal term would be SMALL. Therefore, the monitoring program and NRC staff's conclusion considered cumulative impacts. The NRC and the States of Michigan and Indiana would regulate any future actions in the vicinity of the Palisades site that could contribute to cumulative radiological impacts.

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

4.8.4 Cumulative Socioeconomic Impacts

Continued operation of Palisades would not likely 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, NRC staffing levels, and local tax payments during renewal would be similar to those during the current license period. Similarly, the proposed action would not likely 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 Palisades license renewal would not produce an incremental change in any of the impact measures used. The NRC 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 NRC staff determined that the impact on offsite land use would be SMALL because no refurbishment activities are planned at Palisades, 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 Palisades site, and the potential exists for significant cultural resources to be present within the site boundaries, it does not appear likely that the proposed license renewal would 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 (NMC 2005a). Absent land-disturbing activities, continued operation of Palisades would likely protect any cultural resources present within the Palisades site boundary by protecting those lands from development and providing secured access. If prior to ground-disturbing activity in an undisturbed area, the applicant would evaluate the potential for impacts on cultural resources in consultation with the SHPO and appropriate Native American Tribes, as required under Section 106 of the NHPA, the contribution to a cumulative impact on cultural resources by continued operation of Palisades during the license renewal period would be SMALL. However, if land-disturbing activities are determined necessary, as stated in Section 4.4.5, if appropriate measures are not taken to assure protection of archaeological resources, then impacts could be SMALL to MODERATE.

4.8.5 Cumulative Impacts on Groundwater Use and Quality

Regional geology in Van Buren County consists of 300 to 400 ft of glacial and post-glacial deposits overlying sedimentary bedrock consisting of shale or limestone of the lower Mississippian Coldwater Formation (STS 1987; NMC 2003b). A drilling program conducted at Palisades in the 1960s indicated that the uppermost material is dune sand, which ranges in thickness from about 10 ft in the switchyard area to well over 100 ft near the lake (NMC 2003b). Below the dune sand is dense to very dense gray silty sand or sandy silt, stiff gray clay, and stiff to hard gray glacial till. The bedrock underlies these glacial sediments. The early site studies indicate that unconfined groundwater in the vicinity of Palisades has a hydraulic gradient of approximately 13 ft/mi in a westerly direction, flowing to Lake Michigan at an estimated rate of 650 ft/yr. Field permeability tests during exploratory drilling in 1965 yielded values ranging from 30 to 1720 ft/yr in the site area.

At the power block area, groundwater elevations averaged 580 ft above mean sea level (MSL), approximately equal to the mean level of Lake Michigan. In the eastern portion of the property, groundwater was at approximately 601 ft MSL; beneath the substation, it was at approximately 604 ft MSL (NMC 2003b). These elevations correspond to depths below ground surface of approximately 45 ft at the power block to approximately 10 to 15 ft near the eastern end of the site (NMC 2003b). Hydrogeologic analysis, focused on the sanitary drainfield located just south of the power block, showed the water table to be approximately 30 ft below the surface of the

drainfield. The calculated groundwater flow velocity at this site is eastward at approximately 23 ft/yr. Groundwater sampling and analysis found no halogenated or aromatic hydrocarbons or metals above detection limits; all parameters detected were present at concentrations well below recommended maximum contaminant levels (STS 1987).

Municipal water has been available at Palisades since approximately 2002. Groundwater use at Palisades since then has been only by three small production wells with a combined production capacity of 24 gpm. The pumped water is for grounds maintenance or other miscellaneous uses. NMC does not expect to develop or use any additional groundwater resources at Palisades in the future.

Several releases to site groundwater and soil have occurred and been remediated. One was a hydrocarbon release at a fuel depot. MDEQ has concurred that the remediation of this site is completed. Another was a release of solvents (trichloroethylene and perchloroethylene) from barrels stored onsite. Following a remediation that included pumping and vapor extraction, MDEQ approved closure of this site (MDEQ 2000). In a 1995 incident, 5 to 10 gal of hydraulic oil were released from mechanical equipment due to a line break. The contaminated soil was removed, and MDNR concurred that no further action was necessary (CP 1995). Groundwater monitoring wells are now only at the Steam Generator Storage Building, which houses former equipment.

Groundwater is no longer used significantly as a resource at Palisades. The facility relies on municipal water, and the three remaining production wells are used for landscape watering at low withdrawal rates. Potential impacts on local groundwater have included fuel and solvent leaks, which have been remediated adequately. Septic systems were constructed with approved methods. Their sludge is monitored for detectable radioactivity twice per year on a voluntary basis. The downgradient groundwater flow direction from facilities at Palisades is west, toward Lake Michigan.

Because of the lack of groundwater receptors, the remediation of past sources of groundwater contamination, and good management practices relative to groundwater quality, the cumulative impact on groundwater resources during the license renewal period would be SMALL, and additional mitigation would not be warranted.

4.8.6 Conclusions Regarding Cumulative Impacts

The NRC staff considered the potential impacts resulting from operation of Palisades during the license renewal term and other past, present, and future actions in the vicinity of Palisades. The NRC staff's preliminary determination is that the potential cumulative impacts resulting from Palisades operation during the license renewal term would be SMALL.

4.9 Summary of Impacts of Operations During the Renewal Term

Based on its analysis, NMC has stated that it is not aware of information that is both new and significant related to any of the applicable Category 1 issues associated with operation of Palisades during the renewal term. The NRC staff, after reviewing the application and performing the site audit, also did not find any new and significant information related to any of the applicable Category 1 issues associated with operations of Palisades during the renewal term. Consequently, the NRC 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 eight Category 2 issues applicable to Palisades operation during the renewal term and for environmental justice and chronic effects of electromagnetic fields. For seven issues and environmental justice, the NRC staff concludes that the potential environmental impact of operation of Palisades during the renewal term would be of SMALL significance in the context of the standards set forth in the GEIS, and that additional mitigation would not be warranted. For historic and archaeological resources, the NRC staff's preliminary conclusion is that the impact resulting from license renewal would likely be SMALL. However, potential impacts could be MODERATE if ground disturbing activities in undisturbed areas are determined necessary during the period of operation under license renewal and if appropriate measures are not taken to assure protection of archaeological resources. In addition, the NRC staff determined that a conclusion has not been reached by appropriate Federal health agencies regarding chronic adverse effects from electromagnetic fields. Therefore, the NRC staff did not conduct an evaluation of this issue.

Cumulative impacts of past, present, and reasonably foreseeable future actions were considered, regardless of any other action undertaken by agencies or persons. For purposes of this analysis, where Palisades license renewal impacts are deemed to be SMALL, the NRC 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, Part800, "Protection of Historic Properties."

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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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) 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 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 and severe accidents, as discussed below.

(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 Addendum 1.

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 (OL) must submit a Safety Analysis Report (SAR) as part of its application. The 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.

Design-basis accidents (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 Part 50 and Part 100 of Title 10 of the *Code of Federal Regulations* (10 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 OL. The results of these evaluations are found in license documentation such as the applicant's Final Safety Analysis Report (FSAR), the NRC staff's Safety Evaluation Report (SER), the Final Environmental Statement (FES), and Section 5.1 of this draft 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 maximally 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 the Palisades Nuclear Plant (Palisades), 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, LLC (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 Palisades OL. The NRC staff has not identified any new and significant information during its independent review of the NMC ER, the site visit, the scoping process, or the evaluation of other available information. Therefore, the NRC staff concludes that there are no impacts related to DBAs 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, regardless of offsite consequences. In the GEIS, the NRC staff assessed the impacts of severe accidents 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 Palisades site in the GEIS (NRC 1996). However, in the GEIS, the NRC staff did evaluate existing impact assessments performed by the NRC and by the industry at 44 nuclear plants in the United States and concluded that the risk from beyond design-basis earthquakes at existing nuclear power plants is SMALL. Additionally, the NRC regulatory requirements under 10 CFR Part 73 provide reasonable assurance that the risk from sabotage is SMALL. Furthermore, the NRC staff concluded that the risks from other external events are adequately addressed by a generic consideration of internally initiated severe accidents.

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 Palisades, is listed in Table 5-2.

The NRC 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 site visit, the scoping process, or the evaluation of other available information. Therefore, the NRC 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 NRC staff has reviewed severe accident mitigation alternatives (SAMAs) for Palisades. The results of its review are discussed in Section 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; 5.3.4; 5.4; 5.5.2	L	5.2

5.2 Severe Accident Mitigation Alternatives

Section 51.53(c)(3)(ii)(L) of 10 CFR 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 Palisades Nuclear Plant (Palisades); therefore, the remainder of Chapter 5 addresses those alternatives.

5.2.1 Introduction

This section presents a summary of the SAMA evaluation for Palisades conducted by NMC, as described in the ER, and the NRC staff's review of this evaluation. The details of the review are described in the NRC staff evaluation that was prepared with contract assistance from Pacific Northwest National Laboratory. The entire evaluation for Palisades is presented in Appendix G.

The SAMA evaluation for Palisades 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 (i.e., SAMAs) of reducing that risk. Common ways of reducing risk are changes to components, systems, procedures, and training. NMC initially identified 23 potential SAMAs for Palisades. NMC then screened out 14 SAMAs from further consideration because of non-applicability at Palisades due to (1) design differences; (2) the required extensive changes that would involve implementation costs known to exceed any possible benefit; (3) the excessive dollar value associated with completely eliminating all internal and external event severe accident risk at Palisades, or (4) having only effects on systems with low risk significance based on the plant-specific PSA. The remaining 9 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 8 SAMAs to be evaluated.

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 1997). 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 (positive cost-benefit). NMC found five SAMAs to be potentially cost-beneficial in the baseline analysis, and one additional SAMA to be potentially cost-beneficial when alternative discount rates and analysis uncertainties are considered (NMC 2005a).

None of the SAMAs evaluated relate directly to adequately managing the effects of aging during the period of extended operation; therefore, they need not be implemented as part of license renewal pursuant to 10 CFR Part 54. NMC has indicated that its plans to further

evaluate the potentially cost-beneficial SAMAs 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 Palisades as part of its ER (NMC 2005a) for license renewal. This assessment was based on the most recent Palisades PSA available at that time, a plant-specific offsite consequence analysis performed using the MELCOR Accident Consequence Code System 2 (MACCS2) computer program, and insights from the Palisades Individual Plant Examination (IPE) (CP 1993) and Individual Plant Examination of External Events (IPEEE) (CP 1995 and 1996).

The baseline core damage frequency (CDF) for the purpose of the SAMA evaluation is approximately 4.05×10^{-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 Palisades 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.

As shown in Table 5-3, events initiated by loss of offsite power, small break loss of coolant accidents (LOCAs), and steam generator tube rupture (SGTR) are the dominant contributors to CDF.

In the ER, NMC estimated the dose to the population within 80 km (50 mi) of the Palisades site to be approximately 0.319 person-Sv (31.9 person-rem) per year. The breakdown of the total population dose by containment release mode is summarized in Table 5-4. Basemat failures and steam generator tube ruptures (SGTR) dominate the population dose risk at Palisades.

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 NRC staff based its assessment of offsite risk on the CDFs and offsite doses reported by NMC.

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

Initiating Event	CDF (Per Year)	% Contribution to CDF
Loss of offsite power (including station blackout)	1.24×10^{-5}	31
Small break loss of coolant accident	1.02×10^{-5}	25
Steam generator tube rupture	6.06×10^{-6}	15
General transient with main condenser available	2.94×10^{-6}	7
Loss of instrument air	2.41×10^{-6}	6
Loss of service water	1.84×10^{-6}	5
Loss of main feedwater	9.07×10^{-7}	2
Loss of the main condenser	6.46×10^{-7}	2
Pressurizer safety valve spurious opening	4.08×10^{-7}	1
Other initiators	2.69×10^{-7}	6
Total CDF (internal events)	**4.05×10^{-5}**	**100**

Table G-2. Breakdown of Population Dose by Containment Release Mode

Containment Release Mode	Population Dose (Person-Rem[1] per Year)	% Contribution
SGTR	7.6	23.9
Early Containment Failure	1.6	5
Late Containment Failure	0.3	0.9
Intact Containment	0.6	1.9
Basemat Failure	21.6	67.8
Containment Isolation Failure	0.2	0.6
Total Population Dose	**31.9**	**100**

[1]One person-Rem = 0.01 person-Sv

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 (i.e., 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 fire areas and seismic risk contributors). NMC identified 23 potential risk-reducing improvements (SAMAs) to plant components, systems, procedures and training.

Fourteen SAMAs were removed from further consideration because of non-applicability at Palisades due to (1) design differences; (2) the required extensive changes that would involve implementation costs known to exceed any possible benefit, or (3) the excessive dollar value associated with completely eliminating all internal and external event severe accident risk at Palisades, or (4) having only effects on systems with low risk significance based on the plant-specific PSA. The remaining nine 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 eight remaining SAMAs.

The NRC staff concludes that NMC used a systematic and comprehensive process for identifying potential plant improvements for Palisades, 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

In the third step of its SAMA evaluation, NMC evaluated the risk-reduction potential for each of the remaining eight SAMAs. Most of the SAMA evaluations were performed in a bounding fashion in that the SAMA was assumed to completely eliminate the risk associated with the proposed enhancement.

NMC estimated the costs of implementing the eight 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 NRC 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 conservative (i.e., the estimated risk reduction is similar to or higher than what would actually be realized). Accordingly, the NRC staff based its estimates of averted risk for the various SAMAs on NMC's risk reduction estimates.

The NRC staff reviewed the bases for the applicant's cost estimates. For certain improvements, the NRC 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 NRC staff found the cost estimates to be consistent with estimates provided in support of other plants' analyses.

Subsequently, the NRC 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 1997) and was executed consistent with this guidance. NUREG/BR-0058 has recently been revised to reflect the NRC'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 five potentially cost-beneficial SAMAs in the baseline analysis contained in the ER (using a 7 percent discount rate). Based on an analysis using a 3 percent real discount

rate, as recommended in NUREG/BR-0058 (NRC 2004), no additional SAMA candidates were determined to be potentially cost-beneficial. The potentially cost-beneficial SAMAs are:

- SAMA 10 – Modify the turbine-driven auxilliary feedwater (AFW) system so that it can operate indefinitely without AC, DC, or pneumatic support. This SAMA involves a procedure revision and analysis to direct AFW flow adjustments based on decay heat level so that steam generator level can be maintained when instrumentation fails on DC power depletion.

- SAMA 13 – Add a Nitrogen Station. This SAMA involves the use of a Nitrogen Station to automatically provide backup air supply for critical instrumentation and reduce the importance of loss of instrument air.

- SAMA 16 – Add insulation to the emergency diesel generator (EDG) exhaust ducts. This SAMA involves insulating the EDG exhaust ducts and making procedure modifications to prevent overheating of the EDGs engines.

- SAMA 22 – Replace undervoltage relays with seismically qualified model. This SAMA involves replacing relays to reduce the likelihood of failure of automatic start of the EDGs and reduce the contributions from loss of power due to the relays.

- SAMA 23 – Modify procedures for primary coolant system cooldown and provide associated training. This SAMA involves procedure modifications to reduce the probability of reactor coolant pump seal failures related to long-term high temperature exposure after recovery of component cooling water.

NMC performed additional analyses to evaluate the impact of parameter choices and uncertainties on the results of the SAMA assessment (NMC 2005a). With the benefits increased by a factor of 2.3 to account for uncertainties, one additional SAMA (SAMA 3 – Add a direct drive diesel injection pump) was determined to be potentially cost-beneficial.

NMC noted in its ER that while the above results are believed to accurately reflect areas for improvement at the plant, additional engineering reviews are necessary to determine ultimate implementation. NMC stated that it will implement or continue to consider the six SAMAs identified in the analysis through the appropriate Palisades design process (SAMAs 3, 10, 13, 16, 22, and 23). In response to requests for additional information by the NRC staff (NMC 2005b and 2005c), NMC also committed to further evaluate possible lower cost alternatives for two SAMAs originally eliminated in the Phase 1 screening analysis (SAMAs 1 and 18), and to further evaluate two additional SAMAs determined to be applicable to Palisades but not yet evaluated by NMC (adding capability to flash the field on the EDG and replacing an existing air-operated containment sump valve with a motor-operated valve). NMC has entered these 10

potentially cost-beneficial items into the Palisades corrective action system for further review. If determined to be cost-beneficial, these alternatives will be evaluated for possible implementation in accordance with Palisades plant design processes.

The NRC staff, therefore, concludes that with the exception of the 10 potentially cost-beneficial SAMAs discussed above, the costs of the SAMAs evaluated would be higher than the associated benefits.

5.2.6 Conclusions

The NRC 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 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 seismic and 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, the NRC 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 SAMA. Given the potential for cost-beneficial risk reduction, the NRC staff agrees that further evaluation of these SAMAs by NMC is warranted. However, none of the potentially cost-beneficial SAMAs directly relate to adequately managing the effects of aging during the period of extended operation. Therefore, they 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."

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

National Environmental Policy Act of 1969 (NEPA), as amended. 42 USC 4321, et. seq.

Nuclear Management Company, LLC (NMC). 2005. *Applicant's Environmental Report – Operating License Renewal Stage, Palisades Nuclear Plant.* Docket No. 50-255. Covert, Michigan (March 2005).

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

U.S. Nuclear Regulatory Commission (NRC). 2002a. *Memorandum and Order CLI-02-25.* Private Fuel Storage, LLC. Docket No. 72-22-ISFSI. Rockville, Maryland (December 2002).

U.S. Nuclear Regulatory Commission (NRC). 2002b. *Memorandum and Order CLI-02-24.* Duke Cogema Stone & Webster. Docket No. 70-3098-ML. Rockville, Maryland (December 2002).

U.S. Nuclear Regulatory Commission (NRC). 2002c. *Memorandum and Order CLI-02-27.* Dominion Nuclear Connecticut, Inc. Docket No. 50-423-LA-3. Rockville, Maryland (December 2002).

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 (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.

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 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, Part 51, of the *Code of Federal Regulations* (10 CFR Part 51), Subpart A, Appendix B, and are applicable to the Palisades Nuclear Plant (Palisades). 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

(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.

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 NRC staff also addresses the impacts from radon-222 and technetium-99 in the GEIS.

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 Palisades 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 Section
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	6.1; 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, LLC (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 Palisades operating license (OL). The NRC staff has not identified any new and significant information during its independent review of the NMC ER, the site visit, the scoping process, or the evaluation of other available information. Therefore, the NRC staff concludes that there are no impacts related to these issues beyond those discussed in the GEIS. For these issues, the NRC staff concluded in the GEIS that the impacts are SMALL except for the collective offsite radiological impacts from the fuel cycle and from HLW 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 NRC 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 HLW). Based on information in the GEIS, the Commission found that

  Offsite impacts of the uranium fuel cycle have been considered by the Commission in Table S-3 of this Part [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 NRC staff has not identified any new and significant information during its independent review of the NMC ER, the site visit, the scoping process, or the evaluation of other available information. Therefore, the NRC 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). Based on information in the GEIS, the Commission found that

  The 100-year environmental dose commitment to the U.S. population from the fuel cycle, HLW 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 United States. 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 that will not ever be mitigated (e.g., 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 judgment as to the regulatory NEPA [National Environmental Policy Act] implications of these matters should be made and it makes no sense to repeat the same judgment 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 NRC staff has not identified any new and significant information during its independent review of the NMC ER, the site visit, the scoping process, or the evaluation of other available information. Therefore, the NRC 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 HLW disposal). Based on information in the GEIS, the Commission found that

  For the HLW 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 a 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 Department of Energy in the *Final Environmental Impact Statement: Management of Commercially Generated Radioactive Waste*, October 1980 (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 1,000 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 HLW 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, the 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 the 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 1,000 premature cancer deaths, worldwide for a 100,000 metric tonne (MTHM) repository.

Nevertheless, despite all the uncertainty, some judgment as to the regulatory NEPA implications of these matters should be made and it makes no sense to repeat the same judgment 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 HLW disposal, this issue is considered Category 1.

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) designates Yucca Mountain as the repository for spent nuclear waste. 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.

The 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 the EPA's radiation protection standards for the candidate repository, which required compliance with certain dose limits over a 10,000-year period. The Court's decision also vacated the compliance period in NRC's licensing criteria for the candidate repository in 10 CFR Part 63. In response to the Court's decision, the EPA issued its proposed revised standards on August 22, 2005 (*Federal Register*, Volume 40, page 49014 (70 FR 49014)). In order to be consistent with the EPA's revised standards, the NRC proposed revisions to 10 CFR Part 63 on September 8, 2005 (70 FR 53313).

Therefore, for the HLW 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 NRC staff assumed that limits would be developed along the lines of the 1995 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 that would comply with such limits could and likely would be developed at some site.

Despite the current uncertainty with respect to these rules, some judgment as to the regulatory NEPA implications of offsite radiological impacts of spent fuel and HLW disposal should be made. The NRC 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 NRC staff has not identified any new and significant information during its independent review of the NMC ER, the site visit, the scoping process, or the evaluation of other available information. Therefore, the NRC staff concludes that there are no offsite radiological impacts related to spent fuel and HLW 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 NRC staff has not identified any new and significant information during its independent review of the NMC ER, the site visit, the scoping process, or the evaluation of other available information. Therefore, the NRC 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 NRC staff has not identified any new and significant information during its independent review of the NMC ER, the site visit, the scoping process, or the evaluation of other available information. Therefore, the NRC staff concludes that there are no impacts of low-level waste 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 NRC staff has not identified any new and significant information during its independent review of the NMC ER, the scoping process, the site visit, or the evaluation of other available information. Therefore, the NRC 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 onsite with small environmental effects through dry or pool storage at all plants if a permanent repository or monitored retrievable storage is not available.

The NRC staff has not identified any new and significant information during its independent review of the NMC ER, the site visit, the scoping process, or the evaluation of other available information. Therefore, the NRC 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 NRC staff has not identified any new and significant information during its independent review of the NMC ER, the site visit, the scoping process, or the evaluation of other available information. Therefore, the NRC 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 the NRC up to 62,000 MWd/MTU and the cumulative impacts of transporting HLW 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 the summary table.

Palisades meets the fuel-enrichment and burnup conditions set forth in Addendum 1 to the GEIS. The NRC staff has not identified any new and significant information during its

independent review of the NMC ER, the site visit, the scoping process, or the evaluation of other available information. Therefore, the NRC staff concludes that there are no impacts of transportation associated with license renewal beyond those discussed in the GEIS.

There are no Category 2 issues for the uranium fuel cycle and solid waste management.

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."

Joint Resolution Approving the Site at Yucca Mountain, Nevada, for the Development of a Repository for the Disposal of High-Level Radioactive Waste and Spent Nuclear Fuel, pursuant to the Nuclear Waste Policy Act of 1982. 2002. Public Law 107-200. 116 Stat. 735.

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

National Environmental Policy Act of 1969 (NEPA). 42 USC 4321, et. seq.

Nuclear Management Company, LLC (NMC). 2005. *Applicant's Environmental Report – Operating License Renewal Stage, Palisades Nuclear Plant.* Docket No. 50-255. Covert, Michigan. (March 2005).

U.S. Department of Energy (DOE). 1980. *Final Environmental Impact Statement: Management of Commercially Generated Radioactive Waste.* DOE/EIS-0046F. Washington, D.C.

U.S. Environmental Protection Agency (EPA). 2005. "Public Health and Environmental Radiation Protection Standards for Yucca Mountain, Nevada." *Federal Register*, Vol. 70, No. 161, pp. 49014–49068. Washington, D.C. (August 22, 2005).

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

U.S. Nuclear Regulatory Commission (NRC). 2005. "Implementation of a Dose Standard After 10,000 Years." *Federal Register,* Vol. 63, No. 173, pp. 53313–53320. Washington, D.C. (September 8, 2005).

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, Supplement 1 (NRC 2002). The U.S. Nuclear Regulatory Commission (NRC) 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 evaluated 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 were 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. 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 Part 51 of Title 10 of the *Code of Federal Regulations* (10 CFR Part 51), Subpart A, Appendix B, that are applicable to Palisades Nuclear Plant (Palisades) decommissioning following the renewal term are listed in Table 7-1. Nuclear Management Company, LLC (NMC) stated in its Environmental Report (ER) (NMC 2005) that it is aware of no new and significant information regarding the environmental impacts of Palisades license renewal. The NRC staff has not identified any new and significant information during its independent review of the NMC ER, the site visit, the scoping process, or the evaluation of other available information. Therefore, the NRC staff concludes that there are no impacts related to these issues beyond those discussed in the GEIS. For all of these issues, the NRC 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 Palisades Following the Renewal Term

ISSUE–10 CFR Part 51, Subpart A, Appendix B, Table B-1	GEIS Section
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 NRC 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 applicable 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 NRC staff has not identified any new and significant information during its independent review of the NMC ER, the site visit, the scoping process, or the evaluation of other

available information. Therefore, the NRC 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 NRC staff has not identified any new and significant information during its independent review of the NMC ER, the site visit, the scoping process, or the evaluation of other available information. Therefore, the NRC 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 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 NRC staff has not identified any new and significant information during its independent review of the NMC ER, the site visit, the scoping process, or the evaluation of other available information. Therefore, the NRC 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 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 NRC staff has not identified any new and significant information during its independent review of the NMC ER, the site visit, the scoping process, or the evaluation of other available information. Therefore, the NRC 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 in the GEIS, the Commission found that

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

The NRC staff has not identified any new and significant information during its independent review of the NMC ER, the site visit, the scoping process, or the evaluation of other available information. Therefore, the NRC 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 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 NRC staff has not identified any new and significant information during its independent review of the NMC ER, the site visit, the scoping process, or the evaluation of other available information. Therefore, the NRC 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, LLC (NMC). 2005. *Applicant's Environmental Report – Operating License Renewal Stage, Palisades Nuclear Plant.* Docket No. 50-255, Covert, Michigan (March 2005).

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

U.S. Nuclear Regulatory Commission (NRC). 2002. *Generic Environmental Impact Statement for Decommissioning of Nuclear Facilities: Supplement 1, Regarding the Decommissioning of Nuclear Power Reactors.* NUREG-0586, Supplement 1, 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) (i.e., the no-action alternative); the potential environmental impacts from electric-generating sources other than Palisades Nuclear Plant (Palisades); the possibility of purchasing electric power from other sources to replace power generated by Palisades 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 Palisades. 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 Part 51 of Title 10 of the *Code of Federal Regulations* (10 CFR Part 51), Subpart A, Appendix B:

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

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

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

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

8.1 No-Action Alternative

The NRC's regulations implementing the National Environmental Policy Act (NEPA), 10 CFR Part 51, Subpart A, Appendix A(4), specify that the no-action alternative be discussed in an NRC Environmental Impact Statement (EIS). For license renewal, the no-action alternative refers to a scenario in which the NRC would not renew the Palisades OL, and Nuclear Management Company, LLC (NMC) would then cease plant operations by the end of

(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 current license and initiate the decommissioning of the plant. NMC would be required to shut down Palisades and to comply with NRC decommissioning requirements in 10 CFR 50.82, whether or not the OL is renewed. If the Palisades OL is renewed, shutdown of the unit and decommissioning activities would not be avoided, but would be postponed for up to an additional 20 years.

The environmental impacts associated with decommissioning under a license renewal or 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 draft 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 would occur when the unit shuts down regardless of whether the license is renewed or not and are discussed below, with the results presented in Table 8-1. Plant shutdown would result in a net reduction in power production capacity. The power not generated by Palisades during the license renewal term would likely be replaced by (1) power purchased from other electricity providers, (2) generating alternatives other than Palisades, (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 NRC staff concluded that the impacts of continued plant operation on land use would be SMALL. Onsite land use would 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 the rights-of-way will continue as before. Therefore, the NRC 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. The results of the analysis in Appendix J, however, were not incorporated into 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 would not be expected to result in changes to onsite or offsite land use.
Ecology	SMALL	Impacts are expected to be SMALL because aquatic impacts would be reduced, and terrestrial impacts are not expected because there would not be any changes in rights-of-way maintenance practices.
Water use and quality–surface water	SMALL	Impacts are expected to be SMALL because surface-water intake and discharges would be eliminated.
Water use and quality–groundwater	SMALL	Impacts are expected to be SMALL because discharge to the sanitary drain field would be eliminated.
Air quality	SMALL	Impacts are expected to be SMALL because emissions related to plant operation and worker transportation would decrease.
Waste	SMALL	Impacts are expected to be SMALL because generation of high-level waste would stop, and generation of low-level and mixed waste would 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, would be further reduced.
Socioeconomics	SMALL to LARGE	Impacts are expected to range from SMALL to LARGE because of a decrease in employment and tax revenues.
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 would remain in place, and the visibility of plumes from the cooling towers would be eliminated.
Historic and archaeological resources	SMALL	Impacts are expected to be SMALL because shutdown of the plant would not result in land disturbance.
Environmental justice	SMALL to LARGE	Impacts are expected to range from SMALL to LARGE because a loss of employment opportunities would be expected.

- **Ecology**

  In Chapter 4 of this draft SEIS, the NRC staff concluded that the ecological impacts of continued plant operation would be SMALL. Cessation of operations would be accompanied by a reduction in cooling-water flow and the thermal plume from the plant. These changes would reduce environmental impacts on aquatic species, including threatened and endangered species. The transmission lines associated with Palisades are expected to remain in service after Palisades stops operating. As a result, maintenance of the rights-of-way and subsequent impacts on the terrestrial ecosystem would continue as before. Therefore, the NRC staff concludes that ecological impacts from shutdown of the plant would be SMALL.

- **Water Use and Quality–Surface Water**

  In Chapter 4 of this draft 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 would 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 Lake Michigan. Therefore, the NRC 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 of this draft SEIS, the NRC staff concluded that impacts of continued plant groundwater use on groundwater availability and quality would be SMALL. Groundwater use is limited to that used only for maintenance of the grounds. When the plant stops operating, there would be virtually no change in groundwater use at the site as the facilities would remain until decommissioning. In addition, domestic water disposal would no longer occur at the two onsite sanitary drain fields. Therefore, the NRC staff concludes that groundwater use and quality impacts from shutdown of the plant would be SMALL.

- **Air Quality**

  In Chapter 4 of this draft SEIS, the NRC staff concluded that the impacts of continued plant operation on air quality would be SMALL. When the plant stops operating, there would be a reduction in emissions from activities related to plant operation, such as the use of diesel generators and worker transportation. Therefore, the NRC staff concludes that the impacts 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 Palisades stops operating, it would stop generating high-level waste (HLW), and the generation of low-level and mixed waste associated with plant operation and maintenance would be reduced. Therefore, the NRC staff concludes that the impact of waste generated after shutdown of the plant would be SMALL.

- **Human Health**

In Chapter 4 of this draft 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 would be reduced. Therefore, the NRC 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 would 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 would be SMALL. Therefore, the NRC staff concludes that the impacts of potential accidents following shutdown of the plant would be SMALL.

- **Socioeconomics**

In Chapter 4 of this draft SEIS, the NRC staff concluded that the socioeconomic impacts of continued plant operation would be SMALL. 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 Covert County. The overall impacts would depend on the state of the economy, the net change in workforce at the plant, and the changes in local government tax receipts. Appendix J of Supplement 1 to NUREG-0586 (NRC 2002) shows that the overall socioeconomic impact of plant closure plus decommissioning could be greater than SMALL. The NRC staff concludes that the socioeconomic impacts of plant shutdown would 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.

- **Transportation**

In Chapter 4 of this draft SEIS, the NRC staff concluded that the impacts of continued plant operation on transportation would be SMALL. Cessation of operations would be accompanied by a reduction of traffic in the vicinity of the plant. Most of the reduction would be associated with a reduction in the plant workforce, but there would also be a reduction in

shipment of material to and from the plant. Therefore, the NRC staff concludes that the impacts of plant closure on transportation would be SMALL.

- **Aesthetics**

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

- **Historic and Archaeological Resources**

  In Chapter 4 of this draft SEIS, the NRC staff concluded that the impacts of continued plant operation on historic and archaeological resources would likely be SMALL, but could be MODERATE if ground-disturbing activities were determined necessary in undisturbed areas. Onsite land use would not be affected immediately by the cessation of operations. Plant structures and other facilities would likely 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 rights-of-way would continue as before. Therefore, the NRC staff concludes that the impacts on historic and archaeological resources from plant shutdown would be SMALL.

- **Environmental Justice**

  In Chapter 4 of this draft SEIS, the NRC staff concluded that the environmental justice impact of continued operation of the plant would be SMALL. Continued operation of the plant would not have a disproportionately high and adverse impact on minority and low-income populations. 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 NRC 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 Palisades, assuming that the OL for Palisades is not renewed. The order of presentation of alternative energy sources in Section 8.2 does not imply

which alternative would be most likely to occur or to have the least environmental impacts. The following generation alternatives are considered in detail:

- Coal-fired generation at an alternate site (Section 8.2.1),
- Natural-gas-fired generation at the Palisades site and an alternate site (Section 8.2.2), and
- Nuclear generation at the Palisades site and an alternate site (Section 8.2.3).

The alternative of purchasing power from other sources to replace power generated at Palisades is discussed in Section 8.2.4. Other power-generation alternatives and conservation alternatives considered by the NRC staff and found not to be reasonable replacements for Palisades are discussed in Section 8.2.5. Section 8.2.6 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 2004 with Projections to 2025*, EIA projects that 62 percent of new electric-generating capacity between 2002 and 2025 will be accounted for by combined-cycle,[a] distributed generation, or combustion turbine technology fueled by natural gas (EIA 2004). These technologies are designed primarily to supply peak and intermediate capacity; combined-cycle technology, however, can also be used to meet baseload[b] requirements. Coal-fired plants are projected by the EIA to account for nearly 33 percent of the new capacity during this period. Coal-fired plants are generally used to meet baseload requirements. Renewable energy sources, primarily wind, geothermal, and biomass 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 levelized electricity costs for new plants in 2010, followed by wind generation and then coal-fired plants (EIA 2004). By 2025, coal-fired plants are projected to have the lowest costs, followed by gas combined-cycle plants and wind generation (EIA 2004).

(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; that is, these units generally run near full load.

EIA projects that oil-fired plants will account for very little of new generation capacity in the United States during the 2002 to 2025 time period because of higher fuel costs and lower efficiencies (EIA 2004).

EIA also projects that new nuclear power plants will not account for any new generation capacity in the United States during the 2002 to 2025 time period because natural gas and coal-fired plants are projected to be more economical (EIA 2004). However, there has been an increased interest in constructing new nuclear power facilities, as evidenced by the certification of three standard nuclear power plant designs and recent activities involving the review of other plant designs and potential sites (see Section 8.2.3). In addition, the NRC established a new reactor licensing program organization in 2001 to prepare for and manage future reactor and site licensing applications (NRC 2001). Therefore, contrary to the EIA projection, a new nuclear plant alternative for replacing power generated by Palisades is considered in this draft SEIS.

Palisades has a net summer capacity of 786 megawatts electric (MW(e)) (NMC 2005). For the coal-fired and natural gas alternatives, the NRC staff assumed construction of an approximately 800-MW(e) plant, which is consistent with NMC's Environmental Report (ER) (NMC 2005). For the new nuclear alternative, the staff assumed the same capacity as Palisades.

The Palisades site does not have sufficient land suitable for siting a coal-fired plant; thus, only an alternate site is considered under this alternative. Approximately 30 ac is available in the northeast quadrant of the Palisades site, which could be developed to house a gas-fired plant; therefore, both the Palisades site and an alternate site are evaluated under the gas-fired alternative. No specific alternate sites were identified by the applicant in the ER for the coal-fired or gas-fired plants; however, it was assumed that a suitable location could be found in the region (NMC 2005). A new nuclear alternative was not considered by the applicant. Therefore, this draft SEIS evaluates both the Palisades site and an alternate generic site for the analysis of environmental impacts for the nuclear alternative.

8.2.1 Coal-Fired Generation

The coal-fired alternative is analyzed for a generic alternate site. Unless otherwise indicated, the assumptions and numerical values used in Section 8.2.1 are from the NMC ER (NMC 2005). The staff reviewed the information in the NMC ER and compared it with environmental impact information in the GEIS for license renewal. 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 NRC staff assumed the Palisades plant would remain in operation while the alternative coal-fired plant was constructed.

The NRC staff assumed the construction of two standard 400-MW(e) units for a total capacity of 800 MW(e), as potential replacements for Palisades, which is consistent with the NMC ER

(NMC 2005). The coal-fired plant would consume approximately 3.2 million tons per year of pulverized bituminous coal with an ash content of approximately 7.66 percent (NMC 2005). NMC assumes a heat rate[a] of 9800 Btu/kWh and a capacity factor[b] of 0.85 in its ER (NMC 2005).

In addition to the impacts discussed below for a coal-fired plant at an alternate site, impacts would occur offsite as a result of the mining of coal and limestone. Impacts of mining operations would include an increase in fugitive dust emissions; surface-water runoff; erosion; sedimentation; changes in water quality; disturbance of vegetation and wildlife; disturbance of historic and archaeological resources; changes in land use; and impacts on employment.

The magnitude of these offsite impacts would largely be proportional to the amount of land affected by mining operations. In the GEIS, the staff estimated that approximately 22,000 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). Proportionally, less land would be affected with the construction of an 800-MW(e) plant. Partially offsetting this offsite land use would be the elimination of the need for uranium mining to supply fuel for Palisades. In the GEIS, the NRC 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.

8.2.1.1 Closed-Cycle Cooling System

In this section, the NRC staff evaluates the impacts of a coal-fired plant located at a generic alternate site that uses 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 magnitude of impacts for an alternate site would depend on the particular site selected.

- **Land Use**

  The GEIS estimates that approximately 1700 ac would be needed for a 1000-MW(e) coal-fired plant (NRC 1996). This estimate would be scaled down for the 800-MW(e) capacity of

(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.

(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 Using Closed-Cycle Cooling at an Alternate Site

Impact Category	Impact	Comments
Land use	MODERATE to LARGE	Uses approximately 1460 ac for plant, offices, parking, and waste disposal. Additional land (amount dependent on site chosen) needed for rail spur and transmission line.
Ecology	MODERATE to LARGE	Impact would depend on location and ecology of the site, surface-water body used for intake and discharge, and transmission line and rail spur routes; potential habitat loss and fragmentation; reduced productivity and biological diversity.
Water use and quality–surface water	SMALL to MODERATE	Impact would depend on the volume of water withdrawn and discharged and the characteristics of the surface-water body.
Water use and quality–groundwater	SMALL to MODERATE	Impact would depend on the volume of water withdrawn and discharged and the characteristics of the aquifers.
Air quality	MODERATE	Sulfur oxides • 2750 tons/yr Nitrogen oxides • 690 tons/yr Particulates • 120 tons/yr of total suspended particulates • 28 tons/yr of PM_{10} Carbon monoxide • 800 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 319,000 tons/yr of ash and scrubber sludge, requiring approximately 100 ac for disposal during the 40-year life of the plant. Debris would be generated and removed during construction.
Human health	SMALL	Impacts are uncertain, but considered SMALL in the absence of more quantitative data.

Table 8-2. (contd)

Impact Category	Impact	Comments
Socioeconomics	SMALL to LARGE	Construction impacts depend on location, but could be LARGE if plant is located in an area that is rural. Up to 1500 workers during the peak period of the 5-year construction period. Operation would result in a workforce of 75 to 120 full-time employees, which is a net loss of approximately 500 jobs. Van Buren County's tax base would experience a loss and an additional reduction in employment if the alternate site is not located within the county. Employment impacts could be offset by other economic growth in the area.
Transportation	SMALL to LARGE	Transportation impacts associated with construction workers 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. For rail transportation of coal and lime, the impact is considered MODERATE to LARGE.
Aesthetics	MODERATE to LARGE	Aesthetic impacts due to the presence of plant units, cooling towers, plume stacks, and coal piles. Intermittent noise from construction, commuter traffic, and waste disposal; continuous noise from cooling towers and mechanical equipment. Rail transportation of coal and lime would result in MODERATE noise impacts. Additional impacts would occur from the new transmission line and rail spur that would be needed. Depending on the location of the site chosen, these impacts could be LARGE.
Historic and archeological resources	SMALL to MODERATE	An alternate location would necessitate cultural resource studies to identify, evaluate, and mitigate potential impacts of new plant construction at developed and undeveloped sites.
Environmental justice	SMALL to MODERATE	Impacts would vary depending on population distribution and makeup at the site. Impacts should be similar to those experienced by the population as a whole. Some impacts on housing could occur during construction. Loss of jobs could reduce employment prospects. Impacts could be offset by economic growth in the area and the ability of affected workers to commute to other jobs.

the proposed coal-fired alternative (i.e., 1360 ac). Additional land might be needed for transmission lines and rail lines, depending on the location of the site relative to the nearest intertie connection and rail spur.

Up to 160 ac could be needed for a rail spur if the alternative site is within 10 mi of the nearest railway connection. Additional land would likely be needed for a transmission line to connect to existing lines to transmit power to NMC customers in the area. NMC estimated that approximately 5 mi of a new 345-kV transmission line would be needed (NMC 2005).

The waste would be disposed of onsite, accounting for approximately 100 ac of land area over the 40-year plant life.[(a)]

Depending particularly on the location and length of the transmission line and rail line routing, this alternative would result in MODERATE to LARGE land-use impacts.

- **Ecology**

Locating a coal-fired plant at an alternate site would result in construction and operational impacts. Approximately 1460 ac of land would be converted to industrial use. Even assuming siting at a previously disturbed area, the impacts would affect ecological resources. 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 cause entrainment and impingement of fish and other aquatic organisms, and result in adverse impacts on aquatic resources. If needed, construction and maintenance of an electric power transmission line and a rail spur also would have ecological impacts. There would be some additional impact on terrestrial ecology from drift from the cooling towers. Overall, the ecological impacts of constructing a coal-fired plant with a closed-cycle cooling system at an alternate site are considered to be MODERATE to LARGE and would be greater than renewal of the Palisades OL.

- **Water Use and Quality**

Surface Water. The coal-fired generation alternative at an alternate site is assumed to use a closed-cycle cooling system with cooling towers. For alternate sites, the impact on the surface water would depend on the volume of water needed for makeup water, the discharge volume, and the characteristics of the receiving body of water. Intake from and discharge to any surface body of water would be regulated by the State of Michigan. The impacts would be SMALL to MODERATE and dependent on the receiving body of water.

(a) Only half of the land area needed for by-product disposal is directly attributable to the alternative of renewing the Palisades OL for 20 years.

Groundwater. Groundwater use is possible for a coal-fired plant at an alternate site if surface-water resources are limited for makeup and potable water. Groundwater withdrawal could require a permit. Impacts on groundwater use and quality of a coal-fired plant with a closed-cycle cooling system at an alternate site would be SMALL to MODERATE, depending on the volume of groundwater withdrawn.

- **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), particulate matter, carbon monoxide (CO), hazardous air pollutants such as mercury, and naturally occurring radioactive materials.

A new coal-fired generating plant located in southern Michigan 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 as set forth in 40 CFR Part 60, Subpart D(a). The standards establish limits for particulate matter and opacity (40 CFR 60.42(a)), sulfur dioxide (SO_2) (40 CFR 60.43(a)), and NO_x (40 CFR 60.44(a)).

The U.S. Environmental Protection Agency (EPA) has various regulatory requirements for visibility protection in 40 CFR Part 51, Subpart P, including a specific requirement for review of any new major stationary source in an area designated as attainment or unclassified under the Clean Air Act. All of Michigan has been classified as attainment or unclassified for criteria pollutants (40 CFR 81.323). In the posted amendment to that classification, dated April 30, 2004, there are several instances of nonattainment for ozone, including one for Van Buren County (EPA 2004a).

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 (*Federal Register*, Volume 64, page 35714 (64 FR 35714); July 1,1999 (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 toward 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 area, additional air pollution control requirements could be imposed. Isle Royale National Park and Seney National Wildlife Refuge are Class I areas where visibility is an important value (40 CFR 81.407). Both of these areas are located in the Upper Peninsula of Michigan. Air

quality in these areas would not likely be affected by a coal-fired plant at an alternate site in southern Michigan in the vicinity of Palisades.

In 1998, the EPA issued a rule requiring 22 eastern states, including Michigan, to revise their state implementation plans to reduce NO_x emissions. Nitrogen oxide emissions contribute to violations of the national ambient air quality standard for ozone (40 CFR 50.9). The total amount of NO_x that can be emitted by each of the 22 states in the year 2007 ozone season (May 1 to September 30) is presented in 40 CFR 51.121(e). For Michigan, the amount is 229,702 tons.

Anticipated impacts for particular pollutants that would result from a coal-fired plant at an alternate site are as follows:

Sulfur oxides. A new coal-fired power plant would be subject to the requirements in Title IV of the Clean Air Act. Title IV was enacted to reduce SO_2 and NO_x emissions, 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.

NMC estimates that by using wet limestone flue gas desulfurization to minimize SO_x emissions (90 percent removal), the total annual stack emissions would be approximately 2750 tons of SO_x (NMC 2005).

Nitrogen oxides. Section 407 of the Clean Air Act establishes technology-based emission limitations for NO_x emissions. The market-based allowance system used for SO_2 emissions is not used for NO_x emissions. A new coal-fired power plant would be subject to the new source performance standards for such plants at 40 CFR 60.44a(d)(1). This regulation, issued on September 16, 1998 (63 FR 49453 [EPA 1998]), limits the discharge of any gases that contain NO_x (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.

NMC estimates that by using NO_x burners with overfire air and selective catalytic reduction (SCR) (95 percent reduction), the total annual NO_x emissions for a new coal-fired power plant would be approximately 690 tons (NMC 2005). This level of NO_x emissions would be greater than the Palisades OL renewal alternative.

Particulate matter. NMC estimates that the total annual stack emissions would include 120 tons of filterable total suspended particulates and 28 tons of particulate matter having an aerodynamic diameter less than or equal to 10 μm (PM_{10}) (40 CFR 50.6). Fabric filters (99.9 percent removal) 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 under the Palisades OL renewal alternative.

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

Carbon monoxide. NMC estimates that the total CO emissions would be approximately 800 tons per year (NMC 2005). This level of emissions is greater than that under the Palisades 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 2000a). The EPA determined that coal- and oil-fired electric utility steam-generating units are significant emitters of hazardous air pollutants. The EPA found that coal-fired power plants emit arsenic, beryllium, cadmium, chromium, dioxins, hydrogen chloride, hydrogen fluoride, lead, manganese, and mercury (EPA 2000a). 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 2000a). Accordingly, on March 15, 2005, the EPA issued the Clean Air Mercury Rule to permanently cap and reduce mercury emissions from coal-fired power plants (EPA 2005).

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 that under 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 at an alternate site would be MODERATE. The impacts would be clearly noticeable but would not destabilize air quality.

- **Waste**

Debris would be generated during construction activities. During operations, coal combustion generates waste in the form of ash, and equipment for controlling air pollution generates additional ash and scrubber sludge. Two 400-MW(e) coal-fired plants would generate approximately 319,000 tons of this waste annually for 40 years (NMC 2005). The ash and scrubber sludge would be disposed of onsite, accounting for approximately 100 ac of land area over the 40-year plant life. Waste impacts on groundwater and surface water could extend beyond the operating life of the plant if leachate and runoff from the waste storage area occurs. Disposal of the waste could noticeably affect land use and groundwater quality; however, 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 other uses.

In May 2000, the EPA issued a "Notice of Regulatory Determination on Wastes from the Combustion of Fossil Fuels" (EPA 2000b). 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) the EPA has identified 11 documented cases of proven damages to human health and the environment by improper management of these wastes in landfills and surface impoundments; (c) present disposal practices are such that, in 1995, these wastes were being managed in 40 to 70 percent of landfills and surface impoundments without reasonable controls in place, particularly in the area of groundwater monitoring; and (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 under Subtitle D of the Resource Conservation and Recovery Act.

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

- **Human Health**

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

Regulatory agencies, including the EPA and state agencies, set air emission standards and requirements based on human health impacts. These agencies also impose site-specific emission limits as needed to protect human health. 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 NRC staff assumed that construction would take place while Palisades continues operation and would be completed by the time Palisades permanently ceases operations. The workforce would be expected to vary between 600 and 1500 workers during the 5-year construction period (NRC 1996). These workers would be in addition to the approximately 644 workers employed at Palisades (534 permanent employees and 110 contractors as of the writing of the ER; NMC 2005). During construction, the surrounding communities would experience demands on housing and public services that could have MODERATE impacts. These impacts would be tempered by construction workers commuting to the site from other parts of Van Buren and Berrien Counties or from other counties in the Kalamazoo area. 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 the Kalamazoo area.

Construction of a replacement coal-fired power plant at an alternate site would impact the communities around Palisades as they would experience the impact of Palisades' operational job loss. The communities around the new site would have to absorb the impacts of a large, temporary workforce (up to 1500 workers at the peak of construction) and a permanent workforce of approximately 75 to 120 workers. 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 workforce would need to move to the area to work. Alternate sites would need to be analyzed on a case-by-case basis, and socioeconomic impacts could range from SMALL to LARGE.

- **Transportation**

During the 5-year construction period of replacement coal-fired units, up to 1500 construction workers would be working at the site. The addition of these workers could affect traffic loads on existing highways. Transportation-related impacts associated with commuting construction workers at an alternate 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.

At an alternate site, coal and lime would likely be delivered by rail. Transportation impacts would depend upon the site location. Socioeconomic impacts associated with rail transportation would likely be MODERATE to LARGE.

- **Aesthetics**

The two coal-fired power plant units could be as much as 200 ft tall with cooling towers, stacks, and coal piles visible in daylight hours. The exhaust stacks could be as much as 650 ft high. The units and associated stacks would also be visible at night because of outside lighting. Visual impacts of a new coal-fired plant could be mitigated by landscaping and color selection for buildings that is consistent with the environment. Visual impact at night could be mitigated by reduced use of lighting, providing that the lighting meets Federal Aviation Administration requirements (FAA 2000), and appropriate use of shielding. There could be a significant impact if construction of a new transmission line and/or rail spur is needed. Overall, the addition of a coal-fired plant and the associated stacks at an alternate site would likely have a MODERATE aesthetic impact.

Coal-fired 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, such as cooling towers. 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. These impacts are considered to be MODERATE.

Noise impacts associated with rail delivery of coal and lime to a plant at an alternate site 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 are considered MODERATE.

Aesthetic impacts associated with the construction and presence of the new transmission line and rail spur could be LARGE, depending on the location of the site chosen. Overall, the aesthetic impacts associated with locating a coal-fired plant at an alternate site can be categorized as MODERATE to LARGE.

- **Historic and Archaeological Resources**

Before construction or any ground disturbance at an alternate site, studies would likely be needed to identify, evaluate, and address mitigation of the potential impacts of new plant construction on historic and archaeological 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). Other lands, if any, that are acquired to support the plant would also likely need an inventory of cultural resources to identify and evaluate existing historic and archaeological resources and possible mitigation of adverse effects from subsequent ground-disturbing actions related to physical expansion of the plant site.

Historic and archaeological resources must be evaluated on a site-specific basis. The impacts can generally be effectively managed under current laws and regulations, and as such, the categorization of impacts could range from SMALL to MODERATE, depending on what resources are present, and whether mitigation is necessary.

- **Environmental Justice**

Environmental justice impacts would depend upon the site chosen and the nearby population distribution. Construction activities would offer new employment possibilities. This could affect housing availability and prices during construction, which could disproportionately affect minority and low-income populations. The closure of Palisades would result in a decrease in employment of approximately 644 operating employees.

However, these projected job losses could be offset by economic growth in the Kalamazoo area. Overall, environmental justice impacts would range from SMALL to MODERATE.

8.2.1.2 Once-Through Cooling System

This section discusses the environmental impacts of constructing a coal-fired generation system using once-through cooling at an alternate site. The impacts (SMALL, MODERATE, or LARGE) of this option are the same as the impacts for a coal-fired plant using the closed-cycle system. However, there are minor environmental differences between the closed-cycle and once-through cooling systems. Table 8.3 summarizes the incremental differences. However, the design and operation of the intake would need to comply with Phase I performance standards of the EPA's 316(b) regulations to minimize adverse impacts associated with water withdrawal, and heated discharges would need to comply with 316(a) regulations.

8.2.2 Natural-Gas-Fired Generation

The environmental impacts of the natural-gas-fired generation alternative are examined in this section for both the Palisades site and an alternate site. The NRC staff assumed that the plant would use a closed-cycle cooling system (Section 8.2.2.1). In Section 8.2.2.2, the staff also evaluated the impacts of an open-cycle cooling system at an alternate site.

The existing switchyard, offices, and transmission lines would be used for the gas-fired alternative at the Palisades site. For purposes of analysis, NMC estimates that approximately 5 mi of buried gas supply pipeline would need to be constructed (NMC 2005).

If a new natural-gas-fired plant were built at an alternate site in southern Michigan to replace Palisades, construction of a new natural gas supply pipeline and a new transmission line would be needed. NMC estimated 5 mi of new gas pipeline would be needed and approximately 10 mi of new 345-kV transmission line (NMC 2005). In the GEIS, the NRC staff estimated disturbance of up to 2500 ac for construction of a 60-mi transmission line to an alternate greenfield site (NRC 1996).

The NRC staff assumed that a replacement natural-gas-fired plant would use combined-cycle technology (NMC 2005). In a combined-cycle unit, hot combustion gases in a combustion turbine rotate the turbine to generate electricity. Waste combustion heat from the combustion turbine is routed through a heat-recovery boiler to make steam to generate additional electricity.

NMC assumed two standard-sized units – a 530-MW(e) unit and a 263-MW(e) unit – with a total capacity of 793 MW(e), as the gas-fired alternative at Palisades (NMC 2005). This capacity is approximately equivalent to the Palisades total net capacity of 786 MW(e). NMC estimates that the plant would consume approximately 38.4 billion ft^3 of gas annually (NMC 2005).

Table 8-3. Summary of Environmental Impacts of Coal-Fired Generation Using Once-Through Cooling at an Alternate Site

Impact Category	Change in Impacts from Closed-Cycle Cooling System
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. No impact on terrestrial ecology from cooling-tower drift.
Water use and quality–surface water	Increased water withdrawal leading to possible water-use conflicts; thermal load higher on receiving body of water than with closed-cycle cooling; no discharge of cooling-tower blowdown.
Water use and quality–groundwater	No change
Air quality	No change
Waste	No change
Human health	No change
Socioeconomics	No change
Transportation	No change
Aesthetics	Less aesthetic impact because cooling towers would not be used.
Historic and archaeological resources	No change
Environmental justice	No change

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

8.2.2.1 Closed-Cycle Cooling System

The overall impacts of the natural-gas-generating system are discussed in the following sections and summarized in Table 8-4. The extent of impacts at an alternate site will depend on the location of the particular site selected.

In addition to the impacts discussed below for a gas-fired plant at either the Palisades site or at an alternate site, impacts would occur offsite as a result of gas production and transportation.

Impacts of production operations would include an increase in fugitive dust emissions, surface water runoff, erosion, and sedimentation; changes in water quality; disturbance of vegetation and wildlife; disturbance of historic and archaeological resources; changes in land use; and impacts on employment. The magnitude of these offsite impacts would largely be proportional to the amount of land affected by the production and distribution.

- **Land Use**

  For siting at Palisades, existing facilities and infrastructure would be used to the extent practicable, limiting the amount of new construction that would be required. Specifically, the staff assumed that the natural-gas-fired replacement plant alternative would use the switchyard, offices, and transmission lines. Much of the land that would be used has been previously disturbed. At Palisades, the staff assumed that approximately 30 ac would be needed for the plant and associated infrastructure. There would be an additional impact of up to approximately 120 ac for construction of a gas pipeline. Approximately 30 ac of undeveloped land at the Palisades site is available in the northeastern portion of the site. However, there would be insufficient buffer available between the plant and Van Buren State Park (adjacent to the Palisades site to the north).

  For construction at an alternate site, the NRC staff assumed in the GEIS that 110 ac would be needed for a 1000-MW(e) plant and associated infrastructure (NRC 1996). This estimate would be scaled down for the 793-MW(e) capacity of the proposed gas-fired alternative (i.e., 87 ac). The additional amount of land impacted by the construction of a new transmission line and a gas pipeline is dependent on the site location chosen. The NRC staff assumed in the GEIS that approximately 2500 ac would be impacted for construction of a 60-mi transmission line (NRC 1996), although NMC estimates only 10 mi of transmission line might be needed. In addition, approximately 120 ac could be disturbed

Table 8-4. Summary of Environmental Impacts of Natural-Gas-Fired Generation Using Closed-Cycle Cooling at the Palisades Site and at an Alternate Site

Impact Category	Palisades Site		Alternate Site	
	Impact	Comments	Impact	Comments
Land use	MODERATE to LARGE	Uses approximately 30 ac for power block, cooling towers, roads, and parking areas. Additional impact of up to approximately 120 ac for construction of 5 mi of underground gas pipeline.	MODERATE to LARGE	Uses approximately 87 ac for power block, cooling towers, offices, roads, and parking areas. Additional land needed for new transmission line (amount dependent on site chosen) and for construction and/or upgrade of an underground gas pipeline.
Ecology	MODERATE to LARGE	Uses undeveloped areas at current Palisades site, plus construction of a gas pipeline. Impacts on terrestrial ecology from cooling-tower drift are expected.	MODERATE to LARGE	Impacts depend on location and ecology of the site, surface-water body used for intake and discharge, and transmission and pipeline routes; potential habitat loss and fragmentation; reduced productivity and biological diversity.
Water use and quality–surface water	SMALL	Discharge of cooling tower blowdown containing increased dissolved solids and intermittent low concentrations of biocides would be released to Lake Michigan. Temporary erosion and sedimentation could occur in streams crossed by rights-of-way during pipeline construction.	SMALL to MODERATE	Impacts depend on volume of water withdrawn and discharged and characteristics of surface-water body. Discharge of cooling-tower blowdown containing increased dissolved solids and intermittent low concentrations of biocides would be released to surface water. Temporary erosion and sedimentation could occur in streams crossed by rights-of-way during pipeline construction.

Table 8-4. (contd)

Impact Category	Palisades Site		Alternate Site	
	Impact	Comments	Impact	Comments
Water use and quality–groundwater	SMALL	Use of groundwater limited to grounds maintenance. Adequate surface water available from Lake Michigan.	SMALL to MODERATE	Impacts depend on location of site, volume of water withdrawn and discharged, and characteristics of the aquifer.
Air quality	MODERATE	Sulfur oxides • 12 tons/yr Nitrogen oxides • 190 tons/yr Carbon monoxide • 292 tons/yr PM_{10} particulates • 37 tons/yr Some hazardous air pollutants.	MODERATE	Same emissions as Palisades site, although pollution control standards may vary depending on location.
Waste	SMALL	Minimal waste from fuel production. Debris would be generated and removed during construction.	SMALL	Same waste produced as if produced at the Palisades site. Waste disposal constraints may vary.
Human health	SMALL	Human health risks associated with gas-fired plants may result from NO_x emissions, which are regulated. Impacts are expected to be SMALL.	SMALL	Same impacts as the Palisades site.
Socioeconomics	SMALL to MODERATE	During construction, impacts would be MODERATE. Up to 420 additional workers during the peak of the 3-year construction period, followed by a reduction of the current Palisades workforce from 644 to 30. Van Buren County would experience reduced demand on socioeconomic resources as well as a loss in its tax base and employment, potentially offset by projected economic growth in the area. Impacts during operation would be SMALL.	SMALL to MODERATE	During construction, impacts would be MODERATE. Up to 420 additional workers during the peak of the 3-year construction period. Van Buren County would experience a loss in its tax base and employment, potentially offset by projected economic growth in the area.

Table 8-4. (contd)

Impact Category	Palisades Site		Alternate Site	
	Impact	Comments	Impact	Comments
Transportation	SMALL to MODERATE	Transportation impacts associated with construction workers would be MODERATE as 644 Palisades workers and 420 construction workers would be commuting to the site. Impacts during operation would be SMALL as the workforce would be reduced to 30 commuters.	SMALL to MODERATE	Transportation impacts associated with 420 construction workers and 30 plant workers would be MODERATE and SMALL, respectively.
Aesthetics	MODERATE	MODERATE aesthetic impacts due to impact of plant units, exhaust stacks, and gas compressors. Intermittent noise from construction and continuous noise from cooling towers and mechanical equipment would result in MODERATE impacts.	MODERATE to LARGE	Impacts would be similar to the Palisades site with additional impact from the new 345-kV transmission line that would be needed.
Historic and archeological resources	SMALL to MODERATE	Some construction would affect previously developed parts of the Palisades site; a cultural resource inventory would be needed to identify, evaluate, and mitigate potential impacts of new plant construction on cultural resources in undeveloped areas.	SMALL to MODERATE	Cultural resource studies would be needed to identify, evaluate, and mitigate potential impacts of new plant construction at developed and undeveloped sites.
Environmental justice	SMALL to MODERATE	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 614 operating jobs at Palisades could reduce employment prospects for minority and low-income populations. Impacts could be offset by projected economic growth and ability of affected workers to commute to other jobs.	SMALL to MODERATE	Impacts would vary depending on population distribution and makeup at site.

during construction and/or upgrade of an underground pipeline, assuming an alternate site would be located within 5 mi of a gas pipeline connection.

Regardless of where the gas-fired plant is built, additional land (approximately 3600 ac) would be required for natural gas wells and collection stations (NRC 1996). Partially offsetting these offsite land requirements would be the elimination of the need for uranium mining to supply fuel for Palisades. In the GEIS (NRC 1996), the NRC 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 MODERATE to LARGE.

- **Ecology**

At the Palisades site, there would be ecological impacts related to possible habitat loss and to cooling-tower drift associated with siting of the gas-fired plant. There would also be ecological impacts associated with bringing a new underground gas pipeline to the Palisades site. Impacts due to habitat loss could be reduced through the use of previously impacted land. Ecological impacts at an alternate site would depend on the nature of the land converted for the plant and the possible need for a new gas pipeline and/or transmission line. Construction of the transmission line and construction and/or upgrading of the gas pipeline to serve the plant would be expected to have temporary ecological impacts. Ecological impacts on the plant site and utility easements could include impacts on threatened or endangered species, wildlife habitat loss and reduced productivity, habitat fragmentation, and a local reduction in biological diversity. The cooling makeup water intake and discharge could have aquatic resource impacts. Overall, the ecological impacts are considered MODERATE to LARGE at either location.

- **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 those 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 (e.g., chlorine). In addition to the cooling-tower blowdown, treated process waste streams and sanitary wastewater might also be discharged. All discharges would be regulated by the State of Michigan through a permit. There would be consumptive use of water due to evaporation from the cooling towers. Construction could

cause temporary erosion and sedimentation in streams crossed by the rights-of-way. Overall, the surface-water impacts of the natural-gas-fired alternative at the Palisades site are considered SMALL.

A natural-gas-fired plant at an alternate 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 with 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. Discharges would be the same as those described above for the Palisades site. Construction could cause temporary erosion and sedimentation in streams crossed by the rights-of-way. Intake from and discharge to any surface body of water would be regulated by the State of Michigan. The impacts would be SMALL to MODERATE.

Water-quality impacts from sedimentation during construction were characterized in the GEIS as SMALL (NRC 1996). The NRC staff also noted in the GEIS that operational water-quality impacts would be similar to, or less than, those from other generating technologies.

Groundwater. Any groundwater withdrawal would require a permit from the local permitting authority. Impacts on groundwater would depend on the volume and other characteristics of the source water budget. Use of groundwater at the Palisades site is unlikely because adequate surface water is available from Lake Michigan. Therefore, groundwater impacts at the Palisades site would be SMALL. Impacts at an alternate site would be SMALL to MODERATE depending on site-specific conditions.

- **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 Michigan 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 D(a) and GG. These regulations establish emission limits for particulates, opacity, SO_2, and NO_x.

In 1998, the EPA issued a rule requiring 22 eastern states, including Michigan, to revise their state implementation plans to reduce NO_x emissions. Nitrogen oxide emissions contribute to violations of the national ambient air quality standard (40 CFR 50.9) for ozone. The total amount of NO_x that can be emitted by each of the 22 states in the 2007 ozone

season (May 1 to September 30) is presented in 40 CFR 51.121(e). For Michigan, the amount is 229,702 tons.

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. All of Michigan has been classified as attainment or unclassified for criteria pollutants (40 CFR 81.323). In the posted amendment to that classification dated April 30, 2004, there are several instances of nonattainment for ozone, including one for Van Buren County (EPA 2004a).

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 (64 FR 35714; July 1,1999 (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 toward 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. Isle Royale National Park and Seney National Wildlife Refuge are Class I areas where visibility is an important value (40 CFR 81.407). Both of these areas are located in the Upper Peninsula of Michigan, and air quality in these areas would not likely be affected by a gas-fired plant at the Palisades site or at an alternate site in southern Michigan.

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

Sulfur oxides – 12 tons/yr
Nitrogen oxides – 190 tons/yr
Carbon monoxide – 292 tons/yr
PM_{10} particulates – 37 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 2000a). The EPA found that natural-gas-fired power plants emit arsenic, formaldehyde, and nickel (EPA 2000a). 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.

The preceding emissions would likely be the same at Palisades or at an alternate site. Impacts from the above emissions would be clearly noticeable but would not be sufficient to destabilize air resources as a whole.

Therefore, the overall air quality impact for a new natural-gas-fired plant sited at Palisades or at an alternate site is considered MODERATE.

- **Waste**

There will be spent 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 NRC staff concluded that waste generation from gas-fired technology would be minimal (NRC 1996). Gas firing results in very few combustion by-products because of the clean nature of the fuel. Waste-generation 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 Palisades or at an alternate site.

- **Human Health**

In Table 8-2 of the GEIS, the NRC 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 Michigan, NO_x emissions would be regulated by the Michigan Department of Environmental Quality (MDEQ). 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 Palisades or at an alternate site are considered SMALL.

- **Socioeconomics**

Construction of a natural-gas-fired plant would take approximately 3 years. Peak employment would be approximately 420 workers (NMC 2005). The NRC staff assumed that construction would take place while Palisades continues operation and would be completed by the time it permanently ceases operations. During construction, the

communities surrounding the Palisades 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 Van Buren and Berrien Counties or from other counties. After construction, the communities would be impacted by the loss of jobs. The current Palisades workforce (approximately 644 workers) would decline through a decommissioning period to a minimal maintenance size. The gas-fired plant would introduce a replacement tax base at Palisades or at an alternate site and approximately 30 new permanent jobs. This would represent a net loss of 614 jobs at the Palisades site.

In the GEIS (NRC 1996), the NRC staff concluded that socioeconomic impacts from constructing a natural-gas-fired plant would not be very noticeable and that the small operational workforce would have the lowest socioeconomic impacts of any nonrenewable technology. Compared with the coal-fired and nuclear alternatives, the smaller size of the construction workforce, the shorter construction time frame, and the smaller size of the operations workforce would mitigate socioeconomic impacts. The loss of 614 permanent jobs (up to 644 jobs if an alternate site is not located in Van Buren County) may be partially tempered by the projected economic growth of the Kalamazoo area. 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 Palisades or at an alternate site. Depending on other growth in the area, socioeconomic effects could be noticed, but they would not destabilize any important socioeconomic attribute.

- **Transportation**

Transportation impacts associated with construction and operating personnel commuting to the plant site would depend on the population density and transportation infrastructure in the vicinity of the site. The impacts can be classified as SMALL to MODERATE for siting at Palisades or at an alternate site.

- **Aesthetics**

The turbine buildings (approximately 100 ft tall) and exhaust stacks (approximately 125 ft tall) would be visible during daylight hours from offsite. The gas pipeline compressors would also be visible. Noise and light from the plant would be detectable offsite. Intermittent noise from construction and continuous noise from cooling towers and mechanical equipment would result in MODERATE impacts. Noise impacts would be similar to those described for the Palisades site. Overall, the aesthetic impacts associated with construction and operation of a gas-fired plant at the Palisades site are categorized as MODERATE to LARGE.

At an alternate site, the buildings, cooling towers, cooling-tower plumes, and the associated transmission line and gas pipeline compressors would be visible offsite. There would also

be a visual impact from a new 345-kV transmission line. Aesthetic impacts would be mitigated if the plant were located in an industrial area adjacent to other power plants. Noise impacts would be similar to those described for the Palisades site. Overall, the aesthetic impacts associated with an alternate site are categorized as MODERATE to LARGE. Depending on the site chosen, the greatest contributor to aesthetic impact would be the new transmission line.

- **Historic and Archaeological Resources**

Before construction or any ground disturbance at Palisades or at an alternate site, studies would likely be needed to identify, evaluate, and address mitigation of the potential impacts of new plant construction on historic and archaeological 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). Other lands, if any, that are acquired to support the plant would also likely need an inventory of cultural resources to identify and evaluate existing historic and archaeological resources and possible mitigation of adverse effects from subsequent ground-disturbing actions related to physical expansion of the plant site.

Historic and archaeological resources must be evaluated on a site-specific basis. The impacts can generally be effectively managed under current laws and regulations, and as such, the categorization of impacts ranges from SMALL to MODERATE, depending on what resources are present and whether mitigation is necessary.

- **Environmental Justice**

No environmental pathways or locations have been identified that would result in disproportionately high and adverse environmental impacts on minority and low-income populations if a replacement natural-gas-fired plant were built at the Palisades site. Some impacts on housing availability and prices during construction might occur, and this could disproportionately affect minority and low-income populations. Closure of Palisades would result in a decrease in employment of approximately 644 operating employees, possibly offset by general growth in the Kalamazoo area. 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 are expected to be SMALL to MODERATE. Projected economic growth in the Kalamazoo area and the ability of minority and low-income populations to commute to other jobs outside the area could mitigate any adverse effects.

Impacts at an alternate site would depend upon the site chosen and the nearby population distribution; therefore, impacts could range from SMALL to MODERATE.

8.2.2.2 Once-Through Cooling System

This section discusses the environmental impacts of constructing a natural-gas-fired generation system at an alternate site using once-through cooling. The impacts (SMALL, MODERATE, or LARGE) of this option are the same as the impacts for a natural-gas-fired plant using the closed-cycle system. However, there are minor environmental differences between the closed-cycle and once-through cooling systems. Table 8.5 summarizes the incremental differences. However, the design and operation of the intake would need to comply with Phase I performance standards of EPA's 316(b) regulations to minimize adverse impacts associated with water withdrawal, and heated discharges would need to comply with 316(a) regulations.

Table 8-5. Summary of Environmental Impacts of Natural-Gas-Fired Generation Using Once-Through Cooling at an Alternate Site

Impact Category	Change in Impacts from Closed-Cycle Cooling System
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 the ecology at the site. Potential impacts associated with entrainment of fish and shellfish in early life stages, impingement of fish and shellfish, and heat shock. No impact on terrestrial ecology from cooling-tower drift.
Water use and quality–surface water	Increased water withdrawal leading to possible water-use conflicts, thermal load higher on receiving body of water than with closed-cycle cooling; no discharge of cooling-tower blowdown.
Water use and quality–groundwater	No change
Air quality	No change
Waste	No change
Human health	No change
Socioeconomics	No change
Transportation	No change
Aesthetics	Less aesthetic impact because cooling towers would not be used.
Historic and archaeological resources	No change
Environmental justice	No change

8.2.3 Nuclear Power Generation

Since 1997, the NRC has certified three new standard designs for nuclear power plants under 10 CFR Part 52, Subpart B. These designs are the 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 plants are light-water reactors. Although no applications for a construction permit or a combined license based on these certified designs have been submitted to the NRC, the submission of 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. In addition, System Energy Resources, Inc., Exelon Generations Company, LLC, and Dominion Nuclear North Anna, LLC, have recently submitted applications for early site permits for new advanced nuclear power plants under the procedures in 10 CFR Part 52, Subpart A (SERI 2003; Exelon 2003; Dominion 2003). Consequently, construction of a new nuclear power plant at either the Palisades site or at an alternate site is considered in this section. The NRC staff assumed that the new nuclear plant would have a 40-year lifetime. Consideration of a new nuclear generating plant to replace Palisades was not included in the NMC ER (NMC 2005).

The 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 Palisades or at an alternate site. The impacts shown in Table S-3 are for a 1000-MW(e) reactor and would need to be adjusted to reflect the replacement of 786 MW(e) generated by Palisades. The environmental impacts associated with transporting fuel and waste to and from a light-water-cooled nuclear power reactor are summarized in Table S-4 of 10 CFR 51.52. The summary of the NRC's findings on NEPA issues for license renewal of nuclear power plants in Table B-1 of 10 CFR Part 51, Subpart A, Appendix B, is also relevant, although not directly applicable, for 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 8.2.3.1, and using open-cycle cooling is presented in Section 8.2.3.2.

8.2.3.1 Closed-Cycle Cooling System

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

In addition to the impacts discussed below, impacts would occur offsite as a result of uranium mining. Impacts of mining would include an increase in fugitive dust emissions, surface-water

Table 8-6. Summary of Environmental Impacts of New Nuclear Power Generation Using Closed-Cycle Cooling at the Palisades Site and at an Alternate Site

	Palisades Site		Alternate Site	
Impact Category	**Impact**	**Comments**	**Impact**	**Comments**
Land use	MODERATE to LARGE	Requires approximately 500 to 1000 ac for the plant; would likely require the acquisition of additional land.	MODERATE to LARGE	Same as Palisades site plus additional land for transmission line.
Ecology	MODERATE to LARGE	Uses undeveloped areas at current Palisades site and additional undeveloped land adjacent to the site. Impacts dependent on specific location and ecology of the site. Impacts on terrestrial ecology from cooling-tower drift are expected. Use of cooling makeup water could affect aquatic resources.	MODERATE to LARGE	Impacts would depend 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. Impacts on terrestrial ecology from cooling-tower drift are expected.
Water use and quality–surface water	SMALL	Discharge of cooling-tower blowdown containing increased dissolved solids and intermittent low concentrations of biocides would be released to Lake Michigan.	SMALL to MODERATE	Impacts would depend on the volume of water withdrawn and discharged and the characteristics of the surface-water body. Discharge of cooling-tower blowdown containing increased dissolved solids and intermittent low concentrations of biocides would be released to surface water.
Water use and quality–groundwater	SMALL	Use of groundwater is unlikely because the Palisades site has adequate surface water available from Lake Michigan.	SMALL to MODERATE	Impacts would depend on the volume of water withdrawn and discharged and the characteristics of the aquifer.
Air quality	SMALL to MODERATE	Fugitive emissions and emissions from vehicles and equipment during construction would be MODERATE. Small amount of emissions from diesel generators and possibly other sources during operation would be similar to current operation of Palisades.	SMALL to MODERATE	Same impacts as Palisades site.

Table 8-6. (contd)

	Palisades Site		Alternate Site	
Impact Category	**Impact**	**Comments**	**Impact**	**Comments**
Waste	SMALL	Waste impacts for an operating nuclear power plant are presented in 10 CFR Part 51, Appendix B, Table B-1. Debris would be generated and removed during construction.	SMALL	Same impacts as Palisades site.
Human health	SMALL	Human health impacts for an operating nuclear power plant are presented in 10 CFR Part 51, Appendix B, Table B-1.	SMALL	Same impacts as Palisades site.
Socioeconomics	SMALL to MODERATE	During construction, impacts would be MODERATE. Up to 2500 workers during peak period of the 6-year construction period. Operating workforce assumed to be similar to Palisades; tax base preserved. Impacts during operation would be SMALL.	SMALL to LARGE	Construction impacts would depend on location. Impacts at a rural location could be LARGE. Van Buren County would experience a loss in its tax base and employment if the chosen site is located outside of the county, possibly offset by economic growth in the area.
Transportation	SMALL to LARGE	Transportation impacts associated with 2500 construction workers in addition to 644 Palisades workers would be LARGE. Transportation impacts of commuting plant personnel would be SMALL.	SMALL to LARGE	Impacts would depend on the location of the site. Transportation impacts of 2500 construction workers could be MODERATE to LARGE. Transportation impacts of 644 commuting plant personnel could be SMALL to MODERATE.
Aesthetics	SMALL to MODERATE	Aesthetic impacts due to addition of containment and other associated buildings would be SMALL. No exhaust stacks would be needed, and existing cooling towers would be used, if possible. Intermittent noise from construction and commuter traffic and continuous noise from cooling towers and mechanical equipment could result in impacts ranging from SMALL to MODERATE.	MODERATE to LARGE	Impacts would depend on the characteristics of the alternate site but would be similar to those at the Palisades site. Impacts would be less if the site selected is next to an industrial area. Impacts would be greater if a non-industrial site is selected. Additional visual impacts would occur from the new transmission line that would be needed.

Table 8-6. (contd)

	Palisades Site		Alternate Site	
Impact Category	**Impact**	**Comments**	**Impact**	**Comments**
Historic and archeological resources	SMALL to MODERATE	Some construction would affect previously developed parts of the Palisades site; a cultural resource inventory would be needed to identify, evaluate, and mitigate potential impacts of new plant construction on cultural resources in undeveloped areas.	SMALL to MODERATE	Cultural resource studies would be needed to identify, evaluate, and mitigate potential impacts of new plant construction at developed and undeveloped sites.
Environmental justice	SMALL to MODERATE	Impacts on minority and low-income communities should be similar to those experienced by the population as a whole. MODERATE impacts on housing may occur during construction. Employment impacts would be similar to the current operation of Palisades.	SMALL to LARGE	Impacts would vary depending on population distribution and makeup at the site.

runoff, erosion, sedimentation, changes in water quality, disturbance of vegetation and wildlife, disturbance of historic and archaeological resources, changes in land use, and impacts in employment.

The magnitude of these offsite impacts would largely be proportional to the amount of land affected by mining. However, 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 at Palisades.

- **Land Use**

  The existing facilities and infrastructure at the Palisades site would be used to the extent practicable, limiting the amount of new construction that would be required. Specifically, the NRC staff assumed that a replacement nuclear power plant would use the existing cooling towers, 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 Palisades site would alter approximately 500 to 1000 ac of land, excluding power lines (NRC 1996).

  The impact of a replacement nuclear generating plant on land use at the existing Palisades site is best characterized as MODERATE to LARGE, because the existing site is not large enough to accept the additional land requirements for construction. Additional land would have to be obtained outside of the existing boundaries, or Palisades would have to be

dismantled before new construction began. The impact would be greater than the OL renewal alternative.

Land-use impacts at an alternate site would be similar to siting at Palisades except for the land needed for a 345-kV transmission line to connect to existing lines to transmit power to NMC's customers in Michigan. The amount of land needed for the transmission line is dependent upon the location of the alternate site. 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 site would result in MODERATE to LARGE land-use impacts.

- **Ecology**

Locating a replacement nuclear power plant at the Palisades 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.

Siting at Palisades would have a MODERATE to LARGE ecological impact that would be greater than renewal of the Palisades 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 affect ecological resources. 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. Impacts on terrestrial ecology could result from cooling-tower drift. Construction and maintenance of the transmission line, if needed, would have ecological impacts. Overall, the ecological impacts at an alternate site would be MODERATE to LARGE and would depend on the ecological conditions at the site.

- **Water Use and Quality**

Surface Water. The replacement nuclear plant alternative at the Palisades site is assumed to use the existing closed-cycle cooling tower system, which would minimize incremental water-use and quality impacts. 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 (e.g., chlorine). In addition to the cooling-tower blowdown, treated process waste streams and sanitary wastewater might also be discharged. All discharges would be regulated by the State of Michigan through a permit. 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 by the State of Michigan. The impacts would be SMALL to MODERATE.

Groundwater. The NRC staff assumed that a new nuclear power plant located at Palisades would obtain potable, process, and fire-protection water from the South Haven Municipal Water Authority, similar to the current practice for Palisades (see Section 2.2.2).

No groundwater is currently used for operation of Palisades other than for maintenance of the grounds. It is unlikely that groundwater would be used for an alternative nuclear power plant sited at Palisades. Use of groundwater for a nuclear power plant sited at an alternate site is a possibility. Any groundwater withdrawal would require a permit from the local permitting authority.

Overall, the impacts on groundwater use and quality from a closed-cycle new nuclear alternative at the Palisades site is considered SMALL. Impacts from a similar plant at an alternate site are considered to be SMALL to MODERATE, depending on the volume of groundwater used and characteristics of the aquifer.

- **Air Quality**

Construction of a new nuclear plant sited at Palisades or at an alternate site would result in fugitive emissions during the 6-year construction period. Exhaust emissions would also come from vehicles and motorized equipment used during the construction process. Air quality impacts from construction could be MODERATE. An operating nuclear plant would have minor air emissions associated with diesel generators and other minor intermittent sources and would be similar to the current impacts associated with operation of Palisades (i.e., SMALL). These emissions are not regulated. Emissions for a plant sited in Michigan would be regulated by the MDEQ. Overall, emissions and associated impacts are considered SMALL to MODERATE.

- **Waste**

The waste impacts associated with operation of a nuclear power plant are presented 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 are considered SMALL.

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

- **Human Health**

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

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

- **Socioeconomics**

The construction period and the peak workforce associated with construction of a new nuclear power plant are currently unquantified (NRC 1996). In the absence of quantitative data, NRC staff assumed a construction period of 6 years and a peak workforce of 2500. Additional land would have to be acquired to construct a new nuclear plant at the Palisades site, or Palisades would have to be decommissioned and dismantled before construction began. During construction, the communities surrounding the Palisades 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 Van Buren and Berrien Counties or from other counties.

The replacement nuclear unit is assumed to have an operating workforce comparable to the 644 workers currently working at Palisades. The replacement nuclear unit would provide a new tax base to offset the loss of tax base associated with decommissioning of Palisades. For all of these reasons, the appropriate characterization of nontransportation socioeconomic impacts for replacement nuclear units constructed at Palisades would be SMALL to MODERATE; the socioeconomic impacts would be noticeable, but would be unlikely to destabilize the area.

If a new nuclear power plant were constructed at an alternate site, the communities around the Palisades site would experience the impact of Palisades' operational job loss (although potentially tempered by projected economic growth in the area). The communities around the new site would have to absorb the impacts of a large, temporary workforce (up to 2500 workers at the peak of construction) and a permanent workforce of approximately 644 workers. In the GEIS (NRC 1996), the NRC staff indicated that socioeconomic impacts at a rural site would be larger than at an urban site because more of the peak construction workforce would need to move to the area to work. Alternate sites would need to be analyzed on a case-by-case basis, and impacts could range from SMALL to LARGE.

- **Transportation**

During the 6-year construction period, up to 2500 construction workers and 644 Palisades workers would be commuting to the Palisades site. The addition of the construction workers could place significant traffic loads on existing highways. 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 Palisades and are considered SMALL.

Transportation-related impacts associated with commuting construction workers at an alternate 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 Palisades and other associated buildings would likely be visible in daylight hours over many miles. Natural draft towers could be up to 500 ft high. Mechanical draft towers could be up to 100 ft high and would also have an associated noise impact and condensate plumes. 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. Existing cooling towers would be used, if possible.

Intermittent noise impacts from construction and commuter traffic is likely. More continuous noise from a new nuclear plant would potentially be audible offsite in calm wind conditions or when the wind is blowing in the direction of the listener. Noise impacts from a new nuclear plant would be similar to those from the existing Palisades unit. Mitigation measures, such as reduced or no use of outside loudspeakers, can be employed to reduce noise impacts to levels that would ranges from SMALL to MODERATE.

At an alternate 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 transmission line. The length of the transmission line would be dependent upon the location of the plant. Noise and light from the plant would be detectable offsite. The impact of noise and light would be less if the plant were 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

MODERATE to LARGE. Depending on the location chosen, the greatest contributor to this categorization could be the aesthetic impact of the new transmission line.

- **Historic and Archaeological Resources**

  Before construction or any ground disturbance at Palisades or at an alternate site, studies would likely be needed to identify, evaluate, and address mitigation of the potential impacts of new plant construction on historic and archaeological 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). Other lands, if any, that are acquired to support the plant would also likely need an inventory of cultural resources to identify and evaluate existing historic and archaeological resources and possible mitigation of adverse effects from subsequent ground-disturbing actions related to physical expansion of the plant site.

  Historic and archaeological resources must be evaluated on a site-specific basis. The impacts can generally be effectively managed under current laws and regulations, and as such, the categorization of impacts ranges from SMALL to MODERATE, depending on what resources are present and whether mitigation is necessary.

- **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 Palisades 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 to MODERATE. Projected economic growth in the Kalamazoo area and the ability of minority and low-income populations to commute to other jobs outside the Van Buren County area could mitigate any adverse effects.

  Impacts at an alternate site would depend upon the site chosen and the nearby population distribution, and are likely to vary from SMALL to LARGE.

8.2.3.2 Once-Through Cooling System

This section discusses the environmental impacts of constructing a nuclear power plant at an alternate 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 8.7 summarizes the incremental differences. However, the design and operation of the intake would need to comply with Phase I performance standards of the EPA's 316(b) regulations to minimize adverse impacts associated with water withdrawal, and heated discharges would need to comply with 316(a) regulations.

Table 8-7. Summary of Environmental Impacts of a New Nuclear Power Plant Sited Using Once-Through Cooling at an Alternate Site

Impact Category	Change in Impacts from Closed-Cycle Cooling System
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 the 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. No impact on terrestrial ecology from cooling tower drift.
Water use and quality–surface water	Increased water withdrawal leading to possible water-use conflicts, thermal load higher on receiving body of water than with closed-cycle cooling; no discharge of cooling-tower blowdown.
Water use and quality–groundwater	No change
Air quality	No change
Waste	No change
Human health	No change
Socioeconomics	No change
Transportation	No change
Aesthetics	Less aesthetic impact because cooling towers are not used.
Historic and archaeological resources	No change
Environmental justice	No change

8.2.4 Purchased Electrical Power

If available, purchased power from other sources could potentially obviate the need to renew the Palisades OL. It is unlikely, however, that sufficient baseload, firm power supply would be available to replace the Palisades capacity.

Imported power from Canada or Mexico is unlikely to be available for replacement of Palisades capacity. In Canada, 60 percent of the country's electrical generation capacity is derived from renewable energy sources, principally hydropower (EIA 2004). Canada plans to expand hydroelectric capacity, including large-scale projects (EIA 2004). Canada's nuclear generation is projected to increase from 10,000 MW in 2001 to 15,200 MW in 2020 before reaching a forecasted decline to 12,400 MW in 2025 (EIA 2004). The EIA projected that total gross U.S. imports of electricity from Canada and Mexico will gradually increase from 38.4 billion kWh in 2001 to 47.2 billion kWh in 2010 and then gradually decrease to 15.2 billion kWh in 2025 (EIA 2004). Consequently, it is unlikely that electricity imported from Canada or Mexico would be able to replace Palisades' capacity.

If power to replace Palisades' 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 draft SEIS and in the GEIS (probably coal, natural gas, 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 Palisades OL. Thus, the environmental impacts of imported power would still occur but would be located elsewhere within the region, nation, or another country.

8.2.5 Other Alternatives

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

8.2.5.1 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 2004 to 2025 time period because of higher fuel costs and lower efficiencies (EIA 2004). Nevertheless, an oil-fired generating alternative at the Palisades site for replacement of power generated by Palisades is considered in this section.

Consumers Energy has two oil/gas coal-fired units. These units produce about 1 percent of Consumers Energy's total power (NMC 2005). Oil-fired operation is more expensive than nuclear or coal-fired operation. In addition, future increases in oil prices are expected to make oil-fired generation increasingly more expensive than coal-fired generation. The high cost of oil

has prompted a steady decline in its use for electricity generation. For these reasons, oil-fired generation is not an economically feasible alternative to Palisades license renewal.

Construction and operation of an oil-fired plant would have environmental impacts. For example, in Section 8.3.11 of the GEIS, the NRC staff estimated that construction of a 1000-MWe oil-fired plant would require about 120 acres (NRC 1996). In addition, operation of oil-fired plants would have environmental impacts (including impacts on the aquatic environment and air) that would be similar to those from a coal-fired plant.

8.2.5.2 Wind Power

Wind 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 (of the order of 30 percent) (NRC 1996). 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.

The Lake Michigan shoreline region in the State of Michigan, including Van Buren County, has good wind power potential. The annual average wind power for this part of the state is rated as Class 3. Areas designated Class 3 or greater are suitable for most wind energy applications (DOE 2004a). However, the wind power class attenuates rapidly to Class 2 inland from the lake's coastline. Michigan also has good wind resources in the northern part of the Lower Peninsula. These areas, however, are confined to exposed hilltops and ridge crests, which makes them unsuitable for utility-scale wind energy applications. Further, land-use conflicts such as urban development, farmland, and environmentally sensitive areas, minimize the amount of land suitable for wind energy applications (PNL 1986).

The GEIS estimates a land use of 150,000 ac per 1000 MW(e) for wind power (NRC 1996). The Palisades site is too small to support this level of wind generation capacity. At an alternate site, the large amount of land required along the coastline could result in a LARGE environmental impact. Although impacts would depend on the site chosen, common issues of concern include visual impacts, noise generation, and bird and bat collisions. Consequently, the NRC staff concludes that locating a wind energy facility on or near the Palisades site would not be economically feasible given the current state of wind energy generation technology.

8.2.5.3 Solar Power

Solar technologies use the sun's energy and light to provide heat and cooling, light, hot water, and electricity for homes, businesses, and industry. In the GEIS, the NRC 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 of Palisades. The average capacity factor of photovoltaic cells is about 25 percent, and the capacity factor for solar thermal systems is about 25 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.

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 on natural resources (wildlife habitat, land-use, and aesthetic impacts) from construction of solar-generating facilities. As stated in the GEIS, land requirements are high – 35,000 ac per 1000 MW(e) for photovoltaic and approximately 14,000 ac per 1000 MW(e) for solar thermal systems. Neither type of solar electric system would fit at the Palisades site, and both would have large environmental impacts at an alternate site.

Michigan receives between approximately 2.5 to 3.5 kWh of solar radiation per square meter per day, compared with 6 to 8 kWh of solar radiation per square meter per day in areas of the southwestern United States, such as Arizona and California, which are most promising for solar technologies (DOE 2005). 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 Palisades OL. 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 Palisades would likely result in LARGE environmental impacts.

8.2.5.4 Hydropower

There are no remaining sites in Michigan that would be environmentally suitable for a hydroelectric facility (INEEL 1998). In Section 8.3.4 of the GEIS, the NRC 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 NRC staff estimated in the GEIS that land requirements for hydroelectric power are approximately 1 million ac per 1000 MW(e). Replacement of Palisades generating capacity would require flooding more than this amount of land. Because of the lack of suitable sites in Michigan and the large land-use and related environmental and ecological resource impacts associated with siting hydroelectric facilities large enough to replace Palisades, the NRC staff concludes that local hydropower is not a feasible alternative to Palisades OL renewal on its

own. Any attempts to site hydroelectric facilities large enough to replace Palisades would result in LARGE environmental impacts.

8.2.5.5 Geothermal Energy

Geothermal energy has an average capacity factor of 90 percent and can be used for 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 Michigan for geothermal capacity to serve as an alternative to Palisades. The NRC staff concludes that geothermal energy is not a feasible alternative to renewal of the Palisades OL.

8.2.5.6 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.

DOE estimates that Michigan has good resources for wood fuels consisting of urban, mill, and forest residues; at least 3,720,000 dry tons/yr are available in Michigan (Walsh et al. 2000). It has been estimated by the National Renewable Energy Laboratory (NREL) that 1100 kW(h) of electricity can be produced by one dry ton of wood residue. Therefore, 1.9 TWh of electricity can be generated from wood residue in Michigan (NREL 2004).

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.

While the wood resources in Michigan are adequate, wood energy is not considered as a reasonable alternative to renewal of the Palisades OL because of the disadvantages of low

heat content, handling difficulties, and high transportation costs. There is also no significant environmental advantage.

8.2.5.7 Municipal Solid Waste

Municipal waste combustors incinerate the waste and use the resultant heat to generate steam, hot water, or electricity. The combustion process can reduce the volume of waste by up to 90 percent and the weight of the waste by up to 75 percent (EPA 2004b). Municipal waste combustors use three basic types of technologies: mass burn, modular, and refuse-derived fuel (EIA 2001). Mass-burning technologies are most commonly used in the United States. This group of technologies processes 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 alternatives such as landfills; (2) the 1994 Supreme Court decision *(C&A Carbone, Inc. v. Town of Clarkstown)*, which struck down local flow control ordinances that required waste to be delivered to specific municipal waste combustion facilities rather than landfills that may have had lower fees; and (3) increasingly stringent environmental regulations that increased the capital cost necessary to construct and maintain municipal waste combustion facilities (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. U.S. electricity prices in 2002 dollars are expected to decline by 8 percent between 2002 and 2008 and remain stable until 2011 (EIA 2004). Prices are expected to increase by 0.3 percent per year from 2011 until 2025, following the trend of the generation component of electricity price (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 or scrubbers (EIA 2001).

Currently, there are approximately 89 waste-to-energy plants operating in the United States. These plants generate approximately 2500 MW(e), or an average of approximately 28 MW(e)

per plant (Integrated Waste Services Association 2004), a much smaller capacity than that needed to replace the 786 MW(e) of Palisades.

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. In addition, 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 Palisades. Therefore, municipal solid waste would not be a feasible alternative to renewal of the Palisades OL, particularly at the scale required.

8.2.5.8 Other Biomass-Derived Fuels

In addition to wood and municipal solid-waste fuels, there are several other concepts for fueling electric generators, including burning crops, converting crops to a liquid fuel such as ethanol, and gasifying crops (including wood waste). In the GEIS, the NRC 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 Palisades. For these reasons, such fuels do not offer a feasible alternative to renewal of the Palisades OL.

8.2.5.9 Fuel Cells

Fuel cells work without combustion and its environmental side effects. Power is produced electrochemically by passing a hydrogen-rich fuel over an anode and air over a cathode and separating the two by an electrolyte. The only by-products are heat, water, and carbon dioxide. Hydrogen fuel can come from a variety of hydrocarbon resources by subjecting them to steam under pressure. 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 a cost of approximately $4000 to $4500 per kW of installed capacity (DOE 2004b). 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.

It is unlikely that the costs of existing fuel cell systems will drop below $1000/kW; therefore, the DOE has formed the Solid State Energy Conversion Alliance (SECA), with the goal of producing new fuel cell technologies at a cost of $400/kW or lower by 2010 (DOE 2004c).

Fuel cells have the potential to become economically competitive if SECA can reach its goal. For comparison, the installed capacity cost for a natural-gas-fired, combined-cycle plant is about $500 to $600/kW (Northwest Power Planning Council 2000). At the present time, fuel cells are not economically or technologically competitive with other alternatives for baseload electricity generation. Consequently, fuel cells are not a feasible alternative to renewal of the Palisades OL.

8.2.5.10 Delayed Retirement

NMC has no current plans to retire any existing generating units. For this reason, delayed retirement of other NMC generating units would not be a feasible alternative to renewal of the Palisades OL. NMC concluded in its ER (NMC 2005) that the environmental impacts of delayed retirement are similar to those of the coal- and gas-fired alternatives.

8.2.5.11 Utility-Sponsored Conservation

Market conditions that initially favored utility-sponsored conservation programs (i.e., DSM), including educational programs, energy efficiency programs, and load management programs, have changed significantly and are no longer cost-effective. The viability of new or expanded DSM programs has decreased in recent years because of increased competition in the electric utility industry, mandated energy efficiency standards, and years of customer education programs that have made efficiency the normal practice. The implementation of deregulation resulted in the discontinuation of many of the DSM programs that Consumers Energy once implemented (NMC 2005). A peak load management program is still in effect, but it serves a broader purpose of maintaining system reliability. The environmental impacts of implementing a DSM program would be SMALL, but implementation would not be able to realistically replace the 786 MW(e) of net generating capacity of Palisades. Therefore, the conservation alternative by itself is not considered a reasonable alternative to renewing the Palisades OL.

8.2.6 Combination of Alternatives

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

As discussed in Section 8.2, Palisades has a combined net summer rating of 786 MW(e). For the coal- and natural gas-fired alternatives, the NMC ER (NMC 2005) assumes the use of standard-sized units as potential replacements for Palisades. This approach is followed in this draft SEIS.

There are many possible combinations of alternatives. Table 8-8 contains a summary of the environmental impacts of one assumed combination of alternatives consisting of 530 MW(e) of

combined-cycle natural gas-fired generation using closed-cycle cooling, a 40-MW wind power facility, and 216 MW in purchased power. The NRC staff considered a natural-gas-fired plant over a coal-fired plant because a comparison of the impacts indicates that a coal-fired plant would have greater impacts than a similar-sized gas-fired plant (see Tables 8-2 and 8-4). Also, the footprint of the natural-gas-fired plant is smaller and could be accommodated within the Palisades site. Consumers Energy does not anticipate any new or expanded DSM programs (Section 8.2.5.11); therefore, DSM is not considered part of the combination of alternatives. Although Michigan was identified in Section 8.2.5.6 as a state with significant wood resources, the use of wood waste was not considered in a combination of alternatives because a wood-burning facility is not as efficient as the other electrical generation plants considered by the NRC, and the cost of transporting the fuel would be very high. The impacts are based on the gas-fired generation impact assumptions discussed in Section 8.2.2, adjusted for the reduced generating capacity.

Operation of a new natural-gas-fired plant would result in increased emissions (compared with the OL alternative) and other environmental impacts. Installation of new wind power facilities would have land-use, ecology, and aesthetic impacts. The environmental impacts of power generation associated with power purchased from other generators would still occur, but would be located elsewhere in the region, nation, or another country (Canada) as discussed in Section 8.2.4. The environmental impacts associated with purchased power are not shown in Table 8-8.

The NRC 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 Palisades OL.

8.3 Summary of Alternatives Considered

The environmental impacts of the proposed action, renewal of the Palisades OL, would be SMALL for all impact categories, except for collective offsite radiological impacts from the fuel cycle and from HLW and spent fuel disposal. Collective offsite radiological impacts from the fuel cycle and from HLW 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, that is, no-action alternative (discussed in Section 8.1), new generation alternatives (from coal, natural gas, and nuclear discussed in Sections 8.2.1 through 8.2.3, respectively), purchased electrical power (discussed in Section 8.2.4), alternative technologies (discussed in Section 8.2.5), and the combination of alternatives (discussed in Section 8.2.6) were considered.

Table 8-8. Summary of Environmental Impacts of Combination of Alternatives at the Palisades Site and at an Alternate Site

	Palisades Site		Alternate Site	
Impact Category	Impact	Comments	Impact	Comments
Land use	MODERATE to LARGE	Uses 20 ac for power block, offices, roads, and parking areas. Additional impact of up to approximately 120 ac for construction of a 5-mi underground gas pipeline. 6,000 ac of additional land offsite for wind farm.	MODERATE to LARGE	Uses 58 ac for power-block, offices, roads, and parking areas. Approximately 6000 ac for wind farm. Additional land needed for transmission line (amount dependent on site chosen) and for construction and/or upgrade of an underground gas pipeline.
Ecology	MODERATE to LARGE	Uses developed and undeveloped areas at current Palisades site, plus construction of a gas pipeline. Impacts dependent on the specific location and ecology of the site. See Table 8-4 for impacts on terrestrial and aquatic ecology for a gas-fired plant. Impacts on ecological resources from wind power development would include the potential for bird and bat collisions with turbines.	MODERATE to LARGE	Impacts depend on location and ecology of the site, surface-water body used for intake and discharge, and transmission and pipeline routes; potential habitat loss and fragmentation; reduced productivity and biological diversity. Likely plant sites already have power generation facilities.
Water use and quality–surface water	SMALL to MODERATE	Discharge of cooling-tower blowdown containing dissolved solids and intermittent low concentrations of biocides would be released to Lake Michigan. Temporary erosion and sedimentation could occur in streams during pipeline and wind farm construction.	SMALL to MODERATE	Impacts depend on volume of water withdrawn and discharged and characteristics of surface-water body. Discharge of cooling-tower blowdown containing dissolved solids and intermittent low concentrations of biocides would be released to surface water. Temporary erosion and sedimentation could occur in streams during pipeline and wind farm construction.

Table 8-10. (contd)

Impact Category	Palisades Site Impact	Palisades Site Comments	Alternate Site Impact	Alternate Site Comments
Water use and quality–groundwater	SMALL	Use of groundwater very unlikely because the Palisades site has adequate surface water available from Lake Michigan.	SMALL to MODERATE	Impacts depend on volume of water withdrawn and discharged and the characteristics of the aquifer.
Air quality	MODERATE	Natural-gas-fired units Sulfur oxides • 8 tons/yr Nitrogen oxides • 127 tons/yr Carbon monoxide • 195 tons/yr PM_{10} particulates • 25 tons/yr Some hazardous air pollutants. For wind power, fugitive emissions and emissions from vehicles and equipment during construction.	MODERATE	Same as siting at Palisades, although pollution control standards may vary depending on location.
Waste	SMALL	Minimal waste product from fuel production. Debris would be generated and removed during construction.	SMALL	Same waste produced as if produced at Palisades site. Waste disposal constraints may vary.
Human health	SMALL	Human health risks associated with gas-fired plants may be attributable to NO_x emissions, which are regulated. Impacts considered SMALL.	SMALL	Same impacts as Palisades site.
Socioeconomics	SMALL to MODERATE	During construction, impacts would be MODERATE. Up to 420 additional workers during the peak of the 3-year construction period, followed by reduction in the current Palisades workforce of 644 to 30. 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 Palisades. Van Buren County would experience a loss in its tax base and employment, potentially offset by projected economic growth.

Table 8-10. (contd)

Impact Category	Palisades Site Impact	Palisades Site Comments	Alternate Site Impact	Alternate Site Comments
Transportation	SMALL to MODERATE	Transportation impacts associated with construction workers would be MODERATE. Impacts during operation would be SMALL.	SMALL to MODERATE	Transportation impacts associated with construction workers would be SMALL to MODERATE, depending on the site chosen.
Aesthetics	MODERATE to LARGE	MODERATE aesthetic impacts due to impacts of plant units, cooling towers, plume stacks, gas pipeline compressors, and wind turbines and ancillary facilities.	MODERATE to LARGE	Impacts would be similar to the Palisades site with additional impact from the new transmission line that would be needed.
Historic and archeological resources	SMALL to MODERATE	Some construction would affect previously developed parts of the Palisades site; a cultural resource inventory would be needed to identify, evaluate, and mitigate potential impacts of new plant construction on cultural resources in undeveloped areas.	SMALL to MODERATE	Cultural resource studies needed to identify, evaluate, and mitigate potential impacts of new plant construction at developed and undeveloped sites.
Environmental justice	SMALL to MODERATE	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 644 operating jobs at Palisades could reduce employment prospects for minority and low-income populations. Impacts could be offset by projected economic growth and the ability of affected workers to commute to other jobs.	SMALL to MODERATE	Impacts would vary, depending on population distribution and makeup at site.

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

The NRC 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 50. *Code of Federal Regulations*, Title 40, *Protection of Environment*, Part 50, "National Primary and Secondary Ambient Air Quality Standards."

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

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

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

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9.0 Summary and Conclusions

By letter dated March 22, 2005, Nuclear Management Company, LLC (NMC) submitted an application to the U.S. Nuclear Regulatory Commission (NRC) to renew the operating license (OL) for the Palisades Nuclear Plant (Palisades) 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 March 24, 2011.

Section 102 of the National Environmental Policy Act (NEPA) 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 Part 51 of Title 10 of the *Code of Federal Regulations* (10 CFR Part 51). Part 51 of 10 CFR 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; 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 to prepare an EIS and conduct scoping (*Federal Register*, Volume 70, page 36967 (70 FR 36967) (NRC 2005a)) on June 27, 2005. The NRC staff visited the Palisades site in July 2005 and held public scoping meetings on July 28, 2005, in South Haven, Michigan (NRC 2005b). The NRC staff reviewed the NMC Environmental Report (ER) (NMC 2005b) and compared it with the GEIS, consulted with other agencies, and conducted an independent review of the issues following the guidance set forth in NUREG-1555, Supplement 1, the *Standard Review Plans for Environmental Reviews for Nuclear Power Plants, Supplement 1: Operating License Renewal* (NRC 2000). The NRC staff also considered the public comments received during the scoping process for preparation of this draft Supplemental Environmental Impact Statement (SEIS) for Palisades. 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 draft SEIS.

The NRC staff intends to hold two public meetings in South Haven, Michigan, in April 2006 to describe the preliminary results of the NRC environmental review and to answer questions to

(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.

provide members of the public with information to assist them in formulating their comments on this draft SEIS. Once the comment period ends, the NRC 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, including cumulative impacts, the environmental impacts of alternatives to the proposed action, and mitigation measures available for reducing or avoiding adverse impacts. This draft SEIS also includes the NRC 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) decision makers.

The evaluation criterion for the NRC 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 decision makers 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 impacts 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]

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 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.

(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."

These 69 issues were identified in the GEIS as Category 1 issues. In the absence of new and significant information, the NRC 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 must also 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 NRC staff's consideration of all 92 environmental issues identified in the GEIS. The NRC 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 Palisades) and alternative methods of power generation. These alternatives were evaluated assuming that the replacement power-generation plant is located at either the Palisades site or at some other unspecified location.

9.1 Environmental Impacts of the Proposed Action–License Renewal

NMC and the NRC 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 NRC 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, the NRC staff did not identify, during the scoping process, any new issue applicable to Palisades that had a significant environmental impact. Therefore, the NRC staff relies upon the conclusions of the GEIS for all Category 1 issues that are applicable to Palisades.

NMC's license renewal application presents an analysis of the Category 2 issues that are applicable to Palisades. The NRC 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. Nine Category 2 issues are not applicable because they are related to plant design features or site characteristics not found at Palisades. Four Category 2 issues are not discussed in this draft SEIS because they are specifically related to refurbishment. NMC (NMC 2005a) 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 Palisades 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 Palisades Nuclear Plant (AEC 1972).

Eight 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. Four of the Category 2 issues and environmental justice apply to both refurbishment and operation during the renewal term and are discussed in this draft SEIS only in relation to operation during the renewal term. For eight of the Category 2 issues and environmental justice, the NRC staff concludes that the potential environmental effects would be of SMALL significance in the context of the standards set forth in the GEIS. In addition, the NRC 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 NRC 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 SAMA. Given the potential for cost-beneficial risk reduction, the NRC staff agrees that further evaluation of these SAMAs by NMC is warranted. However, none of the potentially cost-beneficial SAMAs directly relate to adequately managing the effects of aging during the period of extended operation. Therefore, they need not be implemented as part of the license renewal pursuant to 10 CFR Part 54.

Cumulative impacts of past, present, and reasonably foreseeable future actions were considered, regardless of any other actions taken by agencies or persons. For purposes of this analysis, the overall conclusion of the NRC staff is 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 overall adverse impacts of continued operation identified are considered to be of SMALL significance. The adverse impacts of likely alternatives if Palisades ceases operation at or before the expiration of the current OL would 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 Palisades 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. Palisades replaces a portion of the fuel assemblies in its unit during every refueling outage, which occurs on an 18-month cycle.

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

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 Palisades site was set when the unit was approved and construction began. That balance is now well-established. Renewal of the OL for Palisades and continued operation of the plant would not alter the existing balance, but may postpone the availability of the site for other uses. Denial of the application to renew the OL would lead to shutdown of the plant and would alter the balance in a manner that depends on subsequent uses of the site. For example, the environmental consequences of turning the Palisades site into a park or an industrial facility would be quite different.

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

The proposed action is renewal of the OL for Palisades. Chapter 2 describes the site, the plant, and interactions of the plant with the environment. As noted in Chapter 3, no refurbishment and no refurbishment impacts are expected at Palisades. 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, or gas generation of power at the Palisades site and an unspecified alternate site; and a combination of alternatives are compared in Table 9-1. Closed-cycle cooling systems are assumed for all alternatives.

Table 9-1 shows that the significance of the environmental impacts of the proposed action would be SMALL, except in one instance: 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 impacts 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 NRC staff's own independent review, and (5) the NRC staff's consideration of public comments received during the scoping process, the preliminary recommendation of the NRC staff is that the Commission determine that the adverse environmental impacts of license renewal for Palisades would not be so great that preserving the option of license renewal for energy-planning decision makers would be unreasonable.

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

	Proposed Action	No-Action Alternative	Coal-Fired Generation	Natural-Gas-Fired Generation		New Nuclear Generation		Combination of Alternatives	
Impact Category	License Renewal	Denial of Renewal	Alternate Site	Palisades Site	Alternate Site	Palisades Site	Alternate Site	Palisades Site	Alternate Site
Land use	SMALL	SMALL	MODERATE to LARGE	MODERATE to LARGE	MODERATE to LARGE	MODERATE to LARGE	MODERATE to LARGE	MODERATE to LARGE	MODERATE to LARGE
Ecology	SMALL	SMALL	MODERATE to LARGE	MODERATE to LARGE	MODERATE to LARGE	MODERATE to LARGE	MODERATE to LARGE	MODERATE to LARGE	MODERATE to LARGE
Water use and quality–surface water	SMALL	SMALL	SMALL to MODERATE	SMALL	SMALL to MODERATE	SMALL	SMALL to MODERATE	SMALL to MODERATE	SMALL to MODERATE
Water use and quality–groundwater	SMALL	SMALL	SMALL to MODERATE	SMALL	SMALL to MODERATE	SMALL	SMALL to MODERATE	SMALL	SMALL to MODERATE
Air quality	SMALL	SMALL	MODERATE	MODERATE	MODERATE	SMALL to MODERATE	SMALL to MODERATE	MODERATE	MODERATE
Waste	SMALL	SMALL	MODERATE	SMALL	SMALL	SMALL	SMALL	SMALL	SMALL
Human health	SMALL[a]	SMALL	SMALL	SMALL	SMALL	SMALL	SMALL	SMALL	SMALL
Socio-economics	SMALL	SMALL to LARGE	SMALL to LARGE	SMALL to MODERATE	SMALL to MODERATE	SMALL to MODERATE	SMALL to LARGE	SMALL to MODERATE	SMALL to MODERATE
Transportation	SMALL	SMALL	SMALL to LARGE	SMALL to MODERATE	SMALL to MODERATE	SMALL to LARGE	SMALL to LARGE	SMALL to MODERATE	SMALL to MODERATE
Aesthetics	SMALL	SMALL	MODERATE to LARGE	MODERATE	MODERATE to LARGE	SMALL to MODERATE	MODERATE to LARGE	MODERATE to LARGE	MODERATE to LARGE
Historic and archaeological resources	SMALL	SMALL	SMALL to MODERATE	SMALL to MODERATE	SMALL to MODERATE	SMALL to MODERATE	SMALL to MODERATE	SMALL to MODERATE	SMALL to MODERATE
Environmental justice	SMALL	SMALL to LARGE	SMALL to MODERATE	SMALL to MODERATE	SMALL to MODERATE	SMALL to MODERATE	SMALL to LARGE	SMALL to MODERATE	SMALL to MODERATE

(a) Except for collective offsite radiological impacts from the fuel cycle and from HLW and spent fuel disposal, for which a significance level was not assigned. See Section 6 for details.

9.4 References

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National Environmental Policy Act of 1969 (NEPA). 42 USC 4321, et seq.

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U.S. Nuclear Regulatory Commission (NRC). 2005a. "Notice of Intent to Prepare an Environmental Impact Statement and Conduct Scoping Process." *Federal Register,* Vol. 70, No. 122, pp. 36967-36968. Washington, D.C. (June 27, 2005).

U.S. Nuclear Regulatory Commission (NRC). 2005b. *Environmental Impact Statement Scoping Process: Summary Report – Palisades Nuclear Plant, Van Buren County, Michigan.* Rockville, Maryland.

Appendix A

Comments Received on the Environmental Review

Appendix A

Comments Received on the Environmental Review

Part I – Comments Received During Scoping

On June 27, 2005, the U.S. Nuclear Regulatory Commission (NRC) published a Notice of Intent in the *Federal Register* (Volume 70, page 36967) to notify the public of the NRC 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 review the renewal application for the Palisades 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) of 1969, as amended, Council on Environmental Quality (CEQ) guidance, and Part 51 of Title 10 of the *Code of Federal Regulations* (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 comments at the scheduled public meetings and/or by submitting written suggestions and comments no later than August 22, 2005.

The scoping process included two public scoping meetings that were held at Lake Michigan College, South Haven, Michigan, on July 28, 2005. Approximately 65 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. Nineteen attendees provided oral statements that were recorded and transcribed by a certified court reporter and written statements that were appended to the transcript. The meeting transcripts are attached to the October, 2005, Scoping Meeting Summary and supplement dated September 21, 2005. In addition to the comments received during the public meetings, eight comment letters and copies of two news articles were received by the NRC in response to the Notice of Intent.

At the conclusion of the scoping period, the NRC staff and its contractor 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 comments received and NRC staff responses are included in the Palisades Scoping Summary Report dated December 14, 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(s) of comments. The

individuals are listed in the order in which they spoke at the public meeting, and in alphabetical order for the comments received by letter or e-mail. To maintain consistency with the Palisades 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 Palisades 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[a]
A	Ken Richards		Afternoon Scoping Meeting
B	Kevin Kamps	Nuclear Information and Resource Service	Afternoon Scoping Meeting
C	Barbara Geisler		Afternoon Scoping Meeting
D	Corinne Carey	Don't Waste Michigan	Afternoon Scoping Meeting
E	Dale Lewis	Mayor, South Haven	Afternoon Scoping Meeting
F	Tom Tanzlos	County Commssioner: First District of Van Buren County	Afternoon Scoping Meeting
G	Paul Harden	Site Vice President of Palisades	Afternoon Scoping Meeting
H	Nancy Whaley		Afternoon Scoping Meeting
I	Leroy Wolins		Afternoon Scoping Meeting
J	Chuck Jordan		Afternoon Scoping Meeting
K	Michael Keegan		Evening Scoping Meeting
L	Gary Karch		Evening Scoping Meeting
M	Kathy Barnes		Evening Scoping Meeting
N	Corinne Carey	Don't Waste Michigan	Evening Scoping Meeting
O	Maynard Kaufman		Evening Scoping Meeting
P	Ken Richards		Evening Scoping Meeting
Q	Kevin Kamps	Nuclear Information and Resource Service	Evening Scoping Meeting
R	Ross Stein	Supervisor, South Haven Charter Township	Evening Scoping Meeting
S	Paul Harden	Site Vice President of Palisades	Evening Scoping Meeting
T	Larry King	Greater South Haven Chamber of Commerce	Evening Scoping Meeting
U	Elizabeth Anderson		Evening Scoping Meeting
V	Marilyn Miller		Evening Scoping Meeting
W	Wayne Rendell	Supervisor, Covert Township	Evening Scoping Meeting
X	Tonya Schuitmaker		Letter (ML052420495)
Y	Nancy Ann Whaley	Supervisor, Geneva Township	Letter (ML052420497)
Z	Wayne Rendell	Supervisor, Covert Township	Letter (ML052420503)
AA	Swami Tapasanarda		Letter (ML052420506)
BB	Murielle and John Clark		Letter (ML052510389)
CC	Gary Karch		Letter (ML052510391)
DD	Kathryn Barnes		Letter (ML052510393)
EE	Kevin Kamps	Nuclear Information and Resource Service	Letter (ML052510468)
FF	Kevin Kamps	Nuclear Information and Resource Service	Letter (ML052420502)
GG	Kenneth Richards		Letter (ML052420501)

(a) The afternoon and evening transcripts can be found under accession numbers ML052630432 and ML052630449, respectively.

Comments applicable to this environmental review and the NRC staff's responses are summarized in this appendix. The parenthetical alpha-numeric identifier after each comment refers to the comment set (Commenter ID) and the comment number. This information, which was extracted from the Palisades Scoping Summary Report, is provided for the convenience of those interested in the scoping comments applicable to this environmental review. The comments that are general or outside the scope of the environmental review for Palisades are not included here. More detail regarding the disposition of general or inapplicable comments can be found in the Summary Report. The Agencywide Document Access and Management System (ADAMS) accession number for the Scoping Summary Report is ML053490390.

This accession number is provided to facilitate access to the document through the Public Electronic Reading Room (ADAMS) (http://www.nrc.gov/reading-rm.html).

Comments in this section are grouped in the following categories:

A.1.1 License Renewal Process
A.1.2 Support of License Renewal at Palisades Nuclear Plant
A.1.3 Opposition to License Renewal at Palisades Nuclear Plant
A.1.4 Opposition to Nuclear Power
A.1.5 Aquatic Ecology
A.1.6 Threatened and Endangered Species
A.1.7 Surface-Water Quality, Hydrology, and Use
A.1.8 Human Health
A.1.9 Socioeconomics
A.1.10 Postulated Accidents
A.1.11 Uranium Fuel Cycle and Waste Management
A.1.12 Alternative Energy Sources

A.1 Comments and Responses

A.1.1 Comments Concerning License Renewal and Its Processes

Comment: I'm glad you are asking for public input. And it may be that NRC meetings are of a different sort. Maybe hearings that I have attended in the past have needed to seem almost closed. But I'm reading from someone in your system who says, I am truly embarrassed by the way the public is systematically excluded from the regulatory process. It reminds me of the old Soviet bloc countries when they conducted elections with only one name on the ballot. The nuclear industry is carrying a sign in one hand proclaiming that nuclear power is a solution to the global warming problem. It's other hand is locking the door on public participation in the regulatory process. Now today so far that doesn't seem to be true. So I'm hoping that there's

been a change within the NRC and those plants that it is in a sense responsible for, and that, not just at this meeting, but at all meetings, comments will be taken seriously as a part of a democratic planning process. (PS-C-8)

Comment: I'd like to commend the NRC for having these meetings at times that people could come whether during the day or in the evening. I think that is a change that's very good. (PS-J-1)

Comment: I really can't truly say that I feel NRC or the company representatives are truly advocates of the public. And, I understand there are some areas that do have such a commission or an individual, I think Wisconsin has something close to that, if anybody can correct me. I understand that Nevada has something in that line, where the public truly feels that, that they are truly represented. And, I just don't think that that's our feeling here. Even though you're nice guys; I don't, I'm not questioning that you're nice guys. I'm just feeling that the system needs more to be viable. (PS-N-18)

Comment: A process that appears designed to intentionally disenfranchise a population with which it is supposed to promote dialogue can only be looked at with skepticism and must be considered a ruse and a sham. Although the model as presented for public comment regarding the request for a 20-year license extension for the Palisades Nuclear Plant in Van Buren County, Michigan, meets guidelines as established by the NRC, it provides little opportunity and draconian deadlines for true citizen participation to exist. Such restrictions may have been dismissed by communities in which other license renewals have been requested and approved, but I submit that Southwest Michigan holds itself to higher standards and wishes to challenge the industry paradigm and demand a more reasonable and humane response to this license renewal process than the flawed one that has been foisted upon us.

Current standards only allow for easy participation from persons living within the industry-designated 10-mile radius emergency planning zone. Obviously radiation travels far greater distances than that, and even the extended 50-mile radius does not realistically encompass the distance a radiation release can travel. Meetings have been scheduled only in the South Haven area with limited publicity and at times that impede a working public's ability to attend. These dates and locations may be convenient for Palisades representatives and NRC staff but not to residents in the greater area affected by the plant's existence. For example, the next public meeting in which these and other comments submitted by today's deadline will be discussed is scheduled for the Friday before Labor Day. This insults the public, inhibits participation by interested citizens, and denigrates the integrity of the process.

Materials pertinent to the license currently available only at the South Haven library should be made available in a majority of libraries located within the 50-mile radius. The whole process needs to be expanded to include public meetings and comment opportunities in all communities within the entire 50-mile radius who wish to request them. If the plant owners and managers

have nothing to hide and take pride in their operation, then they should have no reservations about taking their meetings on the road and extending the process to a more reasoned pace. And if the NRC believes in the integrity of their process, they should likewise be up to this challenge. It is 6 years before the current license expires. There is no need to rush through the process. In fact, a more lengthy approach that is truly inclusive of citizen participation from affected communities should be encouraged. (PS-CC-1)

Response: *The comments are in regard to license renewal and its processes in general. The Commission has established a process, by rule, for the environmental and safety reviews to be conducted to review a license renewal application. The development of the Commission's regulations governing the license renewal process was subject to public review and comment. The comments will not be evaluated further.*

Comment: On this August 22nd deadline. When does the clock start ticking on that, and I guess why such a short deadline given that today is July 27th? (PS-B-2)

Comment: And I would ask that the August 22nd deadline for comments be extended because this really is the first opportunity for people to learn about this environmental review process. So that doesn't leave much time for people to get up to speed to read these very thick documents and to submit comments. And I guess I'd just like to end by saying that there's a growing coalition of individuals and organizations in this area who fully intend on intervening against the license extension at Palisades. And we would, perhaps this isn't the exact correct forum, but we would express a request for an extension to that August 8th deadline as well, given the limited resources of these nonprofit groups and individuals. (PS-B-19)

Comment: And, the last thing that I'll bring up is, I have to choose here. I would again reemphasize the importance of extending the deadlines, because we're 5 years out right now from the year 2011 when this license expires. So, the question is, what's the rush? Why are these deadlines so rushed? And, also, it's a 20-year license extension. So, we should have more than just 60 days to comment on 20 years of impacts. But, of course, as Mr. Karch said, it's a lot longer than 20 years. The waste is going to be here forever. (PS-Q-13)

Comment: The public is not given enough notification about the meetings, and the meetings are few and poorly scheduled for times most cannot attend. The public is expected to offer comments on the EIS and scope and screening, etcetera, without adequate preparation. Although the current license is valid through 2011, at this time, 2005, an extension is being sought and the time allotted for public comment, debate, and even awareness is under pressure and time constraints. What is the rush? I would like to request an extension beyond August 22 for public comment on the scope of the Palisades-specific supplement to the generic environmental impact statement for a much later date after the public is aware of such documentation and such is offered. (PS-DD-4)

Comment: There are a multitude of environmental concerns in addition to those raised above that we will like to address but, lacking adequate time to digest and respond to voluminous NRC documents, have been unable to do so. By letter dated August 19, 2005, to Andrew L. Bates, Acting Secretary, Office of the Secretary, U.S. Nuclear Regulatory Commission, Washington, D.C., 20555-0001, a request was made for a 60-day extension. Again, we respectfully request that NRC grant an additional 60 days to the concerned citizens of Michigan, Indiana, and Illinois, and the organizations which represent them, in which to file scoping comments on NRC's Environmental Review of the Palisades nuclear power plant 20-year license extension proposal. (PS-EE-40)

Response: *The comments request an extension to the scoping comment period. The U.S. Nuclear Regulatory Commission (NRC) established the time period for comments on the scope of the environmental review for license renewal to balance the Commission's goal of ensuring openness in the regulatory processes, with its goal of ensuring that the NRC's actions are effective, efficient, realistic, and timely. The requests did not provide a sufficient basis for an extension to the established comment period. The comments will not be evaluated further.*

The regulations permit a nuclear power plant licensee to apply to the NRC to renew a license as early as 20 years before expiration of the current license. The NRC staff has determined that 20 years of operating experience is sufficient to assess aging and environmental issues at the site. A major consideration for seeking license renewal so far in advance of the expiration date of the current license is that it can take up to about 10 years to design and construct major new generating facilities, and long lead times are required by energy-planning decision makers.

Comment: I'd also like to point out that this entire licensing or license extension proceeding is premature because the Nuclear Regulatory Commission is reevaluating its pressurized thermal shock rule. And this revision is not complete. So, this proceeding should be postponed until after that proceeding is complete. And, I need clarification from the NRC as to whether the old rule applies at Palisades or the new rule is going to apply at Palisades. And, for that reason alone, this entire proceeding should be postponed. That's another reason for the deadlines to be extended. (PS-Q-5)

Response: *Nuclear plant licensees are required to comply with all applicable currently effective NRC regulations, including the Pressurized Thermal Shock (PTS) Rule. In the event that the PTS Rule is revised, Nuclear Management Company, LLC (NMC), the Palisades licensee, will be expected to comply with the new rule in accordance with the effective date and any implementation date provided for in the revised rule. The comment will not be evaluated further.*

Comment: Further, I would ask as I have at public meetings, that certain essential elements not be excluded from evaluation.

4. The actual and complete analysis of the plant by a scientific and independent agency, and not by Palisades or its subsidiaries, and an analysis not dependent on documentation by Palisades, but based on the actual scientific evaluation of the current status of the facility, including, but not limited to, embrittlement. (PS-DD-7)

Response: *NRC is an independent agency established by the Energy Reorganization Act of 1974 to regulate civilian use of nuclear materials. The NRC's mission is to regulate the nation's civilian use of by-product, source, and special nuclear materials to ensure adequate protection of public health and safety, to promote the common defense and security, and to protect the environment. As part of this mission, the NRC is responsible for the reviewing and issuance of initial licenses and renewed licenses for nuclear power facilities.*

The Advisory Committee on Reactor Safeguards (ACRS) is an advisory committee mandated by the Atomic Energy Act of 1954, as amended, under the Federal Advisory Committee Act (FACA). The ACRS is independent of the NRC staff and reports directly to the Commission, which appoints its members. The operational practices of the ACRS are governed by the provisions of the FACA. The ACRS is composed of recognized technical experts in their fields. It is structured so that experts representing many technical perspectives can provide independent advice, which can be factored into the Commission's decision-making process. Most Committee meetings are open to the public, and any member of the public may request an opportunity to make an oral statement during the committee meeting.

During the license renewal process, the ACRS acts as an independent third-party oversight group that reviews and makes recommendations to the Commission on the safety aspects of renewal applications. The ACRS mandate does not include National Environmental Policy Act (NEPA) reviews. The comment will not be evaluated further.

Comment: I'm looking forward to intervening. But, on the schedule that you put up with all the dates, perfunctory meetings and niceties, I didn't see a scheduling for the ASLB in there. And, what happens once we intervene? And, what happens to this process then? (PS-K-5)

Response: *The Atomic Safety and Licensing Board establishes schedules for its proceedings independently of the NRC staff's safety and environmental reviews. The schedule established by the board is dependent upon the filing of petitions and motions by interested parties.*

The schedule initially established by the staff for the safety and environmental reviews presumes that a hearing will be held. This schedule will be revised as appropriate during the review based on the board's decisions on admissibility of any contentions filed. The comment will not be evaluated further.

Comment: Relating to the EIS, is an Environmental Impact Statement required, or are you going to be looking at an environmental assessment with a FONSI [Finding of No Significant Impact], or are we going to have a full EIS? (PS-K-2)

Response: *The Commission has decided that the NRC will prepare a site-specific supplement (SEIS) to the generic environmental impact statement on license renewal (GEIS; NUREG-1437) for each license renewal application. This decision was made to ensure that the public had the highest level of participation in and confidence about the NRC's action on a license renewal application. The NRC will be issuing a supplement to the GEIS for the renewal of the operating license (OL) of Palisades Nuclear Plant. The comment will not be evaluated further.*

A.1.2 Comments in Support of License Renewal at Palisades Nuclear Plant

Comment: Our City Council passed a resolution favoring the renewal of the Palisades license agreement or renewal. Palisades has been a very good neighbor to South Haven. We kind of wish though that it was in the city so we get more taxes. Palisades has provided many good paying jobs and that's what we're looking for. And Palisades is probably the biggest single employer of our citizens of South Haven. It would be very detrimental to the economy of South Haven, you know, if Palisades were to close. (PS-E-1)

Comment: The plant was built in 1971 and began operation about that time. But I think the track record over the last 35 years has indicated that the plant has operated in an environmentally safe manner. It has been closed down from time to time for refurbishing and changes that come along. (PS-F-1)

Comment: The Mayor is right, it is a large employer to the community. A large part of our tax base. But if it wasn't for the safe operation of that plant we would not support its continued operation. (PS-F-2)

Comment: On March 22nd, we unanimously passed a resolution in support of the continuing operation of the plant and the extension of the license. (PS-F-3)

Comment: Palisades has received letters and resolutions of support from 13 different local government bodies, including the City of South Haven; the townships of Covert, South Haven, Geneva, Antwerp, Columbia, Decatur, and Pine Grove; the Greater South Haven Area Chamber of Commerce; U.S. Representative Fred Upton; and the concurrent resolution from the Michigan State House and Senate. These bodies wouldn't have supported our license renewal if they also didn't feel that we could continue to be a safe provider for another 20 years. (PS-G-3; PS-S-2)

Comment: At our April 12th, 2005, board meeting, the Geneva Township Board unanimously voted to support the license renewal by resolution which was presented to Mark Savage at this meeting. It is my strong belief that the negative personal and economic impact that all of us will feel if the operating license for Palisades is not extended. The loss would be a great magnitude to this community. (PS-H-2)

Comment: Earlier in the year, we passed a motion at a township board meeting supporting the licensing process for Palisades Nuclear Plant. Palisades has been an excellent neighbor for the community. The people that work there are civic minded. We have people that are Boy Scout leaders, have served on township boards. Palisades has been very community oriented. They've helped the, I'm chairman of the emergency services. They've helped the fire department, the emergency services. They help community functions also, so, it's a very welcome aspect to this community. The people there provide, buy homes, have children for the schools. (PS-R-1)

Comment: As probably everybody in this room knows, for every dollar that's spent in the community, that dollar's circulated six or seven times, so it's a good economic asset to the community. (PS-R-2)

Comment: And, you can see in that involvement their commitment to safety out at the plant. I do know a number of folks that work out there, and they are very safety conscious, and they bring that home with them and into the work that they do in the community and in their social lives. So, we're very pleased to have the plant here, and encourage the relicensing and reinvestment here in the South Haven Area. (PS-T-2)

Comment: I really didn't come prepared to speak, but, I wanted to correct, Gary Karch said Covert hasn't benefitted from this power plant. That's very far from the truth. We have a wonderful fire department, we have a full time police department. We have water throughout the township. Without Consumers help with this, that wouldn't happen. Covert is very much in favor of this renewal. (PS-W-1)

Comment: Attached is a copy of House Concurrent Resolution 8 sponsored by myself supporting the relicensure of Consumer Energy's Palisades Nuclear Power Plant. This resolution was adopted unanimously by the Michigan Legislature demonstrating our position that the State of Michigan fully supports the relicensure and long-term support of this facility. (PS-X-1)

Comment: As the Representative of Covert, home of Palisades, I can assure you of their outstanding and expletory record throughout the community as an employer, neighbor, and communicator with the entire Southwest Michigan area. Consumers Energy works tirelessly to keep the public informed and give surety to individuals with questions or concerns. (PS-X-2)

Comment: At the April 12, 2005, board meeting, the Geneva Township Board unanimously voted to support the license renewal by resolution which was presented to Mark Savage at that meeting. (PS-Y-5)

Comment: It is my strong belief that the negative personal and economic impact that all of us will feel if the operating license for Palisades is not extended would be of great magnitude to this community. I am asking your full support for the 20-year renewal of the licensing of Palisades. (PS-Y-6)

Comment: Throughout the years, Consumers Energy (now managed by Nuclear Management Company) and the Palisades Nuclear Plant have been good neighbors. Covert Township is very much in support of their efforts to get their operating license renewal. (PS-W-5)

Response: *The comments are supportive of license renewal at Palisades and are general in nature. The comments will not be evaluated further.*

A.1.3 Comments in Opposition to License Renewal at Palisades Nuclear Plant

Comment: I understand that many people are employed by Palisades and it's a part of the economy here and that makes it difficult to criticize. However, if we look ahead to the seventh generation, as Native Americans say, there are some problems. (PS-C-3)

Comment: We do not need it, and we should stop making it as fast as we can. And the quickest way to do that in this area; we have a chance, we don't have to do anything. We just have to get the NRC to not renew the license of these people out here who are producing all this death potential waiting for that clunk, clunk, clunk, clunk for somebody to drill a hole and open up Pandora's Box and kill God knows how many millions of people. Because that is the ultimate result of nuclear power. Whether, how safe it is now it's like jumping off the Empire State Building. As you go by the fifty-second story, see I haven't been hurt a bit. (PS-I-8)

Comment: But this is very important, and I hope people will listen that death is coming if we stay with these nuclear power plants, and this is one chance to get rid of one of them. (PS-I-9)

Comment: We are opposed to renewing the Palisades license for two main reasons. (PS-J-3)

Comment: So we as Greens oppose the renewal of the Palisades Plant because of its age, because it's old, and because there are no solutions to what to do with the waste. (PS-J-7)

Comment: It's all public risk, private profit. And, I have a problem with that. And, this is an aging plant...This plant should have been shut down in 1981. (PS-K-12)

Comment: I also have a problem with them, Consumers having a fire where trailers of documentation were burnt on the casks; the documentation about the cask was burnt in a fire that was suspect and is still under, I don't know if it's still under investigation, but, I don't believe arson was ever ruled out. A caveat to that was that Consumers Power did provide the local fire department, about 5, 6 years previously, with about an $800,000 piece of fire equipment. So, if it looks like a duck, walks like a duck, smells like a duck, it's a duck. And this is a rotten eggs here. So, don't bring us 20 more years of this. (PS-K-15)

Comment: So, I would just point that out. Let's not make 20 more years, because there certainly is no place for that. There's no place for the first 40 years of waste. (PS-K-16)

Comment: So, I have a lot of concerns about this [Palisades] and I think that it needs to be shut down. (PS-M-16)

Comment: And, I think that another 20 years of this nuclear power plant in operation is risking a meltdown and I don't want it. And, I think anybody in this room does not want that to happen here. And, honestly, I think from studying everything, especially because it's too much of the fox in the hen house doing the reporting, it just cannot be guaranteed. (PS-M-19)

Comment: We need to not sell our souls for jobs or for a "solution" that creates eons of poisonous aftermath. (PS-N-12)

Comment: You know, I know I'm being sold a bill of goods here. I know we're got this 40-year old reactor out there that we're going to just, we're going to run it for another 20 years. I'm nervous about that. It gives me great cause for concern, and I just don't think it's a good idea. (PS-P-2)

Comment: We can turn this greenhouse effect around. We can fix these problems, but right now, we want most of our resources going to what's making the right people a lot of money. And, they're just trapped there. And, we're just getting this continual PR [expletive] that that's all going to be okay. And, I just don't want South Haven, I don't want my hometown to be the place where this really goes wrong, when the world gets taught a lesson it'll never forget, like they had to do over in Russia. Not here. (PS-P-5)

Comment: I just think that maybe it's good, we've got a new power plant right across the way. And, maybe that could just, you know, ease this one [Palisades Nuclear Plant] out and pump this one up. (PS-U-3)

Comment: Relicensing Palisades Nuclear Plant in Michigan is a bad idea. (PS-AA-1)

Comment: I support saving nuclear power. Put money into Pebble Bed Reactors. We don't need another meltdown like Chernobyl! I live nearby! If you do give it another 20 years at least send iodine tablets to everyone in a 50-mile radius! (PS-AA-2)

Comment: The United States decided to put nuclear on hold for a lot of reasons; nothing has changed with respect to those concerns, to fire up nuclear generation again. The Great Lakes are far to valuable a water resource to have it ringed by nuclear power plants and nuclear waste storage. (PS-BB-3)

Comment: We vote NO. (PS-BB-4)

Response: *The comments oppose license renewal at Palisades Nuclear Plant and are general in nature. The comments will not be evaluated further.*

Comment: I feel that to relicense a dangerous, embrittled, and aged plant on the shores of Lake Michigan is pure folly as is the storage of the spent fuel rods which many of us tried through an organization called Palisades Watch to stop a few years ago. We were unsuccessful. I feel this plant should be shut down and retired for service as I believe was originally planned. I may be confused about that but I thought in all of these plants in the beginning it was said, you know, they won't operate forever. They'll last a certain amount of time then they'll be retired because they're not going to be safe after that. So I'm confused as to why relicense, relicense, relicense, how long would this go on? I need more information. I do not feel that it is socially or fiscally prudent to relicense Palisades. I feel it is unacceptable to put local residents at such grave risk. (PS-C-10)

Comment: I say, our psychological body burden, we've had enough psychological body burden in Michigan, here, especially in southwestern Michigan. We've got [DC] Cook and it's probably a done deal that they're going to get another 20 years. But, we don't need this little Palisades with all its history of safety infractions in the hundreds that made headlines over the years. We don't need this anymore. (PS-L-4)

Comment: I believe because of the embrittlement of Palisades, and because of the history of problems with the plant, including staff/management problems and repair backlogs, and after speaking with local residents and finding that there is a cancer pocket in the beach community, and that Palisades has repeatedly asked for safety exceptions to keep operating, one can only conclude that this is a nuclear reactor that is past due and should not be relicensed. (PS-DD-1)

Comment: Since the water of the Great Lakes is being bottled and sold as drinking water, it is an invaluable resource to the citizens of the region and the world. It is not enough to repair problems as they occur, but it is imperative to put an end to the premise that such repairs will

always be possible, and in acknowledging that with a cracked and aging nuclear facility, that is, Palisades, it is not worth the risk to keep it running. (PS-DD-8)

Response: *The NRC makes the decision to grant or deny a license renewal based on whether the applicant has demonstrated that the environmental and safety requirements in the NRC's regulations can be met during the renewal term. The NRC's ongoing reactor licnesing and oversight programs focus on prevention of safety problems so that potential issues such as aging and reactor vessel embrittlement do not lead to accidents and subsequent environmental impacts. The intent of the NRC's safety review is to determine if the licensee has adequately demonstrated that the effects of aging will not adversely affect any systems, structures, or components identified in Part 54.4 of Title 10 of the Code of Federal Regulations (10 CFR 54.4). The safety review process includes site inspections to assess whether the applicant has implemented and complied with the regulations for license renewal. The review results in a publicly available Safety Evaluation Report (SER) available online at http://www.nrc.gov/. The comments oppose license renewal and are general in nature. The comments will not be evaluated further.*

Comment: It is time to close it. It should have been closed a long time ago. We would have had less waste lying out on the shores of Lake Michigan ready for terrorists to make possible use of. (PS-I-5)

Response: *The NRC and other Federal agencies have heightened vigilance and implemented initiatives to evaluate and respond to possible threats posed by terrorists, including the use of aircraft against commercial nuclear power plants and independent spent fuel storage installations (ISFSIs). Malevolent acts remain speculative and beyond the scope of a NEPA review. The NRC routinely assesses threats and other information provided to it by other Federal agencies and sources. The NRC also ensures that licensees meet appropriate security levels. The NRC will continue to focus on prevention of terrorist acts for all nuclear facilities and will not focus on site-specific evaluations of speculative environmental impacts. While these are legitimate matters of concern, they should continue to be addressed through the ongoing regulatory process as a current and generic regulatory issue that affects all nuclear facilities. The NRC has taken a number of actions to respond to the events of September 11, 2001, and plans to take additional measures. However, the issue of security and risk from malevolent acts at nuclear power plants is not unique to facilities that have requested a renewal to their license and, therefore, will not be addressed within the scope of this SEIS. The comment opposes license renewal at Palisades and will not be evaluated further.*

A.1.4 Comments in Opposition to Nuclear Power

Comment: Anyway I was very interested in atomic power and along came my *Scientific American* and my *Popular Mechanics* and so on. We're going to have electricity for one cent a

kilowatt hour I was told on the cover of one of those magazines. This is atomic energy. And I believed it all. I have since come to believe otherwise. (PS-I-1)

Comment: It is false pride, and it is not worth it, because, you talk about kids. What are you going to do if there is a meltdown? How are you ever going to get your kids back? You won't. You will give everything you have to get your life back and get your kids back. You might have kids that have cancer. You might have kids that are killed instantly. You could have kids that will have kids like at Chernobyl, your grandkids might be mutated. I mean, I've met the kids of Chernobyl. And, if you saw those kids, how wounded they were. They were blind, they were handicapped, it was so sad. And, there was American kids who were healthy and playing and vibrant and alive and here are these poor kids. And, the only difference is, a meltdown. (PS-M-18)

Comment: Now, I have the impression after 20 years of Don't Waste Michigan, that the public really doesn't know very much about nuclear issues although I think that, at least I find there are people scattered everywhere I go that are very much interested because they realize that energy is one of the major issues that is part of our world today and our future, my grandkids' time. And, that, yes, we need to do something about these energy issues. But, I still, I'm very much, I'm sorry, my e-mail address is [auntynuke]. And, so you can contact me, [auntynuke] AOL.com. (PS-N-3)

Comment: I think, I agree with him, that the only place for a nuclear reactor is on the sun and obviously we're not going to shoot the waste or do our nuclear stuff on the sun because getting up there is the other part of the problem. (PS-N-4)

Comment: One more comment about clean. Nuclear power is clean in that you cannot taste, or you cannot smell it. You can't see it, you can't write your name on it on the windshield of the car. The particulates are so very very fine that when they use it in depleted uranium ammunition, etcetera, which is involved quite directly with the whole power situation, that the very very fine particulate is very incendiary, and anytime it's, a metal piercing ammunition is, I understand is depleted uranium whether it's done by plane or some ground firing or whatever. But, it's very very fine and it burns and it invades the environment. Now, how much of that very fine particulate is also part of the picture of a nuclear power plant? How much does it invade the environment, in comparison to the heavy particulates of fossil fuels? Oh, and clean, I mentioned this morning that I understand that yes, you can taste a radioactive exposure. It gives a metallic taste on the tongue, you taste a penny. So, I'm not a scientist, obviously, but I am very concerned that we need all forms of science and the emotion that comes from human beings in order to take good care of my five grandkids. (PS-N-13)

Comment: We can't really call it clean when we look at the results of the DU ammo. Depleted uranium ammunition that is being used has been used in every war the United States has been in since Bosnia including Afghanistan, including two now in the Iraq area etcetera. (PS-D-7)

Comment: I don't want to see anybody lose their jobs. But, I must admit, I was raised by people who were against nuclear power. (PS-U-1)

Response: *The comments oppose nuclear power, in general, and will not be evaluated further.*

A.1.5 Comments Concerning Aquatic Ecology Issues

As stated in 10 CFR Part 51, Table B-1, Category 1 aquatic ecology issues for plants with cooling tower heat dissipation systems include:

Category 1

- Accumulation of contaminants in sediments or biota
- Entrainment of phytoplankton and zooplankton
- Cold shock
- Thermal plume barrier to migrating fish
- Distribution of aquatic organisms
- Premature emergence of aquatic insects
- Gas supersaturation (gas bubble disease)
- Low dissolved oxygen in the discharge
- Losses from predation, parasitism, and disease among organisms exposed to sublethal stresses
- Stimulation of nuisance organisms (e.g., shipworms)
- Entrainment of fish and shellfish in early life stages
- Impingement of fish and shellfish
- Heat shock

Comment: Consumers Energy and Nuclear Management Company admit, in Section 3.1.3.3 "Biofouling Control" on Page 3-7 of their Environmental Report that NMC uses biocides such as chlorination, bromination, and amine formulations. The IJC [International Joint Commission] also called for virtual elimination of toxic discharges into the Great Lakes, and identified radionuclides as persistent toxins that also needed to be virtually eliminated from the Great Lakes. The IJC commissioned two reports, the first on the radionuclide inventory in the Great Lakes, and the second on the bioaccumulation of radionuclides in Great Lakes biota. (PS-EE-14)

Response: *The accumulation of contaminants is a Category 1 issue that has been evaluated in the GEIS. All effluent discharges are regulated under the provisions of the Clean Water Act and the implementing effluent guidelines, limitations, and standards established by the U.S. Environmental Protection Agency (EPA) and the States. Conditions of discharge for each plant are specified in its National Pollutant Discharge Elimination System (NPDES) permit issued by the State or the EPA. [In its response to the Ninth Biennial International Joint Commission (IJC) Report, the EPA concluded that "The U.S. will continue to monitor nuclear generating stations to insure that toxic chemicals are not being used in large quantities and that radioactive forms of toxic chemicals are not being generated in sufficient amounts to cause significant impact on the Great Lakes ecosystem."] The comment does not provide new and significant information, and therefore, will not be further evaluated.*

Comment: What has been the impact of zebra mussels and quagga mussels on the Palisades plant? How have these species been controlled at Palisades and how have the use of toxics such as Betz Clam-Trol impacted the water quality on which the public relies? What would be the consequences at Palisades if these toxics were not used? What has the been the history and mitigation attempts regarding fish kills at Palisades? What game fish have been impacted by the operation of the Palisades reactor? What has been the bioaccumulation and bioconcentration of persistent toxics both radiological and nonradiological contamination in recreational and commercial game fish? (PS-EE-38)

Response: *Zebra mussel control is discussed in Sections 2.2.3 and 2.2.5 of the SEIS. Quagga mussels are not present at the Palisades site. Aquatic ecology impacts are Category 1 issues that were analyzed in the GEIS. The comment does not provide new and significant information in these areas; therefore, it will not be evaluated further.*

A.1.6 Comments Concerning Threatened and Endangered Species

Comment: NMC/Consumers Environmental Report identifies numerous federal and State of Michigan endangered, threatened, candidate, or species of special concern – such as eastern box turtle, lake sturgeon, lake herring, creek chubsucker, Pitcher's thistle, prairie warbler, prairie vole, eastern massasauga rattlesnake, spotted turtle, Indiana bat, globe-fruited seedbox, scirpus-like rush, bald rush, Carey's smartweed, and sedge that either already live at or near the Palisades reactor, or very likely could in the future. Twenty more years of reactor operations threatens these already threatened, endangered, or candidate species, including daily "routine" radiation releases and/or potential large-scale radiation releases' harmful impact on the threatened, endangered, or candidate genetics of these species. In addition, the dunes upon which Palisades is built and operates are recognized as Critical Dune Areas under Michigan's Natural Resources and Environmental Protection Act and are recognized by Covert Township as an Environmentally Sensitive Area, and thus should be protected against 20 more years of daily

"routine" and potential large-scale accidental radioactive contamination. Likewise, the Mesic southern forest on the south end of the Palisades site is recognized as a prime example of this ecosystem type by the Michigan National Features Inventory and should be protected against ongoing radioactive contamination for another two decades past 2011. (PS-EE-31)

Response: *The NRC conducts an independent analysis of the impacts of license renewal on threatened and endangered species. Federally-listed and State-listed threatened and endangered species that have the potential to occur in the vicinity of Palisades are discussed in Sections 2.2.5 and 2.2.6 of the SEIS. The potential impacts of renewing the Palisades OL on Federally listed threatened and endangered species are discussed in Section 4.6 of the SEIS.*

A.1.7 Comments Concerning Surface-Water Quality, Hydrology, and Use Issues

Comment: Over the years I've been watching this thing among the issues that first came up is there was a 7-mile cooling tube that went out into the lake from the plant to cool this. That's why eventually they had to build the steam, they had to build the cooling towers because there was a lot of complaint about this, what effect this cooling tube would have on the lake, on the environment, and under the snail garter thing and all of that. And as I understand it, they are using that cooling tube from time to time. So is it really correct to say that, you know, we don't have a pond, we have a fuel pool that we store the old assemblies until they started taking them out and putting them on the beach? But are they still using the cooling tube out there then? (PS-A-1)

Response: *A description of the Palisades Nuclear Plant cooling water systems will be provided in Chapter 2 of the SEIS.*

Comment: And I'd ask you to look at the impacts of the recently built water intake for the drinking water supply of South Haven, just a few years ago, which I was shocked to see was located so very close to the Palisades reactor. So I'd ask you to look at the outflow, the discharge of radioactive particles as well as toxic chemicals from the Palisades Nuclear Plant being drawn into that water intake. What kind of impact that's having on South Haven residents and tourists who are visiting? (PS-B-12)

Comment: The National Discharge Permit, is this part of the consideration? I'm talking about the biocides, the slimicides, the – size, the heavy metals, the petrochemicals that are put out of this plant on a daily, routine basis. Are those going to be part of the EIS? (PS-K-1)

Comment: There are so many things going on in this community. There's a high cancer rate. I have got, you know, different things have happened to me. Swimming, etcetera. When I was a kid, I came here and swam. And, the water was clean, I could drink it. Now, it's full, it's scummy, it's full of algae. It's a huge change in the quality. The water's still cold. That does not

explain the algae. So, there's a lot of things in the environment I think that are happening that are unexplained. (PS-M-6)

Comment: The impact of 20 additional years of pollution by toxics disclosed but not adequately controlled under requirements of the National Pollutant Discharge Elimination System (NPDES) will directly affect water quality of nearby sources, including Lake Michigan. In 2000, for example, Palisades was found to be in "continuing noncompliance" for its apparent multiple misuses of Betz Clam-Trol in Lake Michigan for the dispersion of mussels and clams affecting the reactor's water intakes. See http://www.epa.gov/region5/water/weca/reports/mi4qtr01.txt. NPDES violations also contradict the spirit, intention, and explicit recommendation of the International Joint Commission (IJC). In its "Ninth Biennial Report on Great Lakes Water Quality," the Commission's Recommendation #16 (at p. 42) urges that "[g]overnments monitor toxic chemicals used in large quantities at nuclear power plants, identify radioactive forms of the toxic chemicals and analyze their impact on the Great Lakes ecosystem." (PS-EE-13)

Comment: The radioactive and toxic chemical emissions from the Palisades nuclear power plant into the waters of Lake Michigan contaminate the recently installed drinking water supply intake for the City of South Haven, built just offshore from Van Buren State Park and just downstream from the Palisades reactor, due to the direction of the flow of Lake Michigan's waters and the very close proximity of the Palisades reactor to the South Haven drinking water supply intake. U.S. National Oceanographic and Atmospheric Administration models confirm the direction of water flow in Lake Michigan toward the intake. (PS-EE-2)

Response: *The comments are related to Category 1 surface-water quality, hydrology, and use issues evaluated in the GEIS. Consumers Energy Company Palisades Nuclear Plant's compliance with NPDES requirements and the operations of the South Haven water treatment system will be discussed in Chapter 2 of the SEIS.*

The EPA reviewed the Ninth Biennial IJC Report and concluded that "The U.S. will continue to monitor nuclear generating stations to insure that toxic chemicals are not being used in large quantities and that radioactive forms of toxic chemicals are not being generated in sufficient amounts to cause significant impact on the Great Lakes ecosystem." The comments do not provide new and significant information; therefore, they will not be evaluated further.

Comment: Global warming could also alter the water levels and water temperatures in Lake Michigan over the course of the 20-year license extension, impacting Palisades nuclear reactor operations. Similarly, large-scale water diversion from Lake Michigan or inland groundwater that feeds into the Great Lakes – proposed by southwestern states, for example, to address their drinking water and other needs in current drought conditions (perhaps also attributable to global warming) and water bottling companies – could also impact water levels in Lake Michigan over the next 20 years. (PS-EE-30)

Response: *While climate change is a legitimate concern, the specific impacts of climate change within a particular region or watershed are still 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. The comment does not provide new and significant information; therefore, it will not be evaluated further.*

A.1.8 Comments Concerning Human Health Issues

As stated in 10 CFR Part 51, Table B-1, Category 1 and 2 human health issues include:

Category 1

- Microbiological organisms (occupational health)
- Noise
- Radiation exposures to public (license renewal term)
- Occupational radiation exposures (license renewal term)

Category 2

- Electromagnetic fields, acute effects (electric shock)

Comment: In other words you said air, water, and health. But, you know, what are some of the, what's some of the specific monitoring that you're doing which would include these questions of mine? (PS-C-2)

Comment: There is no independent verifiable monitoring of Palisades. The community of Covert and surrounding communities are dependent upon the operators of Palisades to provide notification of radiological releases. There is an implicit public relations and financial incentive for the operators not to be forthcoming regarding radiological events and accidents. Therefore, these communities must be equipped with independent verifiable radiological monitoring to protect themselves. (PS-EE-33)

Response: *The radiological monitoring program at Palisades will be discussed in Chapter 2 of the SEIS.*

Comment: The same thing has happened in Lake Michigan, that the fallout that occurred during the aboveground testing before 1963 turned out to be fallout like all over everywhere. There are some books, one called *Under the Cloud*, where it'll say Sparta, Michigan, and name several of the other towns in succession where the plumes had gone. In the case of Lake Michigan, there was a Michigan State professor who, a few years back but quite a while back,

had mapped the hot spots in Lake Michigan because the fallout occurred in successive sedimentary layers. And then the storm times come, that's November isn't it, and, you know, the Edward Fitzgerald time etcetera. And the waters rile up and then settle down and rile up and settle down. So there are unexpected hot spots that have been mapped in Lake Michigan. (PS-D-5)

Comment: Oh, the hot spots issue. I would like to see a map of the hot spots in Lake Michigan. Is there one somewhere near our plant here. What has our plant fed into it? When I talk hot spots, around Chernobyl the fallout settled down and the winds came along and picked it up and moved it someplace else. And the winds came along and picked it up and moved it someplace else, creating hot spots in very unexpected locations. The same thing has happened to Lake Michigan. Ever since the fallout time stopped in 1963 from the aboveground testing, which laid down layers of sediments of radioactivity, those have done the same thing in storm time, November. And, it gets it up and it settles down. It gets up and it settles down. And, I feel that a map of that needs to be part of this relicensing process. That's environmental. And, how much of it would our plant here add to it? (PS-N-12)

Response: *It is likely that there is some variation in radionuclide concentrations in lake bed sediments either due to variability in natural background radiation or due to resettlement of radionuclides resulting from weapon program fallout or effluents from Palisades. However, such concentrations, or variations thereof, are expected to fall within the range of natural background radiation found in the area. The doses resulting from radionuclides originating in the Palisades Nuclear Plant are expected to be well below any applicable regulatory limits.*

The comments relate to Category 1 human health issues that were evaluated in the GEIS. The comments provide no new and significant information; therefore, they will not be evaluated further in the SEIS.

Comment: I hear from the NRC that natural radiation is no more dangerous than the radiation produced out here. (PS-A-4)

Comment: There's like you said, there's not that much nuclear energy being, or radiation out there. The problem is we don't know how much is too much. And any addition is more than enough. (PS-J-2)

Comment: So I would ask you to look at the, the health impacts on African-American workers at the facility. I'd ask you to look at health impacts on Latin Americans who work in the agricultural industry in this area. (PS-B-8)

Response: *The comments relate to Category 1 human health issues that were evaluated and discussed in the GEIS. The comments provide no new and significant information; therefore, they will not be evaluated further in the SEIS.*

Comment: I mean we've got to have a better way than putting this stuff out on the beach 150 yards from the lake. I mean that's, yes, I realize in 20 years I haven't seen where this industry has killed anybody. I've heard some things, you know, of people getting cancer, suing the place, the company quickly settling out of court with them. Well, maybe there's something there, maybe not. I really don't know. But I'm not particularly scared of being, of radiation coming my way just living 3 miles from the plant. But I am concerned about those people on the plant and what happens if one of those casks break. I'm concerned about, you say well, we don't, the NRC aren't going to monitor this thing we'll let the plant people do it. Well, that's a requirement for the plant people. When they put on the first VSC24 cask they didn't have internal monitors in those darn things. They didn't want to put on external monitors until the public outcry made them. (PS-A-7)

Comment: And I'd ask along those same lines that you look at the impacts on the Palisades Park community which I visited for the first time recently and was shocked to see how close it actually is to the Palisades reactor. Actually, the Palisades reactor was built in the Palisades Park community. So I'd ask you to look at the health impacts on that population there. (PS-B-11)

Comment: I was wondering also if you were gathering information from public agencies? Have you gathered information from the Public Health Department on the cancer rate in South Haven and Covert? (PS-M-3)

Comment: Do you have any plans to contact the Public Health Department for, you know, reports about the high incidence of cancer in this area? (PS-M-5)

Comment: The last two meetings I mentioned, you know, let's get the public health reports. This should be included. But, no. The public health was not contacted. Do we have to get an FOIA [Freedom of Information Act] to find out the statistics? As I understand it, there was a cancer study that was done and should be able to be procured. (PS-M-15)

Comment: Do you in your monitoring even the DEQ [Department of Environmental Quality] or NRC, do you look at things such as increased cancer rates in the area? Do you look at the soil and see if it's contaminated in any way? (PS-C-1)

Comment: The study that you just mentioned, I've heard studies that are just the opposite. And we have talked with people in this area that up to 8 out of 10 people are saying oh, yes, I know someone with cancer or I have cancer. So I don't know what current studies are showing but are any of these studies available on those tables back there? (PS-D-1)

Comment: So, these are such huge issues. Embrittlement, the cancer rate, I've talked to people in this community who've said different horror stories about workers that have had cancers and terrible things have happened to them. People that are cancer survivors, people that have deaths in the family from cancer. Someone said that 8 out of 10 people in this area either have cancer or know someone with cancer in their family or know someone who has died from cancer. (PS-M-14)

Comment: And, I'd like you to meet my girlfriend..., a cancer survivor, born and raised here. Her mother, cancer survivor, born and raised here. Her sister, cancer survivor born and raised here. Her sister used to swim down by the nuclear power plant, but, in '95 they had to remove a seven and half-pound tumor from her abdomen. Now, I don't know if that has to do with nuclear power, but, you know, they are born and raised here. And, her sister-in-law, her stepfather worked at the nuclear power plant. And, one day, his lungs filled up with blood and he died at the age of 39. I don't know what that was from. (PS-U-2)

Comment: I also ask that public health data regarding cancer rates in surrounding communities of the Palisades Nuclear Plant be included in the discussion, and participation by Michigan Department of Community Health epidemiologists be present at future hearings. (PS-CC-4)

Comment: Further, I would ask as I have at public meetings, that certain essential elements not be excluded from evaluation.

1 .The public health records of the surrounding counties and downwind regions of Palisades. Also, the correlation between the cancer and infant mortality rate as it parallels the plant in operational mode versus shutdown status. (PS-DD-5)

Comment: Does your environmental review, will it include the recent National Academy of Sciences' report on biological effects of iodizing radiation? The Number 7 report, including the finding that low-level radiation does indeed have an adverse health impact? Will that comment on that? (PS-B-3)

Comment: And I'd also challenge something that was brought up by the health physicist from NRC. Depending on the United Nations Scientific Committee on the Effects of Ionizing [Atomic] Radiation [UNSCEAR] is problematic because just to give you one example in their review of the Chernobyl aftermath on human health, they failed to look at the consequences of internal doses of radioactivity. All that they were looking at was external doses of radioactivity. But of course, the people there are eating radiation in their food, drinking it in their water, perhaps even breathing it in. So that's problematic. So I challenge you to look at internal doses especially in light of the Biological Effects of Ionizing Radiation report which recently came out which actually found that at lower levels of radiation the impact may be higher than previously thought, approaching a direct relationship as you mentioned, the no threshold theory was retained. So at

low levels of radiation which we're talking about here in terms of routine radiation releases, there is health damage associated with that. (PS-B-18)

Comment: The third report in the series, on radioactivity's impact on human health, was never completed. This study on radiation's impact on human health in the Great Lakes Basin should be completed prior to granting Palisades an additional 20 years of operations, especially in light of the National Academy of Sciences Biological Effect of Ionizing Radiation Panel's recent report (BEIR VII), which found that no amount of radiation is too small to not have an adverse impact on human health. Baseline health studies are necessary before NRC grants Palisades a license extension, especially considering that the National Cancer Institute's report on cancer near nuclear reactors, published in 1990, is now 15 years old. It does not account for cancers occurring over the past 15 years, and is in addition methodologically flawed. Independent baseline health studies must be performed before NRC grants Palisades a 20-year license extension. (PS-EE-15)

Comment: The BEIR VII report has recently been published. The recent BEIR scientific conclusion that there is no "safe" level of radiation – no matter how low the exposure – requires reconsideration of the "legal" operation of Palisades at all. Palisades acknowledges routine "lawful" radiation releases. The new scientific conclusion compels reconsideration of the feasibility of continuing to allow Palisades to operate at all, especially given the related issues of drinking water pollution via radiation. (PS-EE-32)

Comment: And I would challenge the NRC environmental reviewers to look at the lack of information about cancer rates in the vicinity of nuclear plants like was raised earlier. This 15-year-old study would not include the latency period for certain cancers that have perhaps happened in the last 15 years. And I would also challenge you to, to look for flaws in the methodology of that study. A mother in Morris, Illinois, named Cynthia Sauer whose daughter contracted brain cancer at age 10, age 7 I'm sorry, who is now 10 and in remission, has looked into that study very carefully and has found flaws in the methodology. And of course, Morris, Illinois, is the site of three reactors as well as a large waste storage pool. (PS-B-17)

Comment: And another question is this 1990 study that's 15 years ago and my understanding is latency periods for cancers would not necessarily be included, you know, unless you were to do a review, an update. So do you plan to do an update on that 1990 study in addition to the recent findings by the National Academy that low-level radiation does cause adverse health impacts? (PS-Q-4)

Comment: There is a current need for a baseline public health study to establish cancer and other disease rates prior to consideration of the proposal for a 20-year license extension. The NRC has relied on the National Cancer Institute (NCI) Study of 1990 to address cancer rates near nuclear power plants. However, the only data considered by the NCI was the county that the reactor is located in, not other downwind and downstream counties. Thus, that study is

methodologically flawed. It is also 15 years old, and thus does not include data on occurrences of cancer over the past 15 years, rendering it outdated. In addition to studying cancer, other diseases associated with radiation exposure must also be studied. (PS-EE-26)

Response: *The comments are noted. Radiation exposure to the public during the license renewal term is a Category 1 issue that was evaluated in the GEIS. Health effects from radiation are a well-studied environmental hazard according to the General Accounting Office. More than 86,000 studies have been performed on the biological effects of radiation, and none of the scientifically valid studies shows any radiation effects at doses less than 10,000 millirem. According to the Health Physics Society (www.hps.com), "below the dose of 10,000 millirem, estimation of adverse health effects is speculative. Collective dose remains a useful index for quantifying dose in large populations and in comparing the magnitude of exposure from different radiation sources. However, for a population in which all individuals receive lifetime doses of less than 10,000 millirem above background, collective dose is a highly speculative and uncertain measure of risk and should not be quantified for the purposes of estimating population health risks."*

The NRC evaluated the recently issued Biological Effects of Ionizing Radiation (BEIR) VII report and discussed its findings in a report to the Commission (SECY.05-0202; Accession Number ML052640532). The NRC staff found that the BEIR VII report does not support the need for fundamental revision to International Commission on Radiological Protection (ICRP) recommendations. However, it will provide additional technical basis for the ICRP to consider as it revises its draft 2005 recommendations on radiological protection. The NRC staff will continue to monitor the ICRP's activities, review documents when they become available, and provide comments directly to the ICRP. The NRC staff also will participate in other forums, such as the Expert Group of the Nuclear Energy Agency or the National Academies Board on Nuclear and Radiation Sciences, to express the NRC's views.

The comments provide no new and significant information; therefore, they will not be evaluated further in the SEIS.

A.1.9 Comments Concerning Socioeconomic Issues

As stated in 10 CFR Part 51, Table B-1, Category 1 and 2 socioeconomic issues include:

Category 1

- Public services: public safety, social services, and tourism and recreation
- Public services: education (license renewal term)
- Aesthetic impacts (refurbishment)
- Aesthetic impacts (license renewal term)
- Aesthetic impacts of transmission lines (license renewal term)

Category 2

- Public services: housing impacts
- Public services: public utilities
- Public services: education (refurbishment)
- Offsite land use (refurbishment)
- Offsite land use (license renewal term)
- Public services: transportation
- Historic and archaeological resources

Comment: I appreciate the comments that preceded me and some of the benefits that the plant provides in the community through the employees, the tax base and the economy from the payroll that we pay out to our employees. But I also want to mention that all of our employees live here in the local communities surrounding the plant and the counties, the cities that surround it. And everyone of those employees also has a vested interest in ensuring that this plant continues to operate in a safe environmentally sound manner or we wouldn't stand here in front of you today to support our license renewal process. (PS-G-1)

Comment: Some of the benefits include the support for the local units of government, the tax-sharing entities, the community schools, the district libraries, hospital authorities. But, there's also other things. We support the emergency management activities in the area for the counties of Alleghan, Berrien, and Van Buren. That's also a very important function. (PS-G-2; PS-S-1)

Comment: Many Palisades personnel live in Geneva Township and are taxpayers, which benefits Geneva Township, South Haven area emergency services, Lake Michigan College, South Haven and Bangor Public Schools, Van Buren Intermediate School District, South Haven Hospital, South Haven Senior Services, and Van Buren County. Being a South Haven area emergency services authority board member I have watched as Palisades has contributed much to our fire and ambulance service in the ways of training, equipment, and support. This joint effort for the safety of our citizens and Palisades personnel is a tribute to working together to make our community what it is today. Over the years we have been privileged to reports by Palisades personnel at our township board meetings keeping us informed on happenings, new procedures, updating of the siren warning system, and just being available to answer questions that arise in our public settings.

The seminars presented by Palisades personnel to provide exposure for the local municipalities and businesses and industries to review the plant and safety procedures that are in place as well as having contact personnel for our comments and questions is indeed beneficial. (PS-H-1)

Comment: What I want to speak to, briefly, is the socioeconomic impact and to reiterate some of the things that were in our statement from the Chamber board of directors over to the NRC

and the Palisades plant and Nuclear Management Corporation. The plant has a significant economic impact on the area. Six hundred plus employees, not to mention the contractors in the area. At least one-third of those folks live right here in the immediate South Haven vicinity. That's a lot of payroll dollars being spent right here in our community. A couple of folks I know that work out there said you could bump the payroll anytime you want. And, the other side of it is the contractors when you go into an outage. Lots of the small businesses that sit on the Chamber board and made the decision to support it, look at those outages and those opportunities when the plant is back reinvesting, cleaning things up, doing a lot of maintenance, that's a lot of extra folks in town spending money, doing and making things happen. There's also an element beyond the financial impact from that payroll. That's the involvement of those men and women that work out there. They are involved in the community. You'll find them serving on different public boards and commissions. Boy Scouts, Girl Scouts, 4-H, coaching basketball, baseball, softball. Just a tremendous social impact from their involvement. (PS-T-1)

Comment: I never realized until I became a board member of Geneva Township in 1987 and became acquainted with the operations and effect of Palisades Nuclear Plant on the structure and economic well-being of Geneva Township as well as the surrounding area. Palisades Plant and people continuing to support of our communities, organizations, and businesses through usage, involvement, and monetary support, enhancing the overall Community Health and welfare. (PS-Y-1)

Comment: Many Palisades personnel live in Geneva Township and are tax payers which benefits Geneva Township, South Haven Area Emergency Services, Lake Michigan College, South Haven & Bangor Public Schools, V.B. Intermediate School District, South Haven Hospital, South Haven Senior Citizens and Van Buren County. (PS-Y-2)

Comment: Being a South Haven Area Emergency Services Authority Board Member, I have watched as Palisades has contributed much to our Fire and Ambulance Service in the way of training, equipment, and support. This joint effort for the safety of our citizens and Palisades personnel is a tribute to working together to make our community what it is today. (PS-Y-3)

Comment: Funding for the Covert Township Ambulance/Fire Department and Police Department is through a voted millage for each Department. Currently, the tax revenue from Consumers Energy's Palisades Nuclear Plant is roughly 60 percent of the total taxes collected. If Covert Township were to lose this tax revenue today, they would have to shut down or drastically reduce the services that they provide to the community. (PS-Z-2)

Comment: If Palisades Nuclear Plant does not get a license renewal and Covert Township were to lose their tax base, it would have a very negative effect on the Economic Environment of a very poor diverse community. (PS-Z-4)

Response: *The comments relate to Category 1 socioeconomic issues and are supportive of license renewal for Palisades. The comments provide no new and significant information; therefore, they will not be evaluated further.*

Comment: I understand, you know, it's about the jobs here. I mean our town here in South Haven or Covert where they've put the plant officially, I mean we need jobs. But one thing I don't fear with, if Palisades does not get its license to continue to operate is that we're going to get a loss of jobs here. (PS-A-2)

Comment: And perhaps we would then say we need to gradually move toward other sources of employment. Certainly not just one company for our area. And to look to something that can continue on into the future for many generations. (PS-C-6)

Comment: The tax revenue from the Palisades Nuclear Plant also helps fund the Townships' water system as well as the Township General Fund. The revenue loss to either of these would also mean either reduced services or a raise in taxes. (PS-Z-3)

Response: *The comments relate to Category 2 socioeconomic issues and will be considered in the preparation of the SEIS. Socioeconomic issues will be discussed in Chapters 2 and 4 of the SEIS.*

Cultural Resources

Comment: I'd also ask you to look at not only health impacts but cultural impacts and related socioeconomic impacts on the Native American tribes of this area whose land we stand on and whose land Palisades is located on if the treaties were honored. (PS-B-9)

Comment: Palisades' license extension application also has inadequately addressed the adverse impacts that 20 additional years of operations and waste generation would have on the traditional land uses, spiritual, cultural, and religious practices, and treaty rights of various Federally recognized tribes in the vicinity of the plant and beyond, as well as effects upon nonfederally recognized tribes governed by international law. Only three tribes were contacted by the NRC by August 8, 2005, and invited to participate in the license extension proceedings, which effectively excluded a number of tribes within the 50-mile zone around the reactor, as well as additional tribes beyond the 50-mile zone which have historic and traditional ties to the Palisades site and sites along the electric transmission line connected to Palisades. Despite the Michigan State Historic Preservation Office's concern pertaining to possible unreported archaeological properties present on, or with the vicinity of, the Palisades site (see Page C-2, Cultural Resources Correspondence of the Environmental Report), NMC and Consumers persist in opposing a survey of the project area as unnecessary. But, if unreported Native American archaeological sites are present at or near the Palisades nuclear power plant (which is very possible, given the very close proximity of a large creek in Van Buren State Park just to the north

of the power plant, as well as the very close proximity of Brandywine Creek just to the south of the power plant in Palisades Park, rivers and creeks being common sites for encampments and villages amongst the indigenous peoples of Michigan since time immemorial), then 20 additional years of nuclear operations, radioactive waste generation, and daily radiation emissions would have a significant and severe adverse impact on Native American cultural and religious values at those sites, values which strive to protect sacred areas from such degradation. The fact that NRC contacted only the Nottawaseppi Huron Potawatomi, the Little Traverse Bay Band of Odawa Indians, and the Match-E-Be-Nash-She-Wish Band of Potawatomi, but did not contact the Pokagon Potawatomi (just 30 miles or so from the Palisades site), the Little River Band of Odawa Indians, the Grand River Band of Ottawa Indians, the Saginaw Chippewa Tribe, and the Grand Traverse Band of Ottawa and Chippewa Indians, means that this Environmental Scoping proceeding should be suspended until all stakeholder Native American tribes and bands are contacted and alerted to the opportunity to not only comment on the Environmental Scoping, but to intervene against the Palisades 20-year license extension. Given the sovereignty of these tribes and bands, and the treaty rights that exist between them and the United States Federal government, the NRC has a government-to-government responsibility to consult with these tribes and bands on such significant federal actions as granting the Palisades reactor an additional 20 years of operations. An archaeological survey must be conducted before NRC grants a 20-year license extension to assure that Native American archaeological sites are not negatively impacted by future Palisades reactor operations. (PS-EE-18)

Response: *The comments relate to Category 2 socioeconomic issues and will be considered in the preparation of the SEIS. The NRC sent letters to 11 potentially affected American Indian tribes, including the Pokagon Band of Potawatomi Indians (Accession Number ML051960173), on July 13, 2005, inviting them to participate in the environmental scoping process related to NMC's application for the license renewal of Palisades. The potential impact of renewing the OL of Palisades on cultural resources will be discussed in Chapter 4 of the SEIS.*

Environmental Justice

Comment: Another issue, I was surprised when environmental justice was brought up because my understanding was that the NRC a couple or 3 years ago had largely gutted its environmental justice policy under pressure from the nuclear industry. So I'm glad to hear that you're going to look at that and I would request that you look at impacts on the African-American populations specifically in Covert Township where the facility is located. (PS-B-6)

Comment: And I'd ask that you look at impacts on the low-income community of this area as well. (PS-B-10)

Comment: As for the tax base, and the loss of tax base, that we had members of the Chambers of Commerce and Covert Township say is important, that every dollar generated is

circulated seven times or what have you. Coming here, I drove through Covert. First time I drove through Covert was about 24 years ago. And, I've driven through it since particularly coming up here when, being involved in the Palisades plant before they even put out one dry cask. I was involved in some of the organizing against the dry cask. And, I don't see where Covert has, you know, benefitted anywhere. Maybe, you know, South Haven has, but, talk about environmental justice. Covert looks just as deprived as it has ever been. (PS-L-1)

Comment: Do you consider Covert as an environmental, what do you call that, what was that term you used? Yeah, the justice issue? (PS-M-4)

Comment: Covert Township is a very diverse community. The year 2000 U.S. Census report shows that Covert Township has a 35 percent Black and 15 percent Hispanic population. This report also shows that Covert Township is one of the poorest Townships in the State with a Median Household Income of only $22,829. (PS-W-1)

Comment: Palisades nuclear generating station is the source of environmental justice violations. Located within a predominantly African-American and low-income township, Palisades provides woefully inadequate tax revenues to the host community, considering the large adverse impacts and risks the reactor inflicts. Palisades' African-American employees have traditionally been stuck in the dirtiest and most dangerous jobs at the reactor, with little to no prospects for promotion. Some of Palisades' African American employees have also experienced death threats at the workplace, including nooses hung in their lockers or in public places to symbolize lynching, an apparent attempt to silence their public statements for workplace justice. (PS-EE-17)

Comment: A potential flaw in the NMC/Consumers Environmental Report is its exclusion of census block groups with greater than 50 percent of their area outside the 50- and 20-mile radii from Palisades. Not including these groups in calculating total population, minority or low-income estimates effectively excludes significant minority and low-income populations in Grand Rapids and Battle Creek, particularly African-American and Latin American communities living in these major urban centers. (PS-EE-21)

Comment: In addition, it is odd that NMC/Consumers writes in the Environmental Report (page 2-32) that "Berrien and Van Buren Counties host moderate numbers of migrant workers," when 3,677 and 6,733 temporary farm laborers (many of them Latino) were employed in Berrien and Van Buren Counties, respectively, according to the U.S. Department of Agriculture in 2004. These numbers represent populations as large as the county seats and even the biggest towns in these counties. It is also not clear in the Environmental Report whether those numbers include the families which very often accompany the migrant farm laborers, which would boost the Latino population even higher.

It is ironic that NMC/Consumers acknowledges on page 2-36 of the Environmental Report that "Only one block group with a low-income population is located in Van Buren County. This block group is located in the western portion of Covert Township, which is a largely rural area." Why is it that the largely African-American population of Covert Township is still low-income after 38 years of Palisades nuclear power plant's presence in the township? Wasn't the presence of the reactor supposed to help its hometown to thrive economically? What are the environmental justice implications of such an ironic history?

The fact that "The amount of future property tax payments for Palisades...are dependent on future market value of the plant" seems ripe for manipulation and abuse – such as artificially lowering the market value of the plant in order to lower future property tax payments -- by the politically and economically powerful Palisades nuclear power plant on its host township, county, and region, yet another environmental justice violation. (PS-EE-22)

Comment: Such impacts as harm to lake sturgeon – sacred to some Great Lakes tribes – must also be evaluated. It is interesting and telling that NMC's Environmental Report assigns no "importance" to lake sturgeon (in Table 2.3-1, Page 2-47), despite its State of Michigan Threatened Status, and its sacred status in the cultures and traditions of various Great Lakes Native American tribes, not to mention its importance to the natural history of Lake Michigan as an ancient indigenous species in the ecosystem. This is an indication that NMC/Consumers is not acknowledging or addressing environmental justice impacts of 20 more years of operations at Palisades on Native Americans. (PS-EE-19)

Comment: How has the operation of Palisades impacted Native American fishing rights in the Great Lakes? (PS-EE-39)

Response: *In order to perform a review of environmental justice in the vicinity of a nuclear power plant, the NRC staff examines the geographic distribution of minority and low-income populations within 80 kilometers (50 miles) of the site. The NRC staff uses the most recent census data available. The NRC staff also supplements its analysis by field inquiries to such groups as county planning departments, social service agencies, agricultural extension personnel, and private social service agencies. Once the locations of minority and low-income populations are identified, the staff evaluates whether any of the environmental impacts of the proposed action could affect these populations in a disproportionately high and adverse manner.*

The comments relate to environmental justice issues and will be considered in the preparation of the SEIS. The NRC conducts an independent analysis of the impacts of license renewal with regard to environmental justice; potential impacts will be discussed in Chapter 4 of the SEIS.

A.1.10 Comments Concerning Postulated Accidents

Comment: Farmers downwind of Chernobyl, which melted down as we all know, are out of business because of contaminated soil. That's, that's our livelihood. We do not want to face that possible perhaps probable scenario here at home. Human error contributed to the Chernobyl meltdown and in spite of all the safeguards that you may have in place at Palisades when you factor that in what will the future bring us? (PS-C-12)

Comment: I live in Grand Rapids, 70 miles away. We are definitely downwind. One of the maps in the big books shows I believe the 50-mile radius, and as you know Chernobyl has a 19-mile interdiction area but they also find that the fallout that happens when a nuclear catastrophe does occur, settles down and then the winds pick it up and swirls it around again and the next windy day or windy season it settles it down again and it goes on and you end up with unusual, unexpected hot spots in places that people didn't expect. Where they no longer can go out and collect mushrooms and grow their own apples and so on. (PS-D-4)

Comment: Please don't say that it can't happen here. It can happen here. The chances of it happening we don't know just like we don't know how much radiation is too much because it's different for each individual. Okay. It is a possibility. I'd hate to see the year that South Haven was a town that used to be a great little tourist town. (PS-J-5)

Comment: You know, you can, every nuclear power plant that ever had an accident they said it wouldn't happen. You know, they didn't think Chernobyl would happen, they didn't think Three Mile Island would happen. There have been so many nuclear accidents and spills all along the trail of the nuclear industry from mining on up to transportation. (PS-M-11)

Comment: And, something also that Mr. Keegan mentioned was the environmental review has to look at the socioeconomic impact of a full-scale catastrophe at Palisades. Tourism was mentioned. I would also specifically request that casualties be looked at. The number of deaths, the number of injuries, the number of latent cancer fatalities. The number of genetic damaged children in future generations. (PS-Q-3)

Comment: Palisades' license extension application inadequately addresses the disproportionate adverse socioeconomic impacts of a catastrophic radiation release, such as due to reactor core embrittlement leading to core rupture, to the low-income Latin American agricultural workforce of the Palisades area. Synergistic effects of such chronic and catastrophic radiation releases combined with the toxic chemical exposures these low-income Latin-American agricultural workers already suffer on their jobs have not been evaluated. Finally, there is an unacceptable lack of Spanish language emergency evacuation instructions and notifications to serve the Spanish-speaking Latino population within 50 miles of the Palisades reactor, especially migrant agricultural workers. (PS-EE-20)

Response: *The comments relate to Category 1 design-basis and severe accidents issues. The comments do not provide new and significant information; therefore, they will not be evaluated further. Environmental justice issues will be discussed in Chapters 2 and 4 of the SEIS. Issues pertaining to emergency planning are outside the scope of license renewal and will not be evaluated in the SEIS (see Out of Scope: Emergency Response and Preparedness).*

Comment: It has been recently confirmed by the National Academy of Sciences that there is no safe level of exposure to radiation and that even very low doses can cause cancer. I am therefore disturbed by nuclear industry corporate culture that has a ubiquitous record of dismissing legitimate concerns about radiation exposures. In the case of Three Mile Island, it has been found by a more recent independent analysis of the 1979 accident that placement and frequency of monitoring devices were highly inadequate and unable to establish accurate data from which to establish radiation release patterns. For residents of Harrisburg and the surrounding area, that meant their reported symptoms of metallic taste, erythema, nausea, vomiting, diarrhea, hair loss, and deaths of pets and farm animals were attributed to stress brought on by the accident, not radiation releases from the accident. Apparently, if no monitors were present in any given neighborhood and therefore no radiation data could be collected, then no radiation had been released. People were treated as though they had psychological problems, not legitimate symptoms of radiation exposure. Exactly how will the citizens of Michigan be treated should a similar accident occur at Palisades? I simply refuse to accept my community being treated in such an insulting and degrading manner. I therefore ask that a complete map showing existing radiation detection locations for Palisades be provided and frank discussion on this monitoring methodology be initiated. (PS-CC-3)

Response: *The comments relate to Category 1 design-basis and severe accidents issues. The comments do not provide new and significant information; therefore, they will not be evaluated further. Radiological monitoring and sampling locations are identified in the 2004 Radiological Environmental Operating Report (Accession Number ML051390307). Issues pertaining to emergency planning are outside the scope of license renewal and will not be evaluated in the SEIS (see Out of Scope: Emergency Response and Preparedness).*

A.1.11 Comments Concerning Uranium Fuel Cycle and Waste Management

As stated in 10 CFR Part 51, Table B-1, Category 1 uranium fuel cycle and waste management issues include:

- Offsite radiological impacts (individual effects from other than the disposal of spent fuel and high-level waste)
- Offsite radiological impacts (collective effects)
- Offsite radiological impacts (spent fuel and high-level waste disposal)
- Nonradiological impacts of the uranium fuel cycle

- Low-level waste storage and disposal
- Mixed waste storage and disposal
- Onsite spent fuel
- Nonradiological waste
- Transportation

Comment: Someone has said that radioactive waste is the product of a nuclear power process. The power is a sideline of it. Of course, nuclear power originated because somebody that was working out at Hanford area realized they were wasting an awful lot of heat in the making of the original atomic bombs. And so, what can we do with the heat? Uh, we will boil water, make steam, make power. And so, you know, in a roundabout way we have ended up with nuclear plants all over the country, all over the world. But we have by far the largest number. But radioactive waste is definitely the product of it. (PS-D-6)

Comment: Second, we cannot keep producing nuclear waste without a way to protect us from the nuclear waste. I think enough has been said about that. I won't say a lot more but there is, there is no good permanent solution. My suggestion is that we send it to Washington, D.C. But I think some of our people here live in Washington, D.C. and like, like everybody else they do not want it in their backyard. Nobody wants it in their backyard. I wonder why? (PS-J-6)

Comment: Electricity is but the fleeting by-product of the Palisades nuclear reactor. The actual product is forever deadly radioactive waste. This cannot be excluded from the EIS because if there is no license extension there will not be an additional 20 years of high level nuclear waste generated by Palisades. The indoor irradiated fuel storage pool reached capacity in 1993, thus necessitating the utilization of a shoddy technology of outdoor dry cask storage pads at Palisades. (PS-EE-3)

Comment: I've got a lot of questions. One is, are you going to, in the environmental assessment, take into consideration the creation, storage, and transportation of nuclear waste? (PS-M-1)

Comment: We have a high-level nuclear waste dump 3 miles from my home that's going to be continually decontaminated. Somebody is going to have to be in there taking care of this thing for thousands of years to come. This is going to be not just my problem it's going to be my daughter's problem, her children's problem, her children's children's problem. They're all going to have to pay for that as life goes on. Because this stuff is just going to be around forever and there's no place. I've looked at Rocky Flats. I have looked at all of these different places that are producing all this nuclear material, and this country is just teeming with this stuff and we've got no place to put it. We can't find a safe place. Not Yucca Mountain, they've had earthquakes, starting to find aquifer down there, Christ, they've been testing bombs underground there for years and just shattered everything. It's not going to fly. I really wish it

was. I really wish all that stuff could just disappear and we could maybe get on with producing electricity this way. (PS-A-3)

Comment: If anything, it is the half-life of the waste materials that not only are produced by the Palisades Plant, 125,000, 150,000 somebody told me today, 150 million years. The half-life for this deadly poison to reduce itself by natural processes after man has intervened to gather it together by unnatural processes. When they have that Yucca Mountain thing if they ever get it organized, which I have some doubts about, to bury all this stuff somebody is going to decide to build a bridge or a mine or something and they're going to go clunk, clunk, clunk, clunk, clunk, and they're going to bust it open having forgotten 100 or 150 or a 100,000 years. And they're going to kill a few hundred million people. That is what the net result of nuclear power is. It is poison. The worst poison, the most long-lasting poison in the history of the world. (PS-I-2)

Comment: If Yucca Mountain were to open in Nevada, there's enough waste in the United States by the year 2010 to completely fill it to its legal capacity. It won't be open by 2010, if ever. And so, I just point out the irony of Consumers license expiring in the year 2011 and if Yucca were to open, it possibly could take all the waste generated at Palisades up to that point. But, everything made after that point, after the year 2010, is excess to Yucca. And, the second repository in the United States by law would have to be located in the eastern part of the country. Perhaps Michigan? Who knows? Wisconsin? (PS-K-15)

Comment: But, the professionals in the nuclear industry are being very capricious with the fact that, you know, they're generating a lethal waste here. How much more waste will be generated in 24 more years. It is my understanding that if Yucca Mountain were to open tomorrow, which it's not going to happen because they're still having even more problems there, it already is not capable of handling all the waste that is already generated and sitting in storage across the United States. It already could not hold everything that's generated. So, and also I remember reading not too long ago in the Herald Palladium that there was an article about a new transportable dry cask that Palisades will be using from now on. And that's all well and good, but, where is that waste going to go if there is no place for it. This is the most serious environmental, blatant problem that needs to be addressed. The electricity is fleeting. It's created and it's gone, it's used. What's left is the waste. So, the truth of the matter here is the real product is lethal nuclear waste. Electricity is just a by-product. The waste is what is still here and will be here for hundreds of thousands of years and it is lethal and it is deadly. And then, we have to go through the process of finding how to keep it safe. This industry is holding us psychologically hostage. They're creating a waste, and then patting us on the head, and saying, oh, don't worry, we know what to do with it, it'll be safe, blah, blah, blah. (PS-L-3)

Comment: The nuclear waste issue is a huge issue that isn't being addressed. Twenty more years of nuclear waste buildup, where is it going to go? Are we going dump it on the Indians? I mean, that is not right. It is not right to take nuclear waste and track it across country and dump it on native lands. (PS-M-12)

Comment: The accumulation of nuclear waste along the shore of Lake Michigan is not only a potential terrorist target, as is the reactor itself, but there are also problems with the casks themselves, and the geological strata of the area, which includes the unstable sands which the cask pad sets on. Nuclear waste that is headed for dump sites built on native lands is "environmental racism," and more operation and creation of wastes should be considered as such. (PS-DD-2)

Comment: In its Environmental Impact Statement, NRC should also consider another environmental impact concerning high-level radioactive waste ignored by NMC/Consumers in its Environmental Report: the proposed shipment by barge of 125 or more rail-cask sized containers of irradiated nuclear fuel from Palisades to the Port of Muskegon as part of the Yucca Mountain, Nevada nuclear waste dump proposal. The U.S. Department of Energy describes and documents this proposal on page J-83 of its *Final Environmental Impact Statement for Yucca Mountain*, in Table J-27 ("Barge shipments and ports"). One hundred and twenty-five barge shipments may very well be an underestimate, for DOE assumes only 10-year license extensions, whereas NMC/Consumers is requesting a 20-year extension from NRC. (PS-EE-7)

Comment: What if a barge shipment goes down in the Lake, whether due to accident or attack? What about the potential for a nuclear chain reaction inside the cask involving the still fissile U-235, Pu-239, and other fissile radionuclides present in the waste? What about radioactive contamination of 20 percent of the world's surface freshwater, the drinking water supply for 35 million people downstream? (PS-EE-8)

Comment: Property rights of home owners on the shoreline and inland from Palisades have been compromised by the "de facto" permanent high-level waste site created. This amounts to implementation of eminent domain without any compensation to property owners. The constant threat of a nuclear accident or act of sabotage has violated property owners' rights. (PS-EE-9)

Comment: When I helped build these plants these fuel containments, these high-level containments, we weren't told anything, only low-level radioactive material would be brought in to those for refueling the plant. Once it goes through the reactor cycle it becomes really radioactive. It was going to be sitting in a fuel pool until there would be a national depository to ship it to. That never happened. Now we got it piling up out in these concrete casks, metal casks sitting on the beach out of the high-level containment. (PS-A-6)

Comment: We already have contaminated steam generators and such buried on the site along with contamination of the plant to deal with. Enough. (PS-A-10)

Comment: What happens with the waste? (PS-C-5)

Comment: One of the questions that hasn't come up enough, I think is, what are the plans for the rad waste? Now, old Frank Kelly said a long time back, that nobody knows what to do with a

teaspoon full of the stuff. And, we still don't. Sixty years into the nuclear age and we still don't know. So, I think that has to be a very important environmental component of the issue of whether this plant is relicensed. To keep on making this stuff doesn't make sense. There's a whole bunch of questions. There's comments about the dry casks, but, I won't say too much about that except that there they sit. And, I'm wondering how they're going to get to wherever they're going to go on site. And, how they're going to get beyond that, because they're 28 tons each, I understand. And, they're, they can't be moved, transported on the highways at all, or any other commercial fashion. (PS-N-5)

Comment: Let us not forget that we are discussing the continued production for another 20 years of a lethal waste that requires extreme safety control measures. We are not talking about a tootsie roll factory here. The waste product is being stored on the shores of a body of water that constitutes one-fifth of the earth's surface freshwater and which provides potable water to millions of people. Another 20 years of accumulated waste added to the already existing lineup of outdoor dry cask storage situated on unstable sand dunes is a major concern. (PS-CC-2)

Comment: And, oh, I understand, too, that each dry cask holds the equivalent of 250 Hiroshima bombs. Am I outrageous on that statement? Anybody correct me please? The other thing is, I understand the last I knew anyway there are 16 dry casks. Are there more? What's the current quantity? (PS-N-7)

Comment: What about these 29 casks that are loaded? And, it's my understanding they weigh 132 tons each. This is a defacto high level of a nuclear waste dump on the shore of Lake Michigan. And there are no plans to get it out. And, you're going to make more, give them a 20-year extension to make more of this. I have a problem with that. (PS-K-14)

Response: *The comments are related to Category 1 uranium fuel cycle and waste management issues. The comments do not provide new and significant information; therefore, they will not be evaluated further. Issues pertaining to Yucca Mountain and malevolent acts are outside the scope of license renewal and will not be evaluated in the SEIS (see Out of Scope: Separate Proceedings, and Out of Scope: Safeguards and Security).*

Licensees storing spent fuel in an ISFSI under a general license for storage of spent fuel (10 CFR Part 72, Subpart K), as at Palisades, are required to submit documentation registering the use of each cask at their facility in accordance with 10 CFR 72.212(b)(1)(ii). As of October 31, 2005, the NRC has received documentation registering the use of 18 VSC-24 casks and 4 NUHOMS-32PT casks at Palisades.

A.1.12 Comments Concerning Alternative Energy Sources

Comment: You know, it's using kind of an old nuclear technology. There are new technologies coming along that are clean and my hope all along, what I can clearly see that immediate nuclear decommission, cleanup and conversion of the Palisades Nuclear Power Plant and running it on natural gas like the one they do up in Midland. Or hydrogen fuel is the way it must go rather than allowing these nuclear fuel rods storage casks to be piled up onsite. (PS-A-9)

Comment: The time to convert Palisades Nuclear Power Plant is now. I mean this, rather than relicense this and keep running this poor old reactor that's been going for 40 years that was really embrittled, that they're taking old fuel rod assemblies because they're made out of stainless steel that have already been through the cycles and sitting for years in the fuel pool, stuffing them back in the reactor to sop up radiation away from the critical parts that are already embrittled on the reactor vessel, so if I'm getting a little technical here, but you know, I don't really lose sleep at night over thinking I'm living next to this dangerous reaction about to go but, you know, the thing is 40 years old. It's embrittled, folks. If we're going to keep generating power here we need, what they promised us back when we built the thing in the first place, in 40 years a new plant would come along. It didn't happen. (PS-A-11)

Comment: But what we have learned in 40 years is that there's a heck of a lot of ways to make electricity. And if we quit putting all our effort and all our rate payers' money in keeping this dead horse alive and start pursuing some of these new ones and we can do it right out there at that plant because they got a fine turbine that produces a lot of electricity. And as Ralph Nader says they're only boiling water. We just got to boil water to 700 degrees and we've got this electricity. There's a lot of different ways to do it. And I hope everybody here will start pursuing those different ways than keep going this very dangerous way, which for thousands of years to come people are going to have to answer for and pay for, just for a little electricity now. (PS-A-12)

Comment: My husband cannot be here today because he's hosting a class from the math and science center in Kalamazoo. This center serves the brightest students in that area. The class is visiting to learn about our off-the-grid house. Our personal energy needs are met with solar and wind power and we have a very comfortable life there. This can be done. And we hope that our model will become a model for this alternative to be embraced by more people in our area. The utilities themselves have said they want to include more of this. We have a friend, Art Toy, who has run for office many times in our area who put up a really big wind generator because he understood that Palisades was mandated to take that energy by law. But they have put so many barriers in the way of his doing this that it hasn't worked yet. So I would certainly ask that you reconsider putting barriers in the way of citizens who are trying to help with selling excess power to you. It, this State is not doing what some other States more intelligently are doing with this. (PS-C-9)

Comment: Nuclear energy is clean air energy. In that I mean nuclear power plants produce no controlled air pollutants such as sulfur particulates, green house gases. The use of nuclear energy in place of other sources does help to keep our air clean. To put it in equivalent terms, to replace the electricity that Palisades provides it would require approximately 12 million barrels of oil per year or three million tons of coal per year or the equivalent of about 65 million cubic feet of natural gas per year. Those are some of the fossil fuels that having Palisades in the community displaces that would otherwise be needed to meet Michigan's needs. Something that some may not be aware of is nuclear power produces approximately 25 percent of electricity in Michigan, not just the Palisades plant but other nuclear plants as well. (PS-G-4)

Comment: There are ways of making electricity.... We could use solar power. (PS-I-6)

Comment: But that's what happening to solar power. It's coming. And a lot of other good forms of power are coming. And we don't have to depend on the infinitely prolonged death that is represented by nuclear power. (PS-I-7)

Comment: Up north, Consumers Energy has been combining with Mackinaw Wind Power and they're putting up wind generators. It is possible. Wind generator is a clean energy source and it is like Maynard was saying, it's quick. It takes over quick. It doesn't, it's not like building another monster. It's just, you put it up and it starts working. Combination of wind and other systems, and we've got it made here in Michigan and we can keep our water clean. But, if you take that chance and you relicense this facility thinking well, the next issue we will deal with it, we can analyze it. (PS-M-17)

Comment: The second question has to do with the notion that there might be renewable sources of energy as alternatives and I don't know why that wasn't mentioned among the possibilities that you just reviewed. Because, in fact, wind power is a fantastic source of energy and it would come online a lot faster than additional nuclear power plants, which I know are present at a loss. (PS-O-2)

Comment: I just want to reiterate a word about renewable sources of energy. And, I want to do this in the context of something that all you energy folks are very well aware of which is that within 5 years or so, we will have reached a global peak in oil production. And, geologists have been telling us this for 30 years. But, it seems that they were on target and that indeed, that is going to be happening. And, that means production will decrease as demand, globally, increases, and that means prices for the fossil fuels will go up and up and up. And, at this point in time, therefore, it is so important that we do everything we can to not only conserve which we haven't started yet, but also to use more renewables. And, I'm not here to say that it may not be possible, after lengthy public participation in this issue of what the proper mix of energy sources is. It may be possible that nuclear is part of that. Especially in the post-fossil-fuel era. I want this discussion to be a public discussion. (PS-O-3)

Comment: I think we can have a really good public discussion about what the proper mix of energy sources is. And, it may be, because nuclear is clean in some ways, that that may be part of it. I'm not the one to be able to decide. But, in the mean time, there is much that can be done for renewable energy and incidentally, the argument that you only get it 35 percent of the time, doesn't really apply too much, because the grid is all over the country, and if you use that same grid for distribution, there's going to be wind blowing and sun shining someplace in the country. So, that way we'd have a reasonable source of energy to that as well as whatever other options exist, but, there'll be a lot less of it than we enjoy now. (PS-O-4)

Comment: Let's see. Oh, one of things that I think most of us haven't recognized is that when nuclear power came in, the whole electric thing, energy thing became centralized. The little dam up at Newago, and the other one at Big Rapids. All those little energy producers for their area, even though they had a few environmental problems where the silt filled in and it may have destroyed some of the environment, but, still some of those things could have been handled, but, now they're out. They're gone. So, the de-centralization is what needs to reoccur. And, it might even be that we will have solar power, solar panels on our buildings, our church roofs, in the places where it's possible. And, more and more, we're finding it is. (PS-N-10)

Comment: I wish there was another brand new nuclear power plant to take over, like we were all thinking back in the 70s. Three Mile Island happened, none of that's ever happened. (PS-P-3)

Comment: I'd like to say a little bit about alternatives. I thought it was telling when Bob spoke that renewables were mentioned last and very briefly. And, I think Maynard, and earlier in the day, Barb Geisler pointed out the reality of renewables like wind and solar. They're ready to go. They're viable. And I would add in there efficiency and conservation as alternatives to nuclear power. And, something that Mr. Keegan brought up, at a 44 percent rate of operation at Palisades because of all the breakdowns and violations over the years, how does that compare to the wind not blowing? I mean, the last time I checked the sun comes up every day. So, that's pretty reliable source of energy, I would say. (PS-Q-10)

Comment: You know, it's just that there are new technologies coming along all the time and if we just put half the investment that we put into these old dead industries, that are dying like the nuclear industry. You know, we could have new stuff here that doesn't pollute. (PS-S-4)

Comment: Other sources of energy are available to ths country and we are failing to maximize this value and their sustainability, such as wind power doing valuable service in other countries. (PS-BB-2)

Comment: The plant can be replaced by wind turbines which will not be a public liability and which will not endanger the environment and which will produce a profit and not need taxpayer subsidies to maintain. (PS-DD-10)

Comment: In Section 7.0, "Alternatives to the Proposed Action," renewable energy sources such as wind power and solar power, as well as alternatives to Palisades, such as energy efficiency and conservation, are given remarkably short shrift by NMC/Consumers. In fact, polluting electricity sources such as fossil fuels are given by NMC/Consumers as the only realistic alternatives to a 20 year license extension at Palisades. This is self-serving in that Consumers owns and operates fossil-fuel-fired facilities. In fact, in 2002 nearly three-quarters of Consumers' electricity generation came from fossil fuel facilities. Such reports as *Repowering the Midwest* by the Union of Concerned Scientists and Environmental Law and Policy Center; a recent analysis by Amory Lovins at the Rocky Mountain Institute published in the organization's summer 2005 newsletter (see www.rmi.org); cutting edge research and development conducted by the Midwest Renewable Energy Association; deployment by Mackinaw Power of modern, large capacity wind turbines on the northern tip of Michigan's lower peninsula, and plans to deploy more wind turbines on the Lake Michigan shoreline of west Michigan; long-established Lake Michigan shoreline wind power operation by the Traverse City, Michigan, municipal power company; advances in solar electricity by Solar Ovonics in Troy, Michigan (which manufactures solar electricity generating roofing shingles, which could be installed unobtrusively over huge surface areas atop families' homes); advances in solar power technology documented by Steve Strong at Solar Design Associates; and a recent report commissioned by the U.S. Public Interest Research Group (*Redirecting America's Energy: The Economic and Consumer Benefits of Clean Energy Policies*, February 2005) all clearly show that renewables, efficiency and conservation not only are ready to go, reliable, safe, clean and affordable options for electricity generation and savings, but also the source for tremendous job growth and cost savings. Whereas NMC/Consumers may have a business agenda to ignore and downplay the potential for such promising alternatives to polluting sources of electricity such as fossil fuels and nuclear power, the NRC should fully examine such alternatives in its environmental impact statement. (PS-EE-28)

Comment: The other night a man named J. Herman, I think that was his last name, who approached, he's a bioneer. If you get a chance to look up bioneers in the Internet or something. And he was talking about his and others' discovery that nature's major source of action, energy, has to do with a spiral type of motion that water flows in a spiral. And there is the answer to our energy problems in the not too distance future. (PS-D-11)

Comment: But I once thought that the hydrogen car was going to be the successor. Now I find out that yes, the hydrogen car leaks at the back end only water, marvelous. What we are not being told is the front end, that you need massive electricity to crack the water and make it into hydrogen so you've got fuel cells. (PS-D-8)

Comment: So there are at least six nuclear plants that are in process, some of them simply were started and not completed earlier. I think the Watts in the TVA [Tennessee Valley Authority] system is one of them. And there are others that are being worked up to provide the

extensive amount of electric power needed to make a hydrogen H. So watch it when you talk hydrogen. (PS-D-9)

Comment: I would strongly suggest that you get a chance to listen to Amory Lovens. He has been talking best power energy solutions for years now. One of the last times I heard him personally was talking to the manufactures association over in Lansing. Another time was up at a renewable resources pageant up in Treavor City. (PS-D-10)

Response: *The GEIS includes an extensive discussion of alternative energy sources. Environmental impacts associated with various reasonable alternatives to renewal of the OL for Palisades will be discussed in Chapter 8 of the SEIS.*

Comment: And, I would like to point out in terms of renewables, the job potential. Tremendous job potential. A lot was said about jobs. There's a recent report that the NRC reviewers need to include in this review which is by Amory Lovens of the Rocky Mountain Institute, where he points out that renewables already are leaving nuclear power in the dust in terms of marketplace reality. And, another report by the U.S. Public Research Group shows that hundreds of thousands of jobs could be created through renewables like wind and solar and efficiency measures. And, that could, the Kyoto, the Kyoto global warming quotas could be met in the United States with nuclear power being rolled back 50 percent, we could still meet the Kyoto standards in this country. And so, nuclear power is not the solution to global warming. It would cost too much. It would take too long to build new reactors. (PS-Q-11)

Response: *The socioeconomic impacts associated with reasonable alternatives to renewal of the OL for Palisades will be discussed in Chapter 8 of the SEIS.*

Appendix B

Contributors to the Supplement

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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, Argonne National Laboratory, and Lawrence Livermore National Laboratory.

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(a) Argonne National Laboratory is operated for the U.S. Department of Energy by the University of Chicago.
(b) Lawrence Livermore National Laboratory is operated for the U.S. Department of Energy by the University of California.

Appendix C

Chronology of NRC Staff Environmental Review Correspondence Related to the Nuclear Management Company, LLC Application for License Renewal of Palisades Nuclear Plant

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This appendix contains a chronological listing of correspondence between the U.S. Nuclear Regulatory Commission (NRC) and Nuclear Management Company, LLC (NMC) and other correspondence related to the NRC staff's environmental review, under Title 10, Part 51, of the *Code of Federal Regulations* (10 CFR Part 51), of NMC's application for renewal of the Palisades Nuclear Plant 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, Maryland, 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 Document 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 numbers for each document are included below.

March 22, 2005	Palisades, Applicant's Environmental Report – Operating License Renewal Stage (Accession No. ML050940449)
March 22, 2005	Letter from NMC to NRC, forwarding the application for renewal of operating license for Palisades Nuclear Plant, requesting extension of operating license for an additional 20 years (Accession No. ML050940434)
April 6, 2005	Letter from NRC to NMC, "Receipt and Availability of the License Renewal Application for the Palisades Nuclear Plant" (Accession No. ML050960344)
April 7, 2005	E-mail from Britta Johnson, NMC, regarding Fish and Wildlife Services (FWS) correspondence (Accession No. ML051430125)
April 7, 2005	E-mail from Britta Johnson, NMC, regarding State of Michigan Department of History, Arts, and Libraries (Accession No. ML051430130)

April 8, 2005	Letter from NRC to Ms. Lois Bemis, South Haven Memorial Library, regarding Maintenance of Reference Material at the South Haven Memorial Library at the Palisades Nuclear Plant, License Renewal Application (Accession No. ML051100210)
April 12, 2005	*Federal Register* Notice of Receipt and Availability Regarding the Renewal of Facility Operating License No. DPR-20 for an Additional 20-Year Period (70 FR 19104)
April 26, 2005	Letter from the Honorable Fred Upton, United States House of Representatives, to NRC offering support for Palisades Nuclear Plant license renewal (Accession No. ML051220248)
June 2, 2005	Letter from NRC to NMC transmitting, 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 the Palisades Nuclear Plant (Accession No. ML051530122)
June 8, 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-20 for an Additional 20-Year Period (70 FR 33533)
June 20, 2005	Letter from NRC to NMC, forwarding *Federal Register* Notice of Intent to Prepare an Environmental Impact Statement and Conduct Scoping Process for License Renewal for the Palisades Nuclear Plant (Accession No. ML051710509)
June 27, 2005	Submittal from Kevin Kamps, providing comments regarding Palisades Nuclear Plant license renewal application (Accession No. ML052420502)
June 30, 2005	Letter from NRC to Mr. Craig Czarnecki, FWS, Michigan Field Office, "Request for List of Protected Species Within the Area Under Evaluation for the Palisades Nuclear Plant License Renewal" (Accession No. ML051820473)
June 30, 2005	Letter from NRC to Mr. Brian Conway, Michigan State Historic Preservation Office (SHPO), "Palisades Nuclear Plant License Renewal Review" (Accession No. ML051860359)

June 30, 2005	Letter from NRC to Mr. Don Klima, Director, Office of Federal Agency Programs, Advisory Council on Historic Preservation, "Palisades Nuclear Plant License Renewal Review" (Accession No. ML051870009)
June 30, 2005	Letter from NRC to Mr. Gary L. Randall, Clerk of House, Michigan House of Representatives, "Acknowledgment of Receipt of Your Letter on the Applications for Renewal of the Operating Licenses for Palisades Nuclear Plant and Donald C. Cook, Units 1 and 2, Nuclear Plant" (Accession No. ML051820578)
July 7, 2005	Letter to Mr. Daniel J. Malone, Site Vice President, Palisades Nuclear Plant, from the NRC, "Project Manager Change for the License Renewal Environmental Review for Palisades Nuclear Plant" (Accession No. ML051890081)
July 8, 2005	NRC meeting notice announcing public meeting in South Haven, Michigan, on October 18, 2005, to discuss the environmental scoping process for the application for the license renewal of Palisades (Accession No. ML051920383)
July 13, 2005	Letter from NRC to the Honorable John. A. Barrett, Chairperson, Citizen Potawatomi Nation, Oklahoma, "Request for Comments Concerning Palisades Nuclear Plant Application for Operating License Renewal" (Accession No. ML051960002)
July 13, 2005	Letter from NRC to the Honorable Kenneth Meshigaud, Chairperson, Hannahville Indian Community Council, "Request for Comments Concerning Palisades Nuclear Plant Application for Operating License Renewal" (Accession No. ML051950435)
July 13, 2005	Letter from NRC to the Honorable Robert Kewaygoshkum, Chairperson, Grand Traverse Band of Ottawa and Chippewa Indians, "Request for Comments Concerning Palisades Nuclear Plant Application for Operating License Renewal" (Accession No. ML051950495)
July 13, 2005	Letter from NRC to the Honorable Laura Spurr, Chairperson, Nottawaseppi Huron Pottawatomi, "Request for Comments Concerning Palisades Nuclear Plant Application for Operating License Renewal" (Accession No. ML051950614)

July 13, 2005	Letter from NRC to the Honorable Lee Sprague, Ogema, Little River Band of Ottawa Indians, "Request for Comments Concerning Palisades Nuclear Plant Application for Operating License Renewal" (Accession No. ML051960069)
July 13, 2005	Letter from NRC to the Honorable Frank Ettawageshik, President, Little Traverse Bay Bands of Odawa Indians, "Request for Comments Concerning Palisades Nuclear Plant Application for Operating License Renewal" (Accession No. ML051950574)
July 13, 2005	Letter from NRC to the Honorable David K. Sprague, Chairperson, Match-E-Be-Nash-She-Wish Band of Pottawatomi Indians, "Request for Comments Concerning Palisades Nuclear Plant Application for Operating License Renewal" (Accession No. ML051950602)
July 13, 2005	Letter from NRC to the Honorable Floyd E. Leonard, Chief, Miami Tribe of Oklahoma, "Request for Comments Concerning Palisades Nuclear Plant Application for Operating License Renewal" (Accession No. ML051960027)
July 13, 2005	Letter from NRC to the Honorable Charles Todd, Chief, Ottawa Tribe of Oklahoma, "Request for Comments Concerning Palisades Nuclear Plant Application for Operating License Renewal" (Accession No. ML051960011)
July 13, 2005	Letter from NRC to the Honorable John Miller, Chairperson, Pokagon Band of Potawatomi Indians of Michigan, "Request for Comments Concerning Palisades Nuclear Plant Application for Operating License Renewal" (Accession No. ML051960173)
July 13, 2005	Letter from NRC to the Honorable Audrey Falcon, Chief, Saginaw Chippewa Indian Tribe of Michigan, "Request for Comments Concerning Palisades Nuclear Plant Application for Operating License Renewal" (Accession No. ML051960103)
July 15, 2005	Letter from Ms. Tonya Schuitmaker, Michigan House of Representatives, providing comments regarding Palisades Nuclear Plant license renewal application (Accession No. ML052420495)
July 28, 2005	Submittal from Kenneth Richards, providing comments regarding Palisades Nuclear Plant license renewal application (Accession No. ML052420501)

July 28, 2005	Letter from Nancy Ann Whaley, Supervisor, Geneva Township, providing comments regarding Palisades Nuclear Plant license renewal application (Accession No. ML052420497)
July 29, 2005	Letter to NRC from Mr. Craig Czarnecki, FWS, Michigan Field Office, "Endangered Species List Request, Proposed Palisades Nuclear Plant (Palisades) License Renewal Project, Allegan, Berrien, Kalamazoo, and Van Buren Counties, Michigan" (Accession No. ML052650168)
August 18, 2005	Letter from Wayne Rendell, Supervisor, Covert Township, providing comments regarding Palisades Nuclear Plant license renewal application (Accession No. ML052420503)
August 19, 2005	Letter to NRC from Grant Smith, Cyndi Roper, Michael Keegan, Alice Hirt, James Clift, Chuck Gordon, Maynard Kaufman, David Kraft, Keith Gunter, Kevin Kamps, Mike Shriberg, and Thomas Leonard,"Request for Extension for Comment Period on NRC's Environmental Reviews of the Palisades Nuclear Power Plant" (Accession No. ML052380421)
August 20, 2005	Letter from Swami Tapasanarda, providing comments regarding Palisades Nuclear Plant license renewal application (Accession No. ML052420506)
August 20, 2005	Letter from Kathy Barnes, providing comments regarding Palisades Nuclear Plant license renewal application (Accession No. ML052510393)
August 22, 2005	Letter from Murielle and John Clark, providing comments regarding Palisades Nuclear Plant license renewal application (Accession No. ML052510389)
August 22, 2005	Letter from Kevin Kamps, Nuclear Information and Resource Service, providing comments regarding Palisades Nuclear Plant license renewal application (Accession No. ML052510468)
August 22, 2005	Letter from Gary Karch, providing comments regarding Palisades Nuclear Plant license renewal application (Accession No. ML052510391)

August 24, 2005	Letter to NMC from NRC, "Request for Additional Information (RAI) Regarding Severe Accident Mitigation Alternatives (SAMAs) for the Palisades Nuclear Plant" (Accession No. ML052370327)
September 7, 2005	Letter from NRC to Mr. Kevin Kamps, Nuclear Information and Resource Service, "Response to Request for Extension of Environmental Scoping Comment Period Regarding the Palisades Nuclear Plant License Renewal" (Accession No. ML052410029)
September 21, 2005	Summary of Public Scoping Meetings to Support Review of Palisades Nuclear Plant License Renewal Application (Accession No. ML052630426)
October 12, 2005	Letter from NRC to Dr. David R. Wade, Director, Michigan Department of Community Health, Division of Environmental & Occupational Epidemiology, "Request for Information on Cancer Incidence Within the Area under Evaluation for the Palisades Nuclear Plant License Renewal" (Accession No. ML052900205)
October 18, 2005	Letter from NMC to NRC, "Palisades Nuclear Plant, Response to Supplemental Questions Concerning Radioactive Solid Waste Management" (Accession No. ML053470428)
November 18, 2005	Letter from NMC to NRC, Supplement to "Response to NRC Request for Additional Information dated August 24, 2005, dated October 21, 2005, and telecon on November 10, 2005" (Accession No. ML053470426)
January 24, 2006	Email from J. Holthaus, Environmental, NMC, Covert, Michigan to B. Pham, NRC, Rockville, Maryland, with attachments. Subject: "Palisades Cultural Resources Procedures." Attachment 1: "Archeological, Cultural and Historic Resources," FP-RP-ENV-01; Attachment 2: "Palisades Cultural Resources," LM-330. (ML060240597)

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.

Citizen Potawatomi Nation, Shawnee, Oklahoma.

City of South Haven Water Filtration Plant.

Covert Township, Covert, Michigan.

Grand Traverse Band of Ottawa and Chippewa Indians, Suttons Bay, Michigan.

Hannahville Indian Community Council, Wilson, Michigan.

Little River Band of Ottawa Indians, Manistee, Michigan.

Little Traverse Bay Bands of Odawa Indians, Harbor Springs, Michigan.

Match-E-Be-Nash-She-Wish Band of Potawatomi Indians, Dorr, Michigan.

Miami Tribe of Oklahoma, Miami, Oklahoma.

Michigan Department of Community Health, Lansing, Michigan.

Michigan Department of Environmental Quality, Kalamazoo, Michigan.

Michigan Department of Environmental Quality, Lansing, Michigan.

Michigan Economic Development Corporation, Lansing, Michigan.

Michigan State Historic Preservation Office, Lansing, Michigan.

Nottawaseppi Huron Potawatomi, Fulton, Michigan.

Ottawa Tribe of Oklahoma, Miami, Oklahoma.

Pokagon Band of Potawatomi Indians of Michigan, Dowagiac, Michigan.

Saginaw Chippewa Indian Tribe of Michigan, Mt. Pleasant, Michigan.

U.S. Fish and Wildlife Service, East Lansing, Michigan.

Van Buren-Cass Counties Health Department.

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 Palisades Nuclear Plant (Palisades) 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 Palisades are listed in Table E-2.

Table E-1. Consultation Correspondence

Source	Recipient	Date of Letter
U.S. Nuclear Regulatory Commission (P.T. Kuo)	Michigan State Historic Preservation Office (B. Conway)	June 30, 2005
U.S. Nuclear Regulatory Commission (P.T. Kuo)	U.S. Fish and Wildlife Service (C. Czarnecki)	June 30, 2005
U.S. Nuclear Regulatory Commission (P.T. Kuo)	Advisory Council on Historic Preservation (D. Klima)	June 30, 2005
U.S. Nuclear Regulatory Commission (P.T. Kuo)	Citizen Potawatomi Nation (J. Barrett)	July 13, 2005[a]
U.S. Fish and Wildlife Service (C. Czarnecki)	U.S. Nuclear Regulatory Commission (P. T. Kuo)	July 29, 2005

(a) Similar letters were sent to 10 additional Native American Tribes listed in Appendix C.

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

Agency	Authority	Description	Number	Issue Date	Expiration Date	Remarks
NRC	10 CFR Part 50	Operating license, Palisades Nuclear Plant	DPR-20	03/24/71	03/24/11	Authorizes operation of Palisades Nuclear Plant
FWS	Section 7 of the Endangered Species Act (16 USC 1536)	Consultation	–	–	–	Requires a Federal agency to consult with the FWS regarding whether a proposed action will affect endangered or threatened species
MDEQ	Clean Water Act, Section 402 (33 USC Section 1251 et seq.), Michigan Act 451. Public Acts of 1994, as amended, Parts 31 and 41, et. al.; Michigan Executive Orders 1991-31, 1995-4, and 1995-18.	NPDES permit	M10001457	09/23/04	10/01/08	Discharge of wastewater and stormwater to Lake Michigan
MDEQ	Clean Air Act (42 USC 7401, et seq.); Michigan Act 451, Public Acts of 1994 (as amended), Part 55	Renewable Operating Permit (Air Quality)	200200005	02/04/03	02/04/08	Operation of Palisades air emission sources (evaporator heating boiler, plant heating boiler, feedwater purity boiler, emergency generators, cold cleaners).

Table E-2. (contd)

Agency	Authority	Description	Number	Issue Date	Expiration Date	Remarks
MDEQ	Michigan Act 207. Public Acts of 1941, as amended, Section 5; Michigan Executive Order 1998-2	Aboveground Storage Tank Registration	Facility No. 91084220 (Diesel Tanks No. 1 and 2)	Annual	Annual	Storage of flammable or combustible liquid (diesel fuel) in aboveground storage tanks
SCDHEC	South Carolina Radioactive Waste Transportation and Disposal Act (Act No. 429 of 1980.)	Radioactive Waste License for Delivery	0006-21-04	01/06/04	12/31/04 Renewed Annually	Shipment of radioactive material to a licensed disposal/processing facility within the State of South Carolina
TDEC	Tennessee Code Annotated 68-202-206	Radioactive Waste License for Delivery	T-M 1003-L04	01/01/04	12/31/04	Shipment of radioactive material to a licensed disposal/processing facility within the State of Tennessee

– = A consultation is not given an identifying number and does not have an issue or expiration date.
CFR = Code of Federal Regulations
FWS = U.S. Fish and Wildlife Service
MDEQ = Michigan Department of Environmental Quality
NPDES = National Pollutant Discharge Elimination System
NRC = U.S. Nuclear Regulatory Commission
SCDHEC = South Carolina Department of Health and Environmental Control
TDEC = Tennessee Department of Environment and Conservation
USC = United States Code

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

June 30, 2005

Mr. Brian Conway
Michigan State Historic Preservation Office
Michigan Historical Center
PO Box 30740
717 West Allegan Street
Lansing, MI 48909

SUBJECT: PALISADES NUCLEAR PLANT LICENSE RENEWAL REVIEW

Dear Mr. Conway:

The U.S. Nuclear Regulatory Commission (NRC) staff is reviewing an application to renew the operating license for Palisades Nuclear Plant (Palisades), which is located in Covert Township on the western side of Van Buren County, Michigan. Palisades is operated by Nuclear Management Company, LLC (NMC). The application for renewal was submitted by NMC on March 31, 2005, pursuant to 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 rules that implement 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.

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.

B. Conway - 2 -

On July 28, 2005, the NRC will conduct two public NEPA scoping meetings at the Lake Michigan College, 125 Veterans Boulevard, South Haven, Michigan 49090. 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 Mr. Robert Schaaf, Senior Environmental Project Manager, by phone at 301-415-1312 or by email at rgs@nrc.gov, or Ms. Cristina Guerrero, Project Support, by phone at 301-415-2981 or by e-mail at cxg3@nrc.gov.

Sincerely,

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

Docket No.: 50-255

cc: See next page

Palisades Nuclear Plant

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Hazardous Waste and Radiological Protection Section
Nuclear Facilities Unit
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Director, Plant Life Cycle Issues
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Michigan Department of Attorney General

Palisades Nuclear Plant

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Ms. Lois Bemis
South Haven Memorial Library
314 Broadway St.
South Haven, MI 49090

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

June 30, 2005

Mr. Craig Czarnecki
Field Supervisor
U.S. Fish and Wildlife Service
East Lansing Field Office
2651 Coolidge Road, Suite 101
East Lansing, MI 48823

SUBJECT: REQUEST FOR LIST OF PROTECTED SPECIES WITHIN THE AREA UNDER EVALUATION FOR THE PALISADES NUCLEAR PLANT LICENSE RENEWAL

Dear Mr. Czarnecki:

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 Palisades Nuclear Plant (Palisades). Palisades is located in Covert Township on the western side of Van Buren County, Michigan, and 50 miles west-southwest of Kalamazoo, Michigan. As part of the 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 include 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.

The proposed action would include the use and continued maintenance of existing plant facilities and transmission lines and would not result in new construction or disturbance or change in operations. The area surrounding the Palisades property is characterized by agricultural lands and heavily wooded, rugged sand dunes along the Lake Michigan shoreline. Van Buren State Park is located on the northern border of the site.

Palisades uses an closed-cycle cooling system to dissipate waste heat to the environment. Cooling water is drawn from Lake Michigan through offshore, underwater intake cribs at an approximate water depth of 35 ft. After circulating through the condensers and cooling towers, the cooling water is discharged through two tunnels that end offshore with high-velocity underwater discharge elbows.

For the specific purpose of connecting Palisades to the regional transmission system, there is a Palisades-Argenta 345-kV line, which extends approximately 40 miles eastward from the Palisades Substation to the Argenta Substation near Plainwell, north of Kalamazoo, Michigan, and the initial 0.6 mile segment of the Palisades-Cook 345-kV line, transmission line corridors occupy approximately 2200 acres of land. These transmission line corridors are being evaluated as part of the SEIS process. The corridors pass through land that is primarily agricultural and forest land. The enclosed transmission line map shows the transmission

system that is being evaluated in the SEIS. The switchyards are shown in the enclosed Palisades site layout figure.

To support the SEIS 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 Palisades and its associated transmission lines. In addition, please provide any information you consider appropriate under the provisions of the Fish and Wildlife Coordination Act.

We plan to hold two public NEPA scoping meetings on July 28, 2005, at the Lake Michigan College, 125 Veterans Boulevard, South Haven, Michigan 49090. On July 26, 2005, we plan to conduct a site audit. 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 the NRC staff review of this license renewal application, please contact Mr. Robert Schaaf, Senior Environmental Project Manager, at 301-415-1312 or by e-mail at rgs@nrc.gov or Ms. Cristina Guerrero, Project Support, at 301-415-2981 or by e-mail at cxg3@nrc.gov.

Sincerely,

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

Docket No.: 50-255

Enclosures: 1. Palisades Transmission Line Map
2. Palisades Site Layout

cc w/encls.: See next page

Palisades Nuclear Plant

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FIGURE 3.1-1
TRANSMISSION LINES

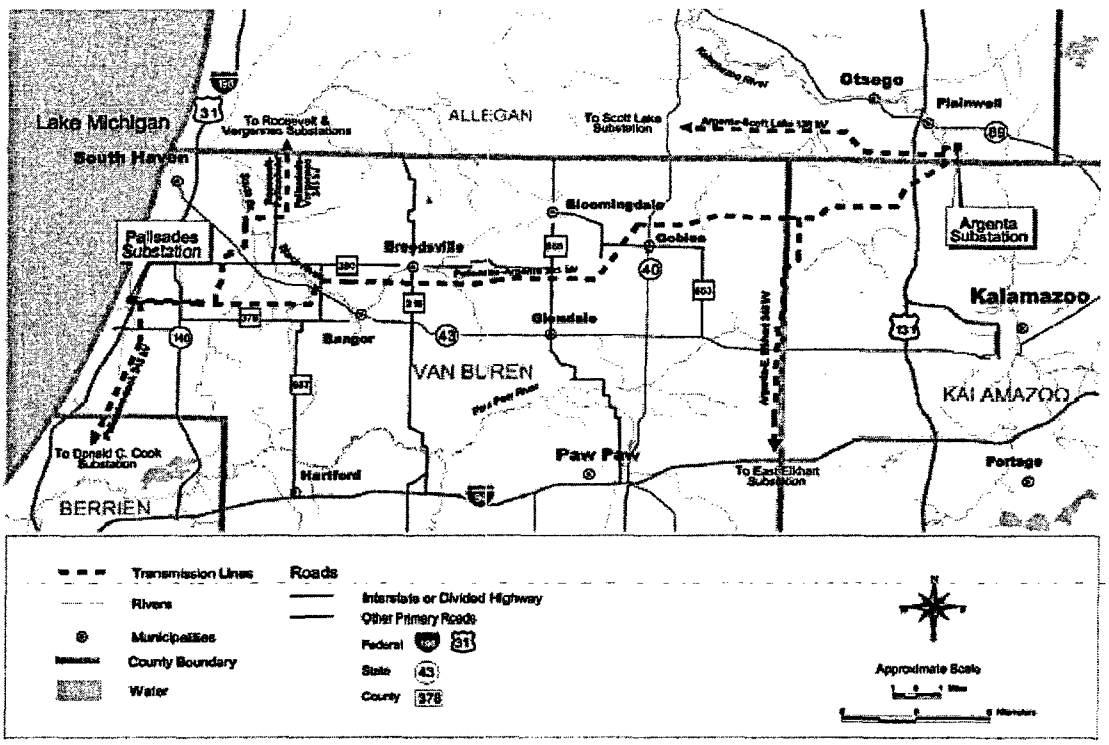
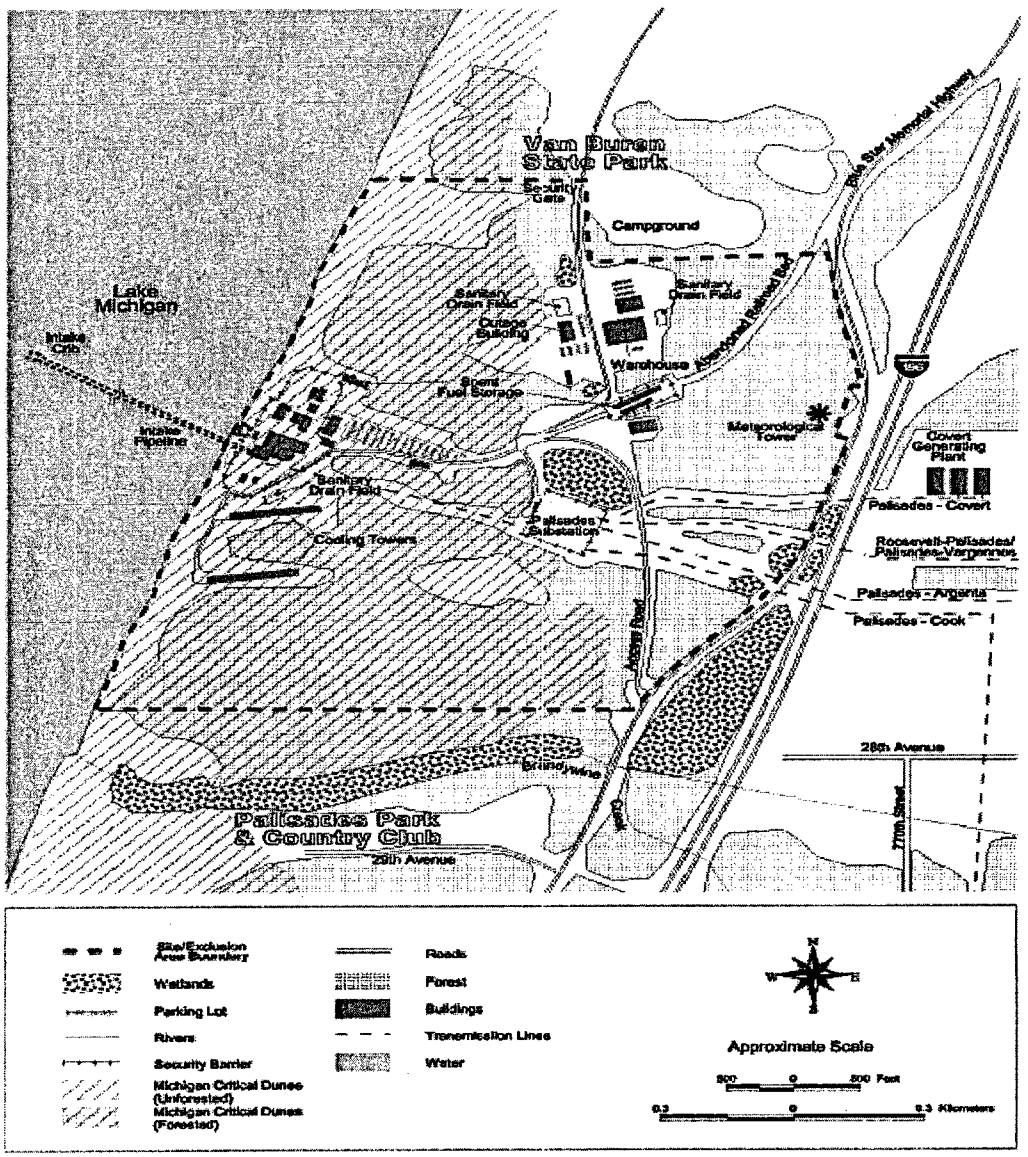


FIGURE 2.1-3
SITE MAP



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

June 30, 2005

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

SUBJECT: PALISADES NUCLEAR PLANT LICENSE RENEWAL REVIEW

Dear Mr. Klima:

The U.S. Nuclear Regulatory Commission (NRC) staff is reviewing an application to renew the operating licenses for the Palisades Nuclear Plant (Palisades), which is located in Covert Township on the western side of Van Buren County, Michigan. Palisades is operated by the Nuclear Management Company, LLC (NMC). The application for renewal was submitted by NMC on March 31, 2005, pursuant to 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 request, 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, which 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 Mr. Robert Schaaf, Senior Environmental Project Manager, by phone at 301-415-1312 or by email at rgs@nrc.gov, or Ms. Cristina Guerrero, Project Support, by phone at 301-415-2981 or by e-mail at cxg3@nrc.gov.

Sincerely,

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

Docket No.: 50-255

cc: See next page

Palisades Nuclear Plant

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Director, Plant Life Cycle Issues
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Jonathan Rogoff, Esquire
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UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

July 13, 2005

The Honorable John A. Barrett, Jr., Chairperson
Citizen Potawatomi Nation
1601 South Gordon Cooper Drive
Shawnee, OK 74801

SUBJECT: REQUEST FOR COMMENTS CONCERNING PALISADES NUCLEAR PLANT APPLICATION FOR OPERATING LICENSE RENEWAL

Dear Chairperson Barrett:

The U.S. Nuclear Regulatory Commission (NRC) is seeking input for its environmental review of an application from the Nuclear Management Company, LLC (NMC) to renew the operating licenses for the Palisades Nuclear Plant (Palisades), located in Covert Township on the western side of Van Buren County, Michigan. Palisades is in close proximity to lands that may be of interest to the Citizen Potawatomi Nation. As described below, the NRC process includes an opportunity for public and inter-governmental participation in the environmental review. We want to ensure that you are aware of our efforts and, pursuant to Title 10 of the *Code of Federal Regulations* Part 51.28(b) (10 CFR 51.28(b)), the NRC invites the Citizen Potawatomi Nation to provide input to the scoping process relating to the NRC's environmental review of the application. In addition, as outlined in 36 CFR 800.8, the NRC plans to coordinate compliance with Section 106 of the National Historic Preservation Act of 1966 through the requirements of the National Environmental Policy Act of 1969.

Under NRC regulations, the original operating license for a nuclear power plant is issued for up to 40 years. The license may be renewed for up to an additional 20 years if NRC requirements are met. The current operating license for Palisades will expire in March 2011. NMC submitted its application for renewal of the Palisades operating license on March 31, 2005.

The NRC is gathering information for a Palisades-specific supplement to its "Generic Environmental Impact Statement for License Renewal of Nuclear Plants" (GEIS), NUREG-1437. The supplement will contain the results of the review of the environmental impacts on the area surrounding the Palisades site that are related to terrestrial ecology, aquatic ecology, hydrology, cultural resources, and socioeconomic issues (among others) and will contain a recommendation regarding the environmental acceptability of the license renewal action. Provided for your information is the Palisades Site Layout (Enclosure 1) and Transmission Line Map (Enclosure 2).

The NRC will hold two public scoping meetings for the Palisades license renewal supplement to the GEIS on July 28, 2005, at the Lake Michigan College, 125 Veterans Boulevard, South Haven, Michigan 49090. There will be two sessions to accommodate interested parties. The first session will convene at 1:30 p.m. and will continue until 4:30 p.m., as necessary. The second session will convene at 7:00 p.m., with a repeat of the overview portions of the meeting, and will continue until 10:00 p.m., as necessary. Additionally, the NRC staff will host informal discussions one hour before the start of each session. To be considered, comments must be provided either at the transcribed public meetings or in writing. No formal comments on the proposed scope of the supplement to the GEIS will be accepted during informal discussions.

The application is electronically available for inspection from the NRC's Agencywide Documents Access and Management System (ADAMS) under Accession Number ML050940449. ADAMS is accessible at http://www.nrc.gov/reading-rm/adams.html. If you do not have access to ADAMS or if there are problems in accessing the documents located in ADAMS, contact the NRC's Public Document Room (PDR) Reference staff at 1-800-397-4209, 1-301-415-4737, or by e-mail at pdr@nrc.gov. In addition, the application can be viewed on the Internet at http://www.nrc.gov/reactors/operating/licensing/renewal/applications.html.

A paper copy of the application can be viewed at the NRC's PDR, located at One White Flint North, 11555 Rockville Pike (first floor), Rockville, Maryland, 20855-2738. Copies will also be available at the South Haven Memorial Library, 314 Broadway St, South Haven, MI 49090. The GEIS, which assesses the scope and impact of environmental effects that would be associated with license renewal at any nuclear power plant site, can also be found on the NRC's Web site or at the NRC's PDR.

Please submit any written comments that the Citizen Potawatomi Nation may have to offer on the scope of the environmental review by August 22, 2005. Comments should be submitted by mail to the Chief, Rules and Directives Branch, Division of Administrative Services, Mail Stop T-6D59, U.S. Nuclear Regulatory Commission, Washington, D.C., 20555-0001. At the conclusion of the scoping process, the NRC staff will prepare a summary of the significant issues identified and the conclusions reached and will mail a copy to you.

The NRC will issue the draft supplemental environmental impact statement (SEIS) for public comment (anticipated publication date, February 2006), and will hold another set of public meetings in the site vicinity to solicit comments on the draft. A copy of the draft SEIS will be sent to you for your review and comment. After consideration of public comments received on the draft, the NRC will prepare a final SEIS. The issuance of the final SEIS for Palisades is planned for October 2006. If you need additional information regarding the environmental review process, please contact Mr. Robert Schaaf, Senior Environmental Project Manager, at 301-415-1312 or by e-mail at rgs@nrc.gov, or Ms. Cristina Guerrero, Project Support, at 301-415-2981 or by e-mail at cxg3@nrc.gov.

Sincerely,

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

Docket No.: 50-255

Enclosures: 1. Palisades Site Layout
2. Palisades Transmission Line Map

cc w/encls.: See next page

Palisades Nuclear Plant

cc:

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Ms. Lois Bemis
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South Haven, MI 49090

FIGURE 2.1-3
SITE MAP

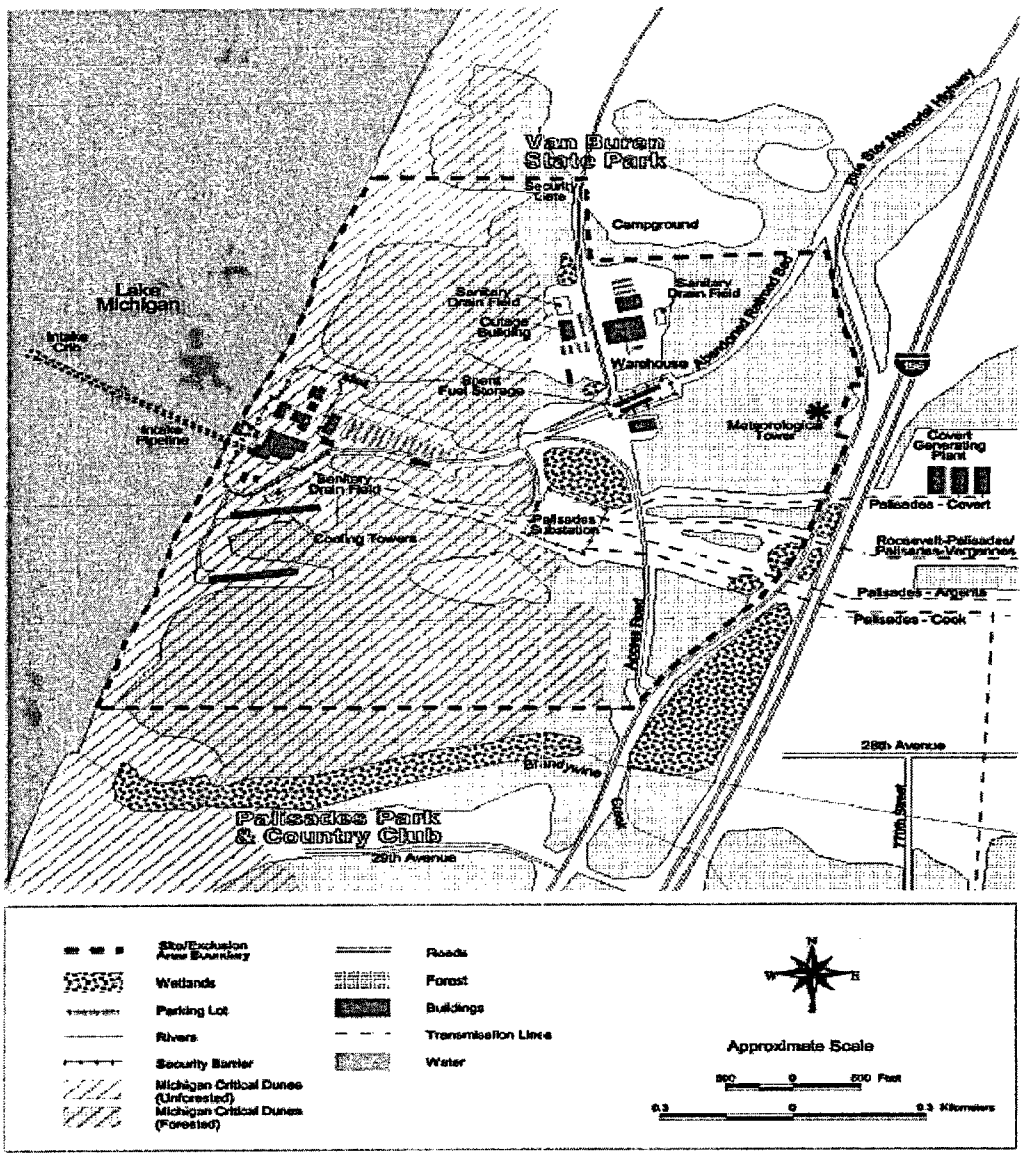


FIGURE 3.1-1
TRANSMISSION LINES

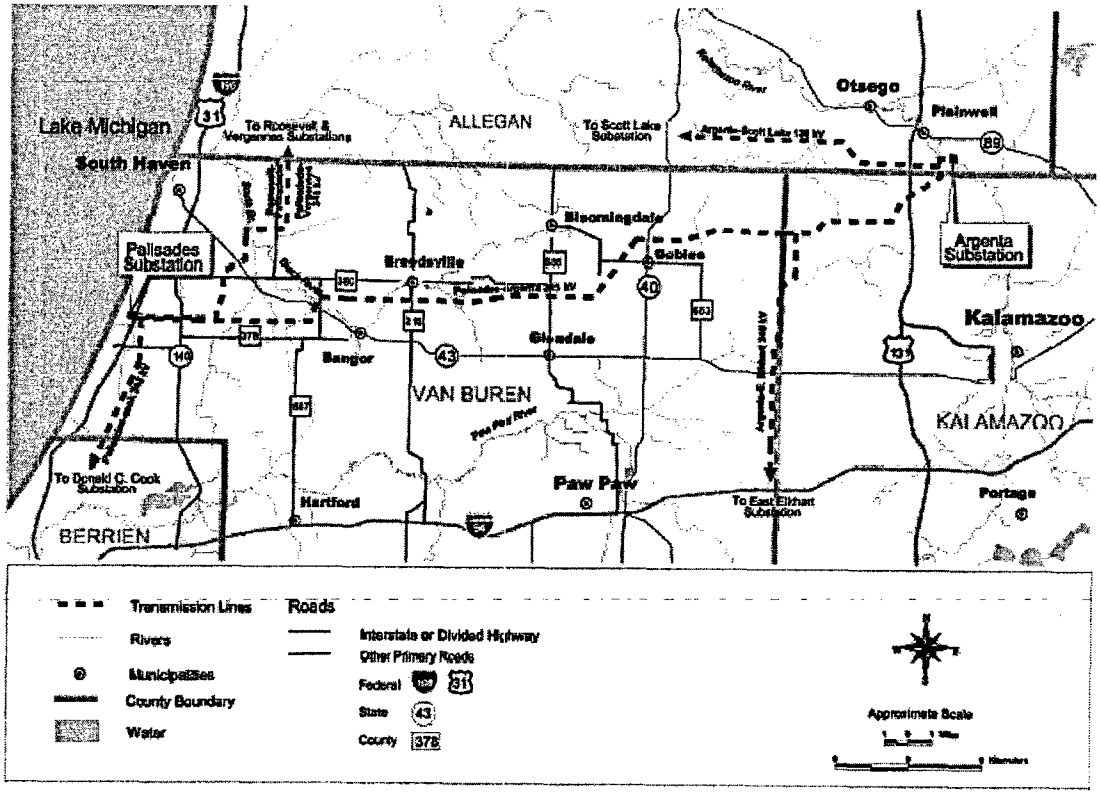
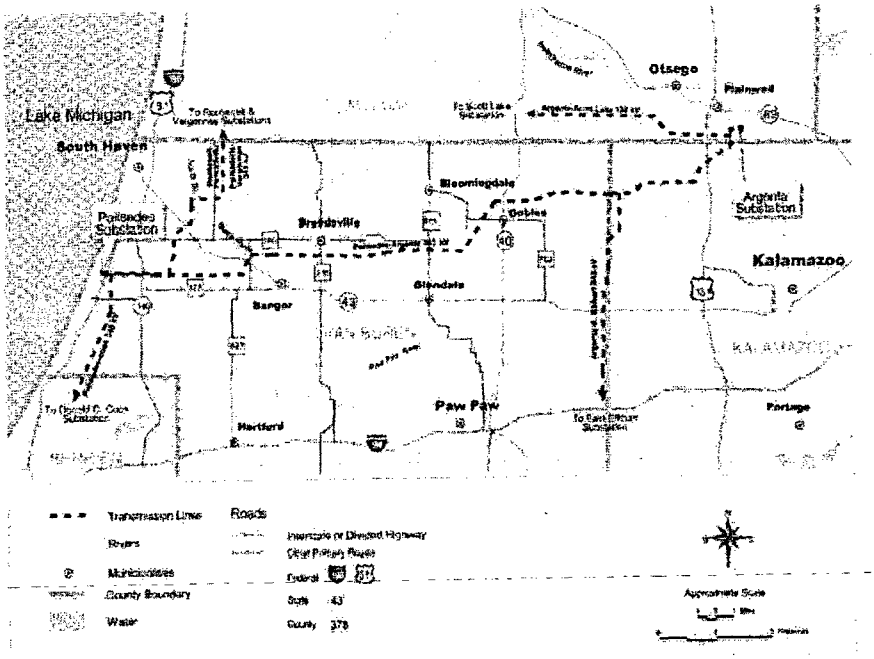


FIGURE 3.1-1
TRANSMISSION LINES



Enclosure 2

United States Department of the Interior

FISH AND WILDLIFE SERVICE
East Lansing Field Office (ES)
2651 Coolidge Road, Suite 101
East Lansing, Michigan 48823-6316

IN REPLY REFER TO:

July 29, 2005

Mr. Pao-Tsin Kuo, Program Director
License Renewal and Environmental Impacts Program
Division of Regulatory Improvement Programs
Office of Nuclear Reactor Regulation
One White Flint North
11555 Rockville Pike
Rockville, Maryland 20852-2738

Re: Endangered Species List Request, Proposed Palisades Nuclear Plant (Palisades) License Renewal Project, Allegan, Berrien, Kalamazoo, and Van Buren Counties, Michigan

Dear Mr. Kuo:

Thank you for your June 30, 2005 request for information regarding federally listed and proposed threatened and endangered species, candidate species, or critical habitat near your proposed project. Your request and this response are made pursuant to section 7 of the Endangered Species Act of 1973, as amended (Act).

Based on your proposed project area and surrounding landscape, the possibility exists for the endangered Indiana bat (*Myotis sodalis*) to occur within suitable habitat near Palisades and its transmission lines. The summer range of Indiana bats in Michigan includes the southern half and most of the western coastal counties of the Lower Peninsula. Suitable Indiana bat habitat typically consists of highly variable forested landscapes in riparian, bottomland, and upland areas, and is composed of roosting trees with crevices or exfoliating bark.

Our records also indicate the following endangered species: Karner blue butterfly (*Lycaeides melissa samuelis*) and Mitchell's satyr butterfly (*Neonympha mitchelli mitchelli*), and threatened Pitcher's thistle (*Cirsium pitcheri*) may occur near Palisades or its associated transmission lines. The Karner blue butterfly may occur near the Argenta-E. Elkhart transmission line in Van Buren County; Mitchell's satyr butterfly may occur near the Palisades-Cook transmission line in Berrien County; and Pitcher's thistle may occur near the Palisades Substation in Van Buren County.

Karner blue butterfly is dependent on wild lupine (*Lupinus perennis*); it's only known larval food plant, grasses and nectar plants. These plants and its habitat occur in remnant barrens and oak savanna ecosystems, as well as other locations such as highway and powerline rights-of-way, gaps within forest stands, young forest stands, forest roads and trails, airports, and military bases. Mitchell's satyr butterflies

A035
C001

rely on wetland habitats characterized as fen communities, which are dominated by sedges (usually *Carex stricta*), with scattered deciduous and/or coniferous trees, most often tamarack, and red cedar. The Pitcher's thistle is endemic to the non-forested dunes of the western Great Lakes and requires active sand dune processes to maintain its early successional habitat. It is a perennial, herbaceous plant, which flowers once in its lifetime, generally after a five to eight year juvenile stage, after which it dies.

You should assess potential effects of future projects on these species. If you determine that implementation of any projects may affect these species, we recommend you conduct the appropriate habitat and species surveys to determine with certainty whether and where these species occur in relation to your project. The individual performing the survey must possess a current U. S. Fish & Wildlife Service permit specific to the surveyed species and use approved survey techniques. Depending on your assessment, the preparation of a biological assessment may be necessary to determine the potential effects, both direct and indirect, of any proposed action upon listed species or critical habitat, and initiate informal consultation with this office.

Please see Enclosure B for a discussion of the responsibilities of federal agencies under the Act and the conditions that require preparation of a biological assessment by the lead federal agency or its designee. We have provided information concerning the distribution, life history, and habitat requirements of the Indiana bat. This information may help you prepare a biological assessment for this project, should it require one. Additional species information may be located at the Michigan Natural Features Inventory website, http://web4.msue.msu.edu/mnfi/pub/abstracts.cfm.

Our records also indicate that a candidate species, eastern massasauga rattlesnake (*Sistrurus catenatus catenatus*), may occur near Palisades and all its associated transmission lines. Eastern massasauga habitat is typically associated with open shallow wetland systems. The rattlesnake prefers habitat with open canopy and a sedge or grass ground cover. If early evaluation of your project indicates that it is likely to adversely impact a candidate, your agency may request technical assistance from this office. While the Act does not extend protection to candidate species, we encourage their consideration in resource planning. Avoidance of unnecessary impacts to candidate species will reduce the likelihood that they will require the protection of the Act in the future.

Section 7 of the Act requires federal agencies, or their designees, to consider impacts to federally listed threatened and endangered species for all federally funded, constructed, permitted, or licensed projects. Should the federal action agency determine that a listed species may be affected (adversely or beneficially) by the project, the action agency should request section 7 consultation with this office. Even if the determination is a "no effect", we would appreciate receiving a copy for our records. We are available to discuss the proposed action and assist you in analyzing potential effects of the action on the species.

Section 7(d) of the Act underscores the requirement that federal agencies or their designees shall not make any irreversible or irretrievable commitment of resources during the consultation period, which in effect would deny the formulation or implementation of reasonable alternatives regarding their actions on any endangered or threatened species. Therefore, in order to comply with the Act, we advise you not to finalize any construction plans until you assure protection of the species and conclude any requisite section 7 consultation with this office.

Since endangered species data changes continuously, we recommend you contact this office for an updated species list if more than six months passes prior to issuance of a permit for proposed activities. In addition, if the project requires modifications or new information becomes available that indicates the presence of listed species or species proposed for listing, or their critical habitat, you should consult with this office.

The Michigan Department of Natural Resources (MDNR) protects endangered and threatened species through Part 365, Endangered Species Protection, of the Natural Resources and Environmental Protection Act, 1994, P.A. 451. For a preliminary check of your project areas for any State natural resources issues, please refer to the MDNR Endangered Species Assessment website located at www.michigan.gov. Click on Online Services then scroll down to Business Online Services and select Endangered Species Assessment. Upon completing the website search, contact the Endangered Species Coordinator of the MDNR at (517) 373-3337 for information regarding the protection of threatened and endangered species under state law. State law requires a permit in advance of any work that could potentially damage, destroy, or displace state listed species.

The opportunity to provide comments is appreciated. Any questions should be directed to Burr Fisher of this office at 517/351-8286 or burr_fisher@fws.gov.

Sincerely,

Michael E. DeCapita

for Craig A. Czarnecki
Field Supervisor

Enclosures (2)

cc: MDNR, Wildlife Division, Lansing, MI (Attn: Todd Hogrefe) w/o enclosures
Kirk LaGory, Argonne National Laboratory, Argonne, IL w/o enclosures

g: admin/archives/july05/Consumers-PalisadesNuclearRelicense.bdf.doc

Appendix F

GEIS Environmental Issues Not Applicable to Palisades Nuclear Plant

Appendix F

GEIS Environmental Issues Not Applicable to Palisades Nuclear Plant

Table F-1 lists those environmental issues listed in the *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS) (NRC 1996, 1999)[a] and Title 10 of the *Code of Federal Regulations* (CFR) Part 51, Subpart A, Appendix B, Table B-1, that are not applicable to Palisades Nuclear Plant (Palisades) because of plant or site characteristics.

Table F-1. GEIS Environmental Issues Not Applicable to Palisades

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)			
Impacts of refurbishment on surface-water quality	1	3.4.1	No refurbishment is planned at Palisades.
Impacts of refurbishment on surface-water use	1	3.4.1	No refurbishment is planned at Palisades.
Altered salinity gradients	1	4.2.1.2.2 4.4.2.2	The Palisades cooling system does not discharge to an estuary.
Water-use conflicts (plants with once-through cooling systems)	1	4.2.1.3	Palisades does not use a once-through cooling system.
Water-use conflicts (plants with cooling ponds or cooling towers using makeup water from a small river with low flow)	2	4.3.2.1 4.4.2.1	The Palisades cooling system does not use makeup water from a small river with low flow.

(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 F.1 (contd)

ISSUE–10 CFR Part 51, Subpart A, Appendix B, Table B-1	Category	GEIS Sections	Comment
AQUATIC ECOLOGY (FOR ALL PLANTS)			
Refurbishment	1	3.5	No refurbishment is planned at Palisades.
AQUATIC ECOLOGY (FOR PLANTS WITH ONCE-THROUGH AND COOLING POND HEAT DISSIPATION SYSTEMS)			
Entrainment of fish and shellfish in early life stages	2	4.2.2.1.2 4.4.3	This issue is related to heat-dissipation systems that are not installed at Palisades.
Impingement of fish and shellfish	2	4.2.2.1.3 4.4.3	This issue is related to heat-dissipation systems that are not installed at Palisades.
Heat shock	2	4.2.2.1.4 4.4.3	This issue is related to heat-dissipation systems that are not installed at Palisades.
GROUNDWATER USE AND QUALITY			
Impacts of refurbishment on groundwater use and quality	1	3.4.2	No refurbishment is planned at Palisades.
Groundwater-use conflicts (potable and service water, and dewatering; plants that use >100 gpm)	2	4.8.1.1 4.8.2.1	Palisades uses <100 gpm of groundwater.
Groundwater-use conflicts (plants using cooling towers withdrawing makeup water from a small river)	2	4.8.1.3 4.4.2.1	The Palisades cooling system does not use makeup water from a small river.

Table F.1 (contd)

	ISSUE–10 CFR Part 51, Subpart A, Appendix B, Table B-1	Category	GEIS Sections	Comment
1	Groundwater-use conflicts (Ranney wells)	2	4.8.1.4	Palisades does not have or use Ranney wells.
2 3	Groundwater quality degradation (Ranney wells)	1	4.8.2.2	Palisades does not have or use Ranney wells.
4 5	Groundwater quality degradation (saltwater intrusion)	1	4.8.2.1	Palisades uses <100 gpm of groundwater and is not located near a saltwater body.
6 7	Groundwater quality degradation (cooling ponds in salt marshes)	1	4.8.3	This issue is related to heat-dissipation systems that are not installed at Palisades.
8 9	Groundwater quality degradation (cooling ponds at inland sites)	2	4.8.3	Palisades is not located at an inland site.
10	**TERRESTRIAL RESOURCES**			
11	Refurbishment impacts	2	3.6	No refurbishment is planned at Palisades.
12 13	Cooling pond impacts on terrestrial resources	1	4.4.4	This issue is related to a heat-dissipation system that is not installed at Palisades.
14	**AIR QUALITY**			
15 16	Air quality during refurbishment (nonattainment and maintenance areas)	2	3.3	No refurbishment is planned at Palisades.

Table F.1 (contd)

ISSUE–10 CFR Part 51, Subpart A, Appendix B, Table B-1	Category	GEIS Sections	Comment
HUMAN HEALTH			
Radiation exposure to the public during refurbishment	1	3.8.1	No refurbishment is planned at Palisades.
Occupational radiation exposures during refurbishment	1	3.8.2	No refurbishment is planned at Palisades.
Microbial organisms (public health) (plants using lakes or canals, or cooling towers or cooling ponds that discharge to a small river).	2	4.3.6	The Palisades cooling system does not discharge to a small river.
SOCIOECONOMICS			
Public services, education (refurbishment)	2	3.7.4.1	No refurbishment is planned at Palisades.
Offsite land use (refurbishment)	2	3.7.5	No refurbishment is planned at Palisades.
Aesthetic impacts (refurbishment)	1	3.7.8	No refurbishment is planned at Palisades.

F.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."

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

Appendix G

NRC Staff Evaluation of Severe Accident Mitigation Alternatives (SAMAs) for Palisades Nuclear Plant in Support of License Renewal Application

Appendix G

NRC Staff Evaluation of Severe Accident Mitigation Alternatives (SAMAs) for Palisades Nuclear Plant in Support of License Renewal Application

Section 51.53(c)(3)(ii)(L) of Title 10 of the *Code of Federal Regulations* (10 CFR) requires that license renewal (LR) 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 Palisades Nuclear Plant (Palisades); therefore, the remainder of Appendix G addresses those alternatives.

G.1 Introduction

Nuclear Management Company, LLC (NMC) submitted an assessment of SAMAs for the Palisades as part of the ER (NMC 2005a). This assessment was based on the most recent Palisades 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 program, and insights from the Palisades Individual Plant Examination (IPE) (CP 1993) and Individual Plant Examination of External Events (IPEEE) (CP 1995). In identifying and evaluating potential SAMAs, NMC considered SAMA candidates that addressed the major contributors to core damage frequency (CDF) and population dose at Palisades, as well as SAMA candidates for other operating plants which have submitted license renewal applications. NMC identified 23 potential SAMA candidates. The list was reduced to 8 unique SAMA candidates by eliminating SAMAs that are not applicable at Palisades due to (1) design differences; (2) the required extensive changes that would involve implementation costs known to exceed any possible benefit; (3) the excessive dollar value associated with completely eliminating all internal and external event severe accident risk at Palisades, or (4) having only effects on systems with low risk significance based on the plant-specific PSA. NMC assessed the costs and benefits associated with each of the potential SAMAs and concluded that several of the candidate SAMAs evaluated would be cost-beneficial and warrant further review for potential implementation.

Based on a review of the SAMA assessment, the NRC issued a request for additional information (RAI) to NMC by letter dated August 24, 2005 (NRC 2005), and in a teleconference with NMC on November 10, 2005. Key questions concerned: peer reviews of the PSA and the potential impact of unresolved peer review comments; major plant and modeling changes

incorporated within each evolution of the PSA model; source term and economic assumptions used in the Level 3 PSA; detailed information on some specific candidate SAMAs; and consideration of additional lower cost SAMAs. NMC submitted additional information by letters dated October 21, 2005 (NMC 2005b), and November 18, 2005 (NMC 2005c). In the responses, NMC provided: summaries of PSA peer review comments and the resolution status of each; a summary of the major changes made to each PSA model version and resultant changes to dominant risk contributors to CDF; additional detail on source term and economic assumptions used in the Level 3 PSA; additional information regarding specific SAMAs; and a description of future plans for evaluating potentially cost-beneficial SAMAs. NMC's responses addressed the NRC staff's concerns, and resulted in the identification of additional potentially cost-beneficial SAMAs.

An assessment of SAMAs for Palisades is presented below.

G.2 Estimate of Risk for Palisades

NMC's estimates of offsite risk at Palisades are summarized in Section G.2.1. The summary is followed by the NRC staff's review of NMC's risk estimates in Section G.2.2.

G.2.1 NMC's Risk Estimates

Two distinct analyses are combined to form the basis for the risk estimates used in the SAMA analysis: (1) the Palisades Level 1 and 2 PSA model, which is an updated version of the IPE (CP 1993), 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 the most recent Palisades Level 1 and Level 2 PSA model available at the time of the ER, referred to as PSA version PSAR1c. The scope of the Palisades PSA does not include external events.

The baseline CDF for the purpose of the SAMA evaluation is approximately 4.05×10^{-5} per year. The CDF is based on the risk assessment for internally-initiated events. NMC did not include the contribution from external events within the Palisades 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 loss of offsite power, small break loss of coolant accidents (LOCAs) and steam generator tube rupture (SGTR) are the dominant contributors to the CDF. The contribution of internal flooding to CDF is 1.0×10^{-7} per year (NMC 2005a).

Table G-1. Palisades Core Damage Frequency for Internal Events

Initiating Event	CDF (per year)	% Contribution to CDF
Loss of offsite power (including station blackout)	1.24×10^{-5}	31
Small break LOCA	1.02×10^{-5}	25
SGTR	6.06×10^{-6}	15
General transient with main condenser available	2.94×10^{-6}	7
Loss of instrument air	2.41×10^{-6}	6
Loss of service water	1.84×10^{-6}	5
Loss of main feedwater	9.07×10^{-7}	2
Loss of the main condenser	6.46×10^{-7}	2
Pressurizer safety valve spurious opening	4.08×10^{-7}	1
Other Initiators	2.69×10^{-6}	6
Total CDF (internal events)	**4.05×10^{-5}**	**100**

The Level 2 Palisades PSA model is based on the original 1993 IPE submittal. Subsequent to the IPE submittal, the containment event tree (CET) was updated to reflect improvements in the state of knowledge on severe accidents and the implementation of a plant modification to prevent early core relocation into the Palisades auxiliary building. The Level 2 PSA consists of a detailed CET to represent dependencies between phenomenological assumptions. The CET is quantified by a relatively detailed process involving the development of probability distributions for a number of key phenomena, along with point estimate values for other issues. The CET end states are grouped into release categories by magnitude and timing of the expected releases. The result of the Level 2 PSA is a set of release categories with their respective frequency and release characteristics. The results of the updated analysis for Palisades are provided in Table E.3-5 of the ER. The frequency of each release category was obtained from the quantification of the containment event tree for each Level 1 accident sequence. The release characteristics were obtained from the results of accident analyses of representative sequences for each release category using the Modular Accident Analysis Program (MAAP) computer code.

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 this analysis

include plant-specific and site-specific input values for core radionuclide inventory, source term and release characteristics, site meteorological data, projected population distribution (within a 80 km (50-mi) radius) for the year 2031, emergency response evacuation modeling, and economic data. The core radionuclide inventory is based on Palisades plant-specific ORIGEN calculations. In response to an RAI (NMC 2005b), NMC stated that the core inventory calculations were developed in response to Generic Letter (GL) 2003-01 concerning control room habitability (NRC 2003) and represent best-estimate Palisades fuel cycle data for 23 GWD/MTU, 18-month fuel cycles. 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 response to an RAI (NMC 2005b), NMC estimated the dose to the population within 80 km (50 mi) of the Palisades site to be approximately 0.319 person-Sv (31.9 person-rem) per year. The breakdown of the total population dose by containment release mode is summarized in Table G-2. Basemat failures and SGTRs dominate the population dose risk at Palisades.

Table G-2. Breakdown of Population Dose by Containment Release Mode

Containment Release Mode	Population Dose (Person-Rem[1] per Year)	% Contribution
SGTR	7.6	23.9
Early containment failure	1.6	5
Intermediate containment failure	0	0
Late containment failure	0.3	0.9
Intact containment	0.6	1.9
Basemat failure	21.6	67.8
Containment isolation failure	0.2	0.6
Total Population Dose	**31.9**	**100**

[1]One person-Rem = 0.01 person-Sv

G.2.2 Review of NMC's Risk Estimates

NMC's determination of offsite risk at Palisades is based on the following three major elements of analysis:

- The Level 1 and 2 risk models that form the bases for the 1993 IPE submittal (CP 1993), and the original and revised IPEEE submittals (CP 1995 and CP 1996).

- The major modifications to the IPE model that have been incorporated in the Palisades PSA, and

- The MACCS2 analyses performed to translate fission product source terms and 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 Palisades PSA model evolved through several stages, starting with development of an initial Level 1 PSA model in 1982 to address the risk associated with failing to satisfy single failure design criteria with respect to the main steam isolation valves (MSIVs). This model was subsequently updated and submitted to NRC in 1993 in response to GL 88-20 (NRC 1988). Palisades has several atypical design features that can affect accident progression. As a result, instead of relying on the results of previous Level 2 PSAs, plant-specific, detailed, deterministic evaluations were performed in support of the IPE submittal for the key severe accident phenomena. These evaluations included reviewing available experimental data, as well as creating a plant-specific version of the Modular Accident Analysis Program (MAAP version 3.0B) referred to as CPMAAP.

The NRC staff's review of the Palisades IPE is described in an NRC report dated February 7, 1996 (NRC 1996). Based on a review of the IPE submittal and responses to RAIs, the NRC staff concluded that the IPE submittal met the intent of GL 88-20 (NRC 1988), i.e., the IPE was of adequate quality to be used to look for design or operational vulnerabilities. The NRC staff, however, encouraged the licensee to improve the human reliability analysis "to make it a valuable tool for other applications."

There have been numerous revisions to the IPE model since its submittal. A comparison of internal events risk profiles between the IPE and the PSA used in the SAMA analysis indicates a decrease of approximately 1.0×10^{-5} per year in the total internal events CDF (from 5.07×10^{-5} per year in the IPE to 4.05×10^{-5} per year in PSAR1c). The PSA updates have involved the examination of plant operating logs, corrective action documents, out-of-service time histories for selected components, industry data, implemented plant modifications, model review comments, and suggested peer review 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 further discussed in the response to an RAI (NMC 2005b). The major changes are summarized in Table G-3.

Table G-3. Palisades PSA Historical Summary

PSA Version	Summary of Changes from Prior Version	CDF (per year)
IPE (1993)	IPE submittal	5.07×10^{-5}
PSAR1 (1999)	- Moved the internal events CDF model from SETS to SAPHIRE	5.95×10^{-5}
PSAR1a (2000)	- Removed the auxiliary feedwater (AFW) alternate steam supply line to AFW pump P-8B from the model to reflect a plant modification - Updated main steam line break and SGTR initiating event frequencies - Updated selected human error probabilities (HEPs)	5.47×10^{-5}
PSAR1b (2000)	- Updated selected common cause failure logic for control and solenoid valves - Incorporated a plant modification that swapped the High Pressure Air power supplies for motor control centers MCC-7 and MCC-8; added additional direct current (DC) bus faults; and added certain DC demand failure modes - Set the summertime emergency diesel generator (EDG) heating, ventilation, and air conditioning system (HVAC) success criteria to True for all nominal baseline calculations - Eliminated the independent anticipated transient without scram (ATWS) event trees by transferring all event trees to a single ATWS event tree	6.18×10^{-5}
PSAR1b-modified (2001)	- Corrected a conservative Shutdown Cooling Heat Exchanger modeling assumption	6.16×10^{-5}
PSAR1b-modified w/HELB (2002)	- Updated model to include main steam line breaks in the component cooling water (CCW) rooms	6.24×10^{-5}

PSAR1c (SAMA; 2004)	- Corrected diesel generator repair/recovery logic - Added modeling of failure of the primary coolant pump (PCP) seals, inadvertent primary coolant system (PCS) safety relief valve opening, and failure of the AFW flow control valves to close - Incorporated modifications to the plant Recirculation Actuation System (RAS) and instrument air compressor - Removed modeling conservatism in the service water (SW) header valve logic - Modified modeling of: fire protection system (FPS) makeup to AFW pump P-8C logic to include failure of condensate storage tank (CST) T-2; FPS logic to include reliance on traveling screens; condensate pump logic to include availability of both the gland seal condenser and air ejector after condenser rupture; CCW pumps P-52A, P-52B and P-52C logic to include failures as a result of steam line breaks outside of containment; and MSIV auto close logic for 'containment high pressure (CHP)' and 'low steam generator (SG) pressure' to correctly account for steam line break and LOCA event initiators - Updated common cause failure data	4.05×10^{-5}

The CDF values for Palisades are comparable to the CDF values reported in the IPEs for other Combustion Engineering plants. Figure 11.6 of NUREG-1560 shows that the IPE-based total internal events CDF for Combustion Engineering plants ranges from approximately 1.0×10^{-5} per year to 2.0×10^{-4} per year, with an average CDF for the group of 7.0×10^{-5} per year (NRC 1997d). 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 Palisades are comparable to the updated estimates for other plants of similar vintage and characteristics.

The NRC staff considered the peer reviews performed for the Palisades PSA, and the potential impact of the review findings on the SAMA evaluation. In the ER and in response to an RAI, NMC described the Combustion Engineering Owners Group (CEOG) Peer Review of the PSA. The CEOG peer review of the PSAR1a model resulted in 9 Level A comments (important and necessary to address before the next regular PSA update) and 50 Level B comments (important and necessary to address, but disposition may be deferred until the next PSA update). The resolution of the peer review comments is described in the ER (NMC 2005a) and in response to an RAI (NMC 2005b). All Level A and Level B comments have either been

addressed in the PSAR1c model used for the SAMA analysis, or further evaluated and judged to have no significant impact on the SAMA evaluation.

Given that the Palisades PSA has been peer reviewed and the peer review findings have either been addressed or judged to have no impact on the SAMA evaluation, that NMC has satisfactorily addressed the NRC staff questions regarding the PSA (NMC 2005b), and that the CDF falls within the range of contemporary CDFs for CE plants, the NRC staff concludes that the Level 1 PSA model is of sufficient quality to support the SAMA evaluation.

As indicated above, the current Palisades PSA does not include external events. In the absence of such an analysis, NMC used the Palisades IPEEE in the SAMA analysis to identify the highest risk accident sequences and the potential means of reducing the risk posed by those sequences, as discussed below.

NMC submitted an IPEEE by letter dated June 30, 1995 (CP 1995) in response to Supplement 4 of GL 88-20. NMC 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. However, a number of areas were identified for improvement in both the seismic and fire areas and were subsequently addressed as discussed below. In a letter dated November 29, 1999, the NRC staff concluded that the Palisades IPEEE met the intent of Supplement 4 to GL 88-20, and that the licensee's IPEEE process is capable of identifying the most likely severe accidents and severe accident vulnerabilities (NRC 1999).

Palisades performed a relatively robust seismic analysis as part of the IPEEE. The seismic analysis utilized the existing plant PSA with event trees specifically developed to evaluate seismic events. The resulting seismic CDF was estimated as 8.88×10^{-6} per year (NMC 2005a), about 20 percent of the internal events CDF. While the seismic analysis did not identify any significant seismic concerns, several insights were gained about the most important equipment failures during and after seismic events. The IPEEE identified four groups of equipment that contributed most of the seismic CDF, specifically: the FPS, the MSIVs, the EDG fuel oil supply (storage tank T-10), and the bus under-voltage relay for safety bus 1D. NMC reviewed these groups to identify potential SAMAs. For three of these contributors, no additional SAMAs were identified. That is: (1) the FPS failures (and possible SAMAs) were already identified as important contributors to the Class 1A and 1B sequences from the internal events analysis; (2) given MSIV modeling more closely representing actual operation, MSIV seismic interactions would not be risk significant; and (3) since EDG fuel storage tank T-10 is not necessary to support a 24-hour mission duration, there is no measurable benefit to strengthening or replacing tank T-10. For the fourth contributor, NMC identified that the under-voltage relay for bus 1D was important to start the EDG, and a SAMA was added to the list of candidate SAMAs to replace this relay with one that is less susceptible to seismic activity (i.e., SAMA 22).

Based on consideration of important random failures in the Palisades seismic analysis, NMC also identified the importance of EDG 1-2 during a seismic event because it provides power to Auxiliary Feedwater (AFW) Pump 8C, which is the only AFW pump with a seismically durable water supply. Adding an electrical cross-tie to provide alternate power to this pump (SAMA 9), which had been identified to address internal initiating events based on the PSA results, was also identified as a plant improvement that would limit the impact of this random failure.

The IPEEE also found that some relays were vulnerable to seismic activity and that some equipment anchorage improvements were required. These were addressed as part of the close-out of USI A-46 (NRC 1997c), and all actions with respect to USI A-46 have now been completed. The NRC review and closure of USI A-46 for Palisades is documented in a letter dated September 25, 1998 (NRC 1998). Completion of the last item requiring resolution was documented in a letter to NRC in June 2003 (NMC 2003).

Based on the licensee's IPEEE efforts to identify and address seismic outliers and their incorporation into the SAMA process, the NRC staff concludes that the opportunity for seismic-related SAMAs has been adequately explored.

A revised internal fire analysis for the Palisades IPEEE was submitted in Revision 1 of the IPEEE, dated May 31, 1996 (CP 1996). The internal fire analysis was revised as the Fire Protection Program and Appendix R analyses were in the process of being upgraded when the original IPEEE was submitted (CP 1995). The Palisades fire analysis was based on EPRI's fire-induced vulnerability evaluation (FIVE) methodology. The methodology employs a graduated focus on the most important fire zones using qualitative and quantitative screening criteria (EPRI 1992). The fire zones or compartments were subjected to at least two screening phases. In the first phase, a compartment was screened out if it was found to not contain any equipment or cables associated with safe shutdown or an initiating event. In the second phase, the licensee used the IPE model of internal events to estimate the CDF resulting from a fire initiating event. The conditional core damage probability associated with each fire compartment was based on the equipment and systems unaffected by the fire. The CDF for each compartment was obtained by multiplying the frequency of a fire in a given fire compartment by the conditional core damage probability associated with that fire compartment. The most important fire areas/rooms identified in Revision 1 of the IPEEE are the cable spreading room, the control room, the 1D switchgear room, the turbine building, and the 1C switchgear room. The resulting fire CDF was estimated as 3.31×10^{-5} per year (NMC 2005a), about 80 percent of the internal events CDF.

The Revision 1 of the IPEEE fire document also provides a summary of the most important contributors to each of the accident classes. NMC used the event rankings within these categories to identify the largest contributors to risk, and to identify additional SAMAs to prevent or mitigate the loss of functions represented by these events. For example:

- The contribution from failures to initiate Once Through Cooling (OTC) following a successfully suppressed fire, failures of AFW pump P8-B, or random failures of the AFW system could all be mitigated by providing an alternate means of secondary heat removal. The installation of a direct drive diesel injection pump (DDDIP) to back up AFW was identified by NMC to address these failures and included as SAMA 3. The DDDIP also provides long-term steam generator makeup assuming a portable generator is included.

- Failure to control AFW steam supply or injection could be mitigated by enhancing primary side cooling. The addition of another high pressure injection (HPI) pump or the conversion of AFW pump P8-C back to a high pressure safety injection (HPSI) pump was identified to address these failures and included as SAMA 4.

- Station blackout (SBO) sequences were identified as important contributors in the Level 1 model. A SAMA to proceduralize the use of a steam driven AFW pump to operate without support systems was included to address these events (SAMA 10).

Each of these SAMAs had also been identified to address internal initiating events based on the PSA results.

The licensee noted that in the IPEEE fire analysis, operator action was required to manually open sub-cooling valves to the suction of the HPSI pumps after the recirculation actuation signal (RAS) to ensure adequate HPSI net positive suction head, and that the alignment of these valves was subsequently automated. The hardware modification addressed the importance of the action to align the sub-cooling valves, accordingly no additional SAMAs were suggested for this contributor.

Based on the licensee's IPEEE efforts to identify and address internal fire outliers and their incorporation into the SAMA process, the NRC staff concludes that the opportunity for internal fire-related SAMAs has been adequately explored.

Other external events considered in the IPEEE included high wind events, external flooding, transportation, and nearby facility accidents. The risk associated with these events is small, with the total CDF from other external events about 1.0×10^{-6} per year. The licensee reviewed the insights from previous assessments of these events performed as part of the NRC Systematic Evaluation Program and the IPEEE, and considered the potential for additional SAMAs to reduce these risks. A detailed discussion is provided in Section E.5.1.6 of the ER. NMC concluded that no further modifications would be cost-beneficial. It is noted that the risks from deliberate aircraft impacts were explicitly excluded since this was being considered in other forums along with other sources of sabotage.

In light of the external events CDF being approximately equal to the internal events CDF, NMC doubled the benefit that was derived from the internal events model to account for the

contribution from external events. This doubling was not applied to the one SAMA that specifically addressed seismic risks (i.e., SAMA 22), since this SAMA is specific to only seismic risk and does not have a corresponding risk reduction in internal events. However, this doubling was applied to those SAMAs that addressed both fire or seismic and internal events (i.e., SAMAs 3, 4, 9, and 10), since these SAMAs do 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 1999). Thus, the degree of conservatism in the result is not clear. Furthermore, the risks due to external events that are discussed above are the results of analyses that were done at varying times prior to the current Palisades internal events PSA. The methodologies also vary in the degree of completeness and conservatism. Consequently, the results cannot be directly compared with those from the current PSA. Not withstanding the above, the NRC staff agrees with the applicant's conclusion that the risk posed by external events is approximately equal to that due to internal events. Therefore, the NRC 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 NRC 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 6 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. Each end state from the Level 2 analysis is assigned to one of the release categories. 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. The release categories and their frequencies are presented in Section E.2.5.5 of the ER (NMC 2005a), as are the source terms used for the SAMA evaluation based on the MAAP 3.0B computer code. The NRC 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.

In response to an RAI (NMC 2005b), NMC identified that the core inventory used for the Palisades MACCS2 analysis was based on plant-specific data, and that fuel cycle parameters were best estimate and consistent with expected Palisades fuel cycles. The NRC staff concludes that the best plant-specific estimate provides a reasonable basis for estimating the reactor core radionuclide inventory in the consequence assessment.

The NRC 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

PSA). This included consideration of 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 a 80 km (50 mile) radius for the year 2031, emergency evacuation modeling, and economic data. This information is provided in Appendix E of the ER (NMC 2005a).

NMC used a composite set of site specific meteorological data, obtained from the plant meteorological tower and the nearby Benton Harbor Ross Field National Weather Station (for hourly precipitation). The data was processed from hourly measurements for the 2000 calendar year as input to the MACCS2 code. The year 2000 data was nearly complete, missing only 4 hours of scattered data. Data from these locations and from this year was selected because it provided an adequate representation of the Palisades meteorological data. Site meteorological data for years 2001, 2002, and 2003 were also evaluated as sensitivity cases to ensure that year 2000 data was a representative data set. Population dose and economic costs were only minimally impacted (less than 8 percent change) due to the use of different data sets. The year 2000 meteorological data was found to result in the highest population dose and economic costs and was therefore chosen as the basis for the SAMA analysis. The NRC staff notes that previous SAMA analyses results have also shown little sensitivity to year to year differences in meteorological data and considers use of the 2000 data to be reasonable.

The population distribution which the applicant used as input to the MACCS2 analysis was estimated for the year 2031, based on extrapolation from the U.S. Census population data for 1990 and 2000. U.S. Census data from 1990 and 2000 was used to determine a total annual average population growth rate (1.1 percent per year). It was assumed that the growth rate would remain the same as that reported between 1990 and 2000. The annual population growth was applied uniformly to all sectors to calculate the year 2031 population distribution. A population sensitivity case was performed using 30 percent uniform increase in population for all sectors. The 30 percent population case showed about a 20 percent change in population dose and about a 50 percent change in cost risk. The NRC staff considers NMC's methods and assumptions for estimating population reasonable and acceptable for purposes of the SAMA evaluation.

The emergency evacuation model assumed a single evacuation zone extending out 16 kilometers (10 miles) from the plant. It was assumed that 95 percent of the population would move at an average speed of approximately 0.81 meters per second (1.8 miles per hour) with a delayed start time of 15 to 30 minutes (NMC 2005). 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. Two evacuation sensitivity cases were performed, one with an evacuation speed of 0.41 m/s (a factor of 2 decrease), and one with a 90 minute delay. The results demonstrated that the population dose and economic costs are

relatively insensitive to this parameter. The evacuation assumptions and analysis are deemed reasonable and acceptable for the purposes of the SAMA evaluation.

Much of the site specific economic data were provided from SECPOP2000 (NRC 2003a) by specifying the data for each of the counties surrounding the plant, to a distance of 50 miles. In addition, generic economic data that are applied to the region as a whole were revised from the MACCS2 sample problem input when better information was available. The agricultural economic data were updated using available data from the 1997 Census of Agriculture (USDA 1998). These included per diem living expenses, relocation costs, value of farm and non-farm wealth, and fraction of farm wealth from improvements (e.g., buildings). In response to an RAI, NMC provided additional information on several economic parameter input values used in the MACCS2 calculations.

The NRC staff concludes that the methodology used by NMC to estimate the offsite consequences for Palisades provides an acceptable basis from which to proceed with an assessment of risk reduction potential for candidate SAMAs. Accordingly, the NRC 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 Palisades PSAR1c Levels 1 and 2 PSA,
- review of potentially cost-beneficial SAMAs from license renewal applications for six other U.S. nuclear sites,
- review of potential plant improvements identified in the Palisades IPE and IPEEE, and
- review of the dominant fire areas and seismic risk contributors, and SAMAs that could reduce the associated fire and seismic risk at Palisades.

In order to provide consistency with previous industry SAMA analyses and to provide a recognized source of ideas for the types of enhancements that could be proposed to address

plant-specific insights, NMC also reviewed a generic list of 266 SAMAs developed from previous industry SAMA analyses.

Based on this process, an initial set of 23 candidate SAMAs, referred to as Phase 1 SAMAs, was identified. In Phase 2 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 Palisades due to design differences,
- the SAMA requires extensive changes that would involve implementation costs known to exceed any possible benefit, or
- the SAMA costs more than $5.6 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 Palisades).

Based on this screening, 14 SAMAs were eliminated, leaving nine for further evaluation. These remaining SAMAs, referred to as Phase 2 SAMAs, are listed in Table E.5-4 of the ER (NMC 2005a). During the initial stage of the Phase 2 evaluation, NMC qualitatively screened out one of the nine remaining SAMA candidates based on plant-specific insights regarding the low risk significance of systems affected by the SAMA (i.e., SAMA 17), bringing the number of remaining SAMAs to eight. A detailed cost-benefit analysis was performed for each of the eight remaining SAMA candidates. 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 the SAMA specific to seismic risk, since this SAMA would not have a corresponding benefit on the risk from internal events).

NMC also assessed the impact on 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 2.3 to reflect the potential impact of uncertainties. As a result, four additional SAMAs would have been retained for the Phase 2 analyses. These SAMAs are discussed further in Section G.6.2.

G.3.2 Review of NMC's Process

NMC's efforts to identify potential SAMAs focused primarily on areas associated with internal initiating events, but also included explicit consideration of SAMAs for seismic and fire events. The initial list of SAMAs generally addressed the accident sequences considered to be important to CDF and population dose from functional, initiating event, and risk reduction worth perspectives at Palisades, and included selected SAMAs from other plants.

A preliminary review of NMC's SAMA identification process raised some concerns regarding the set of 23 SAMAs evaluated in the initial screening and how this set relates to the generic list of 266 SAMAs developed from industry sources. In response to an RAI, NMC clarified that the generic list of 266 SAMAs was used only as a source of ideas for the types of enhancements that could be proposed to address the plant-specific risk insights for Palisades (NMC 2005b).

NMC provided in the ER (NMC 2005a) a listing of basic events ranked by risk reduction worth (RRW) for both CDF (Level 1 PSA) and population dose (Level 2 PSA). For the Level 1 importance list, NMC considered all basic events with a RRW greater than 1.01. For the Level 2 importance list, NMC reviewed a composite file composed of those basic events representing the top 97 percent of all population dose and again considered all basic events with a RRW greater than 1.01. NMC correlated the top risk contributors to CDF and population dose with the SAMAs evaluated in the ER. The two tables provided basic event identifiers, risk reduction worth, and potential SAMAs for each basic event. Two events in the CDF importance list (Table E.5-1 of the ER) were estimated by the staff to have a very large risk achievement worth (e.g., RXC-MECH-FAULTS and RXC-ELEC-FAULTS). In the case of mechanical faults alone, the NRC staff estimated that an order-of-magnitude increase in the failure probability would increase the CDF to 6.8 x 10-5 per year. The NRC staff requested an NMC assessment of whether a SAMA is warranted to ensure these subsystems do not degrade (NRC 2005). In their response, NMC agreed that there may be demonstrable value in assuring that there is no degradation in performance over time. However, given the significant routine testing that already is required by existing plant procedures, NMC stated that what would be considered appropriate as a SAMA has already been implemented at Palisades (NMC 2005b). Based on this information, the NRC staff concludes that the set of SAMAs evaluated in the ER addresses the major contributors to CDF and offsite dose, and that the review of the top risk contributors does not reveal any new SAMAs.

NMC identified Palisades-specific candidate SAMAs for seismic and fire events using a combination of the Palisades PSA models and insights from the IPEEE. As a result, one SAMA related specifically to seismic events was identified and retained for evaluation. Furthermore, four SAMAs already identified and retained for evaluation to address internal initiating events were also recognized as being effective in seismic and fire events. Potential plant enhancements for other external events (high wind events, external flooding and probable maximum precipitation events, and transportation and nearby facility accidents) were determined to be too costly, sufficiently addressed by existing plant features/capabilities, or already addressed by an existing SAMA. The NRC staff considers the applicant's rationale for eliminating these enhancements from further consideration to be reasonable.

The NRC staff questioned NMC about several candidate SAMAs that were identified as potentially cost-beneficial at other Combustion Engineering plants but not addressed by NMC (NRC 2005). In response, NMC provided an assessment of the applicability/feasibility of each

of these enhancements and concluded that most of these SAMAs would not be warranted at Palisades because they either: are not applicable to Palisades, would not provide a significant benefit at Palisades, or are already addressed by existing SAMAs for Palisades (NMC 2005b and NMC 2005c). However, NMC determined that two of the NRC staff-identified enhancements could be applicable to Palisades. These enhancements are as follows:

- add the capability to flash the field on the EDG to enhance SBO recovery and
- replace an existing air-operated containment sump valve with a motor-operated valve to reduce common cause failures.

NMC did not provide a further assessment of these SAMAs as part of their response, but instead, indicated that these two SAMAs have been entered into the Palisades corrective action system for further review and, if determined to be cost-beneficial, they will be further evaluated for possible implementation in accordance with Palisades plant design processes (NMC 2005c)

The NRC staff requested further justification from NMC concerning the elimination of three SAMAs as part of the Phase 1 screening (NRC 2005). The qualitative arguments presented for eliminating these SAMAs were either incomplete, unclear, or unconvincing to the NRC staff. In its response to the RAIs, NMC provided further information (NMC 2005b). The NRC staff concern and NMC response for each of the three SAMAs is discussed below:

- SAMA 12 - automate boron injection for ATWS conditions. This SAMA was eliminated by NMC because it is a boiling-water reactor mitigation feature that is not applicable to a pressurized-water reactor. The NRC staff questioned why then was it identified as a modification to the existing chemical volume control system injection system to reduce ATWS sequences. In their response, NMC noted that the basic events impacted by this SAMA were conservatively modeled in the PSA, hence artificially increasing their RRW importance measure. NMC re-evaluated the RRWs considering both updated reliability data and hardware changes made at Palisades in the 1990s, and showed that none of the basic events would be above the 1.01 RRW threshold for SAMA consideration. Based on this, SAMA 12 was screened from further consideration in the final evaluation.

- SAMA 19 - provide HPI suction crosstie to the opposite heat exchanger. This SAMA specifically addresses failures of the HPSI pump suction sub-cooling valves between the heat exchangers and the HPI pumps, and was eliminated by NMC because failure of these same valves is addressed by SAMA 17. The NRC staff questioned whether the two different sets of plant enhancements would accomplish the same effect since each of these SAMAs addresses different initiating events. In their response, NMC noted that the basic events impacted by this SAMA were conservatively modeled in the PSA, hence artificially increasing their RRW importance measure. NMC indicated that, if containment integrity is preserved, adequate net positive suction head is available regardless of the

state of the two HPSI pump suction sub-cooling valves. Given that the conditional likelihood of containment failure is about $1x10^{-2}$, the importance of these valve failures is actually much less than the current PSA model results. Based on this, SAMA 19 was screened from further consideration in the final evaluation.

- SAMA 20 - improve performance of the traveling screens. This SAMA was eliminated by NMC based on the assumption that existing plant procedures were adequate to prevent traveling screen failure. The NRC staff questioned whether this was a good assumption given the potential for human error during procedure implementation. In their response, NMC noted that the current analysis does not include a human error. NMC re-evaluated the RRW by incorporating the impact of human error and showed that the event would be below the 1.01 RRW threshold for SAMA consideration. Based on this, SAMA 20 was screened from further consideration in the final evaluation.

The NRC staff considers the applicant's rationale for eliminating these three enhancements from further consideration to be reasonable.

Based on the initial screening, NMC eliminated SAMAs 1, 15, and 18 from further consideration because their implementation cost was estimated to exceed the MMACR. The NRC NRC staff identified possible lower cost alternatives for these SAMAs and requested that NMC provide an evaluation of these alternatives (NRC 2005). In its response, NMC provided further information (NMC 2005b):

- SAMA 1 - This SAMA involves installing an additional EDG. The NRC staff questioned whether there were lower cost alternatives such as providing non-safety grade backup power from the gas turbine generating facility co-located near the Palisades Plant or installation of a non-safety grade diesel generator. NMC responded that it had previously looked into the possibility of an agreement with the gas facility to reduce plant risk from SBO events. However, the gas plant is operated as a peaking unit, is online only when there is a need for additional power, and does not have a black start capability. This alternative is therefore not considered feasible. Relative to the installation of a non-safety grade diesel generator, NMC noted that 87 percent of the CDF from LOOP events is associated with the dominant SBO scenario. While SAMA 1 was identified to address the broad category of LOOP events, SAMA 10 was developed as a mitigating strategy to deal specifically with the SBO scenario. NMC's position is that SAMA 10 is a lower cost alternative to the non-safety grade EDG and will provide a significant percentage of the expected benefit of SAMA 1. However, NMC did commit to conduct an evaluation to determine the potential risk reduction and cost benefit of the installation of a non-safety diesel generator as a lower cost alternative to an additional EDG, subsequent to the evaluation of SAMA 10, and has entered this action into the Palisades corrective action program for further review. If determined to be cost-beneficial, the lower cost alternative

will be evaluated for possible implementation in accordance with Palisades plant design processes (NMC 2005c).

- SAMA 15 - This SAMA involves adding a bypass line around the safety injection and refueling water tank (SIRWT) return lines. Adding this line would increase the number of potential leakage paths for contaminated containment sump water back to the SIRWT during the re-circulation phase of an accident. Due to the proximity of the SIRWT vent to the main control room (CR) HVAC normal intakes, this SAMA would increase the CR dose consequences significantly during an accident thereby requiring plant modifications to the CR HVAC if implemented. The NRC staff questioned whether there were lower cost alternatives that would eliminate the need to modify the main CR HVAC system, such as locking open one of the return line valves as an alternative to adding a bypass line. NMC responded that the recirculation line valves perform two distinct functions, and are required to be open during the injection phase and closed when the SIRWT level falls to the low-low setpoint. Improving the probability of opening by locking open one of the valves would increase the probability of failure of the isolation function. Accordingly, locking open one valve is not considered a viable option. However, NMC also indicated that Palisades is currently in a study phase with respect to GL 2003-01 (NRC 2003) and Generic Safety Issue 191 ("Assessment of Debris Accumulation on PWR Sump Performance") where the performance of these valves is being analyzed. Required actions in response to these issues will override any changes considered solely for SAMA. Based on this, SAMA 15 was screened from further consideration in the final evaluation.

- SAMA 18 - The SAMA involves installing a permanent, dedicated pump and line to the EDGs to serve as the primary EDG cooling source. The NRC staff questioned whether there were lower cost alternatives such as installing an additional line or temporary connection directly from the FPS and bypassing the SW lines. NMC did not provide a further assessment of these SAMAs as part of their response, but instead committed to conduct an evaluation to identify a lower cost alternative, and has entered this action into the Palisades corrective action system program for further review. If determined to be cost-beneficial, the lower cost alternative will be evaluated for possible implementation in accordance with Palisades plant design processes (NMC 2005c).

The NRC staff considers NMC's rationale for eliminating SAMA 15 from further consideration to be reasonable and NMC's commitment to further evaluate lower cost alternatives for SAMAs 1 and 18 through the Palisades corrective action program to be acceptable.

The NRC 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 NRC 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 NRC staff concludes that NMC used a systematic and comprehensive process for identifying potential plant improvements for Palisades, and that the set of potential plant improvements identified by NMC is reasonably comprehensive and therefore acceptable. This process 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 eight remaining SAMAs that were applicable to Palisades. Most of the SAMA evaluations were performed in a bounding fashion in that the SAMA was assumed to completely eliminate the risk associated with the proposed enhancement. Such bounding calculations overestimate the benefit and are conservative.

NMC used model re-quantification to determine the potential benefits. The CDF and population dose reductions were estimated using the Palisades PSA model PSAR1c. The changes made to the model to quantify the impact of SAMAs are detailed in Section E.6 of Attachment E to the ER (NMC 2005a) and in response to an RAI (NMC 2005b). Table G-3 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 based on a 7 percent and a 3 percent discount rate. This analysis methodology was also used for the three SAMAs (SAMAs 3, 4, and 10) that were originally identified and retained for evaluation to address internal initiating events, but that were also recognized as being effective in fire events. The determination of the benefits for the various SAMAs is further discussed in Section G.6.

For the one SAMA that specifically addresses seismic events only (SAMA 22), the reduction in CDF and population dose was not directly calculated. For this SAMA, a bounding estimate of the impact of the SAMA was made by assuming that the contribution to risk from external events is approximately equal to that from internal events, that seismic events contribute 21 percent of the external events risk, and that 69 percent of the seismic risk could potentially be eliminated by this SAMA based on information from the IPEEE.

The NRC 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 generally conservative (i.e., the estimated risk reduction is higher than what would actually be realized). Accordingly, the NRC staff based its estimates of averted risk for the various SAMAs on NMC's risk reduction estimates.

Table G-4. SAMA Cost/Benefit Screening Analysis for Palisades

SAMA	Assumptions	% Risk Reduction		Total Benefit Using 7% Discount Rate ($)	Total Benefit Using 3% Discount Rate ($)	Cost ($)
		CDF	Population Dose			
3. Install a direct drive diesel-driven injection pump (DDDIP). Reduces the risk of SBO scenarios by providing an injection method to supplement the turbine-driven AFW pump.	Reduced the existing AFW pump failure probabilities by factors ranging from 7 to 19 to simulate the addition of a DDDIP. Also eliminated common cause failures and random system failures to represent the independence of the DDDIP.	15	14	$793,000	$1,050,000	$1,100,000
4. Install an additional HPI pump. Increases HPI diversity and reduces the probability of requiring RPV depressurization early in an accident.	Reduced the "A" train pump and valve failure rates to reflect the installation of the additional pump and the fact that only one pump train of three is required for success. Modeled by squaring each of the independent failure probabilities of the "A" train, which ranged originally from 2.5E-07 to 2.6E-03. Also reduced the common cause failure term by an order of magnitude.	3	1	$85,400	$108,000	$1,620,000
10. Modify the turbine-driven AFW train so that it can operate indefinitely without AC, DC, or pneumatic support.	**Eliminated all AC power recovery failures to simulate the indefinite operation of the turbine-driven AFW pump.**	**27**	**33**	**$1,750,000**	**$2,340,000**	**$200,000**

SAMA	Assumptions	% Risk Reduction		Total Benefit Using 7% Discount Rate ($)	Total Benefit Using 3% Discount Rate ($)	Cost ($)
		CDF	Population Dose			
13. Provide a Nitrogen Station that would automatically provide a backup air supply to the CV-2010 valve. Reduces the importance of Loss of Instrument Air to the valve.	**Assumed a failure probability of 1E-02 for the Nitrogen Station.**	**5.2**	**4.4**	**$262,000**	**$346,100**	**$220,000**
14. Enhance the main control room to include controls for the cross-tie between the service water system and the FPS. Reduces the time required to establish the cross-tie.	Eliminated seal LOCAs that would occur on loss of seal cooling.	5	7	$344,000	$463,000	$2,900,000
16. Install new insulation and lagging on the EDG exhaust ducts inside the EDG rooms and make procedure changes to align alternate room cooling.	**Eliminated the EDG room cooling recovery event.**	**4**	**4**	**$237,000**	**$316,000**	**$160,000**
22. Replace the undervoltage relays for EDGs 1-1 and 1-2 with seismically-qualified relays.	**Eliminated all Class IA and IB external events.**	**15**	**15**	**$414,000**	**$550,000**	**$110,000**
23. Make procedure changes to direct the cooldown of the PCP seals on loss of PCP seal cooling.	**Eliminated seal LOCAs that would occur on loss of seal cooling.**	**5**	**7**	**$344,000**	**$463,000**	**$100,000**

Note: SAMAs in bold are potentially cost-beneficial when either a 7 percent or 3 percent real discount rate is used in the NRC staff's analysis.

G.5 Cost Impacts of Candidate Plant Improvements

NMC estimated the costs of implementing the remaining candidate SAMAs through the application of engineering judgment, use of estimates from other licensees' submittals 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 (NMC 2005b). Estimates were presented in terms of dollar values at the time of implementation or estimation, and were not adjusted to present-day dollars. For some of that SAMAs considered, so little, if any, benefit would be obtained from implementation of the proposed enhancement that it was not necessary to develop a cost estimate.

The NRC staff reviewed the bases for the applicant's cost estimates (as presented in Section E.6 of Appendix E of the ER and in a response by NMC to an RAI (NMC 2003b)). For certain improvements, the NRC 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 NRC staff reviewed the costs and found them to be consistent with estimates provided in support of other plants' analyses.

The NRC staff questioned the applicant about the cost estimate for SAMA 21, use of the FPS as backup for the containment spray (CS) system. In the ER, the implementation cost for this SAMA is estimated to be $7,000,000. A similar SAMA at Brunswick was estimated to cost only $100,000. In response to an RAI, NMC provided a detailed breakdown of how the site-specific cost estimate was derived and noted that the Brunswick SAMA is for a procedure change while SAMA 21 is a major plant modification (NMC 2005b). Based on a review of this additional information, the NRC staff considers the cost estimate for SAMA 21 to be reasonable.

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

G.6 Cost-Benefit Comparison

NMC's cost-benefit analysis and the NRC staff's review are described in the following sections.

G.6.1 NMC 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 1997d). 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 revised 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 2004c). 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 (Δ person-rem/year)
x monetary equivalent of unit dose ($2,000 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 1997d), 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. NMC calculated an APE of approximately $688,000 for the 20-year license renewal period, which assumes elimination of all severe accidents.

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 $125,000 based on the Level 3 risk analysis. This results in a discounted value of approximately $1,345,000 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 1997d). Best estimate values provided for immediate occupational dose (3,300 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 $2,000 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, NMC calculated an AOE of approximately $15,400 for the 20-year license renewal period, which assumes all severe accidents are eliminated.

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 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 the regulatory analysis handbook to be $1.5 x 10^9$ (undiscounted). This value was converted to present costs over a 10-year cleanup period and 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 $479,000 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 816 MW(e). Therefore, NMC applied a power scaling factor of 816 MW(e)/910 MW(e) to determine the replacement power costs. NMC calculated an RPC of approximately $287,000 for the 20-year license renewal period, which assumes all severe accidents are eliminated.

For the purposes of initial screening, which assumes all severe accidents are eliminated, NMC calculated an AOSC of approximately $766,000 for the 20-year license renewal period.

Using the above equations, NMC estimated the total present dollar value equivalent associated with completely eliminating all severe accidents at Palisades to be about $2,814,000. To account for additional risk reduction in external events, NMC doubled this value to $5,630,000, which is the MMACR and represents the dollar value of completely eliminating all internal and external event severe accident risk at Palisades.

NMC's Results

If the implementation costs for a candidate SAMA were greater than the MMACR of $5.63 million, 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 expected cost for those SAMAs exceeded the calculated benefit, the SAMA was considered not to be cost-beneficial. The cost-benefit results for the individual analysis of the SAMA candidates are presented in Table G-4. In the baseline analysis contained in the ER (using a 7 percent discount rate), NMC

identified five potentially cost-beneficial SAMAs. Based on an analysis using a 3 percent discount rate, as recommended in NUREG/BR-0058 (NRC 2004), no additional SAMA candidates were determined to be potentially cost-beneficial. The potentially cost-beneficial SAMAs are:

- SAMA 10 – Modify the turbine-driven AFW so that it can operate indefinitely without AC, DC, or pneumatic support. This SAMA involves a procedure revision and analysis to direct AFW flow adjustments based on decay heat level so that SG level can be maintained when instrumentation fails on DC power depletion.

- SAMA 13 – Add a Nitrogen Station. This SAMA involves the use of a Nitrogen Station to automatically provide backup air supply for critical instrumentation and reduce the importance of loss of instrument air.

- SAMA 16 – Add insulation to the EDG exhaust ducts. This SAMA involves insulating the EDG exhaust ducts and making procedure modifications to prevent overheating of the EDGs engines.

- SAMA 22 – Replace undervoltage relays with seismically qualified model. This SAMA involves replacing relays to reduce the likelihood of failure of automatic start of the EDGs and reduce the contributions from loss of power due to the relays.

- SAMA 23 – Modify procedures for PCS cooldown and provide associated training. This SAMA involves procedure modifications to reduce the probability of reactor coolant pump seal failures related to long-term high temperature exposure after recovery of CCW.

NMC performed additional analyses to evaluate the impact of parameter choices and uncertainties on the results of the SAMA assessment (NMC 2005a). NMC considered the impact of analysis uncertainties on the results of the SAMA analysis by increasing the benefits by a factor of 2.3. The result of the analysis is that one additional Phase 2 SAMA candidate was determined to be potentially cost-beneficial:

- SAMA 3 – Add a DDDIP. This SAMA involves installing a non-safety related DDDIP to supplement the turbine-driven AFW pump and reduce the risk of SBO scenarios.

In the ER, NMC stated that they will implement or continue to consider the above six SAMAs identified in the analysis (SAMAs 3, 10, 13, 16, 22, and 23) through the appropriate Palisades design process.

In response to RAIs by the NRC staff, NMC committed to further evaluate possible lower cost alternatives for two SAMAs originally eliminated in the Phase 1 screening analysis and to

further evaluate two additional SAMAs determined to be applicable to Palisades but not yet evaluated by NMC:

- lower cost alternative to SAMA 1 - installing an additional EDG,
- lower cost alternative to SAMA 18 - installing a permanent, dedicated pump and line to the EDGs,
- additional SAMA to add the capability to flash the field on the EDG, and
- additional SAMA to replace an existing air-operated containment sump valve with a motor-operated valve

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 NMC'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 the one Phase 2 SAMA that specifically addressed seismic risk only (SAMA 22). Doubling the benefit for SAMA 22 is not appropriate since this SAMA is specific to seismic risk only and would not have a corresponding benefit on the risk from internal events. While SAMAs 3, 4, and 10 were recognized as being effective in fire events, doubling of the benefit for these SAMAs is appropriate since they were also identified based on their importance in internal events. Given that the CDF of 4.3E-05 per year from internal fires, seismic events, and other external events as reported by NMC (NMC 2005a) is about the same as the CDF of 4.05E-05 per year from internal events, the NRC 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. Information regarding the uncertainty distribution of the internal events CDF is summarized in Section E.7.2 of the ER (NMC 2005a). In the uncertainty assessment described therein, the 95th percent confidence level for the internal events CDF is approximately 2.3 times the point estimate CDF. NMC re-examined the initial set of SAMAs to determine if any additional Phase 1 SAMAs would be retained for further analysis if the benefits (and MMACR) were increased by a factor of 2.3. Four such SAMAs were identified: SAMA 11 - install an additional high-pressure boron injection system to increase the means of injecting boron into the reactor in an ATWS, SAMA 15 - add a bypass

pipeline around the SIRWT return valves to prevent injection pump failure given failure of the return valves to open, SAMA 18 - provide a dedicated pump and pipeline to the EDGs for cooling thereby reducing system dependencies, and SAMA 21 - enable the FPS as a backup for the containment spray system. However, based on further consideration of their costs and the limited benefit of eliminating the basic events addressed by three of these SAMAs, NMC concluded that SAMAs 11, 15, and 18 would not be cost-beneficial even if the systems were completely reliable. The specific rationale is provided in Section E.7.2.1 of the ER. The NRC staff considers the applicant's rationale for eliminating SAMAs 11, 15, and 18 from further consideration in the final evaluation to be reasonable. SAMA 21 was retained for consideration in the final evaluation as discussed below.

NMC also considered the impact on the Phase 2 screening if the estimated benefits were increased by a factor of 2.3 (in addition to the factor of two multiplier already included in the baseline benefit estimates to account for external events). Of the SAMAs evaluated in the Phase 2 analysis, only SAMA 3, add a direct drive diesel driven injection pump, was found to be potentially cost-beneficial after having been classified as not cost-beneficial in the baseline analysis. Although not cost-beneficial in the baseline analysis, NMC included SAMA 3 within the set of potentially cost-beneficial SAMAs that they intend to evaluate further for potential implementation

SAMA 21, which was retained for further evaluation as a result of an uncertainty assessment, was subsequently eliminated by NMC. The detailed cost-benefit analysis for this SAMA assumed that all loss of containment spray events would be eliminated. The PSA model result was about a 40 percent reduction in the population dose and, since the containment spray system has a minimal impact on CDF, no reduction in the CDF. The estimated total benefit (present value) of the averted risk assuming a 7 percent discount rate was calculated to be about $3,570,000 (which assumes a doubling of the benefit to account for external events). Since this total estimated benefit is significantly less than the estimated cost of implementation of $7,000,000, NMC concluded that this SAMA would not be cost-beneficial. The NRC staff has reviewed NMC's bases for calculating the risk reduction for this SAMA and concludes that the rationale and assumptions for estimating risk reduction are reasonable and generally conservative (i.e., the estimated risk reduction is higher than what would actually be realized). The NRC staff also reviewed the bases for the estimated implementation cost of this SAMA and found it to be consistent with estimates provided in support of other plants' analyses. Accordingly, the NRC staff agrees with the NMC conclusion that this SAMA is not cost-beneficial.

During its review, the NRC noted that the offsite economic cost risk estimated for Palisades is larger than estimated at other sites having similar CDF and population dose. The NRC staff asked NMC to provide additional information on the input assumptions used in the MACCS2 model and other factors that may contribute to this difference (NRC 2005). In response to the RAI, NMC provided additional detail on the input assumptions made for several MACCS2

economic parameters (NMC 2005b). The NRC staff concludes that the input assumptions are consistent with those used in other recent industry analyses, and that the noted differences in offsite economic cost risk are most likely due to population differences.

In its ER, NMC stated that several SAMAs are cost-beneficial based on the methodology applied in the analysis and warrant further review for potential implementation. Five SAMAs were found to have positive net values in NMC's baseline analysis (SAMAs 10, 13, 16, 22, and 23). One additional SAMA candidate was determined by NMC to be potentially cost-beneficial based on consideration of uncertainties (SAMA 3). NMC noted that three SAMAs in particular show the largest potential for delivering a cost-beneficial risk reduction at Palisades, specifically, SAMAs 10, 13, and 16.

NMC performed a probabilistic evaluation to investigate the impact on the remaining cost-beneficial SAMAs if SAMA 10 were to be implemented. Based on information provided in Section E.6.9 of the ER, implementation of SAMA 10 would alter the cost-effectiveness of the remaining SAMAs such that several of the aforementioned SAMAs would no longer be cost-beneficial.

NMC noted in the ER that while the above results are believed to accurately reflect areas for improvement at the plant, additional engineering reviews are necessary to determine ultimate implementation. NMC stated that they will implement or continue to consider the six SAMAs identified in the analysis through the appropriate Palisades design process (SAMAs 3, 10, 13, 16, 22, and 23). In response to RAIs by the NRC staff, NMC also committed to further evaluate possible lower cost alternatives for two SAMAs originally eliminated in the Phase 1 screening analysis (SAMAs 1 and 18), and to further evaluate two additional SAMAs determined to be applicable to Palisades but not yet evaluated by NMC (add the capability to flash the field on the EDG, and replace an existing air-operated containment sump valve with a motor-operated valve). NMC has entered these 10 potentially cost-beneficial items into the Palisades corrective action system for further review. If determined to be cost-beneficial, these alternatives will be evaluated for possible implementation in accordance with Palisades plant design processes.

The NRC staff notes that all of the potentially cost-beneficial SAMAs identified in either the baseline analysis, or the uncertainty analysis are included within the set of SAMAs that NMC plans to further evaluate. Several additional SAMAs representing lower cost alternatives to SAMAs originally eliminated in the Phase 1 screening analysis, and SAMAs determined to be applicable to Palisades but not yet evaluated by NMC will be assessed as part of this evaluation. The NRC staff concludes that, with the exception of the 10 potentially cost-beneficial SAMAs discussed above, the costs of the SAMAs evaluated would be higher than the associated benefits.

G.7 Conclusions

NMC compiled a list of 23 SAMA candidates based on a review of the most significant basic events from the plant-specific PSA, Phase 2 SAMAs from license renewal activities for other plants, and insights from the plant-specific IPE and IPEEE. A qualitative screening removed 14 SAMA candidates that: (1) were not applicable at Palisades due to design differences, (2) require extensive changes that involve implementation costs known to exceed any possible benefit, or (3) cost more than $5.6 million to implement (the modified maximum averted cost-risk). An additional SAMA candidate was eliminated based on plant-specific insights regarding the low risk significance of systems affected by the SAMA, leaving eight SAMA candidates for further evaluation.

For the remaining SAMA candidates, a more detailed design and cost estimate was developed as shown in Table G-4. The cost-benefit analyses showed that five of the SAMA candidates were potentially cost-beneficial in the baseline analysis (SAMAs 10, 13, 16, 22, and 23). NMC performed additional analyses to evaluate the impact of parameter choices and uncertainties on the results of the SAMA assessment. As a result, one additional SAMA was identified as potentially cost-beneficial (SAMA 3). NMC has indicated that a further evaluation of these six potentially cost-beneficial SAMAs will be performed.

In response to RAIs by the NRC staff, NMC committed to further evaluate possible lower cost alternatives for two SAMAs originally eliminated in the Phase 1 screening analysis (SAMAs 1 and 18) and to further evaluate two NRC staff-identified plant enhancements determined to be applicable to Palisades but not yet evaluated by NMC (add the capability to flash the field on the EDG, and replace an existing air-operated containment sump valve with a motor-operated valve). NMC has entered these 10 potentially cost-beneficial items into the Palisades corrective action system for further review. If determined to be cost-beneficial, they will be further evaluated for possible implementation in accordance with Palisades plant design processes.

The NRC staff reviewed the NMC 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 inclusion of a candidate SAMA related to dominant seismic events, 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 NRC 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. Given the potential for cost-beneficial risk reduction, the NRC staff agrees that further evaluation of these SAMAs by NMC is warranted. However, these SAMAs do not relate to adequately managing the effects of aging during the period of extended operation. Therefore, they need not be implemented as part of the license renewal pursuant to 10 CFR Part 54.

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11. ABSTRACT *(200 words or less)*

This draft supplemental environmental impact statement (SEIS) has been prepared in response to an application submitted to the Nuclear Regulatory Commission (NRC) by Nuclear Management Company, LLC (NMC) to renew the operating license for the Palisades Nuclear Plant (Palisades) 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 effects of the proposed action, the environmental impacts of alternatives to the proposed action, and mitigation measures available for reducing or avoiding adverse impacts.

The NRC staff's recommendation is that the Commission determine that the adverse environmental impacts of license renewal for Palisades are not so great that preserving the option of license renewal for energy-planning decision makers would be unreasonable. This preliminary recommendation is based on the following: (1) the analysis and findings in the Generic Environmental Impact Statement for License Renewal of Nuclear Plants (NUREG-1437); (2) the Environmental Report submitted by NMC; (3) consultation with other Federal, State, Tribal, and Local agencies; (4) the staff's own independent review; and (5) the staff's consideration of public comments.

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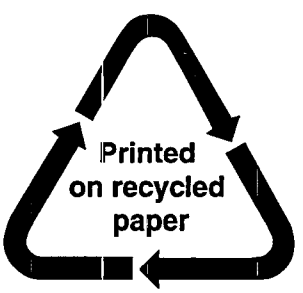

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