NUREG-1437
Supplement 20

Generic Environmental Impact Statement for License Renewal of Nuclear Plants

Supplement 20

Regarding
Donald C. Cook Nuclear Plant, Units No. 1 and 2

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 20

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Regarding Donald C. Cook Nuclear Plant, Units No. 1 and 2

Draft Report for Comment

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R. Schaaf
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001
Phone: 301-415-1312
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Abstract

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

This draft supplemental environmental impact statement (SEIS) has been prepared in response to an application submitted to the NRC by the Indiana Michigan Power Company (I&M) to renew the OLs for the Donald C. Cook Nuclear Plant (CNP) Units 1 and 2 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 including cumulative impacts, the environmental impacts of alternatives to the proposed action, and mitigation measures available for reducing or avoiding adverse impacts. It also includes the staff's preliminary recommendation regarding the proposed action.

Regarding the 69 issues for which the GEIS reached generic conclusions, neither I&M nor the staff has identified information that is both new and significant for any issue that applies to CNP Units 1 and 2. In addition, the staff determined that information provided during the scoping process did not call into question the conclusions in the GEIS. Therefore, the staff concludes that the impacts of renewing the CNP OLs will not be greater than impacts identified for these issues in the GEIS. For each of these issues, the staff's conclusion in the GEIS is that the impact is of SMALL[a] significance (except for collective offsite radiological impacts from the fuel cycle and high-level waste (HLW) and spent fuel, which were not assigned a single significance level).

Regarding the remaining 23 issues, those that apply to CNP Units 1 and 2 are addressed in this draft SEIS. For each applicable issue, the staff concludes that the significance of the potential environmental impacts of renewal of the OLs is SMALL. The staff also concludes that additional mitigation measures are not likely to be sufficiently beneficial as to be warranted. The staff determined that information provided during the scoping process did not identify any new issue that has a significant environmental impact.

(a) Environmental impacts 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 CNP Units 1 and 2 are not so great that preserving the option of license renewal for energy-planning decisionmakers would be unreasonable. This recommendation is based on (1) the analysis and findings in the GEIS; (2) the environmental report submitted by I&M; (3) consultation with Federal, State, and local agencies; (4) the staff's own independent review; and (5) the staff's consideration of public comments.

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Executive Summary

By letter dated October 31, 2003, the Indiana Michigan Power Company (I&M) submitted an application to the U.S. Nuclear Regulatory Commission (NRC) to renew the operating licenses (OLs) for Donald C. Cook Nuclear Plant (CNP) Units 1 and 2 for an additional 20-year period. If the OLs are renewed, State regulatory agencies and I&M 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 OLs are not renewed, then the units must be shut down at or before the expiration dates of the current OLs, which are October 25, 2014, for Unit 1 and December 23, 2017, for Unit 2.

The NRC has implemented Section 102 of the National Environmental Policy Act (NEPA) (42 USC 4321) in 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 I&M application, the NRC began the environmental review process described in 10 CFR Part 51 by publishing a notice of intent to prepare an EIS and conduct scoping. The staff visited the CNP site in March 2004 and held public scoping meetings on March 8, 2004, in Bridgman, Michigan. In the preparation of this draft supplemental environmental impact statement (SEIS) for CNP Units 1 and 2, the staff reviewed the I&M environmental report (ER) and compared it to the GEIS, consulted with other agencies, conducted an independent review of the issues following the guidance set forth in NUREG-1555, Supplement 1, the *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 of this SEIS.

The staff will hold two public meetings in Bridgman, Michigan, in November 2004, to describe the preliminary results of the NRC environmental review, to answer questions, and to provide members of the public with information to assist them in formulating comments on this SEIS. When the comment period ends, the staff will consider and address all of the comments received. These comments will be addressed in Appendix A 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 impacts of the proposed action including cumulative impacts, the environmental impacts of alternatives to the proposed action, and mitigation measures for reducing or avoiding adverse impacts. It also includes the 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) decisionmakers.

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

> ... whether or not the adverse environmental impacts of license renewal are so great that preserving the option of license renewal for energy planning decisionmakers would be unreasonable.

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

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

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

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

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

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

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

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

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

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

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

This draft SEIS documents the staff's consideration of all 92 environmental issues identified in the GEIS. The staff considered the environmental impacts associated with alternatives to license renewal and compared the environmental impacts of license renewal and the alternatives. The alternatives to license renewal that were considered include the no-action alternative (not renewing the OLs for CNP Units 1 and 2) 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 Units 1 and 2 is replaced. These alternatives are evaluated assuming that the replacement power generation plant is located at either the CNP site or some other unspecified alternate location.

I&M and the staff have established independent processes for identifying and evaluating the significance of any new information on the environmental impacts of license renewal. Neither I&M nor the staff has identified information that is both new and significant related to Category 1 issues that would call into question the conclusions in the GEIS. Similarly, neither the scoping process nor the staff has identified any new issue applicable to CNP Units 1 and 2, that has a significant environmental impact. Therefore, the staff relies upon the conclusions of the GEIS for all of the Category 1 issues that are applicable to CNP Units 1 and 2.

I&M's license renewal application presents a site-specific analysis of the applicable Category 2 issues and chronic effects from electromagnetic fields. The staff has reviewed the I&M analysis for each issue and has conducted an independent review of each issue. Six Category 2 issues are not applicable because they are related to plant design features or site characteristics not found at CNP. Four Category 2 issues are not discussed in this draft SEIS because they are specifically related to refurbishment. I&M 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 CNP Units 1 and 2 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 1973 *Final Environmental Statement Related to Operation of Donald C. Cook Nuclear Plant Units 1 and 2.*

Eleven 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 discussed in this draft SEIS only in relation to operation during the renewal term. For all eleven Category 2 issues and environmental justice, the staff concludes that the potential environmental effects are of SMALL significance in the context of the standards set forth in the GEIS. In addition, the staff determined that appropriate Federal health agencies have not reached a consensus on the existence of chronic adverse effects from electromagnetic fields. Therefore, no further evaluation of this issue is required. For severe accident mitigation alternatives (SAMAs), the staff concludes that a reasonable, comprehensive effort was made to identify and evaluate SAMAs. Based on its review of the SAMAs for CNP Units 1 and 2, and the plant improvements already made, the staff concludes that sixteen of the candidate SAMAs, addressing five general areas for improvement, are cost-beneficial.

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

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

If the CNP Units 1 and 2 OLs are not renewed and the units cease operation on or before the expiration of their current operating licenses, then the adverse impacts of likely alternatives will not be smaller than those associated with continued operation of CNP Units 1 and 2. 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 CNP Units 1 and 2 are not so great that preserving the option of license renewal for energy planning decisionmakers would be unreasonable. This recommendation is based on (1) the analysis and findings in the GEIS; (2) the ER submitted by I&M; (3) consultation with other Federal, State, and local agencies; (4) the staff's own independent review; and (5) the staff's consideration of public comments.

Abbreviations/Acronyms

°C	degree(s) Celsius
°F	degree(s) Fahrenheit
μCi/mL	microcuries per milliliter
μm	micrometer(s)
ac	acre(s)
ADAMS	Agencywide Documents Access and Management System
AEA	Atomic Energy Act of 1954
AEC	U.S. Atomic Energy Commission
AEP	American Electric Power
AEPSC	American Electric Power Service Corporation
AQCR	Air Quality Control Region
AQI	air quality index
Bq	becquerel(s)
Btu	British thermal unit(s)
CAA	Clean Air Act
CCW	component cooling water
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
Ci	curie(s)
cm	centimeter(s)
CNP	Donald C. Cook Nuclear Plant
COE	U.S. Army Corps of Engineers
CWA	Clean Water Act
CZMA	Coastal Zone Management Act
DAW	dry active waste
dB	decibel(s)
DBA	design-basis accident
DDT	dichloro-diphenyl-trichloroethane
DOC	U.S. Department of Commerce
DOE	U.S. Department of Energy
DOL	U.S. Department of Labor
DOT	U.S. Department of Transportation
DSM	demand-side management
EIA	Energy Information Administration (of DOE)
EIS	environmental impact statement

ELF-EMF	extremely low frequency-electromagnetic field
EPA	U.S. Environmental Protection Agency
ER	environmental report
ESA	Endangered Species Act
ESRP	Environmental Standard Review Plan, NUREG-1555, Supplement 1, Operating License Renewal
FES	Final Environmental Statement
FNP	Fitzpatrick Nuclear Plant
FR	*Federal Register*
FSAR	Final Safety Analysis Report
ft	foot (feet)
FWS	U.S. Fish and Wildlife Service
gal	gallon(s)
GDC	general design criteria
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
GWh	gigawatt per hour
Gy	gray
ha	hectare(s)
HEPA	high efficiency particulate air
HLW	high-level waste
hr	hour(s)
Hz	hertz
I&M	Indiana Michigan Power Company
IDNR	Indiana Department of Natural Resources
in.	inch(es)
kg	kilogram(s)
kHz	kilohertz
km	kilometer(s)
kPa	kilopascal(s)
kV	kilovolt(s)

kV/m	kilovolt(s) per meter
kWh	kilowatt hour(s)
L	liter(s)
lb	pound
LOCA	loss-of-coolant accident
LWR	light-water reactor
m	meter(s)
m/s	meter(s) per second
m^3/d	cubic meter(s) per day
m^3/s	cubic meter(s) per second
mA	milliampere(s)
MBq	megabecquerel(s)
MDEQ	Michigan Department of Environmental Quality
MDNR	Michigan Department of Natural Resources
MNFI	Michigan Natural Features Inventory
mi	mile(s)
mGy	milligray(s)
mL	milliliter(s)
mrad	millirad(s)
mrem	millirem(s)
mSv	millisievert(s)
MT	metric ton(s) (or tonne[s])
MW	megawatt(s)
MW(e)	megawatt(s) electric
MW(t)	megawatt(s) thermal
MWh	megawatt hour(s)
NEPA	National Environmental Policy Act of 1969
NESC	National Electric Safety Code
ng/J	nanogram(s) per joule
NHPA	National Historic Preservation Act
NIEHS	National Institute of Environmental Health Sciences
NO_x	nitrogen oxide(s)
NPDES	National Pollutant Discharge Elimination System
NRC	U.S. Nuclear Regulatory Commission
NRHP	National Register of Historic Places
NWPPC	Northwest Power Planning Council

ODCM	Offsite Dose Calculation Manual
OL	operating license
Pa	pascal(s)
PCB	polychlorinated biphenyl
pCi/L	picocuries per liter
PM_{10}	particulate matter, 10 microns or less in diameter
ppt	part(s) per thousand
PSD	prevention of significant deterioration
psi	pounds per square inch
psig	pounds per square inch gauge
PSW	plant service water
PWR	pressurized light-water reactor
RCRA	Resource Conservation and Recovery Act
REMP	radiological environmental monitoring program
ROW	right-of-way
s	second(s)
SAMA	severe accident mitigation alternative
SAR	Safety Analysis Report
SCDHEC	South Carolina Department of Health and Environmental Control
SCR	selective catalytic reduction
SECA	Solid State Energy Conversion Alliance
SEIS	Supplemental Environmental Impact Statement
SER	Safety Evaluation Report
SHPO	State Historic Preservation Office(r)
SO_2	sulfur dioxide
SO_x	sulfur oxide(s)
Sv	sievert
TEDE	total effective dose equivalent
TDEC	Tennessee Department of Environment and Conservation
TLAA	time-limited aging analysis
TLD	thermoluminescent dosimeter
TWh	terawatt-hour(s)
UFSAR	Updated Final Safety Analysis Report
U.S.	United States
USC	United States Code

USCB	U.S. Census Bureau
USDA	U.S. Department of Agriculture
W	watt(s)
yr	year(s)

1.0 Introduction

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

The Indiana Michigan Power Company (I&M) operates the Donald C. Cook Nuclear Plant (CNP) Units 1 and 2 in southwestern Michigan under OLs DPR-58 and DPR-74, which were issued by the NRC. These OLs will expire in October 2014 for Unit 1 and December 2017 for Unit 2. On October 31, 2003, I&M submitted an application to the NRC to renew the CNP Units 1 and 2 OLs for an additional 20 years under 10 CFR Part 54. I&M is the licensee for the purposes of its current OLs and the applicant for the renewal of the OLs. Pursuant to 10 CFR 54.23 and 51.53(c), I&M submitted an environmental report (ER) (I&M 2003a) in which I&M 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 I&M license renewal application. This draft SEIS is a supplement to the GEIS because it relies, in part, on the findings of the GEIS. The staff will also prepare a separate safety evaluation report in accordance with 10 CFR Part 54.

(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 SEIS, including the development of the GEIS and the process used by the staff to assess the environmental impacts associated with license renewal; (2) describe the proposed Federal action to renew the CNP Units 1 and 2 OLs; (3) discuss the purpose and need for the proposed action; and (4) present the status of I&M'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 chapters of this SEIS closely parallel the contents and organization of the GEIS. Chapter 2 describes the site, power plant, and interactions of the plant with the environment. Chapters 3 and 4, respectively, discuss the potential environmental impacts of plant refurbishment and plant operation during the renewal term. Chapter 5 contains an evaluation of potential environmental impacts of plant accidents and includes consideration of severe accident mitigation alternatives. Chapter 6 discusses the uranium fuel cycle and solid waste management. Chapter 7 discusses decommissioning, and Chapter 8 discusses alternatives to license renewal. Finally, Chapter 9 summarizes the findings of the preceding chapters and draws conclusions about the adverse impacts that cannot be avoide, the relationship between short-term uses of man's environment and the maintenance and enhancement of long-term productivity, and the irreversible or irretrievable commitment of resources. Chapter 9 also presents the staff's preliminary recommendation with respect to the proposed license renewal action.

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

- The preparers of the supplement

- The chronology of NRC staff's environmental review correspondence related to this SEIS

- The organizations contacted during the development of this SEIS

- I&M's compliance status and copies of consultation correspondence prepared and sent during the evaluation process

- GEIS environmental issues that are not applicable to CNP Units 1 and 2

- Severe accident mitigation alternatives (SAMAs).

1.2 Background

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

1.2.1 Generic Environmental Impact Statement

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

The GEIS documents the results of the systematic approach that was taken to evaluate the environmental consequences of renewing the licenses of individual nuclear power plants and operating them for an additional 20 years. For each potential environmental issue, the GEIS (1) describes the activity that affects the environment; (2) identifies the population or resource that is affected; (3) assesses the nature and magnitude of the impact on the affected population or resource; (4) characterizes the significance of the 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 [HLW] waste and spent fuel disposal).

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

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

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

In the GEIS, the staff assessed 92 environmental issues and determined that 69 qualified as Category 1 issues, 21 qualified as Category 2 issues, and 2 issues were not categorized. The two issues not categorized were 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 OLs is required to submit an ER as part of its application. The license renewal evaluation process involves careful review of the applicant's ER and assurance that all new and potentially significant information not already addressed in or available during the GEIS evaluation is identified, reviewed, and assessed to verify the environmental impacts of the proposed license renewal.

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

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

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

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

- Consider the economic benefits and costs of the proposed action and alternatives to the proposed action except insofar as such benefits and costs are either (1) essential for making a determination regarding the inclusion of an alternative in the range of alternatives considered, or (2) relevant to mitigation

- Consider the need for power and other issues not related to the environmental effects of the proposed action and the alternatives

- Discuss any aspect of the storage of spent fuel within the scope of the generic determination in 10 CFR 51.23(a) in accordance with 10 CFR 51.23(b)

- Contain an analysis of any Category 1 issue unless there is significant new information on a specific issue–this is pursuant to 10 CFR 51.23(c)(3)(iii) and (iv).

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

In preparing to submit its application to renew the CNP Units 1 and 2 OLs, I&M developed a process to ensure that information not addressed in or available during the GEIS evaluation regarding the environmental impacts of license renewal for CNP Units 1 and 2 would be properly reviewed before submitting the ER, and to ensure that such new and potentially significant information related to renewal of the licenses for Units 1 and 2 would be identified, reviewed, and assessed during the period of NRC review. I&M 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 CNP Units 1 and 2. This review was performed by personnel from I&M 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* (ESRP), 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. When new and significant information is identified regarding Category 1 issues, reconsideration of previous 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 CNP Units 1 and 2. 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 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 I&M license renewal application began with publication of a notice of acceptance for docketing and opportunity for a hearing in the *Federal Register* (FR) (68 FR 68956) (NRC 2003) on December 10, 2003. The staff published a notice of intent to prepare an EIS and conduct scoping (NRC 2004a) on February 6, 2004. Two public scoping meetings were held on March 8, 2004 in Bridgman, Michigan. Comments received during the scoping period were summarized in the *Environmental Impact Statement Scoping Process: Summary Report – Donald C. Cook Nuclear Plant Units 1 and 2, Berrien County, Michigan* (NRC 2004b) dated June 3, 2004. Comments that are applicable to this environmental review are presented in Part 1 of Appendix A.

The staff followed the review guidance contained in NUREG-1555, Supplement 1, *Standard Review Plans for Environmental Reviews for Nuclear Power Plants, Supplement 1: Operating License Renewal* (NRC 2000). The staff and contractors retained to assist the staff visited the CNP site on March 9 and 10, 2004, to gather information and to become familiar with the site and its environs. The staff also reviewed the comments received during scoping, and consulted with Federal, State, regional, and local agencies. A list of the organizations consulted is provided in Appendix D. Other documents related to CNP Units 1 and 2 were reviewed and are referenced, including the results of the staff's environmental review during the original licensing of the plant (AEC 1973).

This draft SEIS presents the staff's analysis that considers and weighs the environmental impacts of the proposed renewal of the OLs for CNP Units 1 and 2 (including cumulative impacts), 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 decisionmakers would be unreasonable.

A 75-day comment period will begin on the date of publication of the U.S. Environmental Protection Agency Notice of Filing of the draft SEIS to allow members of the public to comment on the preliminary results of the NRC staff's review. During this comment period, two public meetings will be held in Bridgman, Michigan, in November 2004. During these meetings, the staff will describe the preliminary results of the NRC environmental review and answer questions related to it to provide members of the public with information to assist them in formulating their comments.

1.3 The Proposed Federal Action

The proposed Federal action is renewal of the OLs for CNP Units 1 and 2. The CNP site is located in Lake Charter Township, Berrien County, Michigan, on the southeastern shoreline of Lake Michigan. This location is approximately 89 km (55 mi) east of downtown Chicago, Illinois; 80 km (50 mi) southwest of Kalamazoo, Michigan; and 18 km (11 mi) south-southwest of the twin cities of St. Joseph and Benton Harbor, Michigan. The plant has two Westinghouse-designed light-water reactors. Unit 1 has a design power level of 3304 megawatts thermal (MW[t]) and a net power output of 1044 megawatts electric (MW[e]); Unit 2 has a design power level of 3468 MW(t) and a net power output of 1117 MW(e). To remove heat from the main condenser, CNP uses a once-through circulating water system that draws from and discharges to Lake Michigan. Units 1 and 2 produce electricity to supply the needs of approximately 728,000 customers. The current OL for Unit 1 expires on October 25, 2014, and for Unit 2 on December 23, 2017. By letter dated October 31, 2003, I&M submitted an application to the NRC (I&M 2003b) to renew these OLs for an additional 20 years of operation (i.e., until October 25, 2034, for Unit 1 and December 23, 2037, for Unit 2).

1.4 The Purpose and Need for the Proposed Action

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

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

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

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

1.5 Compliance and Consultations

I&M is required to hold certain Federal, State, and local environmental permits, as well as meet relevant Federal and State statutory requirements. In its ER (I&M 2003a), I&M provided a list of the authorizations from Federal, State, and local authorities for current operations as well as environmental approvals and consultations associated with CNP Units 1 and 2 license renewal.

Authorizations and consultations relevant to the proposed OL renewal action are included in Appendix E.

The staff has reviewed the list and consulted with the appropriate Federal, State, and local agencies to identify any compliance or permit issues or significant environmental issues of concern to the reviewing agencies. These agencies did not identify any new and significant environmental issues. The ER (I&M 2003a) states that I&M is in compliance with applicable environmental standards and requirements for CNP Units 1 and 2. The staff has not identified any environmental issues that are both new and significant.

1.6 References

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

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

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

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

Indiana Michigan Power Company (I&M). 2003a. *Applicant's Environmental Report – Operating License Renewal Stage, Donald C. Cook Nuclear Plant Units 1 and 2.* Docket Nos. 50-315 and 50-316. Buchanan, Michigan. October 2003.

Indiana Michigan Power Company (I&M). 2003b. *Application for Renewed Operating Licenses, Donald C. Cook Nuclear Plant Units 1 and 2.* Docket Nos. 50-315 and 50-316. Buchanan, Michigan. October 2003.

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

U.S. Atomic Energy Commission (AEC). 1973. *Final Environmental Statement Related to Operation of Donald C. Cook Nuclear Plant, Indiana and Michigan Electric Company and Indiana and Michigan Power Company.* Docket Nos. 50-315 and 50-316. Washington, D.C. August 1973.

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). 2003. "Notice of Acceptance for Docketing of the Application and Notice of Opportunity for Hearing Regarding Renewal of License Nos. DPR-58 and DPR-74 for an Additional Twenty-Year Period." *Federal Register*, Vol. 68, pp. 68956-68958, Washington, DC. December 10, 2003.

U.S. Nuclear Regulatory Commission (NRC). 2004a. "Notice of Intent to Prepare an Environmental Impact Statement and Conduct Scoping Process." *Federal Register*, Vol. 69, pp. 5880-5881, Washington, D.C. February 6, 2004.

U.S. Nuclear Regulatory Commission (NRC). 2004b. *Environmental Impact Statement Scoping Process: Summary Report – Donald C. Cook Nuclear Plant Units 1 and 2, Berrien County, Michigan.* Washington, D.C. June 3, 2004.

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

The Donald C. Cook Nuclear Plant (CNP) is owned and operated by Indiana Michigan Power Company (I&M), a wholly owned subsidiary of American Electric Power (AEP). CNP is in Lake Charter Township, Berrien County, Michigan, on the southeastern shoreline of Lake Michigan. The plant consists of two units that are pressurized light-water reactors (PWRs) that produce steam that turns turbines to generate electricity. The site includes two reactor containment buildings, a turbine building, an auxiliary building, service buildings, a fuel-handling facility, switchyards, a radioactive-waste building, a training center, a visitor's center, an indoor firing range, and several other support buildings. 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

CNP Units 1 and 2 are located on approximately 263 ha (650 ac) owned by I&M. The plant is approximately 89 km (55 mi) east of downtown Chicago, Illinois; 80 km (50 mi) southwest of Kalamazoo, Michigan; and 18 km (11 mi) south-southwest of the twin cities of St. Joseph and Benton Harbor, Michigan. The nearest town is Bridgman, which is approximately 3.2 km (2 mi) south of the plant. Figures 2-1 and 2-2 show the site location and features within 80 km (50 mi) and 10 km (6 mi), respectively (I&M 2003a).

Based on 2000 U.S. Census Bureau (USCB) data, approximately 1.4 million people live within 80 km (50 mi) of the site (I&M 2003a). The population density of 177 persons/km^2 (283 persons/mi^2) is considered a high population area based on the criteria described in the Generic Environmental Impact Statement for License Renewal of Nuclear Plants (GEIS), NUREG-1437, Volumes 1 and 2 (NRC 1996, 1999).[a]

CNP employs a permanent workforce of approximately 1200 employees. Up to an additional 700 contract employees and employees on loan from other AEP corporate organizations may be assigned during refueling outages. Upon the initiation of the renewed operating licenses (OLs), the permanent workforce is expected to decrease to approximately 1000 and the contract workforce to approximately 250 (I&M 2003a). Each unit is refueled on an 18-month

(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.

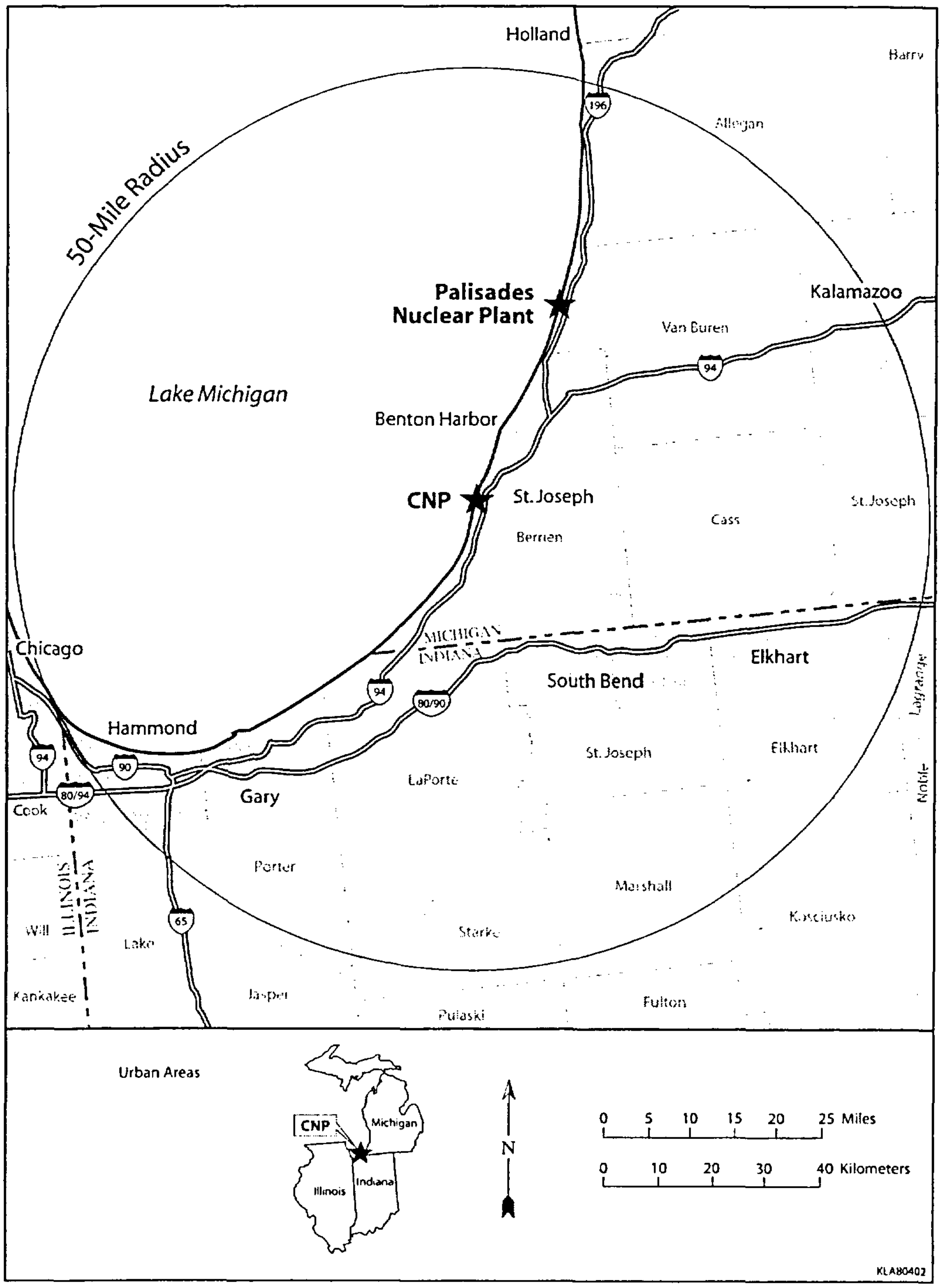

Figure 2-1. Location of CNP Units 1 and 2, 80-km (50-mi) Region

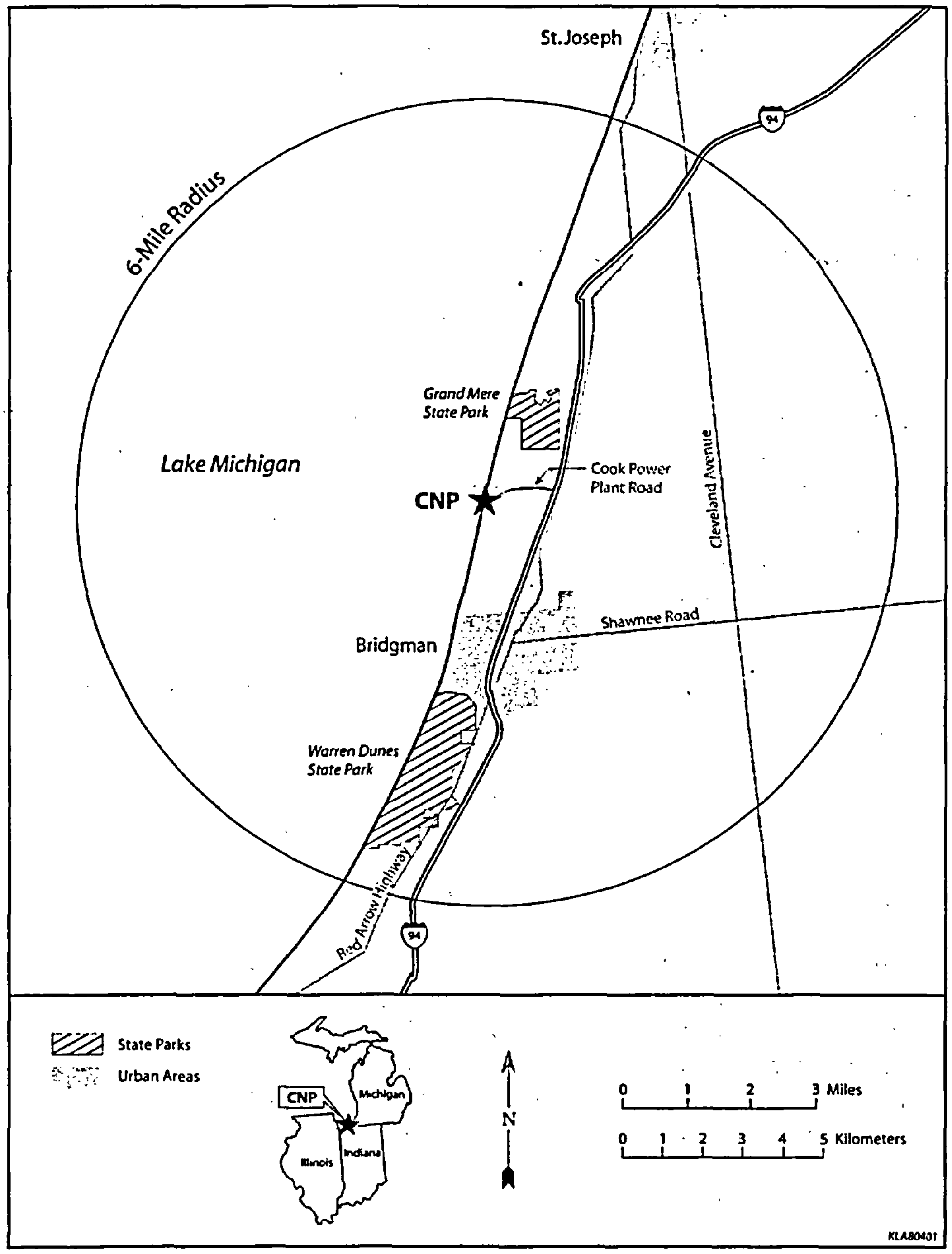

Figure 2-2. Location of CNP Units 1 and 2, 10-km (6-mi) Region

refueling cycle. During refueling outages, site employment increases by as many as 700 workers for temporary duty (28 to 30 days) (I&M 2003a).

2.1.1 External Appearance and Setting

CNP property includes 1326 m (4350 ft) of lake frontage and extends approximately 2 km (1.3 mi) eastward from Lake Michigan. The local terrain consists of a gentle upward sloping beach that rises sharply into sand dunes after about 61 m (200 ft). The area surrounding the plant property is largely rural, characterized by agriculture and heavily wooded, rugged sand dunes along the lakeshore (I&M 2003a). As indicated on Figure 2-2, there are few urban areas and little industrial development within the 10-km (6-mi) radius of the plant.

The Grand Mere State Park is approximately 1.6 km (1 mi) north-northeast of CNP (I&M 2003a). This park includes approximately 1.6 km (1 mi) of Lake Michigan shoreline and is characterized by sand dunes and deep blowouts, as well as three inland lakes that lie in an undeveloped natural area behind the dunes. Warren Dunes State Park is about 5.6 km (3.5 mi) south-southwest of the site. This park has more than 3.2 km (2 mi) of shoreline with sand dunes rising 73 m (240 ft) above Lake Michigan, as well as a variety of natural settings. Figure 2-2 shows the location of these natural areas.

CNP is located within a physiographic area known as the Grand Marais Embayment. This area extends 26 km (16 mi) parallel to the lake and has an average width of 1.6 km (1 mi). On the Lake Michigan side, it is characterized by high sand dunes and shoreline features of several glacial lake stages. The area is bounded on the east by a glacial moraine known as the Covert Ridge, which serves as a drainage divide and groundwater barrier (I&M 2003a).

The geology of the site consists of a surface Pleistocene deposit of dune sand that overlies older beach sand, which in turn is underlain by glacial lake clays, glacial till, and shale bedrock. In the eastern half of the CNP property, the beach sands are absent and the dunes rest directly on glacial lake deposits. The dune sand is generally loose at and near the surface, and becomes moderately compact at increasing depth. The underlying beach sands are generally compact and commonly range from about 7.6 to 11.7 m (25 to 35 ft) in thickness in the west-central portion of the property. The deeper bedrock formations consist predominantly of interbedded dolomite, limestone, shale, and sandstone (I&M 2003a).

2.1.2 Reactor Systems

CNP is a nuclear-powered steam electric generating facility that began commercial operation on August 23, 1975 (Unit 1), and July 1, 1978 (Unit 2). Each unit is powered by a Westinghouse PWR. Unit 1 produces a reactor core power of 3304 megawatts-thermal

(MW[t]); Unit 2 produces 3468 MW(t). The design net electrical capacities are 1044 and 1117 megawatts-electric (MW[e]) for Units 1 and 2, respectively (I&M 2003a). Figure 2-3 depicts the site layout.

The nuclear steam supply system at each CNP unit is a four-loop Westinghouse PWR. The reactor core heats water to approximately 316°C (600°F). Because the pressure exceeds 2000 psi, the water does not boil. The heated water is pumped to four U-tube heat exchangers, known as steam generators, where the heated water transfers heat to boil the water on the shell side into steam. After drying, the steam is routed to the turbines. The steam yields its energy to turn the turbines, which are connected to the electrical generator. In 1988, the Unit 2 steam generators were replaced by new Westinghouse steam generators. In 2000, the Unit 1 steam generators were replaced with Babcock & Wilcox steam generators. The nuclear fuel is low-enriched uranium dioxide with enrichments below 5 percent by weight (I&M 2003a).

The reactor, steam generators, and related systems for each unit 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 a hemispherical dome. A welded steel liner is attached to the inside face of the concrete shell to ensure a high degree of leaktightness. In addition, the 1-m (3.5-ft) thick concrete walls serve as a radiation shield for both normal and accident conditions.

Each CNP unit uses an ice condenser system to condense steam following an improbable loss-of-coolant accident (LOCA). This containment design allows a smaller containment building. The ice condenser is a completely enclosed annular compartment located around approximately 300 degrees of the perimeter of the containment. The ice is held in baskets to transfer heat to the ice from steam released to the containment building in the event of an accident. A refrigeration system maintains the ice between -12.2 and -6.7°C (10 and 20°F) (I&M 2003a).

The containment building for each unit 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. High efficiency particulate air (HEPA) filters are used when needed to filter the air before releasing it.

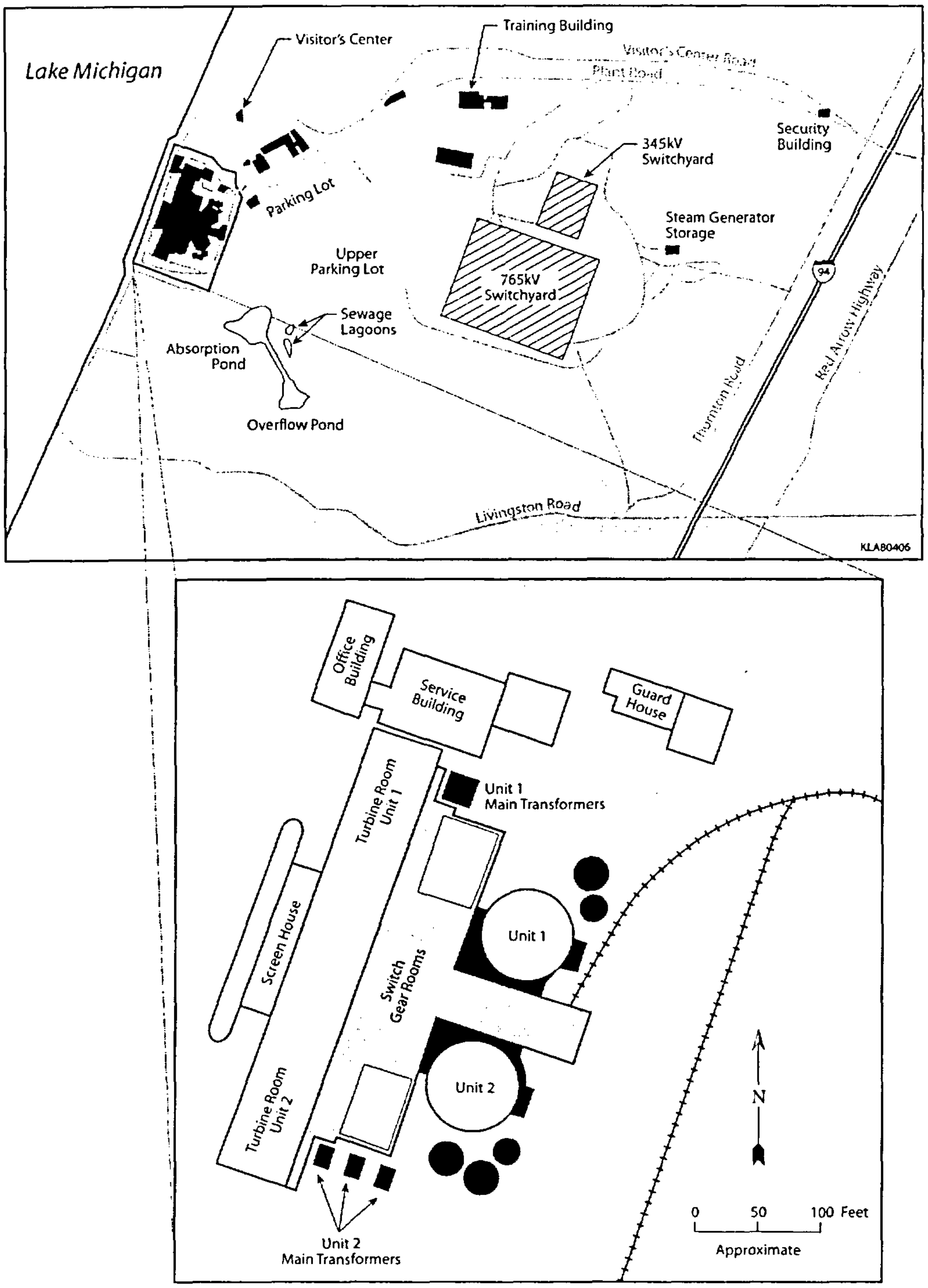

Figure 2-3. CNP Site Layout

2.1.3 Cooling and Auxiliary Water Systems

The condenser cooling system for CNP Units 1 and 2 is a once-through circulating water system that draws from and discharges to Lake Michigan. This system removes heat rejected from the main condensers. The plant does not use cooling towers or cooling ponds.

Condenser cooling water is withdrawn from Lake Michigan through three intake cribs approximately 686 m (2250 ft) from the shoreline in approximately 6.1 m (20 ft) of water. Each intake crib consists of a smoothly rounded intake elbow set in the lake bottom, surrounded by sacked concrete and rip-rap to prevent erosion. The intake elbow is capped by an octagon-shaped heavy steel frame to protect it from ice damage. Bar racks and guides on all sides of the steel frame prevent entry of large debris, and a steel plate roof prevents creation of a vortex and entry of debris from above (I&M 2003a).

Three 4.9 m (16 ft) diameter buried steel pipes connect the intake cribs to the screen house just inland of the beach. The screen house is common to both units and contains the circulating water pumps, traveling screens, essential service water pumps, and associated equipment. There are seven circulating water pumps, three for Unit 1 and four for Unit 2. These pumps move the water to the condensers, from which the circulating water is returned to Lake Michigan through two unit-specific discharge tunnels (4.9 m [16 ft] in diameter for Unit 1 [Outfall 001] and 5.5 m [18 ft] in diameter for Unit 2 [Outfall 002]). Each discharge tunnel ends with a discharge elbow (I&M 2003a). Outfall 003 is located at the intake structure for the cooling system and is used to keep the intake free of ice during the winter months.

The discharge elbows, located approximately 351 m (1150 ft) from shore, terminate in a high-velocity discharge. The high-velocity discharges are used to direct flow away from the intake cribs and promote mixing to minimize the environmental impacts of the warm water. A scour bed is associated with each discharge to protect the lake bottom. During the winter, operators may realign the circulating water system such that the center intake is used as a discharge. The warm water exiting the center intake elbow flows back to the other two intake elbows, raising the intake water temperature. This prevents icing on the traveling screens.

The maximum intake design flow rate is 104 m^3/s (2369 million gpd) (I&M 2003b). Under actual operating conditions, the total plant circulating water flow is approximately 101 m^3/s (1.6 million gpm) at full power (I&M 2003a). The Michigan Department of Environmental Quality (MDEQ) has authorized CNP to discharge to the lake up to 17.3 billion Btu/hr of heat for the total plant discharge (MDEQ 2000a). This constitutes a variance from the State water quality standards, which specify a 1.7°C (3°F) limit above seasonally dependent maxima. There are three outfalls in Lake Michigan through which water carrying heat from the condensers can be discharged – Outfalls 001, 002, and 003. Maximum daily water temperatures measured at the outfalls are presented in Table 2-1. Sodium hypochlorite and various biocides are injected at the intake into the cooling water to control aquatic nuisances and algal growth.

Table 2-1. Maximum Daily Water Temperatures at Outfalls 001, 002, and 003

	Summer			Winter		
Outfall	**°C**	**°F**	**No. of Measurements**	**°C**	**°F**	**No. of Measurements**
001	40.7	105.2	188	26.5	79.8	170
002	35.6	96.0	176	18.5	65.3	170
003	27.1	80.8	188	9.3	48.8	170

Source: I&M 2003b

There are two independent service water systems: the essential service water system and the nonessential service water system. Both systems provide strained water from Lake Michigan for several closed cooling water systems. The two service water systems are shared between the two units (I&M 2003a). The flow rates are variable, but design flow rates are approximately 0.57 m^3/s (9000 gpm) for the essential service water system and 0.63 m^3/s (10,000 gpm) for the nonessential service water. The nonessential service water system is the source of water for the makeup demineralizer and thus represents some of the water consumption of the plant. More than 98 percent of the water withdrawn from Lake Michigan is returned.

Fire protection system water and drinking water are supplied by Lake Charter Township at a rate not exceeding 0.03 m^3/s (500 gpm). The source of water for Lake Charter Township is Lake Michigan (I&M 2003a).

Although there are approximately 50 wells on the CNP property, most are monitoring wells, many of which have been abandoned. There are currently no operable production wells (I&M 2003a).

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. CNP Units 1 and 2 use 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 disposal facilities. The waste disposal system meets the design objectives and release limits as set forth in 10 CFR Part 20 and 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 in the following sections is based on information provided in the CNP Updated Final Safety Analysis Report (UFSAR) (I&M 2002).

With the exception of the reactor coolant drain tanks and drain tank pumps, the waste disposal system is common to Units 1 and 2. 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 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. The system is controlled primarily from a central panel in the auxiliary building. Malfunction of the system is alarmed in the auxiliary building, and annunciated in the control room. All system equipment is located in or near the auxiliary building, except for the reactor coolant drain tanks, which are located in the reactor containments (I&M 2002).

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, but 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 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 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. CNP Units 1 and 2 currently operate on an 18-month refueling cycle per unit. Spent fuel from Units 1 and 2 is stored in a shared spent fuel pool.

The Offsite Dose Calculation Manual (ODCM) for CNP Units 1 and 2, which is included in the *CNP Annual Radioactive Effluent Release Report* (e.g., AEP 2004a), describes the methods used for calculating radioactivity concentrations in the environment and the estimated potential offsite doses associated with liquid and gaseous effluents from the CNP. The ODCM also specifies controls for release of liquid and gaseous effluents to ensure compliance with the following:

- The concentration of radioactive liquid effluents released from the site to areas at or beyond the site boundary (unrestricted areas) will not exceed the concentration specified in 10 CFR Part 20, Appendix B, Table 2, Column 2, for radionuclides other than noble gases. For dissolved or entrained noble gases, the concentration shall not exceed 7.4 Bq/mL ($2 \times 10^{-4} \mu$Ci/mL).

- The dose or dose commitment to a member of the public from any radioactive materials in liquid effluents released from the two reactors at the site to the areas at or beyond the site boundary shall be limited to: (1) less than or equal to 0.015 mSv (1.5 mrem) to the total body and less than or equal to 0.05 mSv (5 mrem) to any organ during any calendar quarter; and (2) less than or equal to 0.03 Sv (3 mrem) to the total body and less than or equal to 0.10 mSv (10 mrem) to any organ during any calendar year.

- The dose rate due to radioactive materials released in gaseous effluents from the site to areas at and beyond the site boundary shall be limited to (1) less than or equal to 5 mSv/yr (500 mrem/yr) to the total body and less than or equal to 30 mSv (3000 mrem/yr) to the skin due to noble gases; and (2) less than or equal to 15 mSv/yr (1500 mrem/yr) to any organ due to iodine-131, iodine-133, tritium, and for all radioactive materials in particulate form with half-lives greater than 8 days.

- The air dose at and beyond the site boundary due to noble gases in gaseous effluents released from the two reactors at the site shall be limited to: (1) less than or equal to 0.05 mGy (5 mrad) for gamma radiation and less than or equal to 0.10 mGy (10 mrad) for beta radiation during any calendar quarter; and (2) less than or equal to 0.10 mGy (10 mrad) for gamma radiation and less than or equal to 0.20 mGy (20 mrad) for beta radiation during any calendar year.

- The dose to any individual member of the public from all uranium fuel cycle sources will not exceed the maximum limits of 40 CFR Part 190 (less than 0.25 mSv [25 mrem] in a year whole body dose).

2.1.4.1 Liquid Waste Processing Systems and Effluent Controls

The bulk of the radioactive liquid discharge from the reactor coolant system is processed and retained inside the plant by the chemical and volume control system recycle train. This minimizes liquid input to the waste disposal system which processes relatively small quantities of generally low-activity level wastes. The processed water from the waste disposal system, from which most of the radioactive material has been removed, is either recycled to the chemical and volume control system or discharged through a monitored line to the circulating water discharge.

The liquid waste disposal system processes liquids from equipment drains and leaks, radioactive chemical laboratory drains, radioactive laundry (use of the onsite radioactive laundry has been discontinued) and hot shower drains, decontamination area drains, chemical and volume control system demineralizer regeneration, and the sampling system. The system also collects and transfers liquids from the following sources in the containment for processing: reactor coolant loops, pressurizer relief tank, reactor coolant pump secondary seals, excess letdown (during startup), accumulators, valve and reactor vessel flange leakoffs, and refueling cavity drains.

The liquids in the containment flow to the reactor coolant drain tank and are discharged by the reactor coolant drain tank pumps either directly to the chemical and volume control system holdup tanks or to the clean waste holdup tank. The pumps can be operated either automatically by a level controller in the tank or by manual control. These pumps also return water from the refueling cavity to the refueling water storage tank. The reactor coolant drain tank pumps are located inside the auxiliary building.

Where possible, waste liquids in the auxiliary building drain to the waste holdup tanks by gravity flow. Other waste liquids drain to the sump tanks and are discharged to the waste holdup tanks by pumps operated automatically by a level controller in the sump tanks. The activity level of waste liquid from the laundry and hot shower area is usually low enough to permit discharge from the plant without processing. If analysis indicates that the liquid is suitable for discharge, it is pumped to waste condensate tanks where the activity is determined before discharging through a line monitored for radiation to the circulating water. Otherwise, the liquid is pumped to the radioactive waste demineralization system for processing. An analysis record is maintained for all releases.

Liquid radioactive waste is processed through a radioactive waste demineralization system. This system is capable of processing all liquid radioactive waste prior to discharge and is designed in accordance with Regulatory Guide 1.143. The process decontaminates the water using filtration and ion exchange.

As a backup to the radioactive waste demineralization process, one of two chemical and volume control system boric acid evaporators has been converted to function as a radioactive waste evaporator. A 57 L/min (15 gpm) radioactive waste evaporator is available as backup to the 57 L/min (15 gpm) boric acid/radioactive waste evaporator in case additional capacity is needed. Liquids requiring cleanup before release are processed in batches in this boric acid/radioactive waste evaporator. Processing liquid waste is similar to processing reactor coolant except for disposal of the processed liquids and vented gases. Liquid waste is pumped to the boric acid/radioactive waste evaporator via the waste evaporator feed pumps. The concentrates are discharged to the waste evaporator's bottom storage tank for drumming prior to shipment to an offsite burial facility or temporary onsite storage.

Radioactive waste demineralizer effluent and evaporator distillate (condensate) to be released are routed to one of two chemical and volume control system monitor tanks that are both functioning as waste condensate tanks. When one tank is filled, it is isolated and sampled for analysis while the second tank is in service. If analysis confirms the activity level is suitable for discharge, the condensate is pumped to the condenser circulating water discharge through a flow meter and a line monitored for radiation. Condensate can also be released under administrative control from the other two chemical and volume control system monitor tanks that serve the other boric acid evaporator. The releases are sampled and analyzed for both tritium and nontritium isotopes and monitored before release into the circulating water discharge.

If analysis indicates the activity level is not suitable for discharge, the condensate is returned to the station drainage waste holdup tank for reprocessing. Although the radiochemical analysis forms the basis for recording activity released, the radiation monitor provides surveillance over the operation by closing the discharge valve if the liquid activity level exceeds a preset value. Measures are taken to minimize the need to process fluids that contain foam-causing substances. If possible, nonfoaming decontamination agents are used for equipment scrubdown where the decontamination agent must be processed through the evaporators. If foaming occurs, a reagent tank is provided for charging the evaporator with an antifoaming reagent.

During the five-year period from 1999 through 2003 (the most recent year for which data were available), there was an average of 62 liquid batch releases per year from Units 1 and 2. During this five-year period, there were no unplanned or uncontrolled liquid releases to the environment. Liquid effluents were reported in the *Donald C. Cook Nuclear Plant Units 1 and 2 Annual Radioactive Effluent Release Reports* for the years 1999 through 2003 (AEP 2000a, 2001, 2002, 2003a, 2004a). Over this period, liquid effluents containing fission and activation products were released into the circulating water discharge. An annual average of 5.4×10^3 MBq (1.46×10^{-1} Ci) of fission and activation products were discharged with an average diluted concentration of 2.7×10^{-4} Bq/mL (7.31×10^{-9} μCi/mL) (AEP 2000, 2001, 2002, 2003a, 2004a). The releases and the average diluted concentrations were well below the NRC regulatory limits. See Section 2.2.7 for a discussion of the theoretical doses to the maximally exposed individual as a result of these releases.

2.1.4.2 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.

Radioactive gases are pumped by compressors through a manifold to one of the gas decay tanks where they are held a suitable period of time for decay. The quantity of radioactive material in each gas decay tank is periodically determined to be within the technical specification limit whenever radioactive materials are added to the tank and during primary coolant system degassing operations. The radioactive material is quantified by analyzing the noble gas activity in the reactor coolant system or directly from samples of the contents of the gas decay tanks. Cover gas is reused to minimize gaseous wastes. During normal operation, gases are discharged intermittently at a controlled rate from these tanks through the monitored plant vent.

The waste disposal system includes nitrogen and hydrogen systems that supply these gases to primary plant components. Most of the gas received by the waste disposal system during normal operation is nitrogen cover gas displaced from the chemical and volume control system holdup tanks and boric acid reserve tank as they are filled with liquid. Since this gas must be replaced when the tanks are emptied during processing, facilities are provided to return gas from the decay tanks to the holdup tanks and boric acid reserve tank. A backup supply from the nitrogen header is provided for makeup if return flow from the gas decay tanks is not available.

Gases vented to the vent header flow to the waste gas compressor suction header. One of the two compressors is in continuous operation, with the second unit instrumented to act as backup for peak load conditions or failure of the first unit. From the compressors, gas flows to one of eight gas decay tanks. The control arrangement on the gas decay tank inlet header allows the operator to place one tank in service and to select another tank for backup. When the tank in service becomes pressurized to 690 kPa (100 psig), a pressure transmitter automatically closes the inlet valve to that tank, opens the inlet valve to the backup tank, and sounds an alarm to alert the operator so he may select a new backup tank. Pressure indicators are provided to aid the operator in selecting the backup tank. The individual tank pressures are continuously recorded on the control panel in the auxiliary building.

Gas held in the decay tanks can either be returned to the chemical and volume control system holdup tanks or, if it has decayed sufficiently for release, discharged to the atmosphere. Generally, the last tank to receive gas will be the first tank recycled to the chemical and volume control system holdup tanks. This permits the maximum decay time before releasing gas to the environment. However, the header arrangement at the tank inlet gives the operator the option to fill, reuse, and discharge gas simultaneously. During degassing of the reactor coolant prior to a cold shutdown, for example, it may be desirable to pump the gas purged from the volume control tank into a particular gas decay tank and isolate that tank for decay rather than reuse the gas in it. This is done by opening the inlet valve to the desired tank and closing the outlet valve to the reuse header.

Simultaneously, one of the other tanks can be opened to the reuse header if desired, while another is discharged to atmosphere. Before a tank is discharged to the environment, it is sampled and analyzed to determine and record the activity to be released, and then is discharged to the plant vent at a controlled rate. The plant vent's radiation monitor enables the operator to monitor the radioactivity in the gas release. Samples of the gas to be released are taken in gas sampling vessels. During release a trip valve in the discharge line is closed automatically by a high radioactivity level indication in the plant vent.

During operation, gas samples are drawn automatically from the gas decay tanks and analyzed to determine their hydrogen and oxygen content. A second analyzer is used to monitor oxygen in the line from the discharge of the waste gas compressor in operation. There should be no significant oxygen content in the waste gas or in any of the gas decay tanks; an alarm sounds if either of the samples contains 2.5 percent or higher by volume oxygen. Upon a "high-high" oxygen content of 2.7 percent by volume, the oxygen analyzer automatically isolates the tank being filled and places the standby gas decay tank in service. The operator then determines the source of oxygen in-leakage and purges the affected component and vent header piping as required with nitrogen. The isolated waste gas decay tank and standby tank can be diluted with nitrogen if they have high oxygen concentrations.

Gaseous effluents for the years 1999 through 2003 (the most recent year for which data were available) were reported in the *Donald C. Cook Nuclear Plant Units 1 and 2 Annual Radioactive Effluent Release Reports* (AEP 2000a, 2001, 2002, 2003a, 2004a). During this five-year period, there were no unplanned or uncontrolled gaseous releases to the environment, but CNP Units 1 and 2 released measurable concentrations of fission and activation gases, radioiodine, and particulate radioactivity in gaseous effluents to the atmosphere. The average annual effluent releases over this 5-year period were 2.5×10^6 MBq (67.5 Ci) of fission and activation gases, 7.99 MBq (2.16×10^{-4} Ci) of iodine-131, and 2.09 MBq (5.65×10^{-5} Ci) of particulates. See Section 2.2.7 for a discussion of the theoretical doses to the maximally exposed individual as a result of these releases.

2.1.4.3 Solid Waste Processing

The waste disposal system at CNP is designed to package solid wastes for removal to disposal facilities. Some solid waste is temporarily stored onsite. Solid wastes consist of spent (dewatered) resin, solidified resin, filters, filter sludge, evaporator bottoms, concentrated wastes, dry compressible waste, air filters from off-gas and radioactive ventilation systems, irradiated components (control rods, etc.), contaminated clothing and tools, paper and rags from contaminated areas, and used reactor equipment.

The solid radioactive waste system consists of those systems and components that are used to condition and package wet and dry solid wastes so that the waste is suitable for transport and disposal. The system is not used for spent fuel storage and shipment. Reactor wastes, such as spent control rod blades and fuel channels, are stored in the fuel storage pool to allow decay, then packaged, and transferred in approved shipping containers for offsite burial. Used reactor equipment is also stored in the spent fuel storage pool before shipment. Maintenance wastes, such as contaminated clothing and tools, are packed in suitable U.S. Department of Transportation (DOT)-approved containers and may be stored prior to shipment. The process wastes, such as filter sludges and spent resins, are collected in tanks, processed, and stored prior to shipment. When required, shipping casks are used to shield the radioactive waste.

Concentrates from the waste evaporator bottoms storage tank are pumped into shipping casks and mixed with a solidification agent. The casks are moved to a shielded storage area until removal to a burial site or temporary onsite storage. Spent resins are either sluiced to the spent resin storage tank or pumped directly into shielded shipping casks within the Auxiliary Building. Resins in the storage tank can be sluiced by first bubbling nitrogen through the tank to the vent header to stir up the resin, then using water to transport the resin at a controlled rate into shipping casks within the Auxiliary Building. Resins are either dewatered and air dried or slurried with a solidification agent for shipment. The casks are handled and stored in a fashion identical to that for the concentrated bottoms.

Dry active wastes (DAWs), generated as a result of operation and maintenance activities, are collected throughout the radiologically controlled areas of the facility. Typical wastes of this type are air filters, cleaning rags, protective tape, paper and plastic coverings, discarded contaminated clothing, tools, equipment parts, and solid laboratory wastes. Most DAWs have 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. DAW may also be stored at an interim storage location away from the processing area while awaiting shipment to the processor or a burial site.

Disposal and transportation of solid radioactive wastes are performed in accordance with the applicable requirements of 10 CFR Part 61 and Part 71, respectively. There are no releases to the environment from solid radioactive wastes created at CNP. During the period 1999 through 2003, CNP Units 1 and 2 made an average of 12 shipments of solid radioactive waste each year with an average volume for spent resins, filter sludges, evaporator bottoms, contaminated equipment, and other sources of 152 m^3 (5360 ft^3) and an average activity of 9.03×10^6 MBq (244 Ci) (AEP 2000a, 2001, 2002, 2003a, 2004a).

2.1.5 Nonradioactive Waste Systems

The principal nonradioactive effluents from the CNP Units 1 and 2 consist of chemical and biocide wastes, lubricating oil wastes, resin regeneration wastes, filters, and sanitary wastes. The chemistry laboratory may generate small quantities of chemical waste. Spent batteries and discarded fluorescent lights are recycled.

The plant uses the natural soil column as a means to provide uniform treatment to selected wastewater discharges. These discharges flow downward through the soil to the groundwater, which ultimately discharges into Lake Michigan. Two separate waste streams are discharged in this manner: the turbine room sump and the sewage treatment plant effluent.

The turbine room sump accumulates various aqueous wastes from the secondary side. These wastes are then neutralized, if necessary, and discharged to absorption ponds. Approximately 251 m (825 ft) southeast of the plant, the ponds consist of a 0.6-ha (1.4-ac) pond and a 0.3-ha (0.7-ac) overflow pond, connected by a small stream. Flow into the ponds is sufficient to keep the first pond full and overflowing to the overflow pond. There are no surface water discharges from the overflow pond. Approximate capacity of the two ponds is 23,000 m^3 (6 million gal).

The sewage treatment plant discharges treated effluent to two sewage lagoons that are used alternately. The sewage lagoons are much smaller than the absorption ponds and are located above and immediately east of the absorption ponds. Turbine room sump discharges to the absorption ponds and sewage treatment plant discharges to the sewage lagoons are permitted by the MDEQ. The groundwater permit limits the turbine room sump effluent to 0.1 m^3/s

(2.4 million gpd) and sewage effluent to 0.003 m^3/s (60,000 gpd). The permit limits concentration of various contaminants and requires groundwater monitoring.

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 CNP Units 1 and 2 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. Each of the two nuclear units is refueled on an 18-month schedule.

As part of the License Renewal Application (Application), I&M 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 Final Safety Analysis Report Supplement as required by 10 CFR Part 54.21(d) for CNP. 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 UFSARs for CNP, following the issuance of the renewed OL. I&M 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

Six 345-kV and one 745-kV transmission lines connecting CNP Units 1 and 2 to the transmission system were identified in the Final Environmental Statement (FES) for operation of CNP Units 1 and 2 (AEC 1973). These lines included a pair of double-circuit lines to the existing Olive-Palisades 345-kV transmission lines, a double-circuit line to the Robison Park Substation near Fort Wayne, Indiana, and a 765-kV single-circuit line to the Dumont Substation south of South Bend, Indiana. Potential electric shock impacts of these lines were not considered in the FES.

The applicant's ER (I&M 2003a) describes changes in the way that CNP is connected to the transmission system that have been made since the FES was published. The changes include rerouting one of the Robison Park circuits to the Twin Branch Substation and rerouting one of the Olive circuits to the Twin Branch Substation. In both cases, the rerouted lines follow preexisting corridors. As a result of these changes, there are an additional 87 km (54 mi) of transmission line corridors that cover 530 ha (1310 ac) that were not considered in the 1973 FES. The scope of this review includes all of the lines described in the FES and the new lines.

The lines currently connecting CNP Units 1 and 2 to the transmission system are shown in Figure 2-4 and listed in Table 2-2. The corridors have a total length of approximately 366 km (227 mi) and cover approximately 1868 ha (4617 ac).

All CNP transmission lines complied with the National Electrical Safety Code (NESC) and industry guidance in effect at the time the lines were constructed. CNP transmission facilities are maintained to ensure continued compliance with the standards and guidance in effect when they were constructed.

The transmission line corridors pass through primarily agricultural land and forests. In general, the corridors are in remote, sparsely populated areas. Where the corridors cross agricultural lands, the land typically continues to be used for agricultural purposes. All of the lines cross Interstate 94 near CNP, and the longer lines cross numerous state and U.S. highways.

Transmission line right-of-way (ROW) vegetation-control measures used by I&M personnel include mowing, trimming, tree removal, and approved herbicide application along the 345-kV and 765-kV lines (I&M 1995). Vegetation management follows a three-year trimming cycle. It is the policy of AEP to maintain transmission line corridors in a clear-cut state with the exception of areas around the base of towers and low-lying areas under the lines where the topography is such that tall-growing trees do not interfere with the conductors.

Herbicide application is performed according to label specifications by certified applicators. Herbicides are used to control shrubs and vines around the base of the transmission towers and other areas along the corridor where access is needed by maintenance crews and equipment. Any woody species greater that 4.6 m (15 ft) tall along cleared portions of the corridor are cut at ground level and stump-treated with herbicides. Herbicide application mixtures used by the contractor is approved and monitored by I&M personnel.

I&M implements procedures used to minimize potential environmental impacts to nontarget areas including guidance for minimizing erosion by maintenance vehicles and application of herbicides in sensitive areas such as near lakes, wetlands, and stream crossings. Personnel are trained on how to recognize Federally and State-listed species and their habitats that may be encountered along the corridors. I&M staff monitor contractor vegetation control practices

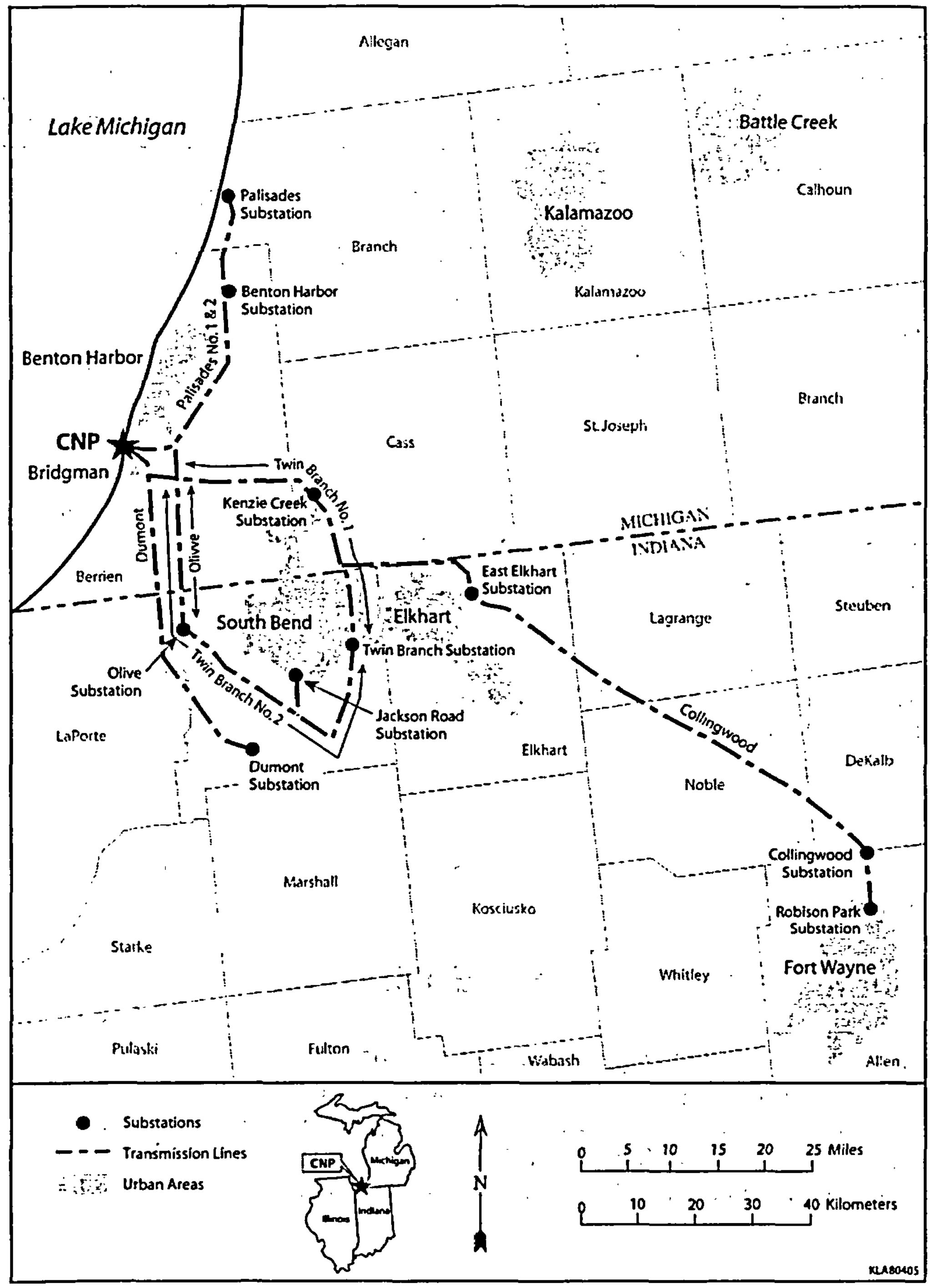

Figure 2-4. CNP Transmission Lines

Table 2-2. CNP Transmission Line Corridors

Substation (line)	Number of Lines	kV	Approximate Corridor Length km	(mi)	Corridor Width m	(ft)	Estimated Corridor Area ha	(ac)
Palisades	2	345	8	5	183	600	147	364
Olive	1	345	38.9[a]	24.2[a]	46[b]	150[b]	141[c]	349[c]
Collingwood-Robison Park	1	345	183	114	46	150	839	2073
Twin Branch No. 1	1	345	60.3[d]	37.5[d]	46	150	115[c]	284[c]
Twin Branch No. 2	1	345	101[e]	62.6[e]	46	150	283[c]	698[c]
Dumont	1	765	56	35	61	200	343	849
Totals	7		366[c]	227[c]			1868[c]	4617[c]

(a) Initial 8 km (5 mi) are shared with Palisades lines
(b) Width of corridor for last 31 km (19.2 mi)
(c) Shared corridors are counted only once
(d) Initial 35.2 km (21.9 mi) are shared with Collingwood-Robison Park line
(e) Initial 38.9 km (24.2 mi) are shared with Olive line

Sources: AEC 1973 and I&M 2003a

through periodic field inspections and review of the contractor's ROW maintenance records (I&M 1995).

2.2 Plant Interaction with the Environment

Sections 2.2.1 through 2.2.8 provide general descriptions of the environment near CNP as background information. They also provide detailed descriptions 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 CNP site is located in Lake Charter Township, Berrien County, Michigan, on the southeastern shoreline of Lake Michigan, about 18 km (11 mi) south-southwest of the twin cities of St. Joseph and Benton Harbor, Michigan. The nearest population center is the city of Bridgman, Michigan, which is approximately 3.2 km (2 mi) south of the CNP site. The Grand Mere State Park is approximately 1.6 km (1 mi) north-northeast of the site, while Warren Dunes State Park is approximately 5.6 km (3.5 mi) south-southwest of the site.

The CNP site is approximately 263 ha (650 ac), and extends an average of approximately 2 km (1.3 mi) inland. A north-south ROW for Interstate 94 and Thornton Road intersects the eastern portion of the CNP site, with approximately 5 percent of CNP's property on the east side of the ROW. The Red Arrow Highway parallels the ROW, serving as the eastern boundary for the southern half of the site, then traverses the northern portion of the site in the same general direction. The property at the northeast corner that extends to the east allows the CNP site to have a corridor of access to the CSX rail line that runs in a north-south direction on the former Pere Marquette Line. Livingston Beach Road runs along the southern boundary of the CNP site. I&M maintains access control over the portion of the site west of the ROW. The entire site is zoned for industrial use (I&M 2003a; AEC 1973).

The CNP site lies on the southwest flank of the Michigan Basin within a 26-km (16-mi) long local physiographic area known as the Grand Marais Embayment that is within the Central Lowland physiographic province. Covert Ridge, a glacial moraine, bounds the embayment 1050 m (3500 ft) east of the lake. The ridge serves as a drainage divide; the water table gradient is nearly flat with a slow westward flow toward the lake (I&M 2003a; AEC 1973).

The topography of the site is strongly characterized by beaches, dunes reaching over 88 m (290 ft) in height, and blowouts caused by wind action. The terrain slopes gently upward from the lake and the beaches for about 61 m (200 ft) before rising sharply into high dunes. CNP has riparian rights for the 1326 m (4350 ft) of lake frontage that extend to the low water line, which in consideration of lake bottom movement, is approximately 30 m (100 ft) outward from the elevation 174 m (580 ft) line. The western part of the site is covered by large, coalescing sand dunes more than 45 m (150 ft) high, while the eastern portion is characterized by scattered lower dunes with broad intervening basins, some of which contain shallow ponds. Units 1 and 2 are located about 600 m (2000 ft) from both the northern and southern boundaries. The majority of the land area is covered by heavily wooded, rugged sand dunes with occasional wetlands. Permanent structures, supporting buildings, switchyards, parking lots, the Cook Energy Center (visitor center), training center, service buildings, roads, laydown areas, and a rail line occupy approximately 73 ha (180 ac) of the CNP site (AEC 1973).

A restrictive land use covenant has been recorded in Berrien County to limit groundwater withdrawal from approximately 84 ha (207 ac) in the southwestern portion of the CNP site (AEP 2000b). The covenant was established because seepage from the CNP absorption pond and overflow pond has resulted in some groundwater quality degradation (see Section 2.2.3).

As a result of events on September 11, 2001, I&M implemented actions to limit and/or monitor the entire beach area along the lakefront portion of the CNP site between the security fence and the lake that is used for recreational purposes. I&M plans to replace current beach area signage with new signs at the southern and northern beach property lines that state that there is no loitering permitted on the beach area in front of CNP. In addition, the adjacent beach property boundary south of the plant to Livingston Beach Road and north to Rosemary Beach has been designated as a zone to be monitored by security (AEP 2004b).

The Cook Energy Center currently accepts only scheduled school groups, and during instances of heightened security, all school tours are canceled. Public tours and use of area hiking trails have been curtailed, as well as use of the facility by community organizations. Overall attendance at the center for 2003 was 5500 (I&M 2004). There is no direct access from the center to the reactor building.

2.2.2 Water Use

CNP has three water systems that withdraw water from Lake Michigan — the circulating water system, essential water system, and nonessential water system. The circulating water system withdraws lake water at approximately 101 m^3/s (1.6 million gpm) at full power (I&M 2003a). The circulating water system carries the heat rejected by the steam turbines to Lake Michigan.

The two independent service water systems, the essential service water system and the nonessential service water system, provide strained water from Lake Michigan for cooling several closed cooling systems. The two service water systems are shared between the two units (I&M 2003a). The essential service water system uses Lake Michigan water taken from the forebay to provide cooling to safety-related equipment. The nonessential service water system also uses water taken from the forebay and provides noncontact cooling for various plant systems, is a source of water for the demineralized makeup system, and is a water supply for nonsafety-related equipment (I&M 2003b). The flow rates are variable, but design flow rates are approximately 0.57 m^3/s (9000 gpm) for the essential service water system and 0.63 m^3/s (10,000 gpm) for the nonessential service water system (I&M 2003a). The nonessential service water system is the source of water for the makeup demineralizer and thus represents some of the water consumption of the plant.

More than 98 percent of the water withdrawn by all three systems from Lake Michigan is returned (I&M 2003a). The two service water systems normally take suction from either unit's circulating water intake tunnels and discharge to the discharge tunnels. The systems can be aligned to take suction from the discharge tunnel. On a seasonal basis, when zebra mussels (*Dreissena polymorpha*) are particularly susceptible, sodium hypochlorite is continuously injected into the service water systems to control zebra mussels and other biofouling organisms (I&M 2003a).

Fire protection system water and drinking water are supplied by Lake Charter Township at a rate not exceeding 0.03 m^3/s (500 gpm). The source of water for Lake Charter Township is Lake Michigan (I&M 2003a).

There are no operable groundwater production wells and there are no consumptive uses of groundwater at CNP (I&M 2003a).

2.2.3 Water Quality

CNP 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 4920 km^3 (1180 mi^3) and third largest by area at 57,800 km^2 (22,300 mi^2). It drains an area of 118,100 km^2 (45,600 mi^2) (Fuller et al. 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.

The water quality of Lake Michigan has been degraded by industrial, municipal, agricultural, navigational, and recreational water users for more than 150 years. Green Bay receives waste from the world's largest concentration of pulp and paper mills. Although phosphorous and chlorophyll concentrations have declined since the late 1970s, chloride concentrations continue to increase. Water quality is diminished near urban areas, mostly due to sewer overflows, direct stormwater 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 PCBs; Section 2.2.5). Fish consumption advisories and beach closings adversely affect the beneficial uses of the lake. Nonnative 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 nonnative 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, 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 the 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 already 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).

Groundwater supplies in the region are obtained primarily from unconsolidated Pleistocene drift deposits, termed water sands, that lie at 6 to 16 m (19 to 54 ft) depths (AEC 1973). This unconfined aquifer is comprised of fine dune and lake sands that are underlain by thick impermeable clays with occasional sand or gravel lenses that do not support heavy groundwater pumping. The shale bedrock has no aquifer properties and the deeper sediments produce brines that are unsuitable for drinking water (AEC 1973). Recharge of groundwater by infiltration of precipitation through the permeable sandy surficial soils is rapid.

The CNP facility is authorized to discharge water to four surface water locations under the National Pollutant Discharge Elimination System (NPDES) administered by the MDEQ

(MDEQ 2000a). Currently, CNP, with consensus of MDEQ, is operating under the requirements of an NPDES permit that expired on October 1, 2003. Because CNP met the appropriate deadlines for applying for permit renewal, they are authorized to discharge under the old permit conditions until the new permit is issued by the State of Michigan (MDEQ 2000a). The CNP facility has maintained full compliance with the standards set forth in the NPDES permit.

At Outfall 001, I&M is authorized to discharge 66 m^3/s (1.5 billion gpd). The principal source of discharge to this outfall is condenser cooling water from Unit 1, but may also include miscellaneous low-volume wastes and storm water. At Outfall 002, I&M is authorized to discharge 80 m^3/s (1.8 billion gpd). The principal source of discharge to this outfall is condenser cooling water from Unit 2, but may also include miscellaneous low volume wastes and storm water. Both Outfalls 001 and 002 are monitored for Total Residual Oxidant (i.e., either chlorine or bromine), pH, and heat load. The total allowable heat load to Lake Michigan is 17.3 billion Btu/hr. However, the heat loads through each outfall must be reported separately in the discharge monitoring reports. In addition to the location monitoring storm water for total suspended solids, there are five additional monitored effluent flows that discharge to Outfalls 001 and 002. They include steam generator blowdown from Units 1 and 2, heating boiler blowdown, reverse osmosis system reject, and turbine sump room emergency overflow. Total suspended solids and oil and grease are monitored prior to entering the main discharge to Outfalls 001 and 002. Water exits the Outfalls 001 and 002 at a velocity of approximately 4 m/s (13 ft/s). Information on the range of temperature of water exiting the outfalls is provided in Section 2.1.3.

Discharge of water used to deice the intakes is permitted via Outfall 003. There are no additional monitoring requirements imposed at Outfall 003 because the effluent limitations and monitoring requirements specified for Outfalls 001 and 002 demonstrate compliance with the applicable water quality standards (MDEQ 2000a).

Discharge from the backwash of the intake screen is authorized and permitted at Outfall 004. In addition, debris accumulated on the intake trash bars must be disposed of "on land in an appropriate manner or by other appropriate disposal means" (MDEQ 2000a).

Storm water discharge is permitted via Outfalls 001 and 002 with the special condition that I&M continuously implements a Storm Water Pollution Prevention Plan. A storm water pollution prevention plan (I&M 2003c) is continuously implemented at CNP.

In addition to discharge to surface water, there are two permitted locations where discharge to groundwater occurs. The CNP facility is authorized to discharge a maximum of 0.1 m^3/s (2.4 million gpd) of process wastewater and a maximum of 0.003 m^3/s (60,000 gpd) of treated sanitary wastewater to two sets of seepage beds (i.e., two absorption ponds for process wastewater and two sewage lagoons for sanitary wastewater) southeast of the plant (MDEQ 2000b) (Figure 2-3).

The turbine room sump accumulates various aqueous wastes (i.e., process wastes) from the secondary side. These wastes are neutralized, if necessary, and discharged to absorption ponds approximately 250 m (825 ft) southeast of the plant (Figure 2-3). The larger of the two ponds is 0.6 ha (1.4 ac) and the smaller overflow pond is 0.3 ha (0.7 ac). The two ponds are connected by a small stream. Flow into the ponds is sufficient to keep the first pond full and overflowing to the overflow pond. There are no surface water discharges from the overflow pond. The combined approximate capacity of the two ponds is 23,000 m^3 (6 million gal).

The sewage treatment plant discharges treated sanitary effluent to two sewage lagoons that are used alternately. The sewage lagoons are much smaller than the absorption ponds and are located above and immediately east of the absorption ponds (Figure 2-3).

Through the use of the sewage lagoons and absorption ponds, CNP uses the natural soil column as a means to provide uniform treatment to selected wastewater discharges. These discharges flow downward through the soil to the groundwater, which ultimately discharges into Lake Michigan. These permitted discharges have created a groundwater mound that has superimposed a radial flow pattern on the regional flow towards Lake Michigan. Five groundwater monitoring wells are specified in the permit for compliance monitoring; wells EW-8 (upgradient), EW-1A, EW-12, EW-13, and EW-19. The groundwater monitoring program shows that the disposal of plant effluents is in compliance with the MDEQ permit requirements and with national drinking water standards, although there is an increase above background for total dissolved solids and sulfate.

Groundwater, characteristic of the absorption ponds, has migrated to the southern plant boundary, but has not exceeded primary drinking water standards (AEPSC 1991). A restrictive covenant has been recorded in Berrien County to assure that groundwater impacted by the seepage from the absorption ponds would not be withdrawn for any purpose from beneath approximately 84 ha (207 ac) in the southwestern portion of the CNP property (AEP 2000). There are no operable groundwater production wells and there are no consumptive uses of groundwater at CNP (I&M 2003a).

Tritium has been detected periodically in the groundwater at monitoring wells across the CNP property. However, the authorization to discharge to groundwater (MDEQ 2000b) does not contain criteria for tritium and no sample has exceeded the drinking water standard of 20,000 pCi/L (740 Bq/L).

A release from an underground fuel oil storage tank associated with the auxiliary boiler occurred at CNP during the middle-1970s. The quantity of the release is unknown. Oil extended westward to the westernmost sheet piling wall installed to prevent shore erosion and then southward along the wall. Free product was recovered by excavating in a trench and then installing recovery and monitoring wells. Remediation activities were coordinated with the Michigan Department of Natural Resources (MDNR). By the early 1990s, over 30 m^3 (8000 gal) of free product had been recovered and no additional free product was recoverable from any of the wells. In addition, sampling indicated degradation of the oil was occurring (I&M 1991). Monitoring of the groundwater in this area is currently continuing with no active remediation required. The extent of the initial migration of oil and subsequent remediation activities is within the portion of the CNP property to which the restrictive covenant discussed above applies.

2.2.4 Air Quality

CNP is located in southwestern Michigan on the southeastern shoreline of Lake Michigan, about 18 km (11 mi) southwest of St. Joseph and Benton Harbor. The shoreline area consists of a gradually sloping beach that changes to sand dunes with a maximum height of about 88 m (290 ft) about 61 m (200 ft) from the lake. Inland of the dunes, the terrain is generally rolling land that is wooded or in agricultural use.

Lake Michigan dominates the weather and climate in the region. It moderates the temperatures, reducing maximum summer time temperatures and increasing minimum winter temperatures. Climatological records for Muskegon, Michigan, which should be generally representative of the CNP site, show normal daily maximum temperatures ranging from about -2°C (29°F) in January to about 27°C (80°F) in July; normal daily minimum temperatures range from about -8°C (18°F) in January to about 16°C (60°F) in July. Precipitation averages about 82.8 cm (32.6 in.) per year, with an average of about 249 cm (97.9 in.) of snow per year. Based on statistics for the 30-year period from 1954 through 1983 (Ramsdell and Andrews 1986), the probability of a tornado striking the site is estimated to be approximately 1×10^{-3} per year.

The primary wind resource in Michigan is found along the shores of the Great Lakes. In these areas, wind power densities are estimated to be in the 400 to 500 W/m^2 range at 50 m (160 ft) above ground. Off shore, wind power densities are estimated to be in the 500 to 600 W/m^2 range, and inland, near the shore, the wind densities are estimated to be in the 300 to 400 W/m^2 range. There is also an area of central Michigan for which wind power densities are estimated to be in the 300 to 400 W/m^2 range. For the remainder of the state, the wind power density is estimated to be below 300 W/m^2 (Elliott et al. 1986).

CNP is in Berrien County, which is part of the South Bend-Elkhart (Indiana)-Benton Harbor (Michigan) Air Quality Control Region (AQCR). Air quality for the AQCR is designated as better than national standards in attainment areas, or unclassifiable for all primary pollutants (40 CFR 81.315). Air quality indices (40 CFR Part 58, Appendix G), which are calculated for Metropolitan Statistical Areas, provide air quality information for the public. The closest Metropolitan Statistical Area to the CNP site with an air quality index (AQI) is the Grand Rapids-Muskegon-Holland area. During the years 2000, 2001, and 2002, the AQI for this area exceeded 100 an average of about 15 days per year. Ozone concentrations cause the AQI to exceed 100 an average of about 11 days per year (EPA 2003). An AQI of 100 or less indicates good to moderate air quality. Air quality in Berrien County is expected to be better than the air quality in the larger region.

CNP has several diesel generators and boilers. In accordance with the Air Pollution Control Rules (MDEQ 2003), the MDEQ reissued an exemption to the Federally enforceable state operating permit requirements of the Clean Air Act (42 USC 7401, et seq.). The exemption applies to emissions from the paint shop as well as the diesel generators and boilers.

No National Park or wilderness area designated in 40 CFR Part 81 as mandatory Class I Federal areas where visibility is an important value is within 160 km (100 mi) of CNP.

2.2.5 Aquatic Resources

The principal aquatic resource in the vicinity of the CNP is Lake Michigan, which is the source and receiving body for the CNP Units 1 and 2 cooling systems. The CNP site is located on the southeast shoreline of Lake Michigan and has 1326 m (4350 ft) of Lake Michigan frontage (I&M 2003a). On the CNP site boundary, there are a 0.6-ha (1.4-ac) absorption pond and a 0.3-ha (0.7-ac) overflow pond that are connected by a small intermittent stream; sewage lagoons; and an intermittent stream that traverses the eastern portion of the CNP site (I&M 2003a). The transmission lines associated with CNP cross a number of streams ranging in size from small intermittent streams to larger rivers. Rivers and larger streams crossed by the transmission lines include the Paw Paw River, St. Joseph River, Dowagiac River, and East Branch of the Galena River in Michigan; and the Kankakee River, St. Joseph River, North Branch of the Elkhart River, and Cedar Creek in Indiana. Transmission line ROW maintenance activities in the vicinity of stream and river crossings include procedures to minimize erosion and shoreline disturbance while encouraging vegetative cover.

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 2002). The Lake Michigan ecosystem continues to change profoundly because of development, nuisance species, and pollutant loading. Overall, the status of Lake Michigan habitats, including open water, wetlands, coastal shore, and tributaries is considered "mixed" to "deteriorating" (EPA 2002).

Mercury is emerging as a growing concern in fish in Lake Michigan and its tributary streams (EPA 2002). Some fish cannot be sold commercially because of high levels of PCBs, mercury, or other substances (Fuller et al. 1995). Both Michigan and Indiana have published advisories governing the consumption of fish from these waterbodies. Within the Indiana portion of Lake Michigan and its tributaries, there are fish consumption advisories for mercury and PCBs for a number of fish species (e.g., bloater [*Coregonus hoyi*], bluegill [*Lepomis macrochirus*], common carp [*Cyprinus carpio*], channel catfish [*Ictalurus punctatus*], freshwater drum [*Aplodinotus grunniens*], largemouth bass [*Micropterus salmoides*], longnose sucker [*Catostomus catostomus*], northern pike [*Esox lucius*], quillback [*Carpiodes cyprinus*], rock bass [*Ambloplites rupestris*], round goby [*Neogobius melanostomus*], silver redhorse [*Moxostoma anisurum*], smallmouth bass [*Micropterus dolomieu*], walleye [*Stizostedion vitreum*], white sucker [*Catostomus commersoni*], and all trout and salmon species). Advisories range from limiting consumption to one meal per month or every two months, to do not eat (ISDH 2003). Within the Michigan portion of Lake Michigan there are advisories for brown (*Salmo trutta*), lake (*Salvelinus namaycush*), and rainbow trout (*Oncorhynchus mykiss*); chinook (*O. tshawytscha*) and coho salmon (*O. kisutch*), common carp, channel catfish, rainbow smelt (*Osmerus mordax*), lake sturgeon (*Acipenser fulvescens*), walleye, whitefish (*Coregonus clupeaformis*), and yellow perch (*Perca flavescens*). There are also advisories issued for carp and smallmouth bass for some of the Lake Michigan tributary streams in the study area. Most of the state of Michigan advisories relate to PCB contamination. Chlordane, DDT, dioxin, and mercury are also contaminants of concern for several species (MDCH 2003).

Despite the modifications and multiple competing uses of Lake Michigan, the overall fish population 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 over 14.6 million pounds of fish annually (EPA 2002). Lake whitefish is the primary commercial species, while lake whitefish and lake trout comprise the tribal fisheries (Stein et al. 2003). Some commercial fishing also targets bloater 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, various sunfish (e.g., bluegill, pumpkinseed [*L. gibbosus*], and rock bass), yellow perch, and walleye (I&M 2003a; IDNR 2004a). Important forage species in Lake Michigan include alewife (*Alosa pseudoharengus*), bloater, rainbow smelt, and deepwater sculpin (*Myoxocephalus thompsoni*) (I&M 2003a).

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 2002). About 70 percent of the Great Lakes trout and salmon fishery is dependent upon fish stocking (MDNR 2004).

Fish sampling was conducted in the CNP site area and at a reference site area off Warren Dunes State Park, located about 7.6 km (4.7 mi) southwest from the CNP site, from 1973 through 1982. During this period, over 1.1 million fish comprising 59 species were collected. The alewife comprised 61 percent of the total catch, spottail shiner (*Notropis hudsonius*) was 21 percent, rainbow smelt and yellow perch were each 7 percent, and trout-perch (*Percopsis omiscomaycus*) and bloater were each just under 2 percent. Fish considered common in the area (e.g., average catch >20 but <1000 fish/yr) included brown trout, chinook salmon, coho salmon, common carp, gizzard shad (*Dorosoma cepedianum*), johnny darter (*Etheostoma nigrum*), lake trout, longnose dace (*Rhinichthys cataractae*), longnose sucker, rainbow trout, slimy sculpin (*Cottus cognatus*), and white sucker (Tesar and Jude 1985).

At least 160 species of plants, plankton, macroinvertebrates, and fish 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, spiny water flea [*Bythotrephes cederstroemi*], and round goby), or as intentionally introduced species (e.g., common carp, rainbow smelt, and various salmonids) (EPA 2002; Peeters 1998). The nonnative 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 middle-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 nonnative 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 nonnative 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 (I&M 2003a). Combined with overfishing, 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 lake-wide 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 made up about 85 percent of the fish biomass of the lake (Peeters 1998). Their increase was aided by the decrease in its main predators (lake trout and burbot) 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). In 2003, the alewife was the most important prey fish in Lake Michigan, with an estimated lake-wide biomass of 42,876 metric tons (47,262 tons) (Madenjian et al. 2004). There is currently 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 fresh water 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 lipid reserves (Eshenroder et al. 1995). In spring, alewives are also in a weakened condition due to 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 three 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 vicinity of CNP (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 CNP intakes. 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 lake-wide changes in the abundance of any Lake Michigan species has 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, and several individuals have been impinged at CNP intakes (AEP 2003b). 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).

Changes to the plankton community of Lake Michigan may be occurring 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. 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 Lake Michigan near CNP was dominated by diatoms, followed by green algae. Densities of total cells ranged from 20,000 to over 8 million/L, varying with location, water depth, and season (I&M 2002). Periphyton (attached algae) was sparse due to substrate limitations. The water intake structure and other underwater components of CNP have provided artificial habitats for periphyton (I&M 2002).

The zooplankton community in Lake Michigan near the CNP is abundant and fairly diverse. Twenty-four taxa of copepods, cladocerans, and rotifers were identified with a combined density of 5000 to 90,000 animals/L (I&M 2002). 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 the specie's parthenogenic reproduction (reproducing asexually). 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 CNP was dominated by *Diporeia* spp. (formerly known as *Pontoporeia* spp., an amphipod), *Tubifex* spp. and *Limnodrilus* spp. (aquatic worms), and *Pisidium* spp. (pill clams) (I&M 2002). Macroinvertebrates such as crayfish, amphipods, mayflies, and caddisflies have colonized the rip-rap around the CNP intake and discharge structures. The species assemblage is similar to the benthic community found on other consolidated substrates in the lake, rather than that normally present over much of the open lake bottom (I&M 2002).

The first Asiatic clam was found at the CNP in 1983. While this species has caused significant clogging problems at water intake systems in southern states, its cold intolerance has prevented it from being a serious biofouling organism at CNP (I&M 2002). Only one live Asiatic clam has been found during annual monitoring between 1982 and 1991; they are no longer monitored at CNP (I&M 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 (I&M 2003a). Nearshore benthic macroinvertebrate communities have been altered dramatically since the 1960s due to a reduction in phosphorus and other nutrient loads and the establishment of the zebra mussel (I&M 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 2002). 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 in the 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, 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).

Unlike the Asiatic clam, the zebra mussel is cold-tolerant and is considered a potential serious biofouling problem at CNP (I&M 2002). 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. These piles can reach heights greater than 3 m (10 ft) (Kotler et al. 1995). Biocides (e.g., sodium hypochlorite), supplemented by mechanical cleaning and design changes (e.g., strainers, filters, screens, and chemical delivery systems), work to protect CNP from zebra mussels. A zebra mussel monitoring program utilizing side-stream and artificial substrate monitoring, along with diver and heat exchanger monitoring, is used to evaluate the effectiveness of chemical and physical control measures (I&M 2002). On a seasonal basis when zebra mussels are particularly susceptible, sodium hypochlorite is continuously injected into the service water system to control zebra mussels and other biofouling organisms (I&M 2003a).

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).

Aquatic species listed by the U.S. Fish and Wildlife Service (FWS), the state of Michigan, or the state of Indiana and that have the potential to occur in the vicinity of CNP and its associated transmission lines are presented in Table 2-3.

No Federally listed threatened, endangered, proposed, or candidate aquatic species occur in Lake Michigan in the vicinity of the CNP. In addition, no designated critical habitat for aquatic species occurs in the site vicinity. Three Federally listed endangered mollusc species are listed for DeKalb County, Indiana, which is crossed by the Collingwood-Robison transmission line. However, these species were not observed during field surveys of the ROWs conducted in 2002 and 2004 (TRC 2002; I&M 2004). The three mollusc species are discussed below.

The white cat's paw pearlymussel (*Epioblasma obliquata perobliqua*) was Federally listed as endangered on June 14, 1976 (Hoggarth 1990), and is also listed as endangered in Indiana. It inhabits small- to medium-sized streams, with areas of coarse gravel and sand substrates within fast flowing riffles and runs (Hoggarth 1990). Fish hosts are not known, but presumed to be darters or sculpins (Hoggarth 1990). The white cat's paw pearlymussel requires a swift

Table 2-3. Federally Listed and State-Listed Aquatic Species Potentially Occurring in the Vicinity of CNP and Associated Transmission Lines

Scientific Name	Common Name	Federal Status[(a)]	Indiana Status[(a)]	Michigan Status[(a)]	Habitat
Plants					
Wolffia papulifera	water-meal	–	–	T	Sloughs, ponds, and low-gradient streams
Insects					
Setodes oligius	a leptocerid caddisfly	–	E	–	Running waters
Mussels					
Epioblasma obliquata perobliqua	white cat's paw pearlymussel	E	E	–	Small to mid-sized streams and rivers
Epioblasma torulosa rangiana	northern riffleshell	E	E	–	Large to small streams
Epioblasma triquetra	snuffbox	–	E	E	Medium to large rivers
Pleurobema clava	clubshell	E	E	–	Medium to small rivers and streams
Quadrula cylindrica cylindrica	rabbitsfoot	–	E	–	Medium to large rivers
Fish					
Acipenser fulvescens	lake sturgeon	–	E	T	Large rivers and shallow water of large lakes
Erimyzon oblongus	creek chubsucker	–	–	E	Low-gradient creeks
Moxostoma carinatum	river redhorse	–	–	T	Deep, swift, gravelly riffles of small and medium-sized rivers
Moxostoma valenciennesi	greater redhorse	–	E	–	Large, clear streams
Notropis chalybaeus	ironcolor shiner	–	–	X	Clear sandy-bottomed creeks and soft-bottomed swamps
Percina evides	gilt darter	–	E	–	Large, fast-flowing rivers

(a) E = endangered, T = threatened, C = candidate for Federal listing, X = extirpated, – = no listing.
Sources: Cummings and Mayer 1992; FWS 2003; I&M 2003a; IDNR 2004b; ILPIN 2004; Scott and Crossman 1973; Smith 1979; Wiggins 1977.

current to avoid being buried in silt (FWS 2003). It has been impacted by siltation and poisoning from pesticides and fertilizers (FWS 2003). There is only one known population of this species, in a 5-km (3-mi) stretch of Fish Creek in Ohio (Hoggarth 1990); therefore, the white cat's paw pearlymussel is one of the most critically endangered animals, and its recovery may be impossible (FWS 2003). The white cat's paw pearlymussel is probably extirpated from the Indiana counties traversed by the CNP transmission lines.

The northern riffleshell (*Epioblasma torulosa rangiana*) was Federally listed as endangered on January 22, 1993 (FWS 1993) and is also listed as endangered in Indiana. It inhabits medium to large rivers in gravel riffles (Cummings and Mayer 1992), burying itself in substrates of firmly packed sand or gravel with only its feeding siphon exposed (FWS 2003). The northern riffleshell may live 15 years or more (Watters 1994). Its fish hosts are unknown, but are assumed to be darters or sculpins (Watters 1994). It has been impacted by siltation, water pollution, and habitat loss by impoundments. Dams and reservoirs may also act as barriers to the distribution of its fish hosts. The zebra mussel may also pose a threat to this mussel (FWS 2003). The species has experienced a range reduction of greater than 95 percent (FWS 1993). The species is not commercially valuable, but the small size and numbers of remaining populations increases its vulnerability to scientific collecting or educational programs. It is also susceptible to predators, especially muskrats (FWS 1993). The northern riffleshell is presently not known to occur in Indiana (FWS 1993).

The clubshell (*Pleurobema clava*) was Federally listed as endangered on January 22, 1993 (FWS 1993), and is also listed as endangered in Indiana. It inhabits medium to large rivers in gravel or mixed gravel and sand in runs, often just downstream of a riffle (Cummings and Mayer 1992; Watters 1994). The clubshell may live 20 years or more (Watters 1994). The primary factors that have impacted the species include impoundments, channelization, loss of riparian habitat, siltation, water pollution, and possibly, the zebra mussel (FWS 2003). The current distribution of the clubshell represents a range reduction of more than 95 percent (FWS 2003). The species is not commercially valuable, but the small size and numbers of remaining populations increases its vulnerability to scientific collecting or educational programs (FWS 1993). Host fish for the clubshell include the central stoneroller (*Campostoma anomalum*), striped shiner (*Luxilus chrysocephalus*), logperch (*Percina caprodes*), and blackside darter (*P. maculata*) (Ohio State University 2004). Within the project area, the clubshell occurs only in Fish Creek, a tributary of the St. Joseph River in DeKalb County, Indiana, more than 25 km (16 mi) from the nearest CNP transmission line (FWS 2003).

Several State-listed aquatic species occur on the CNP site, in Lake Michigan within the CNP site area, and within some of the Indiana and Michigan counties crossed by the transmission lines associated with CNP (Table 2.2). (See Section 2.2.6 for a listing of State-listed plant species, many of which are wetland and/or aquatic species.) The following provides a discussion of the State-listed aquatic animal species listed for the project area counties and the one truly aquatic plant species collected from the CNP site or during the surveys of the transmission line ROWs.

The water-meal (*Wolffia papulifera*) is a small floating aquatic plant of the duckweed family that is listed as threatened in Michigan. The species inhabits low-gradient streams, sloughs, and stagnant waters of ponds, often in the organic floating debris of sink-hole ponds. Water-meal is considered to provide good fish food and cover (ILPIN 2004). It was found to be abundant on the small intermittent stream in the southern portion of CNP, and one population was observed on the Palisades Substation Nos. 1 and 2 transmission line corridor (I&M 2003a).

The caddisfly *Setodes oligius* (Leptoceridae) is listed as endangered in Indiana. Larvae of *Setodes* occur primarily in pockets of sand on limestone shoals or in sand deposited on the leeward side of rocks in riffle areas (Pescador et al. 1995). They feed on aquatic plants and invertebrates (Wiggins 1977).

The snuffbox (*Epioblasma triquetra*), a freshwater mussel, is listed as endangered in both Indiana and Michigan. It inhabits medium to large rivers in clear, gravel riffles. It is widespread but rare throughout the Midwest (Cummings and Mayer 1992). The long-term viability of most populations of the snuffbox is questionable, especially for those that inhabit large rivers where zebra mussels are established (NatureServe 2004). Fish hosts include the banded sculpin (*Cottus carolinae*) and logperch (NatureServe 2004).

The rabbitsfoot (*Quadrula cylindrica cylindrica*), a freshwater mussel, is listed as endangered in Indiana. It occurs in medium to large rivers in mixed sand and gravel. It is rare throughout its range (Cummings and Mayer 1992). The rabbitsfoot is widely distributed, but its occurrence is spotty and it has been eliminated from portions of its historic range (NatureServe 2004).

The lake sturgeon is listed as endangered in Indiana and threatened in Michigan. Since the mid-nineteenth century, exploitation, pollution, habitat degradation, and habitat loss have resulted in substantial declines in the lake sturgeon (Hay-Chmielewski and Whelan 1997; EPA 2002). It inhabits low- and moderate-gradient large rivers and lakes. Preferred substrates include firm sand, gravel, or rock. In the Great Lakes, it lives in shoal water (NatureServe 2004). The lake sturgeon may migrate as far as 125 to 400 km (78 to 250 mi) between nonspawning and spawning habitats. Once mature, females spawn only once every four to six years. However, a female can produce 50,000 to 700,000 eggs per spawn and can live to be 80 years old or more. Eggs of lake sturgeon are eaten by common carp, suckers, catfish, and other sturgeons (NatureServe 2004). The lake sturgeon eats invertebrates such as leeches, snails, small clams, and aquatic insects (NatureServe 2004). Near CNP, the historic distribution of the lake sturgeon included the Galien and St. Joseph River watersheds in Berrien

County, with historic spawning areas occurring 1.6 to 3.2 km (1 to 2 mi) north of New Buffalo in Berrien County and near South Haven in Van Buren County (Hay-Chmielewski and Whelan 1997).

The creek chubsucker (*Erimyzon oblongus*), a small fish listed as endangered in Michigan, inhabits small rivers and creeks of various types. Spawning occurs in river mouths or pools, riffles, lake outlets, and upstream creeks (NatureServe 2004). It eats small invertebrates and algae. Populations of creek chubsucker are declining in streams subject to siltation (NatureServe 2004).

The river redhorse (*Moxostoma carinatum*), a medium-sized fish listed as threatened in Michigan, is generally confined to clearer large creeks and rivers, occasionally occurring in lakes and reservoirs. The river redhorse eats mostly mussels, snails, crustaceans, and aquatic insect larvae. It spawns in spring on shoals and in runs (NatureServe 2004). Major threats to the river redhorse include channelization, impoundments, siltation, and turbidity. It is also vulnerable to major pollution events (e.g., toxic spills). Its large river habitat makes protection difficult (NatureServe 2004).

The greater redhorse (*M. valenciennesi*), a medium-sized fish listed as endangered in Indiana, inhabits high-gradient large rivers and moderate-gradient medium-sized rivers, and occasionally occurs in reservoirs and large lakes (NatureServe 2004). It prefers clear water with substrates of clean sand, gravel, or boulders, and is intolerant of siltation. Spawning beds consist of gravel with mixtures of sand and rubble in moderate to swift currents. The eggs of the greater redhorse are preyed upon by yellow perch and American eels (*Anguilla rostrata*). Molluscs, aquatic insects, and crustaceans comprise the main diet of the greater redhorse, although it also consumes some plant material. The range and abundance of the greater redhorse have declined due to siltation, pollution, and other habitat degradation (NatureServe 2004).

The ironcolor shiner (*Notropis chalybaeus*), a small fish considered extirpated in Michigan, inhabits low-gradient creeks and moderate-gradient, medium-size rivers. The ironcolor shiner generally occurs in pools and runs of low-gradient, small, acidic creeks and small rivers with sandy substrates. It also occurs in clear well-vegetated water and soft-bottomed swamps (NatureServe 2004). Prey items include aquatic and terrestrial insects. Declines and extirpations have occurred as a result of siltation and pollution (NatureServe 2004). The ironcolor shiner is considered extirpated in Michigan and probably does not occur in the aquatic habitats crossed by the CNP transmission lines.

The gilt darter (*Percina evides*), a small fish listed as endangered in Indiana, inhabits pools and riffles of high-gradient creeks and moderate-grade, medium-sized rivers (NatureServe 2004).

The gilt darter feeds mostly on aquatic insect larvae. The gilt darter is threatened by pollution and habitat alteration (NatureServe 2004).

2.2.6 Terrestrial Resources

The CNP site occupies about 263 ha (650 ac) along 1326 m (4350 ft) of Lake Michigan shoreline. Major terrestrial communities on the site are hardwood forest on stable dunes, and wetlands in low-lying areas between the dunes (I&M 2003a). Some dunes are as high as 88 m (290 ft), making them some of the highest dunes along the eastern shore of Lake Michigan (I&M 2003a). The beach zone and windward side of the foredune zone are typically devoid of vegetation along the Lake Michigan shoreline in northern Indiana and southwestern Michigan. Albert (2000) classifies dunes in southwestern Michigan as parabolic dunes, defined by their distinctive U-shape, that are often 76 to 91 m (250 to 350 ft) high. Dunes rise abruptly at about a 30 degree angle from the beach, with approximately 70 percent of each dune area facing the direction of the wind. Dune crests are interrupted frequently by trough-shaped windsweeps (AEC 1973).

The beach zone is approximately 61 m (200 ft) wide, rising abruptly into the foredunes. Where sands are somewhat stable, marram grass (*Ammophila breviligulata)* and reed grass *(Calamovilfa longifolia*) have become established. Windblown sand accumulates around the base of these grasses, dunes form, and shrub species such as red osier dogwood (*Cornus stolonifera*) and sand cherry (*Prunus pumila*) become established on the foredunes (Albert 2000).

Behind the dunes, hardwood forests cover much of the stable dunes. Dominant species include black ash (*Fraxinus nigra*) and black oak (*Quercus velutina*), with jack pine (*Pinus banksiana*) and white pine (*Pinus strobus*) occurring as common species (I&M 2003a). Forested areas further inland support species that require higher soil organic matter and moisture. Common tree species include red oak (*Quercus rubra*), shagbark hickory (*Carya ovata*), pignut hickory (*C. glabra*), and white ash (*Fraxinus americana*).

The CNP site has 27 wetlands in low-lying areas, ranging in size from <0.1 ha (<0.25 ac) to about 4.2 ha (10.5 ac). Some wetlands have standing water, while others are typical of wetlands with a shallow water table. Marshes onsite support a variety of sedges (*Carex* spp.), rushes (*Juncus* spp.), umbrella sedges (*Cyperus* spp.), and cattails (*Typha latifolia*) (I&M 2003a). Swamp wetlands occurring around ponds and along streams onsite contain several woody species including willows (*Salix* spp.) and buttonbush (*Cephalanthus occidentalis*).

The CNP site has not been surveyed for common wildlife species. Common wildlife species expected to occur on the CNP site are likely to be representative of species found in hardwood forests of the upper Midwest. Small mammals that are relatively common in these habitats include the eastern chipmunk (*Tamias striatus),* gray squirrel (*Sciurus carolinensis*), fox squirrel (*Sciurus niger*), white-footed mouse (*Peromyscus leucopus*), raccoon (*Procyon lotor*), red fox (*Vulpes fulva*), and opossum (*Didelphis virginiana*) (Mumford and Whitaker 1982). In a survey of small mammals in foredune habitat at the Indiana Dunes National Lakeshore, an area that is similar to the CNP site and located about 40 km (25 mi) southwest of CNP, Mumford and Whitaker (1982) reported that the most abundant small mammals recorded were white-footed mouse, deer mouse (*Peromyscus maniculatus*), meadow vole (*Microtus pennsylvanicus*), short-tailed shrew (*Blarina brevicauda*), and masked shrew (*Sorex cinereus).*

The eastern shore of Lake Michigan is on a branch of the Mississippi flyway where migrating birds can be seen in relatively large numbers in the dunes and along the shoreline (I&M 2003a). Wallace (1977) reported that over 30 species of sandpipers, plovers, and terns use the Lake Michigan shoreline during migration. Numerous songbirds also use the shore of Lake Michigan as a landmark, especially during spring migration (Wallace 1977). Permanent resident and migrant bird species that breed at the CNP site are expected to be typical of species in early succession shrub and hardwood forest habitats. CNP has not conducted surveys of nesting birds at the site.

Waterfowl also use the Lake Michigan shoreline during migration. Diving ducks observed during migration include greater scaup (*Aythya marila*), lesser scaup (*A. affinis*), bufflehead (*Bucephala albeola*), common goldeneye (*B. clangula*), redhead (*A. americana*), and canvasback (*A. valisineria*). Several hundred scaup overwinter in southwestern Michigan and are observed near the CNP intake structures where they apparently are attracted to zebra mussels that colonize the intake cribs and surrounding rip-rap (I&M 2003a).

Many of the wildlife species expected to occur in hardwood forest, shrubby areas, and wetlands at CNP would likely occur in similar habitat along and adjacent to the 389 km (243 mi) of transmission line corridors in Indiana and Michigan associated with CNP. The transmission corridors cross mostly cultivated agricultural land where row crops are grown in Indiana. Common small mammals that inhabit cultivated land in Indiana include the deer mouse, white-footed mouse, house mouse (*Mus musculus*), eastern cottontail (*Sylvilagus floridanus*), and meadow vole (Mumford and Whitaker 1982). Songbirds commonly observed in pasture fields include the eastern meadowlark (*Sturnella magna*), bobolink (*Dolichonyx oryzivorus*), and horned lark (*Eremophila alpestris*) (Wallace 1977). More than 80 species of birds are known to nest in woodlots within the Lake Michigan Drainage Basin that includes portions of northern Indiana and southwestern Michigan (Wallace 1977).

Federally listed, proposed, or candidate terrestrial species found in Berrien County and therefore possibly present at the CNP site are included in Table 2-4. No designated critical habitat is known on the CNP site, or vicinity, or the associated transmission line ROWs. Species listed as threatened or endangered by the states of Indiana and Michigan known to occur on the CNP site or site vicinity and in the counties crossed by the six transmission lines are also included. No Federally listed plant or animal species were observed during field surveys of the CNP site and associated ROWs conducted in 2002 and 2004 (TRC 2002; I&M 2004).

Two butterfly species that are Federally listed as endangered, the Karner blue butterfly (*Lycaeides melissa samuelis*) and Mitchell's satyr butterfly (*Neonymphya mitchellii*), may occur in counties crossed by the CNP transmission line corridors (FWS 2004a). Neither species was observed during field surveys on the corridors conducted in 2002 and 2004 (TRC 2002; I&M 2004). Based on information from the FWS (2004a), the Karner blue butterfly is known to occur in LaGrange County, Indiana, and may be present along the Collingwood-Robison corridor. The Mitchell's satyr butterfly is found in Berrien, Cass, and Van Buren counties in Michigan (MNFI 2004a) and LaPorte and LaGrange counties in Indiana (FWS 2004a) and may occur along the transmission corridors.

The Karner blue butterfly inhabits areas of sandy soil in oak and oak-pine savanna habitat (MNFI 2004a). It often occurs in old fields and ROWs surrounded by close-canopied oak forest. It feeds only on wild lupine (*Lupinus perennis*). The Mitchell's satyr butterfly inhabits a variety of habitats but is closely affiliated with wetlands such as open fen, wet prairie, sedge meadows, shrub carr, and tamarack savanna communities (MNFI 2004a). Peat bogs, sedge meadows that contain the sedge *Carex stricta*, scattered deciduous communities, and groundwater seeps are typical habitat components (MNFI 2004a). Neither species was observed during surveys of CNP transmission line ROWs conducted in 2002 and 2004 (TRC 2002; I&M 2004).

Table 2-4. Federally Listed and State-Listed Terrestrial Species Potentially Occurring in the Vicinity of CNP and Associated Transmission Lines

Scientific Name	Common Name	Federal Status[a]	Michigan Status[a]	Indiana Status[a]
Insects				
Exyra rolandiana	pitcher plant moth	–	–	E
Glaucopsyche lygdamus couperi	silvery blue (a butterfly)	–	–	E
Lepyronia gibbosa	great plains spittlebug	–	T	–
Lycaeides melissa samuelis	Karner blue butterfly	E	–	E
Melanchra assimilis	a noctuid moth	–	–	E
Neonympha mitchellii mitchellii	Mitchell's satyr butterfly	E	E	E
Oligia bridghami	a noctuid moth	–	–	T
Papaipema silphii	silphium borer moth	–	T	–
Pieris oleracea	veined white (a butterfly)	–	–	E
Prairiana kansana	a leaf hopper	–	–	T
Spartiniphaga includens	a noctuid moth	–	–	T
Speyeria idalia	regal fritillary (a butterfly)	–	E	E
Setoides oligius	a caddisfly	–	–	E
Amphibians				
Ambystoma opacum	marbled salamander	–	T	–
Hemidactylium scutatum	four–toed salamander	–	–	E
Reptiles				
Clemmys guttata	spotted turtle	–	T	E
Clonophis kirtlandii	Kirtland's snake	–	E	E
Emydoidea blandingii	Blanding's turtle	–	–	E
Liochlorophis vernalis	smooth green snake	–	–	E
Macroclemys temminckii	alligator snapping turtle	–	–	E
Nerodia erythrogaster neglecta	copperbelly water snake	T	–	E
Sistrurus catenatus catenatus	eastern massasauga	C	–	E
Terrapene ornata	ornate box turtle	–	–	E
Thamnophis butleri	Butler's garter snake	–	–	E

Table 2-4. (contd)

			State Status[a]	
Scientific Name	**Common Name**	**Federal Status[a]**	**Michigan**	**Indiana**
Birds				
Ammodramus henslowii	Henslow's sparrow	–	T	E
Asio flammeus	short-eared owl	–	E	E
Bartramia longicauda	upland sandpiper	–	–	E
Botaurus lentiginosus	American bittern	–	–	E
Buteo lineatus	red-shouldered hawk	–	T	–
Charadrius melodus	piping plover	E	E	E
Childonias niger	black tern	–	–	E
Circus cyaneus	northern harrier	–	–	E
Cistothorus palustris	marsh wren	–	–	E
Cistothorus platensis	sedge wren	–	–	E
Dendroica discolor	prairie warbler	–	E	–
Dendroica dominica	yellow-throated warbler	–	T	–
Falco peregrinus	peregrine falcon	–	E	E
Grus canadensis	sandhill crane	–	–	E
Haliaeetus leucocephalus	bald eagle	T	T	E
Ixobrychus exilis	least bittern	–	T	E
Lanius ludovicianus	loggerhead shrike	–	E	E
Nyctanassa violacaea	yellow-crowned night heron	–	–	E
Nycticorax nycticorax	black-crowned night heron	–	–	E
Pandion haliaetus	osprey	–	T	E
Phalacrocorax auritus	double-crested cormorant	–	–	X
Rallus elegans	king rail	–	E	E
Sterna caspia	Caspian tern	–	T	–
Sterna hirundo	common tern	–	T	–
Tyto alba	barn owl	–	–	E
Vermivora chrysoptera	golden–winged warbler	–	–	E
Xanthocephalus xanthocephalus	yellow–headed blackbird	–	–	E

Table 2-4. (contd)

Scientific Name	Common Name	Federal Status[a]	State Status[a] Michigan	State Status[a] Indiana
Mammals				
Lutra canadensis	northern river otter	–	–	E
Lynx rufus	bobcat	–	–	E
Microtus ochrogaster	prairie vole	–	E	–
Myotis sodalis	Indiana bat	E	–	E
Spermophilus franklinii	Franklin's ground squirrel	–	–	E
Taxidea taxus	American badger	–	–	E
Plants				
Amelanchier humilis	running serviceberry	–	–	E
Androsace occidentalis	rock–jasmine	–	E	T
Arabis drummondii	Drummond's rockcress	–	–	E
Arabis glabra	tower mustard	–	–	T
Arabis missouriensis var. *deamii*	Missouri rockcress	–	–	E
Aralia hispida	bristly sarsaparilla	–	–	E
Aristida tuberculosa	beach three–awned grass	–	T	–
Aristolochia serpentaria	Virginia snakeroot	–	T	–
Armoracia aquatica	lake cress	–	T	E
Astragalus canadensis	Canadian milk–vetch	–	T	–
Baptisia leucophaea	cream wild indigo	–	E	–
Bartonia paniculata	panicled screw–stem	–	T	–
Berula erecta	cut–leaved water–parsnip	–	T	–
Betula populifolia	gray birch	–	–	X
Besseya bullii	kitten–tails	–	T	E
Bidens beckii	Beck water–marigold	–	–	E
Botrychium matricariifolium	chamomile grape-fern	–	–	T
Botrychium simplex	least grape–fern	–	–	E
Calamagrostris stricta	narrow–leaved reedgrass	–	T	–
Calla palustris	wild calla	–	–	E

Table 2-4. (contd)

Scientific Name	Common Name	Federal Status[a]	State Status[a] Michigan	State Status[a] Indiana
Camassia scilloides	wild–hyacinth	–	T	–
Carex albolutescens	greenish–white sedge	–	T	–
Carex alopecoidea	foxtail sedge	–	–	E
Carex arctata	black sedge	–	–	E
Carex atherodes	awned sedge	–	–	E
Carex atlantica ssp. *atlantica*	Atlantic sedge	–	–	T
Carex atlantica ssp. *capillacea*	Howe sedge	–	–	E
Carex bebbii	Bebb's sedge	–	–	T
Carex chordorrhiza	creeping sedge	–	–	E
Carex crawei	Crawe sedge	–	–	T
Carex crus–corvi	raven's–foot sedge	–	T	–
Carex debilis var. *rudgei*	white–edge sedge	–	–	T
Carex echinata	little prickly sedge	–	–	E
Carex flava	yellow sedge	–	–	T
Carex folliculata	long sedge	–	–	T
Carex gravida	sedge	–	X	E
Carex leptonervia	finely–nerved sedge	–	–	E
Carex limosa	mud sedge	–	–	E
Carex lupuliformis	false hop sedge	–	T	–
Carex oligocarpa	eastern few–fruited sedge	–	T	–
Carex platyphylla	broad–leafed sedge	–	T	–
Carex retrorsa	retrose sedge	–	–	E
Carex scabrata	rough sedge	–	–	E
Carex serosa	sedge	–	T	–
Carex sparganioides var. *cephaloidea*	thinleaf sedge	–	–	T
Carex straminea	straw sedge	–	E	T
Castanea dentata	American chestnut	–	E	–
Chasmanthium latifolium	wild–oats	–	T	–

Table 2-4. (contd)

			State Status[a]	
Scientific Name	**Common Name**	**Federal Status[a]**	**Michigan**	**Indiana**
Chimaphila umbellata ssp. *cisatlantica*	pipsissewa	–	–	T
Chrysosplenium americanum	American golden-saxifrage	–	–	T
Circaea alpina	small enchanter's nightshade	–	–	X
Cirsium hillii	Hill's thistle	–	–	E
Cirsium pitcheri	Pitcher's thistle	T	T	T
Coeloglossum viride var. *virescens*	long–bract green orchis	–	–	T
Commelina erecta	slender day–flower	–	X	–
Conioselinum chinense	hemlock parsley	–	–	E
Coreopsis palmata	prairie coreopsis	–	T	–
Corydalis flavula	yellow fumewort	–	T	–
Corydalis sempervirens	pale corydalis	–	–	E
Crataegus prona	Illinois hawthorn	–	–	E
Cyperus dentatus	toothed sedge	–	–	E
Cypripedium candidum	white lady–slipper	–	T	–
Dalea purpurea	purple prairie–clover	–	X	–
Dasystoma macrophylla	mullein foxglove	–	T	–
Diarrhena americana	beak grass	–	T	–
Digitaria filiformis	slender finger–grass	–	X	–
Dodecatheon meadia	shooting–star	–	E	–
Draba reptans	creeping whitlow–grass	–	T	–
Dryopteris celsa	log fern	–	T	X
Dryopteris clintoniana	Clinton woodfern	–	–	X
Echinacea purpurea	purple coneflower	–	X	–
Eleocharis equisetoides	horse-tail spikerush	–	–	E
Eleocharis melanocarpa	black–fruited spikerush	–	–	T
Equisetum variegatum	variegated horsetail	–	–	E
Eriocaulon aquaticum	pipewort	–	–	E
Eriophorum gracile	slender cotton–grass	–	–	T

Table 2-4. (contd)

Scientific Name	Common Name	Federal Status[a]	State Status[a] Michigan	State Status[a] Indiana
Eriophorum spissum	dense cotton–grass	–	–	X
Eryngium yuccifolium	rattlesnake–master	–	T	–
Eupatorium sessilifolium	upland boneset	–	T	–
Euphorbia commutata	tinted spurge	–	T	–
Euphorbia obtusata	bluntleaf spurge	–	–	X
Filipendula rubra	queen–of–the–prairie	–	T	–
Fimbristylis puberula	chestnut sedge	–	X	E
Fragaria vesca var. *americana*	woodland strawberry	–	–	X
Fuirena pumila	dwarf umbrella–sedge	–	–	T
Fuirena squarrosa	umbrella–sedge	–	T	–
Galearis spectabilis	showy orchis	–	T	–
Gentiana flavida	white gentian	–	E	–
Gentiana puberulenta	downy gentian	–	E	T
Gentiana saponaria	soapwort gentian	–	X	–
Gentianella quinquefolia	stiff gentian	–	T	–
Geranium bicknellii	Bicknell northern crane's bill	–	–	E
Geranium robertianum	herb–robert	–	–	T
Geum rivale	purple avens	–	–	E
Gnaphalium macounii	winged cudweed	–	–	X
Glyceria grandis	American manna–grass	–	–	X
Helianthus microcephalus	small wood sunflower	–	X	–
Helianthus mollis	downy sunflower	–	T	–
Hydrocotyle americana	American water–pennywort	–	–	E
Hydrastis canadensis	goldenseal	–	T	–
Hypericum pyramidatum	great St. John's wort	–	–	E
Iliamna remota	Kankakee globe–mallow	–	–	E
Isotria medeoloides	small whorled pogonia	T	E	–
Isotria verticillata	whorled pogonia	–	T	–
Juncus brachycarpus	short–fruited rush	–	T	–

Table 2-4. (contd)

				State Status[a]	
	Scientific Name	**Common Name**	**Federal Status[a]**	**Michigan**	**Indiana**
1	*Juncus militaris*	bayonet rush	–	T	X
2	*Juncus pelocarpus*	brown–fruited rush	–	–	T
3	*Juncus scirpoides*	scirpus–like rush	–	T	T
4	*Lathyrus maritimus* var. *glaber*	beach peavine	–	–	E
5	*Lathyrus ochroleucus*	pale vetchling peavine	–	–	E
6	*Lathyrus venosus*	smooth veiny pea	–	–	T
7	*Lechea pulchella*	Leggett's pinweed	–	T	–
8	*Lemna perpusilla*	minute duckweed	–	–	X
9	*Lespedeza procumbens*	trailing bush–clover	–	X	–
10	*Linnaea borealis*	twinflower	–	–	X
11	*Linum virginianum*	Virginia flax	–	T	–
12	*Lonicera canadensis*	American fly–honeysuckle	–	–	X
13	*Ludwigia sphaerocarpa*	globe–fruited seedbox	–	T	E
14	*Luzula acuminata*	hairy woodrush	–	–	E
15	*Lycopodiella inundata*	northern bog clubmoss	–	–	E
16	*Lycopodium tristachyum*	deep–root clubmoss	–	–	T
17	*Malaxis unifolia*	green adder's–mouth	–	–	E
18	*Morus rubra*	red mulberry	–	T	–
19	*Myriophyllum pinnatum*	cutleaf water–milfoil	–	–	T
20	*Myriophyllum verticillatum*	whorled water–milfoil	–	–	T
21	*Nelumbo lutea*	American lotus	–	T	–
22	*Oenothera perennis*	small sundrops	–	–	T
23	*Oryzopsis asperofolia*	white–grained mountain ricegrass	–	–	E
24	*Oryzopsis pungens*	slender mountain ricegrass	–	–	X
25	*Oryzopsis racemosa*	black-fruited mountain ricegrass	–	–	T
26	*Oxalis violacea*	violet wood-sorrel	–	T	–
27	*Panax quinquefolius*	ginseng	–	T	–
28	*Panicum leibergii*	Leiberg's panic-grass	–	T	T
29	*Panicum subvillosum*	a panic-grass	–	–	X

Table 2-4. (contd)

			State Status[a]	
Scientific Name	**Common Name**	**Federal Status[a]**	**Michigan**	**Indiana**
Panicum verrucosum	warty panic-grass	–	T	T
Phlox maculata	wild sweet william	–	T	–
Phlox ovata	mountain phlox	–	–	E
Platanthera ciliaris	orange or yellow-fringed orchid	–	T	E
Platanthera hyperborrea	leafy northern green orchis	–	–	T
Platanthera orabiculata	large roundleaf orchid	–	–	X
Poa paludigena	bog bluegrass	–	T	–
Polemonium reptans	Jacob's ladder	–	T	–
Polygonum careya	Carey's smartweed	–	T	T
Polygonum cilinode	fringed black bindweed	–	–	E
Polygonum hydropiperoides var. *opelousanum*	northeastern smartweed	–	–	T
Polygonum hydropiperoides var. *setaceum*	swamp smartweed	–	–	E
Polymnia uvedalia	large-flowered leafcup	–	T	–
Polytaenia nuttallii	prairie parsley	–	–	E
Populus balsamifera	balsam poplar	–	–	X
Populus heterophylla	swamp or black cottonwood	–	E	–
Potamogeton bicupulatus	waterthread pondweed	–	T	X
Potamogeton epihydrus	Nuttall pondweed	–	–	E
Potamogeton friesii	Fries' pondweed	–	–	E
Potamogeton praelongus	white-stem pondweed	–	–	E
Potamogeton pulcher	spotted pondweed	–	T	E
Potamogeton richardsonii	redheadgrass	–	–	T
Potamogeton robbinsii	flatleaf pondweed	–	–	T
Potentilla anserina	silverweed	–	–	T
Psilocarya scirpoides	bald-rush	–	T	T
Pycanthemum pilosum	hairy mountain-mint	–	T	–
Pyrola secunda	one-sided wintergreen	–	–	X

Table 2-4. (contd)

Scientific Name	Common Name	Federal Status[a]	State Status[a] Michigan	State Status[a] Indiana
Pyrola virens	greenish-flowered wintergreen	–	–	X
Quercus prinoides	dwarf chinquapin oak	–	–	E
Rhynchospora globularis var. *recognita*	globe beaked-rush	–	E	E
Rubus alumnus	a bramble	–	–	X
Rubus enslenii	southern dewberry	–	–	E
Rubus setosus	small bristleberry	–	–	E
Ruellia humilis	hairy ruellia	–	T	–
Sabatia angularis	rose-pink	–	T	–
Salix serissima	autumn willow	–	–	T
Satureja glabella var. *angustifolia*	calamint	–	–	E
Scheuchzeria palustris var. *americana*	American scheuchzeria	–	–	E
Schizachne purpurascens	purple oat	–	–	E
Scirpus purshianus	weakstalk bulrush	–	–	E
Scirpus smithii	Smith's bulrush	–	–	E
Scleria pauciflora	few-flowered nut-rush	–	E	–
Scleria reticularis	netted nut-rush	–	T	T
Scutellaria parvula var. *parvula*	small skullcap	–	–	X
Selaginella apoda	meadow spike-moss	–	–	E
Selaginella rupestris	ledge spike-moss	–	–	T
Sida hermaphrodita	Virginia mallow	–	–	E
Silene regia	royal catchfly	–	–	T
Silene stellata	starry campion	–	T	–
Silphium integrifolium	rosinweed	–	T	–
Silphium laciniatum	compass–plant	–	T	–
Silphium perfoliatum	cup–plant	–	T	–
Silphium montanum	strict blue–eyed grass	–	–	E
Solidago simplex var. *gillmanii*	sticky goldenrod	–	–	T

Table 2-4. (contd)

Scientific Name	Common Name	Federal Status[a]	State Status[a] Michigan	State Status[a] Indiana
Sorbus decora	northern mountain ash	–	–	X
Stellaria crassifolia	fleshy stitchwort	–	T	–
Sparganium androcladum	branching bur–reed	–	–	T
Spiranthes magnicamporum	Great Plains ladies' tresses	–	–	E
Spiranthes romanzoffiana	hooded ladies' tresses	–	–	E
Stipa avenacea	blackseed needlegrass	–	–	T
Stipa comata	sewing needlegrass	–	–	X
Stophostyles leiosperma	slick–seed wild–bean	–	–	T
Tipularia discolor	cranefly orchid	–	T	–
Trichostema dichotomum	bastard pennroyal	–	T	–
Triglochin palustre	marsh arrow–grass	–	–	T
Trillium recurvatum	prairie trillium	–	T	–
Trillium sessile	toadshade	–	T	–
Trillium undulatum	painted trillium	–	E	–
Triphora trianthophora	three–birds orchid	–	T	–
Utricularia cornuta	horned bladderwort	–	–	T
Utricularia geminiscapa	hidden–fruited bladderwort	–	–	E
Utricularia inflata	floating bladderwort	–	E	–
Utricularia minor	lesser bladderwort	–	–	E
Utricularia resupinata	northeastern bladderwort	–	–	X
Utricularia subulata	zigzag bladderwort	–	T	T
Vaccinium oxycoccos	small cranberry	–	–	T
Valeriana edulis	hairy valerian	–	–	E
Valeriana uliginosa	marsh valerian	–	–	E
Valerianella chenopodifolia	goosefoot corn–salad	–	T	E
Viburnum cassinoides	northern wild–raisin	–	–	E
Viburnum opulus var. *americanum*	highbush cranberry	–	–	E
Viola pedatifida	prairie birdfoot violet	–	T	T
Vitis vulpina	frost grape	–	T	–

Table 2-4. (contd)

			State Status[a]	
Scientific Name	Common Name	Federal Status[a]	Michigan	Indiana
Wisteria frutescens	wisteria	–	T	–
Woodwardia areolata	netted chain–fern	–	X	–
Wolffia papulifera	water–meal	–	T	–
Xyris difformis	Carolina yellow–eyed grass	–	–	T
Zizania aquatica var. *aquatica*	wild–rice	–	T	–

(a) E = endangered, T = threatened, C = candidate for Federal listing, X = believed extirpated in Michigan or Indiana, – = not listed.

Sources: FWS 2004a; FWS 2004b, MNFI 2004a; MNFI 2004b; IDNR 2004b; I&M 2003a

The copperbelly water snake (*Nerodia erythrogaster neglecta*), Federally listed as threatened, may occur along the transmission line corridors in St. Joseph and LaGrange counties in Indiana (FWS 2004a, 2004b; IDNR 2004b) where riparian habitat exists along streams.

The eastern massasauga (*Sistrurus catenatus catenatus*), a candidate for Federal listing, has not been observed at the CNP site. The distribution of the eastern massasauga is disjunct within the project area and typically is found in marsh vegetation around lakes and in wet meadows (Pentecost and Vogt 1974). No individuals were found during field surveys of the CNP site and transmission line ROWs (TRC 2002; I&M 2004), although they may be present in marsh areas. The eastern massasauga is difficult to find in dense marsh vegetation and may be present along the transmission line corridors traversing wetlands (FWS 2004b). Historical records (Pentecost and Vogt 1974) and updated distribution information compiled by the Indiana Department of Natural Resources (IDNR) (IDNR 2004b) show that the eastern massasauga occurred in Van Buren and Cass Counties in Michigan, and LaPorte, St. Joseph, Elkhart, LaGrange, and Noble counties in Indiana.

The bald eagle (*Haliaeetus leucocephalus*), currently Federally listed as threatened but proposed for delisting, does not breed onsite but is occasionally observed in flight or along the shoreline perched in trees at the CNP site (I&M 2003a). FWS (2004a) indicates that the piping plover (*Charadrius melodus*), a Federally listed endangered species, is known to occur in Berrien County. No individuals were recorded from the site. If piping plovers were to occur, the most likely time would be during migration, according to information on the known breeding range in Michigan compiled by the Michigan Natural Features Inventory (MNFI) (MNFI 2004a). The osprey (*Pandion haliaetus*) and common tern (*Sterna hirundo*), State-listed as threatened in Michigan, have also been observed flying along the CNP shoreline or on the beach. No osprey or common tern nests are known from the CNP site.

The Indiana bat (*Myotis sodalis*) is a Federally listed endangered species that occurs in riparian woodland habitat during the summer months in northern Indiana and southern Michigan. Habitat is usually within 1.6 to 4.8 km (1 to 3 mi) of small to medium-sized rivers. Roosting and nursery habitat is associated with hollowed-out areas or under loose bark of deciduous trees. The FWS Region 3 list of endangered species shows the Indiana bat's geographic distribution to include Berrien, Cass, and Van Buren Counties in Michigan and potentially all counties of Indiana (FWS 2004a). Although the Indiana bat has not been observed at the CNP site or along any of the associated transmission line corridors, apparently suitable habitats do occur in these areas, and could support this species. The FWS considers the Indiana bat to be present in suitable habitat along the transmission line corridors unless surveys indicate its absence (FWS 2004b).

Two Federally listed threatened plant species, the Pitcher's thistle (*Cirsium pitcheri*) and small whorled pogonia (*Isotria medeoloides*), are reported to occur in the project area in Van Buren and Berrien County, Michigan (FWS 2004a; MNFI 2004b). No populations of either species were found during the field surveys of the transmission line corridors or the CNP site (TRC 2002; I&M 2004). The Pitcher's thistle typically grows on open sand dunes or gravelly soil on the shoreline dunes along the shores of the Great Lakes (MNFI 2004b). The small whorled pogonia is known from only one locality in southwestern lower Michigan, occurring in a lowland forest (MNFI 2004b).

Several terrestrial State-listed species were observed during field surveys conducted in 2002 at the CNP site (I&M 2003a). Several Caspian terns (*Sterna caspia*) were observed along the beach and one tern egg was discovered during the 2002 spring survey. The straw sedge (*Carex straminea*), a State-listed endangered species, was found in a wetland in the northeastern portion of the site. The 5 threatened plant species observed and their associated habitats were: rose-pink (*Sabatia angularis*) in a mowed area at CNP and in areas long the transmission corridor; Carey's smartweed (*Polygonum careya*) in wetlands in the northwestern portion of the site; red mulberry (*Morus rubra*) in a wooded dune area near the absorption ponds; and scirpus-like rush (*Juncus scirpoides*) in a wetland in the northeastern portion of the CNP site.

Eight State-listed species were documented during field surveys conducted in 2002 and 2004 along the CNP transmission line ROWs (TRC 2002; I&M 2004). Two bird species, the loggerhead shrike (*Lanius ludovicianus*) and golden-winged warbler (*Vermivora chrysoptera*), listed as endangered in Indiana, were observed during field surveys of the of the Twin Branch No. 2 transmission corridor in Indiana. Three plant species listed as endangered in Indiana

(IDNR 2004b) were discovered during field surveys along the Collingwood, Twin Branch No. 1 and No. 2 corridors. The southern dewberry (*Rubus enslenii*) was found at two locations, along the Collingwood corridor and the Twin Branch No. 2 corridor. One population of Drummond's rockcress (*Arabis drummondi*) was discovered on the Twin Branch No. 1 corridor, near the Twin Branch Substation. A population of swamp smartweed (*Polygonum hydropiperoides* var. *setaceum*) was found on the Twin Branch No. 2 corridor. Two terrestrial plant species listed as threatened in Michigan were found during surveys. Scirpus-like rush was found in wetlands along transmission line corridors. Four populations of the prairie trillium (*Trillium recurvatum*) were observed along transmission line corridors in Berrien County and Cass County.

2.2.7 Radiological Impacts

I&M has conducted a radiological environmental monitoring program (REMP) around the CNP site since 1975. Through this program, radiological impacts to workers, the public, and the environment are monitored, documented, and compared to 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 *Donald C. Cook Nuclear Plant Units 1 and 2 Annual Radiological Environmental Operating Report* (AEP 2003c) and the *Donald C. Cook Nuclear Plant Units 1 and 2 Radioactive Effluent Release Report* (AEP 2000a, 2001, 2002, 2003a, 2004a). The limits for all radiological releases are specified in the ODCM (included in the annual effluent release report), and these limits are designed to meet Federal standards and requirements. 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 [TLD] locations), and atmospheric environment (airborne radioiodine, particulates, gross beta, and gamma).

As required by 10 CFR 20.1301(d), historical data on releases and the resultant dose calculations were compared to limits that are specified in the EPA's environmental radiation standards (40 CFR Part 190). The review revealed that the doses to maximally exposed individuals in the vicinity of the CNP site were a small fraction of the EPA limits. For the period 1999 through 2003, dose estimates were calculated based on actual liquid and gaseous effluent release data (AEP 2000a, 2001, 2002, 2003a, 2004a). Calculations were performed using the plant effluent release data, onsite meteorological data, and appropriate pathways identified in the ODCM.

I&M performs an assessment of radiation dose to the general public from radioactive effluents. For the five-year period 1999 through 2003, the annual total effective dose equivalent (TEDE) calculated each year for the maximally exposed individual 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) (AEP 2000a, 2001, 2002, 2003a, 2004a). Over this five-year period, the maximum TEDE for the maximally exposed individual was estimated to be 9.02×10^{-3} mSv (9.02×10^{-1} mrem) in the year 2001 (AEP 2002), with an annual average TEDE of 6.82×10^{-3} mSv (6.82×10^{-1} mrem) over the period. The TEDE estimates include exposure from liquid and gaseous effluents and direct radiation. These results confirm that the CNP Units 1 and 2 are operating in compliance with 10 CFR Part 50 Appendix I, 10 CFR Part 20, and 40 CFR Part 190.

2.2.8 Socioeconomic Factors

The staff reviewed the ER (I&M 2003a) 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 CNP site.

2.2.8.1 Housing

I&M currently employs approximately 1120 permanent workers at CNP (AEP 2004c). The majority of plant employees live in Berrien County, Michigan (81 percent), and St. Joseph County, Indiana (8 percent), with the majority of the remainder distributed across 20 counties in Michigan and Indiana (Table 2-5). Given the residential location of CNP employees, the most significant impacts of plant operations are likely to occur in Berrien County, Michigan, and

Table 2-5. CNP Units 1 and 2 Permanent Employee Residence Information by County and City

County and City[a]	Number of Employees	Percent of Total
BERRIEN COUNTY		
St. Joseph	260	23
Stevensville	169	15
Bridgman	109	10
Benton Harbor	60	5
Buchanan	51	5
Baroda	46	4
Coloma	45	4
Niles	28	3
Sawyer	21	2
Three Oaks	20	2
Other Cities	97	9
Total Berrien County	906	81
ST. JOSEPH COUNTY		
Granger	61	5
South Bend	24	2
Other Cities	4	<1
Total St. Joseph County	89	8
Other Counties	121	11
Grand Total	1116	100

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

St. Joseph County, Indiana. The focus of the analysis in this SEIS is on the impacts of CNP operations in these two counties.

I&M refuels CNP Units 1 and 2 every 18 months. During refueling, an additional 700 workers are employed for a 30-day period (I&M 2003a). The majority of these workers reside in the same communities as the permanent employees at the plant (AEP 2004c).

The number of housing units and housing vacancies in Berrien County, Michigan, and St. Joseph County, Indiana, are shown in Table 2-6. In Berrien County, the total number of housing units and the number of occupied units grew at an average annual rate of roughly 0.5 percent over the period 1990 to 2000. With an annual average population growth rate of only 0.1 percent during this period, the number of units available grew faster than housing demand, leading to an annual growth rate in the number of vacant units of 1.5 percent. In St. Joseph County, total and occupied housing grew at an average annual rate of slightly less

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

	1990	2000	Approximate Percentage Change 1990 to 2000
		BERRIEN COUNTY	
Housing Units	69,532	73,445	5.6
Occupied Units	61,025	63,569	4.2
Vacant Units	8507	9876	16.1
		ST. JOSEPH COUNTY	
Housing Units	97,956	107,013	9.2
Occupied Units	92,365	100,743	9.1
Vacant Units	5591	6270	12.1

Source: USCB 2004a.

than 1 percent, while vacant housing grew at slightly more than 1 percent per year. The growth rate in housing in St. Joseph County approximately equaled the growth rate in population during this period.

2.2.8.2 Public Services

- **Water Supply**

Water supply in Berrien County comes from both surface and groundwater sources, although surface water (especially Lake Michigan) is the main source of supply (I&M 2003a). Although 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. There are currently 14 water suppliers in the county, with the majority of capacity and water supply provided by St. Joseph, Benton Harbor, Niles, and Lake Charter (Table 2-7). Excess water capacity in the county is high, and suppliers have been able to satisfy new residential, commercial, and industrial demands (I&M 2003a).

St. Joseph County is heavily dependent on groundwater sources for its water supply, with a large number (230) of suppliers involved (I&M 2003a). Private wells are a common source of supply as the cost of providing public infrastructure for water pumping and wastewater services in the county has been prohibitive, often limiting access by new residential developments to these services (I&M 2003a). The largest suppliers in the county, those located in South Bend and Mishawaka, currently have excess capacity. Lake Charter Township provides fire protection and drinking water to CNP at a rate not exceeding 2.7 million L/day (720,000 gpd).

Table 2-7. Major Public Water Supply Systems in Berrien County in 2001

Water System	Source	Average Daily Use in million L/day (million gpd)	Maximum Capacity million L/day (million gpd)
St. Joseph	Surface water	5.7 (1.5)	15.9 (4.2)
Benton Harbor	Surface water	4.9 (1.3)	12.1 (3.2)
Niles	Ground water	1.9 (0.5)	9.8 (2.6)
Lake Charter Township	Surface water	1.9 (0.5)	4.9 (1.3)
Berrien Springs	Ground water	0.4 (0.1)	3.0 (0.8)

Source: I&M 2003a.

- **Education**

CNP is located in the Bridgman Public School district, which has a current enrollment of 1003 students. There are 81 teachers currently employed in the district and expenditures are currently $8803 per student. Enrollment has risen slightly in recent years, together with expenditures per student, while the number of teachers in the district has remained stable over the same period.[a]

Including the Bridgman Public Schools, there are 18 public school districts in Berrien County, with a current total enrollment of 28,181 students. Average expenditure per student in the public school districts in the county is $7260, compared to $8089 for Michigan as a whole (Standard and Poors 2004). The Berrien County Intermediate School District provides special education services for all districts in the county, has a current enrollment of 351 students, and employs 49 teachers.[b] There are also 30 private/parochial schools with

(a) Personal communication with K. Ivers, Bridgman Public School District, Bridgman, Michigan. March 9, 2004.

(b) Personal communication with G. Blasko, Berrien County Intermediate School District, Bridgman, Michigan. March 9, 2004.

a current enrollment of 4030 students, and two public school academies (Berrien County 2004).

There are 43 public elementary schools, 17 middle schools, and 6 high schools in St. Joseph County, Indiana, which had an enrollment of 21,700 students in 2002 (St. Joseph County 2004). There are an additional 2 private high schools and 16 private elementary schools, which had an enrollment of 5971 students in 2002 (St. Joseph County 2004). Average expenditure per student in St. Joseph County was $11,000, compared to $8700 for Indiana as a whole (St. Joseph County 2004).

- **Transportation**

Access to CNP is via Cook Place, which connects with Red Arrow Highway, approximately 1.6 km (1.0 mi) east of the plant (Table 2-8). Red Arrow Highway runs parallel to Interstate 94. Most employees traveling from Bridgman or St. Joseph use these two roads, while employees coming from St. Joseph County, Indiana, use auxiliary roads to reach Red Arrow Highway to access the site.

Moderate increases in traffic have occurred on many of the roads in the vicinity of the plant, in particular Interstate 94, which has seen large increases in commercial traffic (I&M 2003a). Four segments of Interstate 94 for which traffic counts are available were assessed in the ER. 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. Red Arrow Highway also experiences relatively high daily traffic flow (I&M 2003a).

2.2.8.3 Offsite Land Use

Berrien County is rural in character, with its land either in agricultural production, forested, or vacant (Table 2-8). Approximately 84 percent of its 1518 km^2 (583 mi^2) of land area are classified as being used for agriculture or as unused. Approximately 10 percent of the county's land use is residential and 3 percent is devoted to manufacturing, commercial, and sand and gravel mining activities. Less than 2 percent of the land is devoted to public and semipublic uses, with the Lake Michigan lakefront, parks, and recreational areas being strong attractions for summer and fall visitors and seasonal residents (I&M 2003a).

While Berrien County's population has exhibited slightly negative growth over the past 30 years, it has experienced significant residential, industrial, and commercial growth during that period. Residential development has moved away from the urban cores and both the Lake Michigan lakefront and prime farmland are confronting growth pressure. Industrial and commercial

Table 2-8. Land Use in Berrien County, 1999

Land Use	Percent of Total
Residential	9.4
Commercial	1.3
Industrial	1.5
Public and semipublic	3.5
Agriculture and vacant land (i.e., flood plains and natural wetlands)	84.2
Total	100

Source: I&M 2003a

acreage has doubled in that time. The Berrien County Planning Commission has developed an overall land use decision-making strategy that encourages the implementation of a "smart growth" methodology by municipalities within the county. In complying with the strategy, each municipality is advised to create development and planning tools that foster the preservation of open space, farmland, natural beauty, and critical environmental areas while directing development towards strengthening existing communities and promoting mixed land uses (I&M 2003a).

Land use in Bridgman and Lake Charter Township supports a combination of residential/agricultural (50 percent), single-family residential (20 percent), industrial and commercial (20 percent), and recreational (10 percent) uses (Lake Charter Township 2003; City of Bridgman 1997). Lake Charter Township created its first designated industrial use area within the township by rezoning the CNP site from agricultural to industrial use prior to the construction of the plant. In 1984, additional agricultural land to the east of the plant was rezoned industrial, and a mixture of light industrial and commercial ventures have located there; tax incentives often are used as an inducement. The Township owns undeveloped property immediately south of the plant that is zoned recreational and has a water pumping station situated on the western edge. Residential-use areas north and south of the plant are well-established and continue to experience growth, from an influx of both year-round and seasonal residents, usually on a low-density level with no large-scale residential developments. Agricultural land use continues throughout the general area surrounding the plant, although the present outlook is for a continuing gradual decrease in agricultural land within the county (AEC 1973; NRC 1996). Commercial sand and gravel mining operations have ceased in the township. Revenue derived from CNP during its operation allowed the township to extend sewer and water services to approximately 95 percent of the township, thus guiding and permitting residential and industrial development around the plant. In addition, taxes received from CNP have permitted the school district to offer above-average curriculum and facilities to district residents, thus encouraging new residential development.

Recreational opportunities and resources available in Berrien County attract over 1 million summer visitors and thousands of seasonal residents. The Grand Mere State Park is approximately 1.6 km (1 mi) north-northeast of CNP. Warren Dunes State Park is approximately 5.6 km (3.5 mi) south-southwest of CNP. They have 1.6 and 3.2 km (1 and 2 mi) of shoreline, respectively, and sand dunes and inland lakes in undeveloped, natural settings. Warren Woods State Park is located 16 km (10 mi) south of the site. The county is host to several dozen resorts and camps (AEC 1973; I&M 2003a).

2.2.8.4 Visual Aesthetics and Noise

CNP is located on the southeastern shoreline of Lake Michigan. The plant draws its cooling water from the lake, which eliminates a need for cooling towers. The Lake Michigan shoreline in Berrien County serves as a strong draw to summer tourists and seasonal residents who enjoy the recreational and environmental attractions of the area.

The CNP site covers 263 ha (650 ac) of beach and high wooded sand dunes. Plant buildings include a rectangular turbine building (217 m [712 ft] long and 36 m [110 ft] high), two cylindrical, domed-top reactor containment buildings (37 m [122 ft] in diameter and 49 m [162 ft] high), and a T-shaped auxiliary building (29 m [95 ft] high) (AEC 1973). All of the plant's structures and the two reactor domes 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 Interstate 94. All of the buildings, with the exception of the reactor containment buildings, have been painted dark brown to blend with the dune environment (NRC 1996). The transmission lines can be seen from the interstate and Red Arrow Highway (AEC 1973).

Noise measurements are not available for the CNP site. However, noise generated by CNP operations is mitigated at the site boundary because the plant is located midway between the northern and southern boundaries of the site at a distance of approximately 610 m (2000 ft) from either boundary; the plant is surrounded by sand dunes and vegetation; and most equipment is located within the plant buildings. In addition, Interstate 94 bisects the eastern portion of the site and reduces the conspicuousness of any noise generated by CNP operations. Higher noise levels are created on the first Saturday of each month when onsite and offsite warning sirens are tested.

2.2.8.5 Demography

In 2000, there were 156,663 people living within 32 km (20 mi) of CNP, for a density of 149 persons/km^2 (238 persons/mi^2). This density translates to Category 4 (least sparse), using the GEIS measure of sparseness (I&M 2003a). At the same time, there were 1,447,303 persons living within 80 km (50 mi) of the plant, for a density of 177 persons/km^2 (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 growth controls that would limit housing development in this area (I&M 2003a).

Table 2-9 shows population trends for the two counties where the majority of CNP employees live. Annual average growth rates in Berrien County show relatively slow growth during the 1970s, followed by a declining population in the 1980s, and slight increases during the 1990s. The annual average growth rate in Michigan over this period was 0.4 percent. Population is forecasted to decline in both decades between 2000 and 2020. In St. Joseph County, a slightly declining population in the 1970s was followed by moderate growth in the 1980s and 1990s. The annual average growth rate in Indiana over this period was 0.6 percent. Growth is forecasted to continue at moderate levels over the period 2000 to 2020.

Table 2-9. Population Growth in Berrien County, Michigan, and St. Joseph County, Indiana, 1970 to 2020

	Berrien County		St. Joseph County	
Year	**Population**	**Annual Growth Percent[(a)]**	**Population**	**Annual Growth Percent**
1970	163,875	–	245,045	–
1980	171,276	0.5	241,617	-0.1
1990	161,378	-0.6	247,052	0.2
2000	162,453	0.1	265,559	0.7
2010	160,800	-0.1	272,800	0.3
2020	158,900	-0.1	278,093	0.2

(a) Annual percent growth rate is calculated over the previous decade.

– No data available.

Source: USCB 2004a

- **Transient Population**

The transient population in the vicinity of the CNP site consists primarily of tourists visiting St. Joseph, Benton Harbor, and various recreational facilities, including the St. Joseph River, local beaches, and the local annual festival (I&M 2003a). People visiting summer homes 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 (I&M 2003a). Only a small number of seasonal migrant agricultural workers reside in Berrien County, where agriculture is less important to the county economy than it is in adjacent counties. Fluctuations in student enrollment in some of the more rural countiesmay potentially present short-term planning problems in a number of school districts in the area.[a]

2.2.8.6 Economy

- **Employment and Income**

Total employment in Berrien County was 65,177 in 2001 (USCB 2004b). Service industries dominate employment in the county with more than 42 percent of total employment (27,488 people employed). The largest employer in the county is Lakeland Regional Health Systems, with 3000 employees (Table 2-10). Manufacturing also plays an important part in the local economy with more than 23 percent of local employment (15,058 people), and a number of manufacturing firms have a large local labor force, including Whirlpool Corporation and Bosch Braking Systems, in addition to AEP at CNP and other facilities. Wholesale and retail trade employs 15 percent (9975 people) of the county.

Of the 122,356 employed in St. Joseph County, almost 50 percent of employment (60,155 people) is in the various service sectors (USCB 2004b). Manufacturing has a relatively small share of county employment (16.1 percent), with 19,965 people employed. Wholesale and retail trade has more than 20 percent of the county workforce, with 25,016 people.

(a) Personal communication with G. Blasko, Berrien County Intermediate School District, Bridgman, Michigan. March 9, 2004.

Personal income in Berrien County was $4.4 billion in 2001 (in 2003 dollars), with a per capita income of $26,792 (2003 dollars) (DOC 2004). In St. Joseph County, total personal income was almost $7.8 billion, with per capita income of $29,209.

Table 2-10. Major Employment Facilities Within 16 km (10 mi) of the CNP Site

Firm	Number of Employees
Lakeland Regional Health System, Inc	3000
Whirlpool Corporation	2553
American Electric Power	1450
Bosch Braking Systems	1395
Andrews University	800
Berrien County	774
Leco Corporation	743
Benton Harbor Area Schools	705
IPC Communication Services	542
Meijer Inc.	500

Source: Berrien County 2004.

- **Unemployment**

Unemployment in Berrien County was moderately high at 7.2 percent in December 2003. The rate for Michigan as a whole for the same month was 7.1 percent. In St. Joseph County, the rate for December 2003 was lower, at 4.2 percent compared to 5.0 percent for Indiana (DOL 2004).

- **Taxes**

For taxation purposes, CNP is located in Lake Charter Township, which collects sufficient tax revenues from the plant to cover local expenditures and forwards the balance to Berrien County and the State. Revenues are used to fund local, county, and state emergency management programs, 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 2001 to 2003, almost 50 percent (about $8 million in 2003 dollars) of property tax revenues spent in Lake Charter Township came from CNP (Table 2-11). Roughly 2.0 percent (about $2.9 million in 2003 dollars) of county property taxes spent in the county over the period 2001 to 2003 came from CNP.

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 CNP 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 2-11. CNP Units 1 and 2 Contribution to County Property Tax Revenues and Operating Budget

Year	Total Lake Charter Township Property Tax Revenues (millions $ 2003)	Property Tax Paid to Lake Charter Township for Donald C. Cook (millions $ 2003)	Percent of Total Property Taxes
		LAKE CHARTER TOWNSHIP[a]	
2001	17.3	8.5	49.0
2002	15.5	7.5	48.5
2003	15.8	7.6	48.1
Year	**Total Berrien County Property Tax Revenues (millions $ 2003)**	**Property Tax Paid to Berrien County for Donald C. Cook (millions $ 2003)**	**Percent of Total Property Taxes**
		BERRIEN COUNTY[b]	
2001	144.6	2.9	2.0
2002	146.7	2.9	2.0
2003	147.9	2.9	2.0

(a) Source: Personal communication with J. Gast, Lake Charter Township, Bridgman, Michigan. March 9, 2004.
(b) Source: Berrien County 2004

2.2.9 Historic and Archaeological Resources

This section discusses the cultural background and the known historic and archaeological resources at the site of CNP Units 1 and 2 and in the surrounding area.

2.2.9.1 Cultural Background

The area in and around the CNP site has the potential for significant prehistoric and historic resources. This area is unique in that the sand dunes along Lake Michigan are a combination of active (or migrating) and stabilized dunes. Archaeological sites in active dune areas can be continuously exposed and reburied, making them difficult to locate and manage. Archaeological sites in stabilized dunes can be deeply buried, and therefore protected. Human occupation in this region is evident in archaeological sites dated according to the following chronological sequence: Paleoindian 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). In general, the Paleoindian Period is characterized by highly mobile bands of hunters and gatherers. A typical Paleoindian site might consist of an isolated stone point or knife (of a style characteristic of the period) in an upland area along large river valleys or ancient lake beds. The Archaic Period represents a transition from a highly mobile existence to a more sedentary existence. It is a period of increased local resource exploitation (e.g., predominantly deer and small mammals, fish and other aquatic resources, nuts and seeds), more advanced tool development, and increased complexity in social organization. The Woodland Period is a continuation of the complexities begun during the Archaic Period with the introduction of ceramic technology. Pottery begins to appear in the archaeological record during this time. Burials dating to the Woodland Period are characteristically mounded with earth and situated along bluffs, some even in the shapes of animals. In southwestern Michigan, the Upper Mississippian Period is characterized by mostly Late Woodland cultural traits with the distinctive addition of crushed shell temper in the ceramics used to create superior pottery (McAllister 1999).

The historic period in this region begins with the arrival of the first European settlers in the late 1600s. Fort Miami (in present-day St. Joseph) and Fort St. Joseph, the area's first Jesuit mission (in present-day Niles), were the first settlements in the area. The French left the area in 1763; the British held Fort St. Joseph until 1781 when it was captured by the Spanish. Historic Native American tribes known to have inhabited this region at that time include the Potawatomi, Miami, Ottawa, and Chippewa.

Berrien County has 20 sites listed on the National Register of Historic Places (NRHP). Three of these properties are located within approximately 9.7 km (6 mi) of the CNP site: Avery Road - Galien River Bridge (built in 1922), Sandburg House (built in 1928), and the Snow Flake Motel (built in 1960). The Old Berrien Courthouse (built in 1839) and the Ring Lardner House (built ca 1850) are two additional NRHP properties that are located nearby.

2.2.9.2 Historic and Archaeological Resources at CNP Site

The CNP site occupies approximately 263 ha (650 ac), including 1326 m (4350 ft) of Lake Michigan shoreline; approximately 73 ha (180 ac) are occupied by plant structures, parking lots, roads, laydown areas, and a rail line. In addition, 1862 ha (4600 ac) of land along 366 km (227 mi) of ROWs are occupied by seven transmission lines that connect CNP to the electric grid (I&M 2003a). Approximately 50 percent of the CNP site was disturbed during the original construction of Units 1 and 2 and related infrastructure (AEC 1973). Intact archaeological sites could be present within the remaining undeveloped areas. Because of the nature of the topography, there is also the potential for deeply buried sites to be present within the previously disturbed areas (although not necessarily within the more heavily developed areas). Disturbance also occurred along transmission line ROWs during their construction and maintenance.

No archaeological surveys were conducted at the CNP site prior to construction and, based on a file search conducted on March 10, 2004, at the Michigan State Historic Preservation Office (SHPO), no surveys have been conducted or sites recorded since construction. A letter from the Michigan State Liaison Officer for Historic Preservation indicated that resources may have been impacted by already completed construction work, but further construction as indicated in the FES would not result in an adverse impact (AEC 1973). However, the letter also states that an archaeological survey had not been conducted and any evidence of archaeological sites would require notification to the State for salvaging of the sites. The Michigan SHPO was contacted regarding the proposed action on March 2, 2004 (see Appendix E).

No architectural surveys have been conducted at the CNP site to determine whether any standing structures or buildings on the site are eligible for listing on the NRHP.

Although no known sites of significance to Native Americans have been identified at the CNP site, government-to-government consultation with the appropriate Federally recognized Native American tribes has been initiated (copies of the consultation letters are in Appendix E).

2.2.10 Related Federal Project Activities and Consultations

The staff reviewed the possibility that activities of other Federal agencies might impact the renewal of the OLs for CNP Units 1 and 2. Any such activities could result in cumulative environmental impacts and the possible need for the Federal agency to become a cooperating agency for preparation of the SEIS.

CNP is located on the southeastern shoreline of Lake Michigan. I&M periodically has applied to the U.S. Army Corps of Engineers for dredging and sand redistribution permits in the vicinity of the plant and its lake water cooling system. These actions have all been in compliance with Section 307 of the Coastal Zone Management Act, PL 92-583, and Clean Water Act 404 permits. No additional permit needs are anticipated during the license renewal period.

After reviewing the Federal activities in the vicinity of the CNP, the staff determined there are no Federal project activities that would make it desirable for another Federal agency to become a cooperating agency for preparing this SEIS. There are no Federally owned facilities or land or

Native American land within 80 km (50 mi) of CNP. Consumers Energy Company's Palisades Nuclear Plant is located approximately 45 km (28 mi) north-northeast of CNP.

NRC is required under Section 102(c) of National Environmental Policy Act (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. NRC consulted with the FWS; the consultation is described in Section 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 58. Code of Federal Regulations, Title 40, *Protection of Environment*, Part 58, "Ambient Air Quality Surveillance."

40 CFR Part 81. Code of Federal Regulations, Title 40, *Protection of Environment*, 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 [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 in this supplemental environmental impact statement (SEIS) unless new and significant information is identified.

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

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

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

(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 Donald C. Cook Nuclear Plant (CNP) because they are related to plant design features or site characteristics not found at CNP 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. Indiana Michigan Power Company (I&M) indicated that it has performed an evaluation of structures and components pursuant to 10 CFR 54.21 to identify activities that are necessary to continue operation of CNP Units 1 and 2 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) (I&M 2003).

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 staff's environmental impact statement.

However, I&M stated that the replacement of these components and the additional inspection activities are within the bounds of normal plant component replacement and inspections; therefore, they are not expected to affect the environment outside the bounds of plant operations as evaluated in the final environmental statement (AEC 1973). In addition, I&M'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 CNP Units 1 and 2 beyond the end of the existing operating licenses. 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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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 1996a, 1999a).[(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 [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 in this supplemental environmental impact statement (SEIS).

This chapter addresses the issues related to operation during the renewal term that are listed in Table B-1 of 10 CFR Part 51, Subpart A, Appendix B, and are applicable to the Donald C. Cook Nuclear Plant (CNP). Section 4.1 addresses issues applicable to the CNP cooling system. Section 4.2 addresses issues related to transmission lines and onsite land use. Section 4.3 addresses the radiological impacts of normal operation, and Section 4.4 addresses issues related to the socioeconomic impacts of normal operation during the renewal term. Section 4.5 addresses issues related to groundwater use and quality, while Section 4.6 discusses the impacts of renewal term operations on threatened and endangered species. Section 4.7 addresses potential new information that was raised during the staff's review, and Section 4.8

(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.

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 CNP because they are related to plant design features or site characteristics not found at CNP 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 CNP Units 1 and 2 cooling system operation during the renewal term are listed in Table 4-1. Indiana Michigan Power Company (I&M) stated in its environmental report (ER) (I&M 2003) that it is not aware of any new and significant information associated with the renewal of the CNP Units 1 and 2 operating licenses (OLs). The staff has not identified any significant new information during its independent review of the ER (I&M 2003), the scoping process, the staff's site visit, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts related to these issues beyond those discussed in the GEIS. For all of the issues, the staff concluded in the GEIS that the impacts are SMALL, and additional plant-specific mitigation measures are not likely to be sufficiently beneficial to be warranted.

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

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

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

  The staff has not identified any significant new information during its independent review of the ER (I&M 2003), the scoping process, the staff's site visit, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts of altered current patterns at intake and discharge structures during the renewal term beyond those discussed in the GEIS.

- 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.

Table 4-1. Category 1 Issues Applicable to the Operation of the CNP Units 1 and 2 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; 4.3.2.2; 4.4.2
Altered thermal stratification of lakes	4.2.1.2.2; 4.4.2.2
Temperature effects on sediment transport capacity	4.2.1.2.3; 4.4.2.2
Scouring caused by discharged cooling water	4.2.1.2.3; 4.4.2.2
Eutrophication	4.2.1.2.3; 4.4.2.2
Discharge of chlorine or other biocides	4.2.1.2.4; 4.4.2.2
Discharge of sanitary wastes and minor chemical spills	4.2.1.2.4; 4.4.2.2
Discharge of other metals in wastewater	4.2.1.2.4; 4.3.2.2; 4.4.2.2
Water use conflicts (plants with once-through cooling systems)	4.2.1.3
AQUATIC ECOLOGY	
Accumulation of contaminants in sediments or biota	4.2.1.2.4; 4.3.3; 4.4.3; 4.4.2.2
Entrainment of phytoplankton and zooplankton	4.2.2.1.1; 4.3.3; 4.4.3
Cold shock	4.2.2.1.5; 4.3.3; 4.4.3
Thermal plume barrier to migrating fish	4.2.2.1.6; 4.4.3
Distribution of aquatic organisms	4.2.2.1.6; 4.4.3
Premature emergence of aquatic insects	4.2.2.1.7; 4.4.3
Gas supersaturation (gas bubble disease)	4.2.2.1.8; 4.4.3
Low dissolved oxygen in the discharge	4.2.2.1.9; 4.3.3; 4.4.3
Losses from predation, parasitism, and disease among organisms exposed to sublethal stresses	4.2.2.1.10; 4.4.3
Stimulation of nuisance organisms	4.2.2.1.11; 4.4.3
HUMAN HEALTH	
Noise	4.3.7

The staff has not identified any significant new information during its independent review of the ER (I&M 2003), the scoping process, the staff's site visit, its review of monitoring programs, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts of altered thermal stratification of lakes during the renewal term beyond those discussed in the GEIS.

- <u>Temperature effects on sediment transport capacity</u>. 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 staff has not identified any significant new information during its independent review of the ER (I&M 2003), the scoping process, the staff's site visit, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts of temperature effects on sediment transport capacity during the renewal term beyond those discussed in the GEIS.

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

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

The staff has not identified any significant new information during its independent review of the ER (I&M 2003), the scoping process, the staff's site visit, its review of monitoring programs, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts of scouring caused by discharged cooling water during the renewal term beyond those discussed in the GEIS.

- <u>Eutrophication</u>. Based on information in the GEIS, the Commission found that

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

The staff has not identified any significant new information during its independent review of the ER (I&M 2003), the scoping process, the staff's site visit, its review of monitoring programs, or its evaluation of other available information including plant monitoring data and technical reports. Therefore, the staff concludes that there are 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 staff has not identified any significant new information during its independent review of the ER (I&M 2003), the scoping process, the staff's site visit, or its evaluation of other available information including the National Pollutant Discharge Elimination System (NPDES) permit for CNP Units 1 and 2, or discussion with the Michigan Department of Environmental Quality (MDEQ) compliance office. Therefore, the staff concludes that there are no impacts of discharge of chlorine or other biocides during the renewal term beyond those discussed in the GEIS.

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

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

  The staff has not identified any significant new information during its independent review of the ER (I&M 2003), the scoping process, the staff's site visit, or its evaluation of other available information including the NPDES and groundwater discharge permits for CNP Units 1 and 2 or discussion with the MDEQ compliance office. Therefore, the staff concludes that there are no impacts of discharges of sanitary wastes and minor chemical spills during the renewal term beyond those discussed in the GEIS.

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

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

  The staff has not identified any significant new information during its independent review of the ER (I&M 2003), the scoping process, the staff's site visit, or its evaluation of other available information including the NPDES and groundwater discharge permits for CNP Units 1 and 2 or discussion with the MDEQ compliance offices. Therefore, the staff concludes that there are no impacts of discharges of other metals in wastewater during the renewal term beyond those discussed in the GEIS.

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

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

  The staff has not identified any significant new information during its independent review of the ER (I&M 2003), the scoping process, the staff's site visit, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts of water use conflicts for plants with once-through cooling systems during the renewal term beyond those discussed in the GEIS.

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

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

  The staff has not identified any significant new information during its independent review of the ER (I&M 2003), the scoping process, the staff's site visit, or its evaluation of available information. Therefore, the staff concludes that there are no impacts of accumulation of contaminants in sediments or biota during the renewal term beyond those discussed in the GEIS.

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

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

  The staff has not identified any significant new information during its independent review of the ER (I&M 2003), the scoping process, the staff's site visit, its review of monitoring programs, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts of entrainment of phytoplankton and zooplankton during the renewal term beyond those discussed in the GEIS.

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

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

The staff has not identified any significant new information during its independent review of the ER (I&M 2003), the scoping process, the staff's site visit, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts of cold shock during the renewal term beyond those discussed in the GEIS.

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

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

The staff has not identified any significant new information during its independent review of the ER (I&M 2003), the scoping process, the staff's site visit, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts of thermal plume barriers to migrating fish during the renewal term beyond those discussed in the GEIS.

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

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

The staff has not identified any significant new information during its independent review of the ER (I&M 2003), the scoping process, the staff's site visit, its review of monitoring programs, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts on distribution of aquatic organisms during the renewal term beyond those discussed in the GEIS.

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

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

  The staff has not identified any significant new information during its independent review of the ER (I&M 2003), the scoping process, the staff's site visit, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts of premature emergence of aquatic insects during the renewal term beyond those discussed in the GEIS.

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

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

  The staff has not identified any significant new information during its independent review of the ER (I&M 2003), the scoping process, the staff's site visit, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts of gas supersaturation during the renewal term beyond those discussed in the GEIS.

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

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

  The staff has not identified any significant new information during its independent review of the ER (I&M 2003), the scoping process, the staff's site visit, its review of monitoring programs, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts of low dissolved oxygen during the renewal term beyond those discussed in the GEIS.

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

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

The staff has not identified any significant new information during its independent review of the ER (I&M 2003), the scoping process, the staff's site visit, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts of losses from predation, parasitism, and disease among organisms exposed to sublethal stresses during the renewal term beyond those discussed in the GEIS.

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

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

The staff has not identified any significant new information during its independent review of the ER (I&M 2003), the scoping process, the staff's site visit, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts of stimulation of nuisance organisms during the renewal term beyond those discussed in the GEIS.

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

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

The staff has not identified any significant new information during its independent review of the ER (I&M 2003), the scoping process, the staff's site visit, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts of noise during the renewal term beyond those discussed in the GEIS.

The Category 2 issues related to cooling system operation during the renewal term that are applicable to CNP Units 1 and 2 are discussed in the sections that follow, and are listed in Table 4-2.

Table 4-2. Category 2 Issues Applicable to the Operation of the CNP Units 1 and 2 Cooling System 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
AQUATIC ECOLOGY			
Entrainment of fish and shellfish in early life stages	4.2.2.1.2; 4.3.3	B	4.1.1
Impingement of fish and shellfish	4.2.2.1.3; 4.3.3	B	4.1.2
Heat shock	4.2.2.1.4; 4.3.3	B	4.1.3

4.1.1 Entrainment of Fish and Shellfish in Early Life Stages

For plants with once-through cooling systems, entrainment of fish and shellfish in early life stages into cooling water systems associated with nuclear power plants is considered a Category 2 issue, requiring a site-specific assessment before license renewal. To perform this evaluation, the staff reviewed the applicant's ER (I&M 2003) and Updated Final Safety Analysis Report (UFSAR) (I&M 2002); visited the CNP site; and reviewed the applicant's State of Michigan NPDES Permit No. MI0005827, effective on January 1, 2001, and in force until October 1, 2003 (I&M 2003). (The applicant applied for a renewal of their NPDES permit in a timely manner [i.e., 180 days prior to the October 1, 2003, permit expiration date]. Until the submitted permit application is acted upon by the MDEQ, CNP Units 1 and 2 would operate under the stipulations of the existing permit.)

Section 316(b) of the Clean Water Act (CWA) requires that the location, design, construction, and capacity of cooling water intake structures reflect the best technology available for minimizing adverse environmental impacts (33 USC 1326). Entrainment of fish and shellfish into the cooling water system is a potential adverse environmental impact that can be minimized by use of the best available technology. The fact that the intake structure is located more than 305 m (1000 ft) from the discharge structure, and that both structures are physically removed from the plant, causes the time period of entrainment (about 10 min) to be longer than would occur with a shoreline intake and discharge. Nevertheless, this is somewhat offset by the discharge being located closer inshore than the intake thereby decreasing the period of entrainment following condenser passage (Jude 1995).

On July 9, 2004, EPA published a final rule in the *Federal Register* (69 FR 41575) (EPA 2004) addressing cooling water intake structures at existing power plants, such as CNP, whose flow levels exceed a minimum threshold value of 190,000 m^3/d (50 million gpd). The rule is Phase II in EPA's development of 316(b) regulations that establish national requirements applicable to the location, design, construction, and capacity of cooling water intake structures at existing facilities that exceed the threshold value for water withdrawals. The national requirements, which are implemented through NPDES permits, minimize the adverse environmental impacts associated with the continued use of the intake systems. Licensees are required to demonstrate compliance with the Phase II performance standards at the time of renewal of their NPDES permit. Licensees may be required as part of the NPDES renewal to alter the intake structure, redesign the cooling system, modify station operation, or take other mitigative measures as a result of this regulation. The new performance standards are designed to significantly reduce entrainment losses due to plant operation. Any site-specific mitigation would result in less impact due to continued plant operation.

Condenser cooling water is withdrawn from Lake Michigan through three intake cribs located about 686 m (2250 ft) from the shoreline in approximately 6 m (20 ft) of water (I&M 2003). The CNP withdraws 6227 m^3/min (1,645,000 gpm) for cooling and plant process water from Lake Michigan (I&M 2002). More than 98 percent of the water withdrawn from the lake is returned (I&M 2003). Entrainment studies at CNP were conducted from 1975 through 1982. During that period, 13 identifiable species of fish larvae and six categories of fish larvae that could not be identified to species (i.e., sculpins, minnows, coregonines, darters, fish in poor condition, and unidentifiable fish) were collected. Fish eggs were also collected in entrainment samples. From 1975 through a portion of 1978, only one unit was in operation. After Unit 2 came online, entrainment rates were generally higher. The numbers of larvae entrained during one-unit operation ranged from 33.5 to 77.1 million/yr; whereas during two-unit operation, larval entrainment ranged from 92.2 to 167.1 million/yr. Similarly, the numbers of eggs entrained during one-unit operation ranged from 743.2 million/yr in 1975 to 2.27 billion/yr; whereas during two-unit operation, egg entrainment ranged from 995.9 million/yr to 7.0 billion/yr. This can be compared to the yearly total CNP flow rates that averaged 1244 million m^3 (3.3×10^{11} gal) during one-unit operation and 2702 million m^3 (7.1×10^{11} gal) during two-unit operation (I&M 2002).

Over the entire eight-year survey period, an estimated 746 million fish larvae and 22.9 billion fish eggs were entrained (I&M 2002). For all years combined, the major species entrained as larvae were alewife (*Alosa pseudoharengus;* 74.3 percent), spottail shiner (*Notropis hudsonius;* 9.0 percent), rainbow smelt (*Osmerus mordax;* 4.8 percent), and yellow perch (*Perca flavescens;* 1.8 percent). Larvae that could not be identified due to poor condition comprised 7.4 percent of the total. The other identifiable fish species included trout-perch (*Percopsis omiscomaycus*), johnny darter (*Etheostoma nigrum*), slimy sculpin (*Cottus cognatus*), mottled sculpin (*Cottus bairdi*), common carp (*Cyprinus carpio*), ninespine stickleback (*Pungitius pungitius*), quillback (*Carpiodes cyprinus*), burbot (*Lota lota*), and deepwater sculpin (*Myoxocephalus thompsoni*). These identifiable species and the other species groups each contributed less than 1 percent of the larvae entrained (I&M 2002).

Variations observed in annual entrainment losses at CNP were caused by a combination of fluctuations in year-class strength and differences in plant operation (Noguchi et al. 1985). Larval entrainment generally began in April, peaked in June or July (when alewife spawning and hatching peaked), and ended in October or November as larvae and young-of-year migrated to deeper offshore areas (Noguchi et al. 1985). Fish eggs were entrained during most months, although no eggs were entrained in September and less than 1 million per month in October and November. Eggs were not identified to species, but Noguchi et al. (1985) made some assumptions on probable species composition. For example, eggs collected in January and February were probably burbot, as it spawns in midwinter under the ice. The 102 million eggs collected in January and February 1982 were probably all burbot. The 1.1 billion eggs entrained from April 3 to May 3, 1982, were most likely rainbow smelt eggs. Most eggs collected in summer were probably alewives as its eggs are not as demersal as are those of spottail shiner; while yellow perch eggs remain in a gelatinous mass on the lake bottom. This included peak egg entrainment episodes of 2.6 billion eggs in June 1980; 470 million in June 1981; and 5.0 billion in June 1982. The few large eggs entrained in October and November may have been those of trout or salmon, which spawn in fall (Noguchi et al. 1985).

Entrainment of fish eggs can be compared to the production of eggs per fish. For example, an individual burbot can produce between 45,600 to 1.4 million eggs; a rainbow smelt, 8500 to 69,600; and an alewife, 10,000 to 12,000 eggs (Scott and Crossman 1973). Therefore, the 102 million burbot eggs collected in January and February, 1982, would be equivalent to the egg production output of 75 to 2237 female burbots; the 1.1 billion rainbow smelt eggs would be equivalent to the egg production output of about 16,450 to 135,530 female rainbow smelt; and the largest egg entrainment episode of 5.0 billion eggs (assumed to be mostly those of alewife) would equate to the egg production of 496,000 female alewives.

To clearly interpret the impacts of entrainment on the fish community in southeastern Lake Michigan, entrainment losses must be compared to the distribution, abundance, and life cycles of the species that occur near the CNP and assess the associated impacts on individual fish populations and community structure. The ultimate impact of entrainment losses must be evaluated in terms of a system's resiliency (i.e., environmental stability, productivity, population compensation, and ecological and economic importance of the individual species) (Noguchi et al. 1985). Production-forgone estimates were calculated for losses of alewife and spottail shiner from plant operation (one-unit operation, with most losses for these two species attributed to larval entrainment). Estimated production forgone for the alewife was 186,024 kg (410,112 lb) for 1975 and 327,964 kg (723,036 lb) for 1976. Production forgone for spottail shiner was 6011 kg (13,252 lb) for 1975 and 1736 kg (3827 lb) for 1976. These weights are approximately equivalent to 6.2 and 10.9 million alewives for 1975 and 1976, respectively; and 865,000 and 250,000 spottail shiners for 1975 and 1976, respectively. These numbers represent a very small percentage of lakewide production for these two species.

No consistent patterns in the abundance of phytoplankton, zooplankton and macroinvertebrates were observed between preoperational and operational periods in the CNP area. Therefore, it was concluded that entrainment was not impacting these organisms (I&M 2002). Zooplankton sampled in the intake and discharge bays found that dead individuals comprised 10 percent and 12 percent of the samples, respectively (I&M 2002), indicating a low rate of entrainment mortality. Dead plankton would be distributed throughout the thermal plume area, contributing to the detrital food chain.

Macroinvertebrate entrainment studies were conducted for *Diporeia* spp. and *Mysis relicta* (during one-unit operation) (I&M 2002). Entrainment losses were evaluated based on the amount of lake bottom required to compensate for annual entrainment losses: *Diporeia* spp. 48 ha (119 ac) and *Mysis relicta* - 59 ha (146 ac). Estimates were not done for *Gammarus* spp. entrainment as it was present at the CNP area only because of the rip-rap around the intakes. *Hyallela azteca* and *Asellus* spp. contributed only 0.1 and 0.4 percent of the macroinvertebrates entrained, respectively. Thus, their losses were not considered significant (I&M 2002). Benthic macroinvertebrate surveys did not indicate any changes in the numbers or biomass of macroinvertebrates even with the observed entrainment losses (I&M 2002).

The staff considered mitigation measures for the continued operation of CNP Units 1 and 2. Based on the assessment to date, the staff expects that the measures in place at CNP (e.g., an offshore intake located where there are no bays or points to act as fish nurseries or other attracting features [except for the rip-rap around the intake structures]; and no substantial unique spawning grounds that occur in the plant area [Jude 1995]) provide mitigation for impacts related to entrainment. The fish-deterrent system being installed in 2004 to reduce fish impingement (see Section 4.1.2) would also reduce spawning activities near the intake for species such as alewife. This would also reduce entrainment of fish eggs and larvae. The staff concludes that the potential impacts of entrainment of fish and shellfish in the early life stages into the cooling water intake system are SMALL, and further mitigation measures are not warranted.

4.1.2 Impingement of Fish and Shellfish

For plants with once-through cooling systems, impingement of fish and shellfish on debris screens of cooling water system intakes is considered a Category 2 issue, requiring a site-specific assessment before license renewal. To perform this evaluation, the staff reviewed the applicant's ER (I&M 2003) and UFSAR (I&M 2002); visited the CNP site; and reviewed the applicant's State of Michigan NPDES Permit No. MI0005827, effective on January 1, 2001, and in force until October 1, 2003 (I&M 2003). The applicant applied for a renewal of their NPDES permit in a timely manner [i.e., 180 days prior to the October 1, 2003 permit expiration date]. Until the submitted permit application is acted upon by the MDEQ, CNP Units 1 and 2 will operate under the stipulations of the existing permit.

Condenser cooling water is withdrawn from Lake Michigan through three intake cribs located about 686 m (2250 ft) from the shoreline in approximately 6 m (20 ft) of water (I&M 2003). The CNP withdraws 6227 m^3/min (1,645,000 gpm) for cooling and plant process water from Lake Michigan (I&M 2002). More than 98 percent of the water withdrawn from the lake is returned (I&M 2003). With both units operating, water velocity at the entrance to the intake crib is 0.4 m/s (1.3 ft/s) and the maximum water velocity within the intake pipe is 1.8 m/s (5.9 ft/s) (Thurber and Jude 1985).

Impingement studies were conducted at CNP from 1975 through 1982 (Thurber and Jude 1985). During that period, 61 species were impinged at CNP. Nineteen of these species were impinged infrequently. Fourteen species that were impinged were never collected in lake sampling done in the CNP vicinity, and 12 species collected in the lake sampling program were never found to be impinged (Thurber and Jude 1985). From 1975 through a portion of 1978, only Unit 1 was in operation. Once Unit 2 came online, impingement rates were notably higher. The numbers of adult and juvenile fish impinged during one-unit operation ranged from 53,190 (1977) to 224,725 (1975); whereas during the period of two-unit operation, fish impingement ranged from 480,776 (1979) to 2,307,754 (1980). The biomass of fish impinged followed similar trends between one- and two-unit operations (i.e., 1833 kg [4041 lb] in 1977 to 6131 kg [13,517 lb] in 1975 for one operating unit compared to 9480 kg [20,900 lb] in 1979 to 71,209 kg [156,989] in 1980 for two operating units) (I&M 2002). The mean percent contribution of total fish impinged during all eight years was: alewife (72.3 percent), yellow perch (10.6 percent), spottail shiner (7.4 percent), rainbow smelt (5.5 percent), trout-perch (2.8 percent), bloater (0.7 percent), slimy sculpin (0.6 percent), and all other species combined (0.6 percent) (Thurber and Jude 1985). Table 4-3 provides the range and mean numbers for the most numerous fish species impinged between 1975 and 1982.

Most of the salmon and trout species that occur in Lake Michigan were found in impingement samples made during 1975 to 1982. Yearly total impingement ranges for the salmonids were: brown trout (0 to 176), chinook salmon (0 to 875), coho salmon (8 to 530), lake trout (101 to 517), and rainbow trout (0 to 37) (Thurber and Jude 1985). The number of salmonids impinged was only a small fraction of the numbers stocked annually into Lake Michigan (i.e., an average of 14.5 million) (Bronte and Schuette 2002).

Spawning, spring warming of inshore water, fall overturn, upwellings, and storms are all conditions that increase fish movement through the area of the intakes (Thurber and Jude 1985). Generally, species most abundant in the impingement collections were also most abundant in field catches (Thurber and Jude 1985). Alewife, bloater (*Coregonus hoyi*), and rainbow smelt populations were not affected by plant operations even though they were abundant in impingement catches. These species are among the most abundant and mobile forage species in Lake Michigan, so immigration from other areas could obscure any local depletions caused by impingement (I&M 2002). Species attracted to the rip-rap around the intakes (e.g., sculpins, yellow perch, johnny darter, spottail shiner, ninespine stickleback, and round goby [*Neogobius melanostomus*]) are more susceptible to impingement (Thurber and Jude 1985).

Table 4-3. Range and Mean Numbers of the Most Common Fish Species Impinged at CNP from 1975-1982

Common Name (Scientific Name)	Minimum (% in Year)	Maximum (% in Year)	Mean (%)
Alewife (*Alosa pseudoharengus*)	31,498 (59.2 in 1977)	1,815,490 (78.7 in 1980)	619,000 (72.3)
Bloater (*Coregonus hoyi*)	49 (0.02 in 1975)	23.085 (3.8 in 1978)	6345 (0.7)
Rainbow smelt (*Osmerus mordax*)	1488 (2.8 in 1977)	149,085 (6.5 in 1980)	46,275 (5.4)
Slimy sculpin (*Cottus cognatus*)	1034 (0.2 in 1978)	8371 (0.4 in 1980)	5324 (0.6)
Spottail shiner (*Notropis hudsonius*)	5032 (9.5 in 1977)	178,009 (28.9 in 1978)	62,000 (7.2)
Trout-perch (*Percopsis omiscomaycus*)	1998 (0.2 in 1982)	88,692 (14.4 in 1978)	23,878 (2.8)
Yellow perch (*Perca flavescens*)	7195 (13.5 in 1977)	391,983 (19.1 in 1981)	89,091 (10.4)
Total number for all species	53,190 (100 in 1977)	2,307,754 (100 in 1980)	855,584 (100)
Total weight in kg (lb) for all species	1833 (404) (100 in 1977)	71,209 (156,989) (100 in 1980)	18,328 (40,406) (100)

Source: Thurber and Jude 1985

Among the State-listed fish species that may occur within the project area (Section 2.2.5), only the lake sturgeon (*Acipenser fulvescens*) was collected in lake and impingement collections (Tesar and Jude 1985; Thurber and Jude 1985). A total of eight lake sturgeon were collected in 1980. They comprised less than 0.01 percent of the number and 0.5 percent of the weight of fish impinged that year (Thurber and Jude 1985).

In addition to fish, crayfish (mostly *Orconectes propinquus*) have been impinged at CNP. From 1975 through 1978, 50,256 crayfish were impinged. However, the crayfish were likely individuals that inhabited the rip-rap surrounding the intake cribs and were present only as a result of the rip-rap reef (Thurber and Jude 1985). Zebra mussels (*Dreissena polymorpha*) are also now commonly encountered on the intake screens, but number estimates have not been made.

Impinged fish, crayfish, and zebra mussels are washed off the intake screens and emptied into dumpsters and are not returned to the lake. Therefore, there is no impingement survival.

Section 316(b) of the CWA requires the location, design, construction, and capacity of cooling water intake structures to reflect the best technology available for minimizing adverse environmental impacts (33 USC 1326). Impingement of fish and shellfish on the debris screens of the cooling water intake system is a potential adverse environmental impact that can be minimized by use of the best available technology.

On July 9, 2004, EPA published a final rule in the *Federal Register* (69 FR 41575) (EPA 2004) addressing cooling water intake structures at existing power plants, such as CNP, whose flow levels exceed a minimum threshold value of 190,000 m^3/d (50 million gpd). The rule is Phase II in EPA's development of 316(b) regulations that establish national requirements applicable to the location, design, construction, and capacity of cooling water intake structures at existing facilities that exceed the threshold value for water withdrawals. The national requirements, which are implemented through NPDES permits, minimize the adverse environmental impacts associated with the continued use of the intake systems. Licensees are required to demonstrate compliance with the Phase II performance standards at the time of renewal of their NPDES permit. Licensees may be required as part of the NPDES renewal to alter the intake structure, redesign the cooling system, modify station operation, or take other mitigative measures as a result of this regulation. The new performance standards are designed to significantly reduce impingement losses due to plant operation. Any site-specific mitigation would result in less impact due to continued plant operation.

In 2004, the applicant installed a permanent fish-deterrent system around the intake structures to reduce fish impingement, particularly alewife.[a] This system became operational before the start of the 2004 alewife spawning season. It uses intermittent high-frequency sound (125 kHz) to minimize the influx of fish into the intakes. The decision to add a fish-deterrent system was based in part on an unusual 9-hour event on April 24, 2003, when an influx of about 1.8 to 2.0 million alewives entered the intakes and overwhelmed the traveling screens and screen-wash system, resulting in a significant number of fish being carried over into the plant, including the essential service water system (AEP 2003). There were an estimated 16.5 billion adult alewives in Lake Michigan in 2003 (Madenjian et al. 2004); therefore the unusual impingement incident at CNP was more a concern for plant operation safety than for the lake ecosystem. As discussed in Section 2.2.5, alewives are attracted to warmer nearshore waters in spring for spawning. Due to their lakewide abundance, coupled with their weakened condition associated with osmotic stress, low fat reserves, spawning stress, and thermal stress caused by nearshore temperature variations (e.g., cold water associated with upwellings can cause die-offs), the alewife is the major fish species impinged at CNP. The fish-deterrent system installed at CNP is identical to the system currently in use at the James A. Fitzpatrick Nuclear Plant (FNP), and has a minimum sound pressure of 170 dB at about 10 m (33 ft) from the intake and 190 dB at 1 m (3.3 ft) from the intake (AEP 2003).

When the fish-deterrent system was operating at the FNP, fish density near the intake decreased by as much as 96 percent and the number of alewives impinged decreased by as much as 87 percent. Following an unusually cold winter, alewife impingement was reduced by 81 to 84 percent. The lower percent reduction following a cold winter was probably due to the deterrent system not being as effective on alewives that are in poor condition (Ross et al. 1993, 1996). The use of a similar sound deterrent system for a power plant located on a Belgium estuary decreased total fish impingement by 60 percent (Maes et al. 2004). Avoidance response varied among species, with impingement rates for the Atlantic herring (*Clupea harengus*), a species similar to the alewife, decreasing by 95 percent. During periods of maximum herring abundance in the estuary, more than 99 percent of the herring were deterred by the sound system (Maes et al. 2004). The use of high-frequency sound is considered a practical alternative to physical barriers to prevent alewives from entering power plant intakes (Dunning et al. 1992).

The fish-deterrent system speakers will be removed at CNP each fall and reinstalled in spring to protect them from winter conditions. Based on the fish impingement studies conducted at CNP between 1975 and 1982, few fish are impinged during winter. The total number of fish impinged from January through March ranged from 3946 in 1975 to 50,099 in 1981, in contrast

(a) Personal communication with J. Carlson, American Electric Power, Bridgman, Michigan. July 14, 2004.

to the hundreds of thousands to millions impinged from May through July (Thurber and Jude 1985).

During the course of the SEIS preparation, the staff considered mitigation measures for the continued operation of CNP. Based on the assessment to date, the staff expects that the measures in place at CNP, including the fish-deterrent system, provide mitigation for impacts related to impingement. The staff concludes that the potential impacts of impingement of fish and shellfish are SMALL, and further mitigation measures are not warranted.

4.1.3 Heat Shock

For plants with once-through cooling systems, the impacts of heat shock are listed as a Category 2 issue and require plant-specific evaluation before license renewal. The NRC made impacts on fish and shellfish resources resulting from heat shock a Category 2 issue because of continuing concerns about thermal discharge impacts and the possible need to modify thermal discharges in the future in response to changing environmental conditions (NRC 1996a). Information to be considered includes (1) the type of cooling system (whether once-through or cooling pond) and (2) evidence of a CWA Section 316(a) variance or equivalent State documentation. To perform this evaluation, the staff reviewed the applicant's ER (I&M 2003) and UFSAR (I&M 2002); visited the CNP site; and reviewed the applicant's State of Michigan NPDES Permit No. MI0005827, effective on January 1, 2001, and in force until October 1, 2003 (I&M 2003). (The applicant applied for a renewal of their NPDES permit in a timely manner [i.e., 180 days prior to the October 1, 2003, permit expiration date]. Until the submitted permit application is acted upon by the MDEQ, CNP Units 1 and 2 would operate under the stipulations of the existing permit.)

The CNP has a once-through heat dissipation system. The unit-specific discharge tunnels terminate with a discharge elbow located approximately 351 m (1150 ft) from shore. The maximum allowed heat rejection rate for CNP is 17.3 billion Btu/hr for the total plant discharge to the lake. This constitutes a variance from the Michigan State Water Quality Standards, which specify a 1.7°C (3°F) limit above seasonally dependent maxima (I&M 2003). During the winter, the center water intake crib can be used as a discharge, so that the water withdrawn by the other two intakes is warm enough to prevent icing on the traveling screens (I&M 2003). The plant discharge ΔT is 11°C (20°F) (I&M 2002). The surface thermal plume size originally allowed for CNP was 231 ha (570 ac) at the 1.7°C (3°F) isotherm. This has been found to range from as small as 8.5 ha (21 ac) to as large as 231 ha (740 ac). Exceedence of the 231-ha (570-ac) plume size has been rare and short-lived. The thermal plume is dynamic and continually altered by wind and lake currents. The ambient lake current in the vicinity of the CNP discharge is recognized as being the single most important physical parameter affecting the size, position, and trajectory of the thermal plume and the dispersion of heat (Jude 1995).

The thermal plume exceeds the 231-ha (570-ac) limit only during conditions of light winds and shifting currents (I&M 2002).

To minimize heated-water recirculation problems, the intake structure is located more than 305 m (1000 ft) from the discharge structures and well below the normal depth of the thermal plume. Although occasional conditions of recirculation have occurred, no adverse impacts on lake biota due to plume recirculation have been observed (Jude 1995). Recirculation occurs most often in winter months when the lake temperature is about 4°C (39.2°F) or less and the thermal discharge mixes relatively uniformly from top to bottom instead of stratifying on the surface. When both units are operational, some recirculation may occur throughout the winter, which may increase the intake temperature on the order of 1 to 2°C (1.8 to 3.6°F) (Jude 1995). This would raise discharge temperatures by almost an equivalent amount.

Ambient water temperature is the second-most important aspect affecting the CNP thermal plume (Jude 1995). Natural temperature changes demonstrate a rate of change in the energy content of water that is greater than that caused by CNP. Daily temperature variations of 1.1 to 1.7°C (2 to 3°F) up to 11.1 to 16.7°C (20 to 30°F) have been recorded. The smaller temperature variations generally occur between late October and early May, with the greatest daily temperature fluctuations occurring during the summer months (I&M 2002). Fish and other biota are consistently exposed to large, natural fluctuations of water temperature, especially during upwellings and downwellings, which are a common feature in the nearshore zone to which aquatic biota have adapted (Jude 1995).

The CNP thermal discharges are located such that fish do not become entrapped in areas of elevated temperatures. Thus, acute thermal impacts (e.g., death or immediate disability) are unlikely. No heat shock events have been reported for CNP. In addition, the thermal discharges related to the operation of CNP Units 1 and 2 affect a relatively small area of Lake Michigan. The greatest difference between discharge temperature and the ambient lake water temperature is reached immediately upon exiting into Lake Michigan (maximum of 11.6°C [20.9°F] for Unit 1 and 8.9°C [16.0°F] for Unit 2) (Jude 1995). The temperatures ranged from 5.5 to 10.8°C (9.9 to 19.4°F) above ambient within a plume area less than 0.4 ha (1 ac). The velocity from the diffusers is also quite high in this area (i.e., exit velocity for each discharge is 14 m/s [46 ft/s]) and would prevent almost all warm-water fish from coming in contact with this part of the plume (Jude 1995). At a temperature range of 3.9 to 5.6°C (7.0 to 10.1°F) above ambient, the thermal plume would encompass an area of 7.6 ha (18.8 ac) (Jude 1995).

I&M (2002) presented a summary of the area, width, and volume of CNP's thermal plume (i.e., that portion of the water raised at least 1.7°C [3°F]) for three sampling periods collected on Aug/Sept 1978, Nov/Dec 1978, and July 1979. As expected, the thermal plume size was smallest in July and largest in winter (Table 4-4). Plume size was also variable within a day.

Table 4-4. Summary of the 1.7°C (3°F) Thermal Plume Areas (acres), Widths (feet), and Volumes (acre-feet) Observed at CNP

Observation Period	Mean Area (Range)	Mean Width (Range)	Mean Volume (Range)
Aug/Sept 1978	313 (24 - 740)	2890 (984 - 5642)	2400 (413 - 4852)
Nov/Dec 1978	372 (142 - 655)	3250 (1705 - 6724)	3323 (1105 - 5615)
July 1979	200 (21 - 450)	2244 (918 - 3182)	1559 (173 - 2412)

Source: I&M 2003

For example, on September 8, 1978, the area, width and volume of the plume were 222 ha (549 ac), 1720 m (5642 ft), and 4.5 million m^3 (3678 ac-ft), respectively, for one observation, compared to 300 ha (740 ac), 1300 m (4264 ft), and 6.0 million m^3 (4852 ac-ft), respectively, for the second observation (I&M 2002).

Any thermal plume impacts can be considered to be very localized due to the small maximum plume size relative to that within the nearshore area of southeastern Lake Michigan. Also, the discharge is located within a featureless sandy substrate in offshore waters that have several positive features for minimizing thermal impacts: (1) rapid plume dissipation; (2) no bays or points to act as fish nurseries or other attracting features (except for the rip-rap around the intake and discharge structures); and (3) no substantial unique spawning grounds occur in the plant area (Jude 1995).

The staff has reviewed the available information, including that provided by the applicant, the staff's site visit, the State of Michigan NPDES permit, and other public sources. The staff evaluated the potential impacts to aquatic resources due to heat shock during continued operation. It is the staff's conclusion that the potential impacts to fish and shellfish due to heat shock during the renewal term are SMALL, and further mitigation measures are not warranted.

4.2 Transmission Lines

The Final Environmental Statement (FES) for CNP Units 1 and 2 (AEC 1973) describes seven transmission lines that connect CNP with the transmission system. Two 345-kV double circuit lines connect CNP with an existing Olive-Palisades 345-kV power line. A third 345-kV double circuit line connects CNP with the Robison Park substation near Fort Wayne, Indiana, and a 765-kV line connects CNP with the Dumont substation south of South Bend, Indiana.

Changes to the transmission system are described in the applicant's ER (I&M 2003) and Section 2.1.7. The changes include rerouting one of the Robison Park circuits to the Twin Branch Substation and rerouting one of the Olive circuits to the Twin Branch Substation. In both cases, the rerouted lines follow preexisting corridors. As a result of these changes, there are an additional 87 km (54 mi) of transmission line corridors covering 530 ha (1310 ac) that were not considered in the 1973 FES. The scope of this review includes all of the lines described in the FES and the new lines.

The transmission line corridors pass through primarily agricultural land and forests. In general, the corridors are in remote, sparsely populated areas. Where the corridors cross agricultural lands, the corridor typically continues to be used for agricultural purposes. All of the lines cross Interstate 94 near CNP, and the longer lines cross numerous State and U.S. highways.

All CNP transmission lines were constructed to the National Electrical Safety Code (NESC) and industry guidance in effect at the time the lines were constructed. CNP transmission facilities are maintained to ensure continued compliance with the standards and guidance in effect when they were constructed.

Vegetation control along CNP transmission lines is accomplished through 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 (ROW) but could cause a line outage from windfall of healthy or diseased trees. Procedures are in place by I&M to ensure that vegetation management along ROWs 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 used by the applicant comply with Federal and State regulations, and are applied by licensed applicators. Application methods are by basal spray using backpack-sprayers where conditions are not conducive to the use of vehicle-mounted sprayers.

Category 1 issues in 10 CFR Part 51, Subpart A, Appendix B, Table B-1, that are applicable to transmission lines from CNP are listed in Table 4-5. The applicant stated in its ER that it is not aware of any new and significant information associated with the renewal of the CNP Unit 1 and 2 OLs. The staff has not identified any significant new information during its independent review of the applicant's ER, the scoping process, the staff's site visit, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts related to these issues beyond those discussed in the GEIS. For all of those issues, the staff concluded in the GEIS that the impacts are SMALL, and additional plant-specific mitigation measures are not likely to be sufficiently beneficial to be warranted.

Table 4-5. Category 1 Issues Applicable to the CNP 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

A brief description of the 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 staff has not identified any significant new information during its independent review of the ER (I&M 2003), the scoping process, the staff's site visit, consultation with the U.S. Fish and Wildlife Service (FWS) and the Michigan Department of Natural Resources (MDNR), or its evaluation of other information. Therefore, the staff concludes that there are no impacts of power line ROW maintenance during the renewal term beyond those discussed in the GEIS.

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

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

  The staff has not identified any significant new information during its independent review of the ER (I&M 2003), the scoping process, the staff's site visit, consultation with the FWS and

MDNR, or its evaluation of other information. Therefore, the staff concludes that there are no impacts of bird collisions with power lines during the renewal term beyond those discussed in the GEIS.

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

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

The staff has not identified any significant new information during its independent review of the ER (I&M 2003), the scoping process, the staff's site visit, or its evaluation of other information. Therefore, the staff concludes that there are no impacts of electromagnetic fields on flora and fauna during the renewal term beyond those discussed in the GEIS.

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

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

The staff has not identified any significant new information during its independent review of the ER (I&M 2003), the scoping process, the staff's site visit, consultation with the FWS and MDNR, or its evaluation of other information. Therefore, the staff concludes that there are no impacts of power line ROWs 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 staff has not identified any significant new information during its independent review of the ER (I&M 2003), the scoping process, the staff's site visit, or its evaluation of other information. Therefore, the staff concludes that there are no air quality impacts of transmission lines during the renewal term beyond those discussed in the GEIS.

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

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

  The staff has not identified any significant new information during its independent review of the ER (I&M 2003), the scoping process, the staff's site visit, or its evaluation of other information. Therefore, the staff concludes that there are no onsite land use impacts during the renewal term beyond those discussed in the GEIS.

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

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

  The staff has not identified any significant new information during its independent review of the ER (I&M 2003), the scoping process, the staff's site visit, or its evaluation of other information. Therefore, the staff concludes that there are no impacts of power line ROWs 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 4-6 and are discussed in Sections 4.2.1 and 4.2.2.

Table 4-6. Category 2 and Uncategorized Issues Applicable to the CNP 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

In the GEIS (NRC 1996a), the staff found that without a review of the conformance of each nuclear plant transmission line with NESC (NESC 1997) 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.

All CNP transmission lines were constructed to the NESC and industry guidance in effect at the time the lines were constructed. CNP transmission facilities are maintained to ensure continued compliance with the standards and guidance in effect when they were constructed. However, 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.

I&M has reviewed its power lines for compliance with this criterion. The span on each line where the potential for induced current would be the greatest was identified. The electric field strengths and potential induced currents for these spans were calculated using Version 2.5 of the ENVIRO computer code (EPRI 1996). Input to the code included line sag at 49°C (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 all six CNP 345-kV lines were well below the NESC 5-mA criterion, and the calculated induced current for the 765-kV line was 5 mA or below.

The staff has reviewed the applicant's evaluation and computational results. Based on this review, the staff concludes that the impact of the potential for electric shock is SMALL and that no further mitigation measures are 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). NIEHS (1999) contains the following conclusion:

> The NIEHS concludes that ELF-EMF [extremely low frequency-electromagnetic field] exposure cannot be recognized as entirely safe because of weak scientific evidence that exposure may pose a leukemia hazard. In our opinion, this finding is insufficient to warrant aggressive regulatory concern. However, because virtually everyone in the

> United States uses electricity and therefore is routinely exposed to ELF-EMF, passive regulatory action is warranted such as a continued emphasis on educating both the public and the regulated community on means aimed at reducing exposures. The NIEHS does not believe that other cancers or noncancer health outcomes provide sufficient evidence of a risk to currently warrant concern.

This statement is not sufficient to cause the staff to change its position with respect to the chronic effects of electromagnetic fields. The 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 CNP Units 1 and 2 in regard to radiological impacts are listed in Table 4-7. I&M stated in its ER (I&M 2003) that it is not aware of any new and significant information associated with the renewal of the CNP OLs. The staff has not identified any significant new information during its independent review of the ER, the scoping process, the staff's site visit, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts related to these issues beyond those discussed in the GEIS. For these issues, the staff concluded in the GEIS that the impacts are SMALL, and additional plant-specific mitigation measures are not likely to be sufficiently beneficial to be warranted.

Table 4-7. Category 1 Issues Applicable to Radiological Impacts of Normal Operations During the Renewal Term

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

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

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

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

  The staff has not identified any significant new information during its independent review of the ER (I&M 2003), the scoping process, the staff's site visit, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts of radiation exposures to the public during the renewal term beyond those discussed in the GEIS.

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

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

  The staff has not identified any significant new information during its independent review of the ER (I&M 2003), the scoping process, the staff's site visit, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts of 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 4-8. I&M stated in its ER (I&M 2003) that it is not aware of any new and significant information associated with the renewal of CNP Units 1 and 2 OLs. The staff has not identified any significant new information during its independent review of the ER, the scoping process, the staff's site visit, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts related to these issues beyond those discussed in the GEIS (NRC 1996a). For these issues, the staff concluded in the GEIS that the impacts are SMALL, and additional plant-specific mitigation measures are not likely to be sufficiently beneficial to be warranted.

Table 4-8. Category 1 Issues Applicable to Socioeconomics During the Renewal Term

ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1	GEIS Sections
SOCIOECONOMICS	
Public services: public safety, social services, and tourism and recreation	4.7.3; 4.7.3.3; 4.7.3.4; 4.7.3.6
Public services: education (license renewal term)	4.7.3.1
Aesthetic impacts (license renewal term)	4.7.6
Aesthetic impacts of transmission lines (license renewal term)	4.5.8

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

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

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

  The staff has not identified any significant new information during its independent review of the ER (I&M 2003), the scoping process, the staff's site visit, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts on public safety, social services, and tourism and recreation during the renewal term beyond those discussed in the GEIS.

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

  > Only impacts of small significance are expected.

  The staff has not identified any significant new information during its independent review of the ER (I&M 2003), the scoping process, the staff's site visit, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts on education during the renewal term beyond those discussed in the GEIS.

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

  > No significant impacts are expected during the license renewal term.

  The staff has not identified any significant new information during its independent review of the ER (I&M 2003), the scoping process, the staff's site visit, or its evaluation of other available information. Therefore, the staff concludes that there are no aesthetic impacts during the renewal term beyond those discussed in the GEIS.

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

  > No significant impacts are expected during the license renewal term.

  The staff has not identified any significant new information during its independent review of the ER (I&M 2003), the scoping process, the staff's site visit, or its evaluation of other available information. Therefore, the staff concludes that there are no aesthetic impacts of transmission lines during the renewal term beyond those discussed in the GEIS.

Table 4-9 lists the Category 2 socioeconomic issues, which require plant-specific analysis, and environmental justice, which was not addressed in the GEIS.

Table 4-9. 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 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 1996a), which presents a population characterization method that is based on two factors, "sparseness" and "proximity" (GEIS Section C.1.4 [NRC 1996a]). Sparseness measures population density within 32 km (20 mi) of the site, and proximity measures population density and city size within 80 km (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, 156,663 people were living within 32 km (20 mi) of the CNP site. Using the GEIS measure of sparseness, the area within 32 km (20 mi) has a density of 149 persons/km^2 (238 persons/mi^2), placing it in the least sparse (high density) category, Category 4 (I&M 2003a). In 2000, 1,447,303 persons lived within 80 km (50 mi) of the plant, giving the area a density of 177 persons/km^2 (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.

10 CFR Part 51, 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 CNP site is located in a high-population area, and Berrien County is not subject to growth-control measures that would limit housing development. Based on the NRC criteria, housing impacts are expected to be SMALL during continued operations (I&M 2003).

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 1996a). The ER (I&M 2003) 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 13.4 percent in Berrien County and 5.9 percent in St. Joseph 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 staff reviewed the available information relative to housing impacts and I&M's conclusions. Based on this review, the 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 consequently 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 1996a).

Analysis of impacts on the public water supply system considered both plant demand and plant-related population growth. Section 2.2.2 describes the CNP Units 1 and 2 permitted withdrawal rate and actual use of water.

The staff has reviewed the available information including permitted and actual water-use rates at CNP, and water use and water supply capacities for the major water supply systems in Berrien County. Based on this information, the staff concludes that the potential impacts of CNP Units 1 and 2 operation during the license renewal period are SMALL. During the course of its evaluation, the staff considered mitigation measures for continued operation of CNP

Units 1 and 2. Based on this evaluation, the staff expects that mitigation measures in place at CNP are appropriate and 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 51, Subpart A, Appendix B, Table B-1). Table B-1 of 10 CFR 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.

I&M expects to utilize existing employees, possibly adding a maximum of two employees, to support CNP operations during the license renewal term. In Section 3.7.5 of the GEIS (NRC 1996a), the 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 23 persons/km^2 (60 persons/mi^2), and at least one urban area with a population of 100,000 or more within an 80-km (50-mi) radius. In this case, population growth would be 0 percent of the radius' total 2000 population of 1,447,303, the area has established patterns of residential and commercial development, a population density of 177 persons/km^2 (283 persons/mi^2), and at least one urban area (Benton Harbor Metropolitan Statistical Area) with a population of 100,000 or more within the 80-km (50-mi) radius. Consequently, the staff concludes that population changes resulting from renewal of CNP Units 1 and 2 OLs are likely to result in SMALL impacts to 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 staff stated 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. In Section 4.7.2.1 of the GEIS, the staff stated 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 preestablished pattern of development or has not provided adequate public services to support and guide development.

Lake Charter Township and the Bridgman Public School District receive significant tax payments from the plant's property tax payments. As discussed in Section 2.2.8.6 and shown in Table 2-11, CNP paid an average of $8 million annually in property taxes to the township over the 3-year period from 2001-2003, or approximately 48 percent of the township's revenues. The Bridgman Public School District received an average of $200,000 annually from taxes paid by CNP over the 5-year period (1996 to 2000). These payments represent a substantial, positive impact on the fiscal condition of the township and the school district. Lake Charter Township forwards the balance of the property tax revenues to Berrien County and the State of Michigan. Berrien County received an average of $3 million annually in property tax payments over the 3-year period (2001 to 2003), or approximately 2 percent of county revenues. 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 CNP 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.

Berrien County's population changes have fluctuated between positive and negative growth rates over the last 30 years (Table 2-9). I&M projects the addition of one or two additional employees to support the CNP operations during the license renewal term, thus, land use changes from CNP population-related growth are negligible. While the county has experienced significant residential, industrial, and commercial growth during this 30-year period, the Berrien County Planning Commission has developed an overall land-use decision-making strategy that encourages the implementation of a "smart growth" methodology by municipalities that relies on a mix of development and planning tools (I&M 2003).

I&M projects that annual property taxes from CNP to Lake Charter Township, Bridgman Public School District, and Berrien 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 the CNP tax rates due to the restructuring would be independent of license renewal (I&M 2003).

No adverse impacts on offsite land use will occur because of license renewal. Consequently, the staff concludes that offsite land-use impacts are likely to 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 to the transportation network in the vicinity of the CNP site.

4.4.5 Historic and Archaeological Resources

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

Although no surveys have been conducted to date at the CNP site and the potential exists for significant cultural resources to be present within the site boundaries, it does not appear that the proposed license renewal will adversely affect cultural 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 (I&M 2003). Therefore, continued operation of the CNP would likely protect any cultural resources present within the CNP site boundary by protecting those lands from development and providing secured access. However, because there is the potential for significant cultural resources to be present at the site, care should be taken by the applicant during normal operations and maintenance activities that could inadvertently affect cultural resources. Prior to any ground-disturbing activity in an undisturbed area, the applicant evaluates the potential for impact to cultural resources in consultation with the Michigan SHPO and appropriate Native American tribes as required under Section 106 of the NHPA. On this basis, the staff's preliminary conclusion is that operation of CNP Units 1 and 2 during the license renewal period will not adversely affect historic properties. Therefore, the staff has concluded that the impact is SMALL, and that further mitigation is not warranted.

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).

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

The staff looks for minority and low-income populations within the 80-km (50-mi) radius of the site. For the staff's review, a minority population exists in a census block group[b] if the percentage of each minority and aggregated minority category within the census block group exceeds the corresponding percentage of minorities in the state of which it is a part by

(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).

(b) A census block group is a combination of census blocks, which are statistical subdivisions of a census tract. A census block is the smallest geographic entity for which the USCB collects and tabulates decennial census information. A census tract is a small, relatively permanent statistical subdivision of counties delineated by local committees of census data users in accordance with USCB guidelines for the purpose of collecting and presenting decennial census data. Census block groups are subsets of census tracts (I&M 2003).

20 percent, 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 CNP review, the staff examined the geographic distribution of minority and low-income populations within 80 km (50 mi) of the site, employing the 1991 census (I&M 2003) for low-income populations and the 2000 census (I&M 2003) for minority populations. The analysis was supplemented by discussions with the planning department and social service agencies in Berrien County.

Figures 4-1 and 4-2 show the distribution of census block groups for the minority and low-income populations, respectively, in the vicinity of the CNP site.

Figures 4-1 and 4-2 show the geographic distribution of low-income and minority groups within 80 km (50 mi) of the plant. A number of tracts within Berrien County exceed the NRC thresholds defining low-income; these are located in Benton Harbor and in Coloma in the northeastern corner of the county. Other tracts within the 80-km (50-mi) region are located in Kalamazoo to the east of the plant, South Bend to the southeast, and Gary to the southwest. Census block groups with a minority population within the 80-km (50-mi) region in Michigan are located in Benton Harbor, Coloma, and Berrien Springs in Berrien County, and in Cass, Van Buren, and Allegan Counties. In Indiana, minority populations are located in Gary, Michigan City, Westville, South Bend, Plymouth, Goshen, and Elkhart.

With the locations of minority and low-income populations identified, the 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 staff guidance (NRC 2004a), air, land, and water resources within about 80 km (50 mi) of the CNP site were examined. Within that area, a few potential environmental impacts could affect human populations; all of these were considered SMALL for the general population.

The pathways through which the environmental impacts associated with CNP Units 1 and 2 license renewal can affect human populations are discussed in each associated section. The staff evaluated whether minority and low-income populations could be disproportionately affected by these impacts. The 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 staff did not identify any location-dependent disproportionately high and adverse impacts affecting these minority and low-income populations. The staff concludes that offsite impacts from CNP Units 1 and 2 to

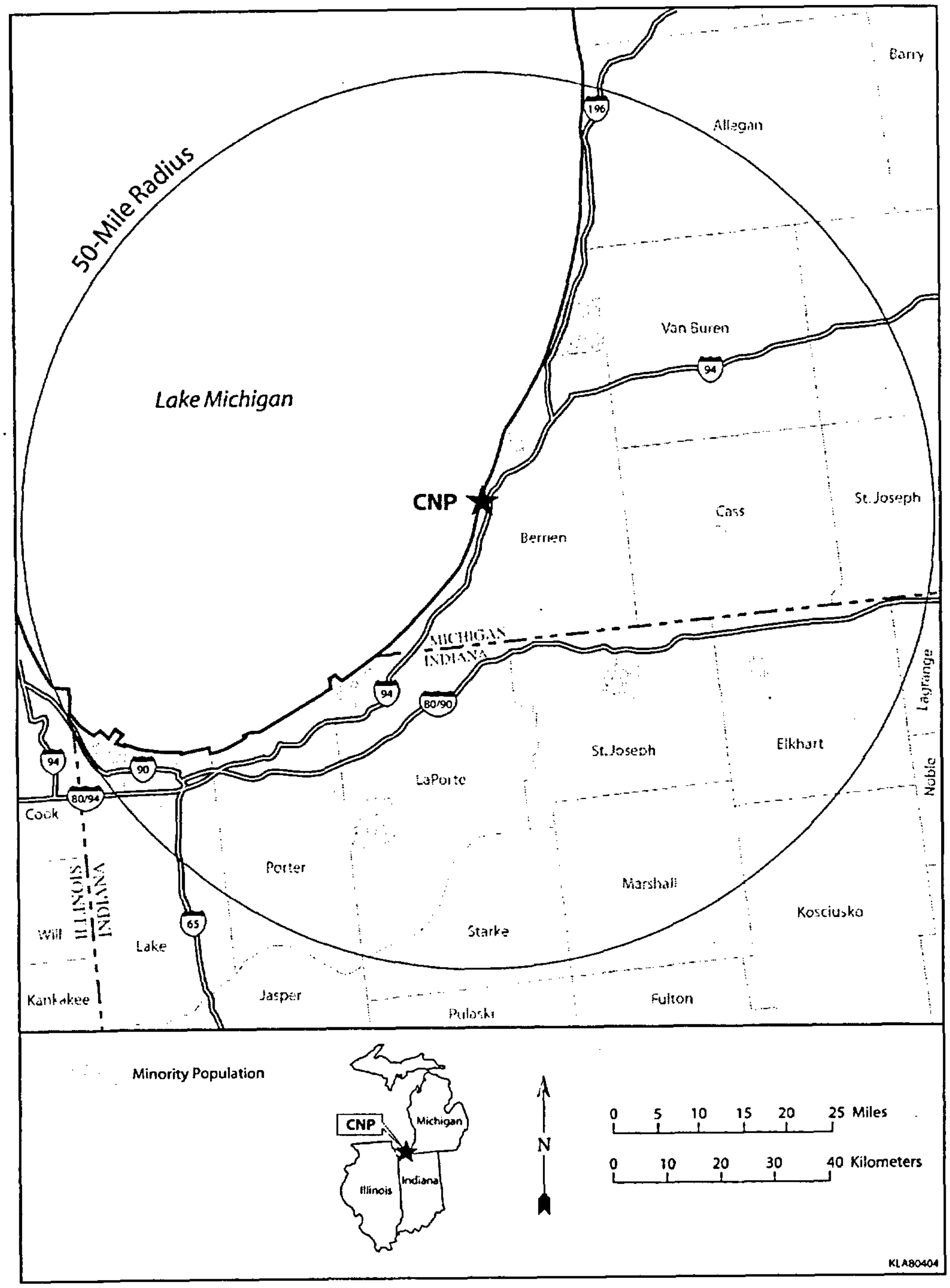

Figure 4-1. Geographic Distribution of Minority Populations (shown in shaded areas) Within 80 km (50 mi) of the CNP Site Based on Census Block Group Data

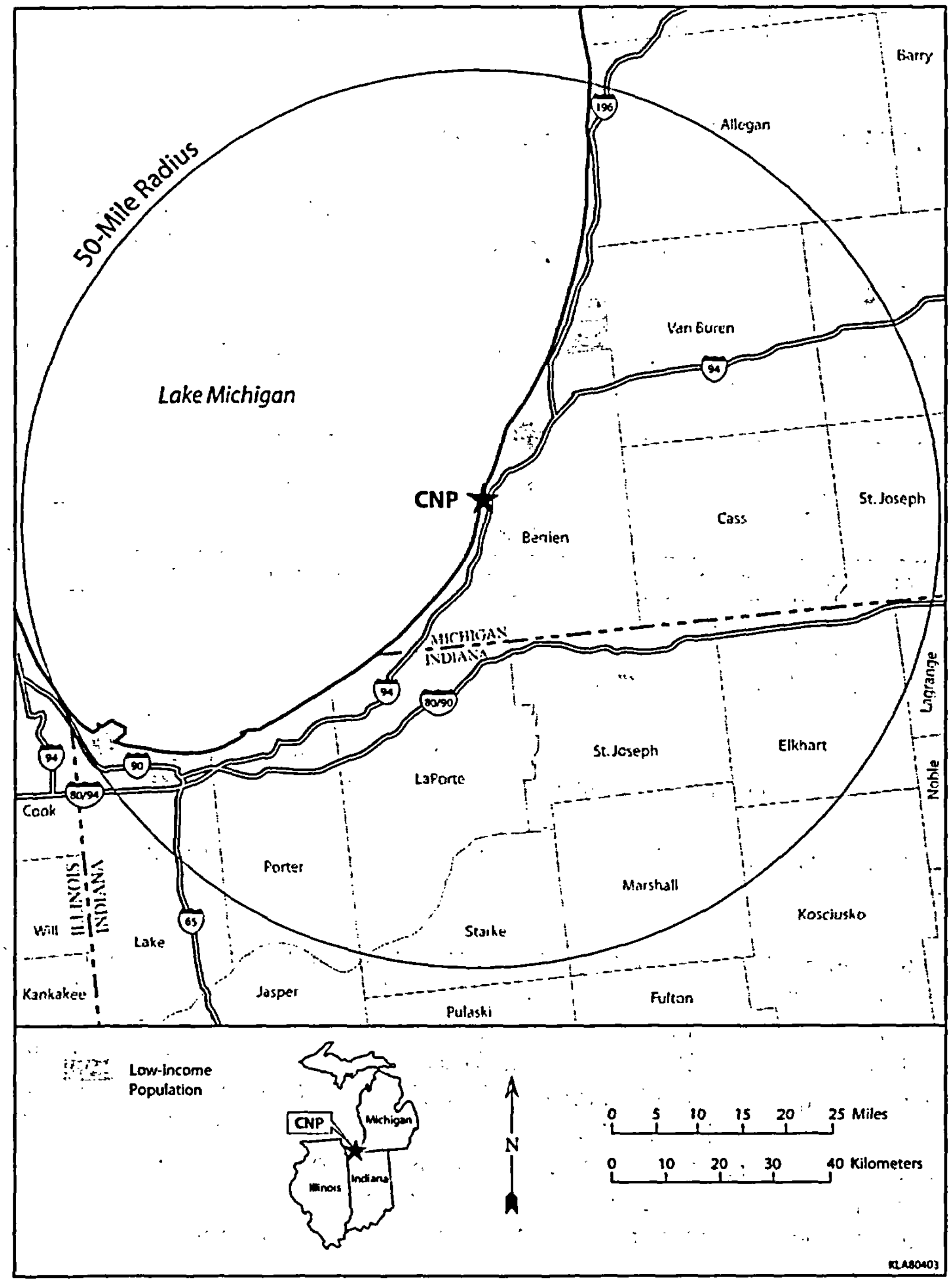

Figure 4-2. Geographic Distribution of Low-Income Populations (shown in shaded areas) Within 80 km (50 mi) of the CNP Site Based on Census Block Group Data

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 CNP Units 1 and 2, and is listed in Table 4-10.

Table 4-10. Category 1 Issues Applicable to Groundwater Use and Quality During the Renewal Term

ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1	GEIS Sections
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 staff's review regarding this issue and the GEIS conclusions, as codified in Table B-1, 10 CFR 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, there are no operable groundwater production wells at CNP, therefore groundwater use is less than 0.068 m^3/s (100 gpm). I&M stated in its ER (I&M 2003) that it is not aware of any new and significant information associated with the renewal of the CNP Units 1 and 2 OLs (I&M 2003). The staff has not identified any significant new information during its independent review of the ER (I&M 2003), the scoping process, the staff's site visit, or its evaluation of other available information. Therefore, the staff concludes that there are 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.

The NRC identified degradation of groundwater quality resulting from closed-cycle cooling ponds as a Category 2 issue. Because CNP does not use cooling ponds, this Category 2 issue does not apply to relicensing of CNP Units 1 and 2. The potential impacts to groundwater quality from the onsite absorption pond, overflow pond, and sewage lagoons are addressed in Section 4.7.

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 4-11.

Table 4-11. 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

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 CNP site is discussed in Sections 2.2.5 and 2.2.6.

I&M contacted the Field Offices of the FWS in East Lansing, Michigan, and Bloomington, Indiana, on August 27, 2002, to obtain information on Federally listed threatened and endangered species that could be affected by actions associated with continued operation of CNP Units 1 and 2 and associated transmission lines during the license renewal period. The correspondence is included in Appendix E. On March 1, 2004, and April 29, 2004, the NRC independently contacted the FWS to request information on Federally listed threatened and endangered species and the impacts of relicensing (NRC 2004b, NRC 2004c). In response, on March 23, 2004, and May 18, 2004, the FWS provided additional information regarding Federally listed species that could occur in the vicinity of CNP or along the transmission line ROWs. In addition, the FWS stated in these letters, based on the information provided, no further consultation under Section 7 of the Endangered Species Act (ESA) was warranted.

4.6.1 Aquatic Species

As described in Section 2.2.5, no Federally listed threatened, endangered, proposed, or candidate aquatic species occur in Lake Michigan in the vicinity of CNP. There is no Federally designated critical habitat identified on or near the CNP site or along the transmission line ROWs. Additionally, CNP cooling-water intake and discharge are closely monitored under the NPDES program, and permit limits are reviewed on a regular basis by State regulatory agencies to ensure the protection of aquatic biota. Three mussel species that are Federally listed as endangered (white cat's paw pearlymussel [*Epioblasma obliquata perobliqua*], northern riffleshell [*E. torulosa rangiana*], and clubshell [*Pleurobema clava*]) have been reported from DeKalb County, Indiana. However, these species were not found during surveys conducted *within the transmission line corridors (TRC 2002; I&M 2004a).

There are no plans for refurbishment or construction at CNP during the license renewal period (I&M 2003). Therefore, the staff has preliminarily concluded that continued operation of the plant and maintenance of associated transmission line ROWs under license renewal is not likely to adversely affect any Federally listed aquatic species. Thus, it is the staff's preliminary findings that the impact on threatened or endangered aquatic species from an additional 20 years of operation of CNP would be SMALL, and additional mitigation is not warranted. The FWS has indicated that the project should have no impact on listed species or critical habitats (FWS 2004a).

4.6.2 Terrestrial Species

The FWS identified four Federally listed terrestrial species (FWS 2004b). The Indiana bat (*Myotis sodalis*) could occur in suitable habitat throughout the project vicinity, and Mitchell's satyr butterfly (*Neonympha mitchellii*) is known to occur in LaPorte and LaGrange counties in Indiana. The bald eagle (*Haliaeetus leucocephalus*) could occur throughout northern Indiana and southwestern Michigan, and the northern copperbelly water snake (*Nerodia erythrogaster neglecta*) occurs in St. Joseph County, Indiana. The eastern massasauga (*Sistrurus catenatus catenatus*), a candidate for Federal listing, was identified as a species that could be found in Berrien County, Michigan (FWS 2004a), and along the transmission line ROWs in northern Indiana (FWS 2004b).

Federally listed threatened and endangered species that have the potential to occur on or in the vicinity of the CNP site or transmission lines associated with CNP Units 1 and 2 are described in Section 2.2.6. These species include the Indiana bat, piping plover (*Charadrius melodus*), bald eagle, copperbelly water snake, Karner blue butterfly (*Lycaeides melissa samuelis*), Mitchell's satyr butterfly, Pitcher's thistle (*Cirsium pitcheri*), and small whorled pogonia (*Isotria medeoloides*). The eastern massasauga, a candidate for Federal listing, also may occur in the project area in Berrien County, Michigan (FWS 2004a). Survey of the CNP site and associated transmission line ROWs conducted during 2002 and 2004 did not report the occurrence of any Federally listed species along the transmission line corridors or at the CNP site (TRC 2002; I&M 2004a).

The Indiana bat, a Federally listed endangered species, is not known to occur at the CNP site or along the transmission lines based on surveys conducted in 2002 (TRC 2002; I&M 2004a). Although the project area includes potential habitat, no known occurrences have been reported from the project area. The Indiana bat could possibly occur in forested riparian and adjacent upland forest areas with large mature trees along the transmission line ROWs in northern Indiana (FWS 2004b). Species such as the shagbark hickory and other species such as red oak or bur oak often have loose or decaying bark that provide nursery habitat for females with young. The Indiana bat is reported to occur in suitable habitat during the summer months in all counties crossed by the CNP transmission lines in Indiana and Michigan (FWS 2004c, FWS 2004d). By following vegetation-management guidelines (I&M 1995), potential damage to nursery trees along and adjacent to the transmission line corridor is avoided.

Bald eagles have been observed occasionally flying along the Lake Michigan shoreline at CNP or perched in trees overlooking the shorelines during fall and winter migration (I&M 2003). No bald eagle nests have been found at the CNP site. Surveys of the transmission lines associated with the CNP site during 2002 and 2004 did not find bald eagles or nests along any of the lines (TRC 2002; I&M 2004a).

No management actions for bald eagles nesting or breeding areas (i.e., those actions recommended by the Management Guidelines and Breeding Areas of the Northern States Recovery Plan for the Bald Eagle) along the transmission lines have been required of I&M staff and its vegetation-management contractors since no nests have been discovered along any of the corridors during the time the CNP has operated. In the event that a nest is discovered in the future, I&M staff would follow best management practices to identify necessary actions and implement them to protect the bald eagle and its habitat. I&M (2004b) has committed to practices for notifying Federal and State agencies upon identification by field personnel of bald eagle and other raptor mortalities or problem nests should they occur along the transmission line ROWs.

The piping plover, a Federally endangered species, may occur in Berrien County, Michigan (FWS 2004c). However, it has not been observed at the CNP site (I&M 2003). Piping plovers likely stop during spring migration along the shoreline of northern Indiana, and lower Michigan en route to their documented breeding grounds in northern lower Michigan and the Upper Peninsula of Michigan. Nest sites are typically wide, open, sandy, gravelly beaches with sparse vegetation along the shoreline (MNFI 2004a). Since the piping plover was listed as endangered in 1986, nests sites at 30 locations have been reported in Alger, Benzie, Chalevoix, Cheboygen, Chippewa, Emmet, Leelanau, Luce, and Mackinac Counties in Michigan (MNFI 2004a). It is unlikely that the piping plover would nest at the CNP site because of the distance to known nesting locations and the lack of suitable habitat at the CNP site.

Transmission lines pose a potential collision hazard to migrant and resident bird species, including those that are Federally listed. In the GEIS evaluating the impacts of nuclear power plant license renewal, the NRC assessed the impacts of transmission lines on avian populations (NRC 1996a). The NRC concluded that mortality resulting from bird collisions with transmission lines associated with license renewal and an additional 20 years of operation would be of

SMALL significance. This conclusion was based on: (1) no indication in the existing literature that collision mortality is high enough to result in population-level impacts and, (2) the lack of known instances where nuclear power plant lines affect large numbers of individuals in local areas. See Section 4.2 for additional discussion of this topic.

The copperbelly water snake, a Federally listed threatened species, may occur in wetland habitat along the CNP transmission lines. It is known to occupy shrub-covered ditches, floodplain wetlands with dense shrub cover, and is known to occur in St. Joseph and LaGrange counties in Indiana (FWS 2004d; IDNR 2004b) and could occur along portions of the Twin Branch line (Figure 2-4), although surveys of the line in 2002 and 2004 did not detect this species (TRC 2002; I&M 2004a). Vegetation-management practices, described in Section 2.1.7, avoid disturbance of wetland habitats and would reduce the potential for impacts to this species.

The eastern massasauga, 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 2004a; FWS 2004b). It is unlikely that the eastern massasauga would be affected during the license renewal period because ROW maintenance procedures (I&M 1995) avoid disturbance to wetland habitats and stream crossings.

The Karner blue butterfly, a Federally listed endangered species, is known to occur in Indiana and Michigan (I&M 2003). The FWS Region 3 database of endangered species in Michigan does not report finding the Karner blue butterfly in the counties along the transmission corridors (FWS 2004d). Also, surveys of the transmission lines did not find habitat for the Karner blue butterfly (TRC 2002; I&M 2004a). The Michigan Natural Features Inventory (MNFI) reports the Karner blue butterfly's habitat as landscapes on sandy soils that support oak or oak-pine savanna where wild lupine (*Lupinus perennis*) grows (MNFI 2004a). The wild lupine is the only known food used by the larvae. The nearest documented populations of the Karner blue butterfly are more than 16 km (10 mi) from the project area in Lake and Porter Counties in Indiana, and Allegan County in Michigan (FWS 2004c, FWS 2004d).

The Mitchell's satyr butterfly may occur in wetland areas along portions of the transmission lines in Michigan and Indiana (FWS 2004c, FWS 2004d, MNFI 2004a). Mitchell's satyr occupies a range of habitats from open fens, to wet prairie, sedge meadow, shrub-carr, and tamarack savanna (MNFI 2004a). A strong preference for the sedge (*Carex stricta*) as a host plant for oviposition and larval feeding is known from laboratory and field observations. Other herbaceous species may be used for egg laying. Surveys conducted in 2002 identified 22 wetland sites, although the Mitchell's satyr was not observed. I&M has procedures in place for vegetation management near wetland sites to prevent habitat loss from vegetation pruning, cutting, or herbicide applications (I&M 1995).

Three Federally listed threatened plant species could occur at the CNP site or along the transmission line corridors (I&M 2003). The eastern prairie fringed orchid is not known to occur along the transmission line corridors nor is it reported to occur in the project area (MNFI 2004b, FWS 2004c, 2004d). A survey of the CNP site failed to find the Pitcher's thistle. It is often found along the extensive dune systems in all counties along Lake Michigan and is more common in the northern counties of the Lower Peninsula of Michigan (MNFI 2004b). The small whorled pogonia is reported to occur in Berrien County based on data from the Michigan Natural Features Inventory data base (MNFI 2004b). The small whorled pogonia is not known to occur in Indiana (FWS 2004d). Typical habitat for this species is dry woodland sites in second- and third-growth forest stands. Appropriate control measures are present at CNP to review any future activities that would disturb woodlands that could provide habitat for the small whorled pogonia, prior to the activity taking place.

Based on the staff's review of the applicant's environmental report and the staff's independent analysis, the staff has preliminarily concluded that continued operation of CNP Units 1 and 2 during the license renewal term is not likely to 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 CNP site and its associated transmission lines. The applicant currently plans no power plant refurbishment activities. The staff anticipates that best management practices for protecting Federally listed species and their habitats, while carrying out vegetation management activities, will be implemented by I&M and its contractors. Therefore, it is the staff's preliminary finding that the impact on threatened or endangered species of an additional 20 years of operation of CNP Units 1 and 2 and associated transmission lines, would be SMALL and further mitigation is not warranted.

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

The staff reviewed the discussion of environmental impacts associated with operation during the renewal term in the GEIS and has conducted its own independent review, including public scoping meetings, to identify issues with significant new information on environmental issues listed in 10 CFR Part 51, Subpart A, Appendix B, Table B-1, related to operation of CNP Units 1 and 2 during the renewal term. Processes for identification and evaluation of new information are described in Section 1.2.2.

The NRC identified degradation of groundwater quality resulting from closed-cycle cooling ponds as a Category 2 issue. Because CNP does not use cooling ponds, this Category 2 issue does not apply to relicensing of CNP Units 1 and 2. However, as discussed in Section 2.2.3, wastewater disposal at CNP has the potential to degrade groundwater quality and is examined here as new information.

There are two permitted locations where discharge occurs to groundwater. The CNP facility is authorized to discharge a maximum of 0.1 m^3/s (2.4 million gpd) of process wastewater and a maximum of 0.003 m^3/s (60,000 gpd) of treated sanitary wastewater to two absorption ponds for process wastewater and two sewage lagoons for sanitary wastewater (MDEQ 2000).

The turbine room sump accumulates process wastes from the secondary side. These wastes are neutralized, if necessary, and discharged to absorption ponds approximately 250 m (825 ft) southeast of the plant (Figure 2-3). The larger of the two ponds is a 0.6-ha (1.4-ac) pond and the overflow pond is 0.3 ha (0.7 ac), and is connected to the larger pond by a small stream. Discharge into the larger pond is sufficient to keep it full and overflowing to the overflow pond. The combined approximate capacity of the two ponds is 23,000 m^3 (6 million gal).

The sewage treatment plant discharges treated sanitary effluent to two sewage lagoons that are used alternately. The sewage lagoons are much smaller than the absorption ponds and are located above and immediately east of the absorption ponds.

These two wastewater disposal systems use the natural soil column to provide treatment. Discharges flow downward through the soil to the groundwater, which ultimately discharges into Lake Michigan. These permitted discharges have created a groundwater mound that has superimposed a radial flow pattern on the regional flow towards Lake Michigan. Five groundwater monitoring wells are specified in the permit for compliance monitoring. The groundwater monitoring program has shown that wastewater disposal has been in compliance with permit requirements and with national drinking water standards, although there has been an increase above background for total dissolved solids and sulfate.

Groundwater from the absorption ponds has migrated to the southern plant boundary, but has not exceeded primary drinking water standards (AEPSC 1991). A restrictive covenant has been recorded in Berrien County to ensure that groundwater impacted by the seepage from the absorption ponds would not be withdrawn for any purpose from beneath approximately 84 ha (207 ac) in the southwestern portion of the CNP property (AEP 2000). There are no operable groundwater production wells and there are no consumptive uses of groundwater at CNP (I&M 2003).

Tritium has been detected periodically in groundwater at monitoring wells across the CNP site. However, the authorization to discharge to groundwater (MDEQ 2000) does not contain criteria for tritium, and no sample has exceeded the drinking water standard of 20,000 pCi/L (740 Bq/L).

On the basis of this information, the staff concludes that impacts to groundwater quality that would result from continued disposal of wastewater to onsite absorption ponds and sewage lagoons during the license renewal period would be SMALL, and further mitigation is not warranted.

4.8 Cumulative Impacts of Operations During the Renewal Term

The staff considered potential cumulative impacts of operations of CNP Units 1 and 2 during the renewal term. For the purposes of this analysis, past actions were those related to the resources at the time of the plant licensing and construction, present actions are those related to the resources at the time of current operation of the power plant, and future actions are considered to be those that are reasonably foreseeable through the end of plant operation. Therefore, the analysis considers potential impacts through the end of the current license term as well as the 20-year renewal license term. The geographical area over which past, present, and future actions that could contribute to cumulative impacts would occur is dependent on the type of action considered and is described below for each impact area.

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

4.8.1 Cumulative Impacts Resulting from Operation of the Plant Cooling System

For the purposes of this analysis, the geographic area considered for cumulative impacts resulting from operation of the CNP Units 1 and 2 cooling system is primarily the southeastern portion of Lake Michigan, particularly that portion bounded by St. Joseph, Michigan, to the north and Michigan City, Indiana, to the south and extending to about 3 km (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 staff found no significant new information that would indicate that the conclusions regarding any of the cooling system-related Category 1 issues related to CNP are inconsistent with the conclusions in the GEIS (NRC 1996a). Additionally, the staff determined that none of the cooling system-related Category 2 issues is likely to have greater than a SMALL impact on local water quality and aquatic resources.

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 nonnative species. Physical and chemical stresses that have impacted Lake Michigan include: urban, industrial, and agricultural contaminants (e.g., nutrients, toxic chemicals, 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 to the fish communities due to habitat modification and development, overfishing, and nonnative species introductions has 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), coupled with habitat alterations and degradation, contributed to the decline of important commercial and sport fisheries by the end of the 1950s (IDNR 2004a). The alewife is believed to have contributed to the extinction of three deepwater cisco species; suppression of burbot, emerald shiner (*Notropis atherinoides*), lake herring (*Coregonus artedi*), yellow perch, deepwater sculpin, and spoonhead sculpin (*Cottus ricei*); and has recently been implicated as a possible factor inhibiting success of lake trout (*Salvelinus namaycush*) reproduction, as they have been observed eating lake trout fry (Eshenroder et al. 1995). 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 to 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 nonnative species). Primary management challenges will be to keep the salmonid community in balance with 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).

There is a potential for severe impacts to aquatic resources from large oil or chemical spills within Lake Michigan, but the risk of such spills 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 nonnative species that have already begun to occur in Lake Michigan, and for additional nonnative 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 nonnative 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 staff, while preparing this assessment, assumed that other industrial, commercial, or public installations could be located in the general vicinity of the CNP site prior to the end of CNP Units 1 and 2 operations. The discharge of water to Lake Michigan from these facilities would be regulated by the MDEQ or the Indiana Department of Environmental Management. The discharge limits are set considering the overall or cumulative impact of all of the other regulated activities in the area. Compliance with the CWA and its NPDES permits minimizes CNP's cumulative impacts on aquatic resources. Continued operation of CNP Units 1 and 2 will require renewed discharge permits from the MDEQ, which will address changing requirements so that cumulative water quality objectives are served.

The staff concludes that the SMALL impacts of CNP Units 1 and 2 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 staff concludes that the potential cumulative impacts of operation of the cooling system of CNP Units 1 and 2 will be SMALL, and that no further mitigation measures are warranted.

4.8.2 Cumulative Impacts Resulting from Continued Operation of the Transmission Lines

Continued operation of the electrical transmission facilities associated with relicensing of CNP Units 1 and 2 was evaluated to determine if there is the potential for interactions with other past, present, and future actions that could result in adverse cumulative impacts to terrestrial resources (e.g., wildlife populations, the size and distribution of habitat areas), wetlands, floodplains, or aquatic resources. For the purposes of this analysis, the geographic area that encompasses the past, present, and foreseeable future actions that could contribute to adverse cumulative impacts includes those Michigan and Indiana counties that contain the transmission lines associated with the CNP site (Allen, DeKalb, Elkhart, LaGrange, LaPorte, Noble, and St. Joseph Counties, Indiana; and Berrien, Cass, and Van Buren Counties, Michigan).
As described in Section 4.2, the staff found no new and significant information indicating that the conclusions regarding any of the transmission line-related Category 1 issues as related to

CNP Units 1 and 2 are inconsistent with the conclusions within the GEIS. The applicant uses vegetation-management procedures (I&M 1995) over all of its ROWs that are protective of wildlife and habitat resources. None of the management procedures are expected to alter wetland or floodplain hydrology or adversely affect vegetation characteristics of these habitats or other habitats. The maintenance procedures ensure minimal disturbance to wildlife. Continued operation and maintenance of these ROWs are not likely to contribute to a regional decline in wildlife and habitat resources.

Therefore, the staff has determined that the cumulative impacts of the continued operation of the CNP transmission lines will be SMALL, and that no additional mitigation is warranted.

4.8.3 Cumulative Radiological Impacts

EPA and NRC established radiological dose limits for protection of the public and workers from both instantaneous and cumulative impacts of exposure to radiation and radioactive materials. These dose limits are codified in 40 CFR Part 190 and 10 CFR Part 20. For the purpose of this analysis, the area within an 80-km (50-mi) radius of the CNP site was included. As stated in Section 2.2.7, I&M has conducted a radiological environmental monitoring program (REMP) around the CNP site since 1975. The REMP measures radiation and radioactive materials from all sources, including CNP Units 1 and 2. Additionally, in Sections 2.2.7 and 4.3, the staff concluded that impacts of radiation exposure to the public and workers (occupational) from operation of CNP Units 1 and 2 during the renewal term are SMALL. Therefore, the monitoring program and staff's conclusion considered cumulative impacts. The NRC and the States of Michigan and Indiana would regulate any reasonably foreseeable future actions in the vicinity of the CNP site that could contribute to cumulative radiological impacts.

Therefore, the staff concludes that cumulative radiological impacts of continued operations of CNP Units 1 and 2 would be SMALL, and that no further mitigation measures are warranted.

4.8.4 Cumulative Socioeconomic Impacts

The continued operation of CNP Units 1 and 2 is not likely to result in significant cumulative impacts for any of the socioeconomic impact measures assessed in Section 4.4 of this SEIS (public services, housing, and offsite land use). This is because operating expenditures, staffing levels, and local tax payments during renewal would be similar to those during the current license period. Similarly, the proposed action is not likely to result in significant cumulative impacts on historic and archaeological resources.

When combined with the impact of other potential activities likely in the area surrounding the plant, socioeconomic impacts would not produce an incremental change in any of the impact measures used. The staff therefore determined that the impacts on employment, personal income, housing, local public services, utilities, and education occurring in the local socioeconomic environment as a result of license renewal activities, in addition to the impacts of other potential economic activity in the area, would be SMALL. The staff determined that the impact on offsite land use would be SMALL because no refurbishment activities are planned at CNP, and no new incremental sources of 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 CNP site, and the potential exists for significant cultural resources to be present within the site boundaries, it does not appear that the proposed license renewal will adversely affect these resources. The applicant has indicated that no refurbishment or replacement activities, including additional land-disturbing activities, at the plant site (or along existing transmission corridors) are planned for the license renewal period (I&M 2003). Therefore, continued operation of CNP Units 1 and 2 would likely protect any cultural resources present within the CNP site boundary by protecting those lands from development and providing secured access. Prior to ground-disturbing activity in an undisturbed area, the applicant evaluates the potential for impacts to cultural resources in consultation with the SHPO and appropriate Native American tribes as required under Section 106 of the NHPA. On the basis of this preliminary analysis of cultural resources, the contribution to a cumulative impact on cultural resources by continued operation of CNP Units 1 and 2 during the license renewal period is considered SMALL.

4.8.5 Cumulative Impacts on Groundwater Use and Quality

Groundwater supplies in the region are obtained primarily from unconsolidated Pleistocene deposits, termed water sands, which lie at depths of 6 to 16 m (19 to 54 ft) (AEC 1973). This unconfined aquifer is comprised of fine dune and lake sands that are underlain by thick impermeable clays with occasional sand or gravel lenses that do not support heavy groundwater pumping. The shale bedrock has no aquifer properties and the deeper sediments produce brines that are unsuitable for drinking water (AEC 1973). Recharge of groundwater by infiltration of precipitation through the permeable sandy surficial soils is rapid.

For the purposes of this analysis, the geographic area that encompasses the past, present, and reasonably foreseeable future actions that could contribute to adverse cumulative impacts to groundwater extends westward from Covert Ridge to Lake Michigan, a distance of approximately 1.6 km (1 mi). The axis of Covert Ridge is roughly coincident with Interstate 94 and trends in a north-south direction. Because Covert Ridge is a glacial moraine, it forms the watershed divide for the unconfined aquifer underlying the CNP site (I&M 2002). Groundwater in the unconfined aquifer that occurs west of the ridge flows toward Lake Michigan (I&M 2002). Because the groundwater flow direction is westward, the extent of the area of this analysis in the north-south direction is bounded by the northern and southern boundaries of the CNP site.

Groundwater, characteristic of the absorption ponds, has migrated to the southern plant boundary, but has not exceeded primary drinking water standards (AEPSC 1991), although there is an increase above background for total dissolved solids and sulfate. A restrictive covenant has been recorded in Berrien County to ensure that groundwater impacted by the seepage from the absorption ponds would not be withdrawn for any purpose from beneath approximately 84 ha (207 ac) in the southwestern portion of the CNP property (AEP 2000). There are no operable groundwater production wells and there are no consumptive uses of groundwater at CNP (I&M 2003).

Tritium has been detected periodically in the groundwater at monitoring wells across the CNP property. However, the authorization to discharge to groundwater (MDEQ 2000) does not contain criteria for tritium and no sample has exceeded the drinking water standard of 20,000 pCi/L (740 Bq/L).

A fuel spill of very limited extent that occurred in the middle 1970s has been appropriately addressed and no further remedial action is required (I&M 1991). The potential for future spills has been greatly reduced by Federal and State regulations promulgated in the 1980s and 1990s that apply to the storage of fuel, oil, and petroleum products.

On the basis of this analysis, the staff concludes that the cumulative impact to groundwater resources during the license renewal period would be SMALL and that additional mitigation would not be warranted.

4.8.6 Cumulative Impacts on Threatened and Endangered Species

The geographic area considered in the analysis of potential cumulative impacts to threatened or endangered species includes those Michigan and Indiana counties that contain the CNP site and its associated transmission line ROWs (Allen, DeKalb, Elkhart, LaGrange, LaPorte, Noble and St. Joseph counties, Indiana; and Berrien, Cass and Van Buren counties, Michigan) and the waters of Lake Michigan in the vicinity of the CNP site. As discussed in Sections 2.2.5 and 2.2.6, there are several Federally listed threatened or endangered species that could occur within this area. The staff's preliminary findings, presented in Section 4.6, are that continued operation of CNP Units 1 and 2 would have no effect and therefore a SMALL impact on these species. No critical habitat, as designated in the ESA, occurs in the area affected by the CNP site; therefore, cumulative impacts on critical habitats are not addressed.

Aquatic Species

The only Federally listed aquatic species that occur within the area of the CNP and its associated ROWs are three molluscs (white cat's paw pearlymussel, northern riffleshell, and clubshell) that occur in DeKalb County, Indiana (IDNR 2004b), which is crossed by the Collingwood-Robison transmission line. As mentioned in Section 2.2.5, these species have not been found and are not likely to occur along the transmission line ROWs.

On this basis, the staff has determined that operations of CNP Units 1 and 2 do not contribute to cumulative impacts to these species and no further mitigation measures are warranted.

Terrestrial Species

Eight Federally listed terrestrial species and one candidate for listing may occur in the area of the CNP site and its associated transmission lines (Table 2-2). These species include the Indiana bat, bald eagle, piping plover, copperbelly water snake, Karner blue butterfly, Mitchell's satyr butterfly, Pitcher's thistle, and small whorled pogonia. The eastern massasauga, a small rattlesnake, is a candidate for Federal listing.

Federally listed and candidate species in the project area are associated with open water, prairie, wetland, or forested habitats. These species could occur in portions of the ROWs that cross these habitats. Although most of the land crossed by transmission lines is devoted to agriculture, some segments of the line cross natural areas that could contain suitable habitat for listed and candidate species. As discussed in Section 4.6.2, I&M ROW management practices (I&M 1995) limit disturbance to habitats and avoid impacts to wetland and open water areas. These practices reduce or eliminate the possibility of impact to listed and candidate species.

Federally listed and candidate species that could occur on or in the vicinity of the CNP site are the Indiana bat, bald eagle, piping plover, eastern massasauga, and Pitcher's thistle. Of these species, only the bald eagle has been observed in the area. Bald eagles are occasional winter visitors along the Lake Michigan shoreline adjacent to the CNP site and may be attracted to these areas when other large water bodies are frozen. In the winter, water without ice cover provides foraging areas for the bald eagle, and the normal plant operations that maintain these open areas can be considered beneficial to eagles. Adverse impacts to other Federally listed or candidate species resulting from continued operations of CNP Units 1 and 2 are considered unlikely. Undeveloped portions of the CNP site that could support these species are not affected by ongoing plant operations, and no refurbishment activities that could disturb these areas are planned.

The staff has determined that continued operations of CNP Units 1 and 2 and associated transmission lines would not contribute to cumulative impacts on terrestrial threatened or endangered species and therefore the cumulative impacts to these species would be SMALL, and additional mitigation measures would not be warranted.

4.9 Summary of Impacts of Operations During the Renewal Term

Neither I&M nor the staff is aware of information that is both new and significant related to any of the applicable Category 1 issues associated with CNP Units 1 and 2 operation during the renewal term. Consequently, the staff concludes that the environmental impacts associated with these issues are bounded by the impacts described in the GEIS. For each of these issues, the GEIS concluded that the impacts would be SMALL and that additional plant-specific mitigation measures are not likely to be sufficiently beneficial to warrant implementation.

Plant-specific environmental evaluations were conducted for 11 Category 2 issues applicable to CNP Units 1 and 2 operation during the renewal term and for environmental justice and chronic effects of electromagnetic fields. For nine issues and environmental justice, the staff concludes that the potential environmental impact of operations of CNP 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 threatened and endangered species, the staff's preliminary conclusion is that the impact resulting from license renewal would be SMALL and further mitigation is not warranted. In addition, the staff determined that a consensus has not been reached by appropriate Federal health agencies regarding chronic adverse effects from electromagnetic fields. Therefore, the staff did not conduct an evaluation of this issue.

4.10 References

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

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

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

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

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

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

5.1 Postulated Plant Accidents

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

(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 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.

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

The Commission has determined that the environmental impacts of DBAs are of SMALL significance for all plants because the plants were designed to successfully withstand these accidents. Therefore, for the purposes of license renewal, DBAs are designated as a Category 1 issue in 10 CFR Part 51, Subpart A, Appendix B, Table B-1. The early resolution of the DBAs makes them a part of the current licensing basis of the plant; the current licensing basis of the plant is to be maintained by the licensee under its current license, and therefore, under the provisions of 10 CFR 54.30, is not subject to review under license renewal. This issue, applicable to the Donald C. Cook Nuclear Plant (CNP) Units 1 and 2, 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.

Indiana Michigan Power Company (I&M) stated in its environmental report (ER) (I&M 2003) that it is not aware of any new and significant information associated with the renewal of the CNP Units 1 and 2 OLs. The staff has not identified any significant new information during its independent review of the I&M ER (I&M 2003), the scoping process, the staff's site visit, or its evaluation of other available information. Therefore, the 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, whether or not there are serious offsite consequences. In the GEIS, the staff assessed the impacts of severe accidents during the license renewal period, using the results of existing analyses and site-specific information to conservatively predict the environmental impacts of severe accidents for each plant during the renewal period.

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

Based on information in the GEIS, the Commission found that

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

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

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

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

The staff has not identified any significant new information with regard to the consequences from severe accidents during its independent review of the I&M ER (I&M 2003), the scoping process, the staff's site visit, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts of severe accidents beyond those discussed in the GEIS. However, in accordance with 10 CFR 51.53(c)(3)(ii)(L), the staff has reviewed severe accident mitigation alternatives (SAMAs) for CNP Units 1 and 2. The results of its review are discussed in Section 5.2.

5.2 Severe Accident Mitigation Alternatives

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

5.2.1 Introduction

This section presents a summary of the SAMA evaluation for CNP conducted by I&M and described in the ER and the NRC's review of that 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 is presented in Appendix G.

The SAMA evaluation for CNP used a four-step approach. In the first step I&M quantified the level of risk associated with potential reactor accidents using plant-specific probablistic risk assessments (PRAs) and other risk models.

In the second step I&M examined the major risk contributors and identified possible ways (SAMAs) of reducing that risk. Common ways of reducing risk are changes to components, systems, procedures and training. I&M initially identified 194 potential SAMAs. I&M screened out SAMAs that were not applicable to CNP due to design differences, were already addressed in the existing design, or would involve major plant design or structural changes. This screening reduced the list of potential SAMAs to 72.

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

Finally, in the fourth step, the costs and benefits of each of the remaining SAMAs were compared to determine whether the SAMA was cost-beneficial, meaning the benefits of the SAMA were greater than the cost (a positive cost-benefit). I&M determined in its ER that 16 of the SAMAs were cost beneficial. These 16 SAMAs were grouped into five categories as alternative ways to achieve risk reduction in the following categories:

- Minimize consequences of reactor coolant pump (RCP) seal LOCAs,
- Minimize consequences of loss of HVAC,
- Remove dependance of Distributed Ignition System on AC power,
- Minimize consequences of AC bus failures,
- Improve recovery from Interfacing Systems Loss of Coolant Accidents (ISLOCA).

The grouping of the SAMAs into these categories allows I&M to compare options to reduce the impact of severe accidents. I&M is conducting additional analyses to allow them to select the specific actions which achieve the most cost-beneficial risk reduction in each category.

None of these SAMAs relate to adequately managing the effects of aging during the period of extended operation, and they, therefore, need not be implemented as part of license renewal pursuant to 10 CFR Part 54. I&M's SAMA analysis and the NRC's review are discussed in more detail below.

5.2.2 Estimate of Risk

I&M submitted an assessment of SAMAs for CNP as part of the ER (I&M 2003). This assessment was based on the most recent CNP PRA 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 CNP Individual Plant Examination (IPE) (AEP 1992, 1995) and Individual Plant Examination of External Events (IPEEE) (AEP 1992).

The baseline core damage frequency (CDF) for the purpose of the SAMA evaluation is approximately 5.0 x 10^{-5} per year. The CDF is based on the risk assessment for internally initiated events. I&M did not include the contribution to risk from external events within the CNP risk estimates; however, it did account for the potential risk reduction benefits associated with external events by doubling the estimated benefits for internal events. The breakdown of CDF by initiating event is provided in Table 5-3. As shown in this table, loss of offsite power, small LOCAs, transients with the Power Conversion System available and loss of Essential Service Water are dominant contributors to the CDF.

Table 5-3. DC Cook Core Damage Frequency for Internal Events

Initiating Event	CDF (per year) [(a)]	Percent Contribution [(b)]
Single Unit Loss of Offsite Power (LSP)	1.2×10^{-5}	23.2
Small LOCA (SLO)	8.6×10^{-6}	17.1
Dual Units Loss of Offsite Power (DSLP)	7.2×10^{-6}	14.3
Transient with Power Conversion System Available (TRA)	6.6×10^{-6}	13.3
Loss of All ESW to Both Units (ESW4)	6.5×10^{-6}	12.9
Loss of ESW to Unit (ESW2)	2.5×10^{-6}	5.0

Table 5-3. (contd)

Initiating Event	CDF (per year)[a]	Percent Contribution[b]
Loss of CCW (CCW)	$2.3x10^{-6}$	4.6
Steamline Break Outside MSIV (SLB-5)	$6.5x10^{-7}$	1.3
SGTR in Any of 4 Loops(SGR-1; SGR-2; SGR-3; SGR-4)	$5.0x10^{-7}$	1.0
Breaks Beyond ECCS Capability (VEF)	$3.0x10^{-7}$	0.6
Steamline Break In Any of 4 Loops (SLB-1; SLB-2; SLB-3; SLB-4)	$3.0x10^{-7}$	0.6
Transient without Power Conversion System Available (TRS)	$2.0x10^{-7}$	0.4
Others	$<5.0x10^{-8}$	<0.1
TOTAL CDF	$5.0x10^{-5}$	100

(a) Unit 1 CDF taken from Table F.2-1 of the ER (I&M 2003). Unit 2 values are similar.
(b) Values based on Unit 1.

In the ER, I&M estimated the dose to the population within 80 km (50 mi) of the CNP site to be approximately 0.425 person-Sv (42.5 person-rem) per year. The breakdown of the total population dose by containment release mode is summarized in Table 5-4. Late containment failure and bypass events dominate the population dose risk at CNP.

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

Containment Release Mode	Population Dose (Person-rem[a] per year)	% Contribution
Containment Bypass	13.2	31.0
Containment Isolation Failure	<.01	~0.0
Early Containment Failure	9.6	22.6
Late Containment Failure	19.7	46.4
No Containment Failure	~0.0	~0.0
Total	42.5	100

(a) One person-Rem per year = 0.01 person-Sv per year

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

5.2.3 Potential Plant Improvements

Once the dominant contributors to plant risk were identified, I&M searched for ways to reduce that risk. In identifying and evaluating potential SAMAs, I&M considered SAMA analyses performed for other operating plants which have submitted license renewal applications, as well as industry and NRC documents that discuss potential plant improvements, such as NUREG-1560 (NRC 1997b). I&M identified 194 potential risk-reducing improvements (SAMAs) to plant components, systems, procedures and training.

All but 72 of the these SAMAs were removed from further consideration because: (1) the SAMA is not applicable at CNP due to design differences, (2) the SAMA has already been addressed in the existing CNP design, or (3) the cost to implement the SAMA would clearly be well in excess of the maximum possible benefit.

Preliminary cost estimates were prepared for each of the 72 remaining candidates. The cost estimates were compared to the maximum attainable benefit, or MAB. The MAB is the dollar value of the benefit that would be achieved if the plant risk and population dose from postulated accidents could be reduced to zero. If the cost of a SAMA exceeds the MAB, it could not be cost-beneficial because no single SAMA could eliminate all the risk. To account for external events and analysis uncertainties, the maximum attainable benefit or MAB was doubled, and then applied to the remaining candidates.

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

5.2.4 Evaluation of Risk Reduction and Costs of Improvements

I&M evaluated the risk-reduction potential of the remaining 72 SAMAs that were applicable to CNP. A majority 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 of the risk reduction and are conservative.

I&M estimated the costs of implementing the 72 candidate SAMAs through the application of engineering judgment using estimates from other licensee 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 Cost estimates typically included changes to and implementation of procedures, engineering analysis, training, and documentation, in addition to any hardware costs (I&M 2004).

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

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

5.2.5 Cost-Benefit Comparison

The cost-benefit analysis performed by I&M was based primarily on NUREG/BR-0184 (NRC 1997a) and was executed consistent with this guidance. The total benefit associated with each of the 72 SAMAs was evaluated by I&M. These values were determined for the various averted costs based on the estimated annual reductions in CDF and person-rem dose.

If the calculated cost of implementation of the SAMA is greater than the calculated benefit, the SAMA would generally be considered to not be cost beneficial. However, in order to account for the contribution of external events and analysis uncertainties, I&M determined a SAMA to be potentially cost beneficial if the cost of implementation was estimated to be less than two times the calculated benefit.

I&M identified 16 cost-beneficial SAMAs. These 16 SAMAs were grouped into five areas. This grouping recognizes that some of the SAMAs accomplish the same general result in a different way. For example, six of the SAMAs involve different ways to minimize the impact of RCP seal LOCAs. Moreover, these six items are not independent, that is, implementation of any one would achieve a portion of the benefit of the others. I&M is continuing to study the 16 SAMAs in groups to determine the optimum subset of the 16. The 16 SAMAs are grouped into the following five areas:

- Minimize Consequences of RCP Seal LOCAS,
- Minimize Consequences of Loss of HVAC,
- Remove Dependance of Distributed Ignition System on AC Power,
- Minimize Consequences of AC Bus Failures,
- Improve Recovery from ISLOCA Events.

The staff questioned the use of a factor of two to account for uncertainties in the evaluation, and requested additional justification (NRC 2004). In its response, I&M considered the uncertainties associated with the calculated CDF and the impact of other analysis assumptions on the results of the SAMA assessment, and provided additional justification for its use of a factor of two to account for the evaluation uncertainties. The staff concludes that the use of the factor of two to account for uncertainties, coupled with the fact that the calculated benefits and the estimated implementation costs are generally conservative, provides a reasonable treatment of uncertainties and is adequate for the SAMA evaluation.

The staff concludes that, with the exception of the cost-beneficial SAMAs identified in five different areas, the costs of the SAMAs would be higher than the associated benefits. This conclusion is supported by uncertainty assessment and sensitivity analysis.

One of the cost-beneficial SAMAs involves providing a backup AC power source for the distributed hydrogen ignition system. The NRC staff is currently evaluating a potential requirement for a similar enhancement as part of the resolution of Generic Safety Issue 189 (GSI-189), "Susceptibility of Ice Condenser and Mark III Containments to Early Failure from Hydrogen Combustion During a Severe Accident."

5.2.6 Conclusions

The staff reviewed I&M's SAMA analysis and concluded that the methods used and the implementation of those methods were sound. Based on its review of the I&M SAMA analysis, the staff concurs that out of the 194 candidate SAMAs, there are five areas in which risk can be further reduced in a cost-beneficial manner through the implementation of a subset of the 16 identified cost-beneficial SAMAs. Given the potential for cost-beneficial risk reduction in these five areas, the staff agrees with I&M that further evaluation of these SAMAs by I&M is warranted. However, none of the cost-beneficial SAMAs relate 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.

5.3 References

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

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

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

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

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American Electric Power Service Corporation (AEP). 1995. "Donald C. Cook Nuclear Plant Units 1 and 2, Individual Plant Examination Summary Report," American Electric Power Service Corporation, Revision1, October 1995.

Indiana Michigan Power Company (I&M). 2003. *Applicant's Environmental Report – Operating License Renewal Stage, Donald C. Cook Nuclear Plant Units 1 and 2.* Docket Nos. 50-315 and 50-316. Buchanan, Michigan. October 2003.

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

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

U.S. Nuclear Regulatory Commission (NRC). 1997b. *Individual Plant Examination Program: Perspectives on Reactor Safety and Plant Performance.* NUREG-1560, 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). 2004. "Request for Additional Information (RAI) Regarding Severe Accident Mitigation Alternatives for the Donald C. Cook Nuclear Plant Units 1 and 2" Washington, D.C., March 18, 2004

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 10 CFR Part 51, Subpart A, Appendix B, and are applicable to Donald C. Cook Nuclear Plant (CNP) Units 1 and 2. The generic potential impacts of the radiological and nonradiological environmental impacts of the uranium fuel cycle and transportation of nuclear fuel and wastes are described in detail in the GEIS based, in part, on the generic impacts provided in 10 CFR 51.51(b), Table S-3, "Table of Uranium Fuel Cycle Environmental Data," and in 10 CFR 51.52(c), Table S-4,

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

"Environmental Impact of Transportation of Fuel and Waste to and from One Light-Water-Cooled Nuclear Power Reactor." The staff also addresses the impacts from radon-222 and technetium-99 in the GEIS.

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 CNP Units 1 and 2 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)	6.1; 6.2.2.1; 6.2.3; 6.2.4; 6.6
Nonradiological impacts of the uranium fuel cycle	6.1; 6.2.2.6; 6.2.2.7; 6.2.2.8; 6.2.2.9; 6.2.3; 6.2.4; 6.6
Low-level waste storage and disposal	6.1; 6.2.2.2;6.4.2; 6.4.3; 6.4.3.1; 6.4.3.2; 6.4.3.3; 6.4.4; 6.4.4.1; 6.4.4.2; 6.4.4.3; 6.4.4.4; 6.4.4.5; 6.4.4.5.1; 6.4.4.5.2; 6.4.4.5.3; 6.4.4.5.4; 6.4.4.6;6.6
Mixed waste storage and disposal	6.4.5.1; 6.4.5.2; 6.4.5.3; 6.4.5.4; 6.4.5.5; 6.4.5.6; 6.4.5.6.1; 6.4.5.6.2; 6.4.5.6.3; 6.4.5.6.4; 6.6
Onsite spent fuel	6.1; 6.4.6; 6.4.6.1; 6.4.6.2; 6.4.6.3; 6.4.6.4; 6.4.6.5; 6.4.6.6; 6.4.6.7; 6.6
Nonradiological waste	6.1; 6.5; 6.5.1; 6.5.2; 6.5.3; 6.6
Transportation	6.1; 6.3.1; 6.3.2.3; 6.3.3; 6.3.4; 6.6, Addendum 1

Indiana Michigan Power Company (I&M) stated in its environmental report (ER) (I&M 2003) that it is not aware of any new and significant information associated with the renewal of the CNP Units 1 and 2 operating licenses (OLs). The staff has not identified any significant new information during its independent review of the ER (I&M 2003), the scoping process, the staff's site visit, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts related to these issues beyond those discussed in the GEIS. For these issues, the staff concluded in the GEIS that the impacts are SMALL except for the collective offsite radiological impacts from the fuel cycle and from 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 staff review and the GEIS conclusions, as codified in Table B-1, 10 CFR 51, for each of these issues follows:

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

  > 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 staff has not identified any new and significant information during its independent review of the ER (I&M 2003), the scoping process, the staff's site visit, or its evaluation of other available information. Therefore, the staff concludes that there are no offsite radiological impacts of the uranium fuel cycle during the renewal term beyond those discussed in the GEIS.

- Offsite radiological impacts (collective effects). 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, high level waste and spent fuel disposal excepted, is calculated to be about 14,800 person rem [148 person Sv], or 12 cancer fatalities, for each additional 20-year power reactor operating term. Much of this, especially the contribution of radon releases from mines and tailing piles, consists of tiny doses summed over large populations. This same dose calculation can theoretically be extended to include many tiny doses over additional thousands of years as well as doses outside the U. S. The result of such a calculation would be thousands of cancer fatalities from the fuel cycle, but this result assumes that even tiny doses have some statistical adverse health effect which will not ever be

> mitigated (for example no cancer cure in the next thousand years), and that these doses projected over thousands of years are meaningful. However, these assumptions are questionable. In particular, science cannot rule out the possibility that there will be no cancer fatalities from these tiny doses. For perspective, the doses are very small fractions of regulatory limits and even smaller fractions of natural background exposure to the same populations.
>
> Nevertheless, despite all the uncertainty, some judgement as to the regulatory NEPA [National Environmental Policy Act] implications of these matters should be made and it makes no sense to repeat the same judgement in every case. Even taking the uncertainties into account, the Commission concludes that these impacts are acceptable in that these impacts would not be sufficiently large to require the NEPA conclusion, for any plant, that the option of extended operation under 10 CFR Part 54 should be eliminated. Accordingly, while the Commission has not assigned a single level of significance for the collective effects of the fuel cycle, this issue is considered Category 1.

The staff has not identified any new and significant information during its independent review of the ER (I&M 2003), the scoping process, the staff's site visit, or its evaluation of other available information. Therefore, the staff concludes that there are no offsite radiological impacts (collective effects) from the uranium fuel cycle during the renewal term beyond those discussed in the GEIS.

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

> For the high level waste and spent fuel disposal component of the fuel cycle, there are no current regulatory limits for offsite releases of radionuclides for the current candidate repository site. However, if we assume that limits are developed along the lines of the 1995 National Academy of Sciences (NAS) report, "Technical Bases for Yucca Mountain Standards," and that in accordance with the Commission's Waste Confidence Decision, 10 CFR 51.23, a repository can and likely will be developed at some site which will comply with such limits, peak doses to virtually all individuals will be 100 millirem [1 mSv] 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 millirem [1 mSv] 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 millirem [1 mSv] per year. The lifetime individual risk from 100 millirem [1 mSv] annual dose limit is about 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 high level waste repository, especially for the candidate repository at Yucca Mountain. More meaningful estimates of doses to population may be possible in the future as more is understood about the performance of the proposed Yucca Mountain repository. Such estimates would involve very great uncertainty, especially with respect to cumulative population doses over thousands of years. The standard proposed by the NAS is a limit on maximum individual dose. The relationship of potential new regulatory requirements, based on the NAS report, and cumulative population impacts has not been determined, although the report articulates the view that protection of individuals will adequately protect the population for a repository at Yucca Mountain. However, EPA's generic repository standards in 40 CFR Part 191 generally provide an indication of the order of magnitude of cumulative risk to population that could result from the licensing of a Yucca Mountain repository, assuming the ultimate standards will be within the range of standards now under consideration. The standards in 40 CFR Part 191 protect the population by imposing "containment requirements" that limit the cumulative amount of radioactive material released over 10,000 years. Reporting performance standards that will be required by EPA are expected to result in releases and associated health consequences in the range between 10 and 100 premature cancer deaths with an upper limit of 1,000 premature cancer deaths world-wide for a 100,000 metric tonne (MTHM) repository.

Nevertheless, despite all the uncertainty, some judgement as to the regulatory NEPA implications of these matters should be made and it makes no sense to repeat the same judgement in every case. Even taking the uncertainties into account, the Commission concludes that these impacts are acceptable in that these impacts would not be sufficiently large to require the NEPA conclusion, for any plant, that the option of extended operation under 10 CFR part 54 should be

> eliminated. Accordingly, while the Commission has not assigned a single level of significance for the impacts of spent fuel and high level waste disposal, this issue is considered Category 1.

On February 15, 2002, subsequent to the receipt of a recommendation by the Secretary, 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. Public law 107-200, 116 Stat. 735 (2002) designates Yucca Mountain as the repository for spent nuclear waste. Joint Resolution 87 approves the site at Yucca Mountain, Nevada, for the development of a repository for the disposal of high-level radioactive waste and spent nuclear fuel. This development does not represent new and significant information with respect to the offsite radiological impacts related to spent fuel and HLW disposal related to license renewal.

The staff has not identified any new and significant information during its independent review of the ER (I&M 2003), the staff's site visit, the scoping process, or its evaluation of other available information. Therefore, the staff concludes that there are no offsite radiological impacts related to spent fuel and HLW disposal during the renewal term beyond those discussed in the GEIS.

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

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

The staff has not identified any new and significant information during its independent review of the ER (I&M 2003), the scoping process, the staff's site visit, or its evaluation of other available information. Therefore, the staff concludes that there are no nonradiological impacts of the uranium fuel cycle during the renewal term beyond those discussed in the GEIS.

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

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

  The staff has not identified any new and significant information during its independent review of the ER (I&M 2003), the scoping process, the staff's site visit, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts of 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 staff has not identified any new and significant information during its independent review of the ER (I&M 2003), the scoping process, the staff's site visit, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts of 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 staff has not identified any new and significant information during its independent review of the ER (I&M 2003), the scoping process, the staff's site visit, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts of onsite spent fuel associated with license renewal beyond those discussed in the GEIS.

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

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

  The staff has not identified any new and significant information during its independent review of the ER (I&M 2003), the scoping process, the staff's site visit, or its evaluation of other available information. Therefore, the staff concludes that there are no nonradiological waste impacts during the renewal term beyond those discussed in the GEIS.

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

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

CNP Units 1 and 2 meet the fuel-enrichment and burnup conditions set forth in Addendum 1 to the GEIS. The staff has not identified any new and significant information during its independent review of the ER (I&M 2003), the scoping process, the staff's site visit, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts of 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."

40 CFR Part 197. Code of Federal Regulations, Title 40, *Protection of Environment*, Part 197, "Public Health and Environmental Radiation Protection Standards for Management and Disposal for Yucca Mountain, Nevada."

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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. 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.

7.0 Environmental Impacts of Decommissioning

Environmental impacts from the activities associated with the decommissioning of any reactor before or at the end of an initial or renewed license are evaluated in the *Generic Environmental Impact Statement for Decommissioning of Nuclear Facilities, Supplement 1, Regarding the Decommissioning of Nuclear Power Reactors,* NUREG-0586 (NRC 2002). The staff's evaluation of the environmental impacts of decommissioning presented in Supplement 1 resulted in a range of impacts for each environmental issue. These results may be used by licensees as a starting point for a plant-specific evaluation of the decommissioning impacts at their facilities.

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 evaluation in NUREG-1437 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. 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 10 CFR Part 51, Subpart A, Appendix B, that are applicable to Donald C. Cook Nuclear Plant (CNP) decommissioning following the renewal term are listed in Table 7-1. Indiana Michigan Power Company (I&M) stated in its environmental report (ER) (I&M 2003) that it is aware of no new and significant information regarding the environmental impacts of CNP Units 1 and 2 license renewal. The staff has not identified any significant new information during its independent review of the ER (I&M 2003), the scoping process, the staff's site visit, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts related to these issues beyond those discussed in the GEIS. For all of these issues, the staff concluded in the GEIS that the impacts are SMALL, and additional plant-specific mitigation measures are not likely to be sufficiently beneficial to be warranted.

Table 7-1. Category 1 Issues Applicable to the Decommissioning of CNP Units 1 and 2 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 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 person-rem [0.01 person-Sv] caused by buildup of long-lived radionuclides during the license renewal term.

The staff has not identified any new and significant information during its independent review of the ER (I&M 2003), the scoping process, the staff's site visit, or its evaluation of other available information. Therefore, the staff concludes that there are no radiation dose impacts associated with decommissioning following the license renewal term beyond those discussed in the GEIS.

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

  Decommissioning at the end of a 20-year license renewal period would generate no more solid wastes than at the end of the current license term. No increase in the quantities of Class C or greater than Class C wastes would be expected.

  The staff has not identified any new and significant information during its independent review of the ER (I&M 2003), the scoping process, the staff's site visit, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts from solid waste associated with decommissioning following the license renewal term beyond those discussed in the GEIS.

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

  Air quality impacts of decommissioning are expected to be negligible either at the end of the current operating term or at the end of the license renewal term.

  The staff has not identified any new and significant information during its independent review of the ER (I&M 2003), the scoping process, the staff's site visit, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts on air quality associated with decommissioning following the license renewal term beyond those discussed in the GEIS.

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

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

  The staff has not identified any new and significant information during its independent review of the ER (I&M 2003), the scoping process, the staff's site visit, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts on water quality associated with decommissioning following the license renewal term beyond those discussed in the GEIS

- Ecological resources. Based on information 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 staff has not identified any new and significant information during its independent review of the ER (I&M 2003), the scoping process, the staff's site visit, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts on ecological resources associated with decommissioning following the license renewal term beyond those discussed in the GEIS.

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

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

The staff has not identified any new and significant information during its independent review of the ER (I&M 2003), the scoping process, the staff's site visit, or its evaluation of other available information. Therefore, the staff concludes that there are no socioeconomic impacts associated with decommissioning following the license renewal term beyond those discussed in the GEIS.

7.2 References

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

Indiana Michigan Power Company (I&M). 2003. *Applicant's Environmental Report – Operating License Renewal Stage, Donald C. Cook Nuclear Plant Units 1 and 2.* Docket Nos. 50-315 and 50-316. Buchanan, Michigan. October 2003.

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, Vols. 1 and 2. Washington, D.C.

8.0 Environmental Impacts of Alternatives to License Renewal

This chapter examines the potential environmental impacts associated with: denying the renewal of the operating licenses (OLs) for the Donald C. Cook Nuclear Plant (CNP) Units 1 and 2 (i.e., the no-action alternative); electric generating sources other than CNP; purchasing electric power from other sources to replace power generated by Units 1 and 2; a combination of generating and conservation measures; and other generation alternatives that were deemed unsuitable for replacement of power generated by Units 1 and 2. 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 (CEQ) guidelines and set forth in the footnotes to Table B-1 of 10 CFR 51, Subpart A, Appendix B:

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

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

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

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

8.1 No-Action Alternative

The NRC regulations implementing the National Environmental Policy Act (NEPA) of 1969 specify that the no-action alternative be discussed in an NRC environmental impact statement (EIS); see 10 CFR Part 51, Subpart A, Appendix A(4). The no-action alternative refers to a scenario in which the NRC would not renew the CNP OLs. Then, Indiana Michigan Power Company (I&M) would cease plant operations by the end of the current licenses and decommission Units 1 and 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.

I&M eventually will be required to shut down CNP and comply with NRC decommissioning requirements in 10 CFR 50.82 whether or not the OLs are renewed. If the CNP OLs are renewed, shutdown of the units and decommissioning activities will not be avoided, but will be postponed for up to an additional 20 years.

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

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

Land Use

In Chapter 4, the staff concluded that the impacts of continued operation of CNP Units 1 and 2 on land use would be SMALL. Onsite land use will not be affected immediately by the cessation of operations. Plant structures and other facilities are likely to remain in place until decommissioning. The transmission lines associated with the project are expected to remain in service after the plants stop operating. As a result, maintenance of the rights-of-way (ROWs) will continue as before. Therefore, the staff concludes that the impacts on land use from plant shutdown would be SMALL.

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

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

Impact Category	Impact	Comment
Land use	SMALL	Impacts are expected to be SMALL because plant shutdown is not expected to result in changes to onsite or offsite land use.
Ecology	SMALL	Impacts are expected to be SMALL because aquatic impacts would be reduced and terrestrial impacts are not expected because there will not be any changes in ROW maintenance practices.
Water use and quality–surface water	SMALL	Impacts are expected to be SMALL because surface-water intake and discharges will be eliminated.
Water use and quality–groundwater	SMALL	Impacts are expected to be SMALL because discharge to absorption ponds and sewage lagoons, and subsequent discharges to groundwater, will be eliminated.
Air quality	SMALL	Impacts are expected to be SMALL because discharges related to plant operation and worker transportation will decrease.
Waste	SMALL	Impacts are expected to be SMALL because generation of high-level waste (HLW) will stop, and generation of low-level and mixed waste will decrease.
Human health	SMALL	Impacts are expected to be SMALL because radiological doses to workers and members of the public, which are within regulatory limits, will be 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 will remain in place.
Historic and archaeological resources	SMALL	Impacts are expected to be SMALL because shutdown of the plant will not change land use.
Environmental justice	SMALL to LARGE	Impacts are expected to range from SMALL to LARGE because a loss of employment opportunities is expected.

Ecology

In Chapter 4, the staff concluded that the ecological impacts of operation of CNP Units 1 and 2 were SMALL. Cessation of operations will be accompanied by a reduction in cooling water flow and the thermal plume from the plant. These changes will reduce environmental impacts to aquatic species. The transmission lines associated with CNP are expected to remain in service after CNP stops operating. As a result, maintenance of the ROWs and subsequent impacts to the terrestrial ecosystem will continue as before. Therefore, the staff concludes that ecological impacts from shutdown of the plant would be SMALL.

Water Use and Quality–Surface Water

In Chapter 4, the staff concluded that impacts of operation of CNP Units 1 and 2 on surface-water use and quality were SMALL. When the plant stops operating, there will be a reduction in the consumption of water because of reduction in cooling water flow and in the amount of heat rejected to Lake Michigan. Therefore, the staff concludes that the impacts on surface-water use and quality from plant shutdown would be SMALL.

Water Use and Quality–Groundwater

In Chapter 4, the staff concluded that impacts of operation of CNP Units 1 and 2 on groundwater availability and quality were SMALL. When the plant stops operating, there will be a reduction in effluents released to the absorption ponds and sewage lagoons. CNP does not use groundwater, and there would be no impact of the no-action alternative on groundwater supply. Therefore, the staff concludes that groundwater use and quality impacts from shutdown of the plant would be SMALL.

Air Quality

In Chapter 4, the staff found the impacts of operation of CNP Units 1 and 2 on air quality were SMALL. When the plant stops operating, there will be a reduction in emissions from activities related to operation such as use of diesel generators and worker transportation. Therefore, the staff concludes that the impact on air quality from shutdown of the plant would be SMALL.

Waste

The impacts of waste generated by operation of CNP Units 1 and 2 are discussed in Chapter 6. The impacts of low-level and mixed waste from plant operation are characterized as SMALL. When the CNP Units 1 and 2 stop operating, the plant will stop generating HLW. Generation of low-level and mixed waste associated with operation and maintenance will be reduced.

Therefore, the staff concludes that the impact of waste generated after shutdown of the plant would be SMALL.

Human Health

In Chapter 4, the staff concluded that the impacts of plant operation on human health were SMALL. After the cessation of operation of CNP Units 1 and 2, the amount of radioactive material released to the environment in gaseous and liquid forms will be reduced. Therefore, the staff concludes that the impact of shutdown of the plant on human health will be SMALL. In addition, the variety of potential accidents at the plant will be reduced to a limited set associated with shutdown events and fuel handling. In Chapter 5 of this SEIS, the NRC staff concluded that the impacts of accidents during operation were SMALL. Therefore, the staff concludes that the impacts of potential accidents following shutdown of the plant would be SMALL.

Socioeconomics

In Chapter 4, 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 Berrien County. 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. See Appendix J to NUREG-0586, Supplement 1 (NRC 2002), for additional discussion of the potential socioeconomic impacts of plant shutdown.

Transportation

In Chapter 4, the staff concluded that the impacts of continued operation of CNP Units 1 and 2 on transportation were SMALL. Cessation of operations will be accompanied by a reduction of traffic in the vicinity of the plant. Most of the reduction will be associated with a reduction in the plant workforce, but there will also be a reduction in shipment of material to and from the plant. Therefore, the staff concludes that the impacts of plant closure on transportation would be SMALL.

Aesthetics

In Chapter 4, the staff concluded that the aesthetic impacts of continued operation of CNP Units 1 and 2 were SMALL. Plant structures and other facilities are likely to remain in place until decommissioning. Therefore, the staff concludes that the aesthetic impacts of plant closure would be SMALL.

Historic and Archaeological Resources

In Chapter 4, the staff concluded that the impacts of continued operation of CNP Units 1 and 2 on historic and archaeological resources would be SMALL. Onsite land use will not be affected immediately by the cessation of operations. Plant structures and other facilities are likely to remain in place until decommissioning. The transmission lines associated with the project are expected to remain in service after the plants stop operating. As a result, maintenance of transmission line ROWs will continue as before. Therefore, the staff concludes that the impacts on historic and archaeological resources from plant shutdown would be SMALL.

Environmental Justice

In Chapter 4, the staff concluded that the environmental justice impact of continued operation of CNP Units 1 and 2 would be SMALL because 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 an adverse impact on minority and low-income populations because of the loss of employment opportunities at the site and because of secondary socioeconomic impacts (e.g., loss of patronage at local businesses). The staff concludes that the environmental justice impacts of plant shutdown could range from SMALL to LARGE. Some of these impacts could be offset if new power generating facilities are built at or near the current site. See Appendix J to NUREG-0586, Supplement 1 (NRC 2002), for additional discussion of these impacts.

8.2 Alternative Energy Sources

This section discusses the environmental impacts associated with alternative sources of electric power to replace the power generated by CNP, assuming that the OLs for Units 1 and 2 are 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 the CNP site and at an alternate site (Section 8.2.1)
- Natural gas-fired generation at the CNP site and at an alternate site (Section 8.2.2)
- Nuclear generation at the CNP site and at an alternate site (Section 8.2.3)

The alternative of purchasing power from other sources to replace power generated at CNP Units 1 and 2 is discussed in Section 8.2.4. Other power generation alternatives and conservation alternatives considered by the staff and found not to be reasonable replacements for CNP Units 1 and 2 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 likely be accounted for by combined-cycle,[a] distributed generation, or combustion turbine technology fueled by natural gas (EIA 2004). Both technologies are designed primarily to supply peak and intermediate capacity, but combined-cycle technology can also be used to meet baseload[b] requirements. Coal-fired plants are projected by EIA to account for nearly one-third of new capacity during this period. Coal-fired plants are generally used to meet baseload requirements. Renewable energy sources, primarily wind 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).

EIA projects that oil-fired plants will account for very little 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

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

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

reactor licensing program organization in 2001 to prepare and manage future reactor and site licensing applications (NRC 2001). Therefore, in spite of the EIA projection, a new nuclear plant alternative for replacing power generated by CNP is considered in this SEIS.

CNP Units 1 and 2 have a combined net electrical output of 2161 megawatts electric (MW[e]) (I&M 2003a). The combined summer net capability of Units 1 and 2 is 2060 MW(e) (I&M 2001). For the remainder of this section, the staff assumed the total capacity of CNP Units 1 and 2 to be 2161 MW(e). For the coal and natural gas alternatives, the staff assumed construction of a 1872 MW(e) plant, which is consistent with I&M's environmental report (ER) (I&M 2003b). This assumption will understate the environmental impacts of replacing the 2161 MW(e) from CNP Units 1 and 2 by roughly 13 percent. For the new nuclear alternative, the staff assumed the same capacity as CNP Units 1 and 2.

No specific alternate sites were identified by the applicant in the ER because the existing CNP site was determined to be large enough for the construction of the gas- and coal-fired alternatives and the use of the existing CNP site would minimize any additional environmental impacts (I&M 2003b). A new nuclear alternative also was not considered by the applicant. Therefore, this SEIS considers an alternate generic site, in addition to the existing CNP site, for the analysis of environmental impacts for the three alternative generating technologies.

8.2.1 Coal-Fired Generation

The coal-fired alternative is analyzed for the CNP site and a generic alternate site. Unless otherwise indicated, the assumptions and numerical values used in Section 8.2.1 are from the ER (I&M 2003b). The staff reviewed this information and compared it to environmental impact information in the GEIS. Although the OL renewal period is only 20 years, the impact of operating the coal-fired alternative for 40 years is considered (as a reasonable projection of the operating life of a coal-fired plant). The staff assumed that CNP Units 1 and 2 would remain in operation while the alternative coal-fired plant was constructed.

The staff assumes the construction of three 624-MW(e) units for a total capacity 1872 MW(e), as potential replacements for CNP Units 1 and 2, which is consistent with the ER (I&M 2003b). I&M chose this configuration to be consistent with the total capacity of the standard-size units selected for the natural gas-fired alternative. The assumption of 1872 MW(e) is less than the existing 2161 MW(e) from CNP Units 1 and 2 and therefore understates the environmental impacts of the coal and gas-fired alternatives. The remaining capacity could be made up from other sources, or the pertinent impacts (e.g., air emissions) could be adjusted accordingly for a specific capacity. Although the total capacity is less under the coal- and gas-fired alternatives, the staff has determined that the difference between 1872 MW(e) and 2161 MW(e) is not likely to result in a significant difference among impact levels.

The coal-fired plant would consume approximately 7.37 million MT (7.25 million tons) per year of pulverized bituminous coal with an ash content of approximately 6.7 percent (I&M 2003b). I&M assumed a heat rate[(a)] of 10,200 Btu/kWh and a capacity factor[(b)] of 0.85 (I&M 2003b). After combustion, 99.9 percent of the ash, 493,000 MT/yr (485,000 tons/yr), would be collected by particulate control equipment. In addition, approximately 236,000 MT (232,000 tons) of scrubber sludge would be disposed of at the plant site based on annual calcium oxide usage of approximately 79,000 MT (78,000 tons). I&M recycles about 26 percent of its coal ash (I&M 2003b); therefore, approximately 365,000 MT (359,000 tons) of ash would be disposed of onsite. Calcium oxide would be used in the scrubbing process for control of sulfur dioxide (SO_2) emissions.

In addition to the impacts discussed below for a coal-fired plant at either the CNP site or an alternate site, impacts would occur offsite as a result of the mining of coal and limestone. Impacts of mining operations 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 8900 ha (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 more land will be affected with the construction of an 1872 MW(e) plant. Partially offsetting this offsite land use would be the elimination of the need for uranium mining to supply fuel for CNP Units 1 and 2. In the GEIS, the staff estimated that approximately 400 ha (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 staff evaluated the impacts of a coal-fired plant located at either the CNP site or a generic alternate site that uses a closed-cycle cooling system. CNP currently uses a once-through cooling system. A replacement closed-cycle coal-fired plant built on the existing CNP site could require the acquisition of additional land adjacent to the site. The magnitude of impacts for the alternate site would depend on the particular site selected.

(a) Heat rate is measure of generating station thermal efficiency. In English units, it is generally expressed in Btu per net 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.

The overall impacts of the coal-fired generating system are discussed in the following sections and summarized in Table 8-2.

Land Use

The existing facilities and infrastructure at the CNP site would be used to the extent practicable, limiting the amount of new construction that would be required. Specifically, the staff assumed that the coal-fired replacement plant alternative would use the existing cooling water system (modified to be used in conjunction with a new closed-cycle system), switchyard, offices, and transmission line ROWs. Land that has been previously disturbed would be used to the extent practicable.

In the ER, I&M noted that new and revised U.S. Environmental Protection Agency (EPA) requirements could necessitate the construction of cooling towers for the coal- and gas-fired alternatives if surface water was previously used for cooling (I&M 2003b). The existing cooling water system could be modified to provide makeup water to and discharge blowdown from the closed-cycle system (I&M 2003b).

The coal-fired generation alternative would necessitate the use of approximately 200 ha (500 ac) of the CNP site for the construction of the powerblock, coal storage area, and waste disposal area for a 20-year operating period (120 ha [300 ac] for powerblock and coal storage, 80 ha [200 ac] for ash and scrubber waste disposal [I&M 2003b]). Additional ash and scrubber sludge disposal needed for a 40-year operating period[a] would increase the size of land needed to approximately 280 ha (700 ac). An additional, undetermined amount of land would be required for the construction of cooling towers. During construction of the coal plant, it is likely that the land requirements would exceed the 260 ha (650 ac) size of the existing CNP site, which would necessitate the acquisition of additional land adjacent to the site. No new construction would be needed for coal and lime delivery. In the ER, I&M assumed coal and lime would be delivered by rail after upgrading the existing rail line spur into CNP (I&M 2003b).

Locating the plant at an alternate site may require more site acreage than locating the plant at CNP to provide for additional onsite support infrastructure and buffer areas. The NRC estimate for the construction of a 1000 MW(e) coal-fired plant is 700 ha (1700 ac) (NRC 1996). This

(a) Only half of the land area needed for by-product disposal is directly attributable to the alternative of renewing the CNP, Units 1 and 2, OLs for 20 years.

Table 8-2. Summary of Environmental Impacts of Coal-Fired Generation at the CNP Site and an Alternate Site Using Closed-Cycle Cooling[a]

	CNP Site		Alternate Site	
Impact Category	**Impact**	**Comments**	**Impact**	**Comments**
Land use	MODERATE to LARGE	Uses approximately 200 ha (500 ac) of developed and undeveloped land for plant, waste disposal, and rail spur over 20-year period, and 280 ha (700 ac) over a 40-year period. Additional land needed for cooling tower construction.	MODERATE to LARGE	Uses approximately 1310 ha (3237 ac). Additional land (amount dependent on site chosen) likely needed for 345-kV transmission line and rail spur.
Ecology	MODERATE to LARGE	Uses developed and undeveloped areas at current CNP site and additional undeveloped land adjacent to the site (see land use for acreage). Impacts dependent on specific location and ecology of site. Impacts to terrestrial ecology from cooling tower drift are expected. Impacts to aquatic ecology are reduced because the replacement of surface water cooling by cooling towers reduces thermal discharge and intake impacts on entrainment and impingement of fish, although some impacts still expected from intake of makeup water.	MODERATE to LARGE	Impact depends on location and ecology of the site, surface-water body used for intake and discharge, and transmission line route. Impacts to terrestrial and aquatic ecology similar to but probably larger than those listed for CNP site.
Water use and quality–surface water	SMALL	Partial use of existing intake and discharge structures, although additional cooling infrastructure will be needed. Discharge of cooling tower blowdown containing increased dissolved solids and intermittent low concentrations of biocides, as well as waste water discharge, would be released to Lake Michigan. Operational impacts similar to or less than CNP.	SMALL to MODERATE	Impact will 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.

Table 8-2. (contd)

	CNP Site		Alternate Site	
Impact Category	**Impact**	**Comments**	**Impact**	**Comments**
Water use and quality–groundwater	SMALL	Groundwater use at CNP is unlikely because the CNP site has adequate surface water available from Lake Michigan and water requirements are less for closed-cycle cooling. Therefore, groundwater use and quality are unlikely to be affected at CNP.	SMALL to MODERATE	Impact depends on the volume of water withdrawn and discharged and the characteristics of the aquifers.
Air quality	MODERATE	Sulfur oxides • 4547 MT/yr (4475 tons/yr) Nitrogen oxides • 1841 MT/yr (1812 tons/yr) Particulates • 247 MT/yr (243 tons/yr) of total suspended particulates • 57 MT/yr (56 tons/yr) of PM_{10} Carbon monoxide • 1841 MT/y (1812 tons/yr) Small amounts of mercury and other hazardous air pollutants and naturally occurring radioactive materials, mainly uranium and thorium. Unregulated CO_2 emissions could contribute to global warming.	MODERATE	Potentially same impacts as the CNP site, although pollution control standards may vary depending on location.
Waste	MODERATE	Total waste volume after recycling would be approximately 600,000 MT/yr (591,000 tons/yr) of ash and scrubber sludge requiring approximately 163 ha (403 ac) for disposal during the 40-year life of the plant. Land offsite would have to be obtained in addition to onsite facilities for waste disposal. Debris would be generated and removed during construction.	MODERATE	Same impacts as the CNP site; waste disposal constraints may vary.
Human health	SMALL	Human health risks from inhalation of toxins and particulates are possible but difficult to quantify. Radiological doses from uranium and thorium discharge likely to be greater than current CNP operations.	SMALL	Same impact as the CNP site.

Table 8-2. (contd)

	CNP Site		Alternate Site	
Impact Category	**Impact**	**Comments**	**Impact**	**Comments**
Socioeconomics	SMALL to MODERATE	Up to 2500 construction workers during the peak of the 5-year construction period could create temporary demands on housing and public services. There would be a decrease from 1200 CNP workers to a new plant workforce of 350. Berrien County would experience a reduced demand on socioeconomic resources, as well as a loss of tax base and employment, potentially offset by the proximity of the site to South Bend, Indiana.	SMALL to LARGE	Construction impacts depend on location. There would be an influx of up to 2500 temporary construction jobs during the peak of a 5-year construction period. Operation of the plant would result in 350 permanent jobs. Berrien County could experience an even greater loss of tax base and employment than if the CNP site were chosen; there could be a total loss of 1200 jobs, as opposed to 850 jobs, if the alternate site were not in Berrien County.
Transportation	SMALL to LARGE	Transportation impacts associated with construction workers could be MODERATE, with up to 2500 transient workers during the peak period. Impacts during operation would be SMALL, with a workforce reduced by 850 commuters compared to CNP operations. For rail transportation of coal and lime, the impact is considered MODERATE to LARGE, with 340 trains/yr.	SMALL to LARGE	Transportation impacts associated with construction workers could range from MODERATE to LARGE, depending on the site. Transportation impacts associated with workers at the coal-fired plant range from SMALL to MODERATE, depending on the site. For rail transportation of coal and lime, the impact is considered MODERATE to LARGE, depending on the site.

Table 8-2. (contd)

	CNP Site		Alternate Site	
Impact Category	**Impact**	**Comments**	**Impact**	**Comments**
Aesthetics	MODERATE to LARGE	Aesthetic impact due to the addition 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; and rail transportation of coal and lime would result in MODERATE noise impacts.	MODERATE to LARGE	Impacts would be similar to the CNP site with additional impact from the new 345-kV transmission line and railroad spur that would be needed.
Historic and archaeological resources	SMALL to MODERATE	Some construction would affect previously developed parts of CNP site; cultural resource inventory 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 850 operating jobs 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 LARGE	Impacts will vary depending on population distribution and makeup at the site.

(a) Additional offsite impacts would occur from coal and limestone mining operations.

estimate would be scaled up to accommodate the 1872 MW(e) capacity of the proposed coal-fired alternative (i.e., 1310 ha or 3237 ac). A new 345-kV transmission line would be needed to connect existing lines to I&M customers in eastern and northern Indiana and a portion of southwestern Michigan. The length of the line would be dependent upon the new site location. Up to 70 ha (160 ac) could also be needed for a rail spur for coal and lime delivery, assuming that the alternate site location is within 16 km (10 mi) of the nearest railway connection.

The impact of a coal-fired generating unit with a closed-cycle cooling system on land use at the existing CNP site or at an alternate site is best characterized as MODERATE to LARGE. The impact would be greater than the OL renewal alternative.

Ecology

Locating a coal-fired plant at the CNP site would impact ecological resources because of the need for roughly 200 ha (500 ac) of land for powerblock construction, coal storage, and ash and scrubber sludge disposal over a 20-year period. An additional 81 ha (200 ac) of land would be needed for additional onsite waste disposal over a 40-year plant operating life. Some of this land would have been previously disturbed. However, the coal-fired alternative at the CNP site would also use undeveloped areas of the site, which is primarily heavily wooded sand dunes (I&M 2003b). Additional land acquisition would be necessary to accommodate the coal-fired alternative. Cooling tower drift could result in some minor impacts to terrestrial ecology. The use of cooling towers to replace surface-water cooling would reduce thermal discharge and the entrainment and impingement of fish.

Because the CNP site area was determined to be inadequate for the coal-fired alternative and the acquisition of additional undisturbed land adjacent to the site is likely to be necessary, the staff considers the ecological impacts of a new coal-fired plant with a closed-cycle cooling system at the CNP site to be MODERATE to LARGE.

Coal-fired generation at an alternate site would result in construction and 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 cause entrainment and impingement of fish, resulting in adverse impacts on aquatic resources. If needed, construction and maintenance of an electric power transmission line and a rail spur 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 CNP OLs and probably greater than construction of a coal-fired plant at the CNP site.

Water Use and Quality

<u>Surface Water</u>. Coal-fired generation at the CNP site would use water from Lake Michigan for cooling. It is possible that some of the existing intake and discharge structures could be used, but the construction of additional cooling infrastructure would be needed to accommodate a closed-cycle cooling system. Cooling water demands would be reduced in comparison with the once-through cooling system currently in use. Plant discharges would consist mostly of cooling

tower blowdown, characterized primarily by an increased temperature and concentration of dissolved solids relative to the receiving water body and intermittent low concentrations of biocides (e.g., chlorine). Treated process waste streams and sanitary waste water may also be discharged. All discharges would be regulated by the State of Michigan. There would be a consumptive use of water. Some erosion and sedimentation would likely occur during construction (NRC 1996). Some impacts to water quality are possible offsite from coal mining operations. The staff considers the impacts to surface-water use and quality of a new coal-fired plant with a closed-cycle cooling system located at the CNP site to be SMALL.

Alternate sites would likely use a closed-cycle cooling system with cooling towers. For alternate sites, the impact on 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.

<u>Groundwater</u>. Use of groundwater at the CNP site is unlikely because adequate surface water is available from Lake Michigan and water requirements are much less for a closed-cycle system than the existing once-through cooling system. 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. Overall, impacts to groundwater use and quality of a coal-fired plant with a closed-cycle cooling system at the CNP site are considered SMALL and the impacts to groundwater use and quality of such a plant at an alternate site are considered SMALL to MODERATE, depending on the volume of groundwater withdrawn.

Air Quality

The air quality impacts of coal-fired generation differ considerably from those of nuclear generation because the burning of coal emits sulfur oxides (SO_x), nitrogen oxides (NO_x), particulates, carbon monoxide, hazardous air pollutants such as mercury, and naturally occurring radioactive materials.

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

The 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 CAA. 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 Berrien County (EPA 2004a).

Section 169A of the CAA 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. EPA issued a new regional haze rule on July 1, 1999 (64 FR 35714) (EPA 1999). The rule specifies that for each mandatory Class I area, the State must establish goals that provide for reasonable progress towards achieving natural visibility conditions. The reasonable progress goals must provide for an improvement in visibility for the most-impaired days over the period of the implementation plan and ensure no degradation in visibility for the least-impaired days over the same period [40 CFR 51.308(d)(1)]. If a coal-fired plant were located close to a mandatory Class I area, additional air pollution control requirements could be imposed. Isle Royale National Park and Seney National Wildlife Refuge are Class I areas in Michigan where visibility is an important value (40 CFR 81.414). Both of these areas are located in the upper peninsula of Michigan and air quality in these areas would not be affected by a coal-fired plant in the vicinity of CNP.

In 1998, EPA issued a rule requiring 22 eastern states, including Michigan, to revise their state implementation plans to reduce NO_x emissions. NO_x emissions contribute to violations of the national ambient air quality standard for ozone. 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 set out at 40 CFR 51.121(e). For Michigan, the amount is 233,388 MT (229,702 tons).

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

Sulfur oxides emissions. A new coal-fired power plant would be subject to the requirements in Title IV of the CAA. Title IV was enacted to reduce emissions of SO_2 and NO_x, the two principal precursors of acid rain, by restricting emissions of these pollutants from power plants. Title IV caps aggregate annual power plant SO_2 emissions and imposes controls on SO_2 emissions through a system of marketable allowances. 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.

To be in compliance with the CAA, I&M would use AEP Energy Services, which markets and trades SO_2 credits, to secure enough credits to operate a coal-fired plant at CNP (I&M 2003b).

I&M estimates that by using the best technology to minimize SO_x emissions, the total annual stack emissions would be approximately 4547 MT (4475 tons) of SO_x (I&M 2003b).

Regardless, SO_2 emissions would be greater for the coal-fired power plant alternative than the OL renewal alternative.

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

I&M estimates that by using low 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 1841 MT (1812 tons) (I&M 2003b). This level of NO_x emissions would be greater than the OL renewal alternative.

Particulate emissions. I&M estimates that the total annual stack emissions would include 247 MT (243 tons) of filterable total suspended particulates and 57 MT (56 tons) of particulate matter having an aerodynamic diameter less than or equal to 10 μm (PM_{10}) (40 CFR 50.6). Fabric filters or electrostatic precipitators would be used for control. In addition, coal-handling equipment would introduce fugitive particulate emissions. Particulate emissions would be greater under the coal-fired power plant alternative than the OL renewal alternative.

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

Carbon monoxide emissions. I&M estimates that the total carbon monoxide emissions would be approximately 1841 MT (1812 tons) per year for a coal-fired power plant (I&M 2003b). This level of emissions is greater than the OL renewal alternative.

Hazardous air pollutants including mercury. In December 2000, EPA issued regulatory findings on emissions of hazardous air pollutants from electric utility steam-generating units (EPA 2000a). EPA determined that coal- and oil-fired electric utility steam-generating units are significant sources of hazardous air pollutants. Coal-fired power plants were found by EPA to emit arsenic, beryllium, cadmium, chromium, dioxins, hydrogen chloride, hydrogen fluoride, lead, manganese, and mercury (EPA 2000a). EPA concluded that mercury is the hazardous air pollutant of greatest concern. 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 individuals who rely on fish for subsistence) are believed to be at potential risk of adverse health effects due to mercury exposures (EPA 2000a). Accordingly, EPA added coal- and oil-fired electric utility steam-generating units to the list of source categories under Section 112(c) of the CAA for which emission standards for hazardous air pollutants will be issued (EPA 2000a).

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

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

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

Siting a coal-fired power plant at an alternate site would not significantly change air quality impacts from those described above, although it could result in installing more or less stringent pollution control equipment to meet applicable local requirements. Therefore, the impacts would be MODERATE.

Waste

Coal combustion generates waste in the form of ash, and equipment for controlling air pollution generates additional ash and scrubber sludge. Three 624-MW(e) coal-fired plants would generate approximately 729,000 MT (717,000 tons) of this waste annually for 40 years. I&M recycles 26 percent of its coal ash, 128,000 MT (126,000 tons) per year (I&M 2003b). The remaining 600,000 MT (591,000 tons) of waste would be disposed of onsite, and on additional land acquired outside of the existing site, accounting for approximately 163 ha (403 ac) of land area over an estimated 40-year plant life. Debris would be generated during construction activities.

Waste impacts to groundwater and surface water could extend beyond the operating life of the plant if leachate and runoff from the waste storage area occurs. Disposal of the waste could noticeably affect land use and groundwater quality, but with appropriate management and monitoring, it would not destabilize any resources. After closure of the waste site and revegetation, the land could be available for other uses. Because of the limited acreage of the CNP site, an additional offsite waste disposal area would need to be identified.

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

Siting the facility at an alternate site would not alter waste generation, although other sites might have more constraints on disposal locations.

On the basis of these considerations, the staff concludes that the impacts from waste generated using closed-cycle cooling at either the CNP site or at an alternate site would be MODERATE; the impacts would be clearly noticeable, but would not destabilize any important resource.

Human Health

Coal-fired power generation introduces human health risks from fuel and limestone mining; fuel and lime transportation; disposal of coal combustion waste; and 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 associated inhalation risks.

In the GEIS, the staff stated that there could be human health effects (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 EPA and State agencies, set air emission standards and requirements based on human health effects. These agencies also impose site-specific emission limits as needed to protect human health. As discussed previously, EPA has recently concluded that certain segments of the U.S. population (e.g., the developing fetus and individuals who rely on fish for subsistence) 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 effects from radiological doses and inhaling toxins and particulates generated by burning coal at either the CNP site or an alternate site are characterized as SMALL.

Socioeconomics

Construction of the coal-fired alternative would take approximately 5 years. Due to size limitations of the CNP site, additional land would be needed beyond the site. The workforce would be expected to vary between 1200 and 2500 workers during the 5-year construction period (NRC 1996). During construction, the surrounding communities would experience demands on housing and public services that could have MODERATE impacts depending upon the actual size of the workforce. These impacts would be tempered by construction workers commuting to the site from other parts of Berrien County or from other counties.

If the coal-fired plant were constructed at the CNP site and Units 1 and 2 were shut down, there would be a loss of approximately 850 permanent high-paying jobs (from 1200 for two nuclear units to 350 for the coal-fired plant), with a commensurate reduction in demand on socioeconomic resources and contribution to the regional economy. However, the mitigating influence of the site's proximity to South Bend, Indiana, could temper or offset the projected loss of jobs from the closure of Units 1 and 2. The coal-fired plants would provide a new tax base to partially offset the loss of tax base associated with closure of the nuclear units. For these reasons, the appropriate characterization of socioeconomic impacts for a coal-fired plant constructed at the CNP site would be SMALL to MODERATE.

Construction of a replacement coal-fired power plant at an alternate site would relocate some socioeconomic impacts, but would not eliminate them. The communities around CNP would still experience the impact from loss of jobs associated with operation of CNP Units 1 and 2, and the communities around the new site would have to absorb the impacts of a large, temporary workforce (up to 2500 workers at the peak of construction) and a permanent workforce of approximately 350 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 impacts could range from SMALL to LARGE.

Transportation

During the 5-year construction period, up to 2500 construction workers could be commuting to the site, placing significant traffic loads on existing highways. Such impacts would be MODERATE.

For transportation related to commuting of plant operating personnel, the impacts are considered SMALL. The maximum number of plant operating personnel would be approximately 350. The current CNP Units 1 and 2 workforce is approximately 1200. Therefore, traffic impacts associated with plant personnel commuting to a coal-fired plant would be expected to be SMALL compared to the current impacts from CNP Units 1 and 2 operations.

For rail transportation related to coal and lime delivery to a coal-fired plant at the CNP site, the impacts are considered MODERATE to LARGE. Approximately 340 trains per year would be needed to deliver the coal and lime for the three coal-fired units. A total of 13 train trips is expected per week, or nearly 2 trips per day, because there would be a corresponding empty train for each full train delivery. On several days per week, there could be three trains per day using the rail spur to the CNP site.

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 are 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

If sited at CNP, the three coal-fired power plant units could be as much as 61 m (200 ft) tall and visible in daylight hours over many miles. The three exhaust stacks would be somewhere in the range of 120 to 185 m (400 to 600 ft) high. Cooling towers and associate plumes would also have an aesthetic impact. Natural draft towers could be up to 160 m (520 ft) high. Mechanical draft towers could be up to 30 m (100 ft) high. The units, associated stacks and towers 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 and appropriate use of light shielding. Overall, the coal-fired units and the associated exhaust stacks and cooling towers at the CNP site would likely have a MODERATE to LARGE aesthetic impact.

Coal-fired generation would introduce 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 and mechanical draft 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. The incremental noise impacts of a coal-fired plant compared to existing CNP Units 1 and 2 operations are considered to be MODERATE.

Noise impacts associated with rail delivery of coal and lime to a plant at CNP 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.

At an alternate site, there would be an aesthetic impact from the buildings, exhaust stacks, cooling towers, and the plume associated with the cooling towers. There could be a significant aesthetic impact associated with construction of a new 345-kV transmission line. The new line would connect to existing lines in order to transmit power to I&M's customers in northern and eastern Indiana, and a portion of southwestern Michigan. The length of that transmission line would be dependent on the location of the site. Noise and light from the plant would be detectable offsite. Aesthetic impacts at the plant site would be mitigated if the plant were located in an industrial area adjacent to other power plants. Noise impacts from a rail spur, if required, would be similar to the impacts at the existing site. Overall the aesthetic impacts associated with locating at an alternate site can be categorized as MODERATE to LARGE. The greatest contributor to aesthetic impact would be the new transmission line.

Historic and Archaeological Resources

Before construction or any ground disturbance at the CNP site or an alternate site, studies would likely be needed to identify, evaluate, and address mitigation of the potential impacts to cultural resources. The studies would likely be needed for all areas of potential disturbance at the proposed plant site and along associated corridors where new construction would occur (e.g., roads, transmission corridors, rail lines, or other ROWs). 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 impacts from subsequent ground-disturbing actions related to physical expansion of the plant site.

Historic and archaeological resource impacts must be evaluated on a site-specific basis. The impacts can be effectively managed, and as such, the categorization of impacts could vary between SMALL and MODERATE, depending on what resources are present, and whether mitigation is necessary.

Environmental Justice

No disproportionately high and adverse environmental impacts on minority and low-income populations have been identified for a replacement coal-fired plant at the CNP site. Some impacts on housing availability and prices during construction might occur, and this could disproportionately affect the minority and low-income populations. Closure of CNP Units 1 and 2 would result in a decrease in employment of approximately 850 operating employees, possibly offset by the proximity of the site to South Bend, Indiana. Following construction, it is possible that the ability of local government to maintain social services could be reduced at the same time as diminished economic conditions reduce employment prospects for minority or low-income populations. Overall, impacts would be SMALL to MODERATE, and would depend on the ability of minority or low-income populations to commute to other jobs outside the Berrien County area.

Impacts at other sites would depend upon the site chosen and the nearby population distribution. These impacts could range from SMALL to LARGE.

8.2.1.2 Once-Through Cooling System

The environmental impacts of constructing a coal-fired power plant at the CNP site using once-through cooling were considered by the staff. In general, the impacts (SMALL, MODERATE, or LARGE) of this option are similar to 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.

Differences result primarily from the increased water intake needed for a once-through cooling system and its associated impacts and the elimination of cooling tower construction and operation impacts.

Table 8-3. Summary of Environmental Impacts of Coal-Fired Generation at the CNP Site and an Alternate Site Using a Once-Through Cooling System[(a)]

	CNP Site		Alternate Site	
Impact Category	Impact	Comparison with Closed-Cycle Cooling System	Impact	Comparison with Closed-Cycle Cooling System
Land use	MODERATE to LARGE	10 to 12 ha (25 to 30 ac) less land required because cooling towers and associated infrastructure are not needed.	MODERATE to LARGE	10 to 12 ha (25 to 30 ac) less land required because cooling towers and associated infrastructure are not needed.
Ecology	MODERATE to LARGE	Slightly less loss of terrestrial habitat and elimination of potential cooling tower impacts. Increased water withdrawal and thermal discharge, but aquatic impacts would be similar to current CNP operations with regard to entrainment and impingement of fish.	MODERATE to LARGE	Slightly reduced habitat loss, and no impacts to terrestrial resources from cooling towers, but increased water withdrawal and thermal discharge may impact aquatic resources.
Water use and quality–surface water	SMALL to MODERATE	No discharge of cooling tower blowdown. Increased water withdrawal and more thermal load on receiving body of water.	SMALL to LARGE	Impact will depend on the characteristics of the surface water body, volume of water withdrawn, and characteristics of the discharge. No impact from cooling water blowdown.
Water use and quality–groundwater	SMALL	Groundwater use is not likely because CNP has adequate surface water available from Lake Michigan.	SMALL to MODERATE	It is unlikely that groundwater would be used for a once-through cooling system but could be used for makeup water and sanitary water discharge.
Air quality	MODERATE	No change.	MODERATE	No change.
Waste	MODERATE	No change.	MODERATE	No change.
Human health	SMALL	No change.	SMALL	No change.
Socioeconomics	SMALL to MODERATE	No change.	SMALL to LARGE	No change.
Transportation	SMALL to LARGE	No change.	SMALL to LARGE	No change.
Aesthetics	MODERATE	Reduced aesthetic impact because cooling towers would not be used.	MODERATE	Reduced aesthetic impact because cooling towers would not be used.

Table 8-3. (contd)

	CNP Site		Alternate Site	
Impact Category	**Impact**	**Comparison with Closed-Cycle Cooling System**	**Impact**	**Comparison with Closed-Cycle Cooling System**
Historic and archaeological resources	SMALL to MODERATE	Less land impacted, but otherwise no change.	SMALL to MODERATE	Less land impacted, but otherwise no change.
Environmental justice	SMALL to MODERATE	No change.	SMALL to LARGE	No change.

(a) Additional offsite impacts would occur from coal and limestone mining operations.

8.2.2 Natural Gas-Fired Generation

The environmental impacts of the natural gas-fired alternative are examined in this section for both the CNP site and an alternate site. The evaluation of the impacts from the use of a closed-cycle cooling system are included in Section 8.2.2.1, the impacts from an open-cycle cooling system are considered in Section 8.2.2.2.

The existing switch yard and transmission lines would be used for the gas-fired power plant alternative at the CNP site. For the purposes of analysis, I&M has assumed that it would provide gas through AEP Resources, Inc. Five miles of buried 40 cm (16 in.) gas pipeline would be constructed along the existing ROWs (I&M 2003b).

If a new natural gas-fired plant were built at an alternate site to replace CNP Units 1 and 2, a new pipeline would have to be constructed from the plant site to a supply point where a reliable supply of natural gas would be needed. In addition, a new 345-kV transmission line would have to be constructed to transmit power to I&M customers in northern and eastern Indiana and a portion of southwestern Michigan. The length of the line would be dependent on the site location.

The staff assumed that a replacement natural gas-fired plant would use combined-cycle technology (I&M 2003b). 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.

I&M assumed four 468-MW(e) units, having a total capacity of 1872 MW(e), as the gas-fired alternative at the CNP site (I&M 2003b). Although this configuration results in approximately 13 percent less power generation than the existing 2161 MW(e) capacity of CNP, it ensures against overestimating environmental impacts from the alternatives. I&M estimates that the plant would consume approximately 94.3 billion ft^3 of gas annually (I&M 2003b).

Unless otherwise indicated, the assumptions and values used in Section 8.2.2 are from the applicant's ER (I&M 2003b). The staff reviewed this information and compared it to environmental impact information in the GEIS. Although the OL renewal period is only 20 years, the impact of operating the natural gas-fired alternative for 40 years is considered (as a reasonable projection of the operating life of a natural gas-fired plant).

In addition to the impacts discussed below for a gas-fired plant at either the CNP site or an alternate site, impacts would occur offsite as a result of gas production and transportation. Impacts of production operations 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 production and distribution. In the GEIS, it was estimated that approximately 45 ha (110 ac) would be needed for the construction of a 1000 MW(e) gas-fired plant (NRC 1996). Proportionately more land would be needed for the construction of a 1872 MW(e) plant. (A total of 84 ha [208 ac] would be needed.) The land impacted by the construction of a new transmission line to transmit power to I&M customers is dependent on the site location chosen.

Regardless of where the gas-fired plant is built, 1500 ha (3600 ac) would be required for natural gas wells, collection stations, and pipelines (NRC 1996). Partially offsetting these offsite land requirements would be the elimination of the need for uranium mining to supply fuel for Units 1 and 2. In the GEIS (NRC 1996), the staff estimated that approximately 400 ha (1000 ac) would be affected by uranium mining and processing during the operating life of a nuclear power plant. Overall, land-use impacts of constructing and operating a gas-fired plant at either the CNP site or an alternate site would be MODERATE to LARGE.

8.2.2.1 Closed-Cycle Cooling System

The overall impacts of the natural gas-fired power plant alternative are discussed in the following sections and summarized in Table 8-4. The extent of impacts at an alternate site would depend on the location of the particular site selected.

Table 8-4. Summary of Environmental Impacts of Natural Gas-Fired Generation at the CNP Site and an Alternate Site Using Closed-Cycle Cooling[(a)]

	CNP Site		Alternate Site	
Impact Category	**Impact**	**Comments**	**Impact**	**Comments**
Land use	MODERATE to LARGE	Uses approximately 45 ha (110 ac) for powerblock, offices, roads, and parking areas. Additional impact of up to approximately 35 to 40 ha (90 to 100 ac) for easements for a new gas pipeline.	MODERATE to LARGE	Uses approximately 84 ha (208 ac) for powerblock, 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 developed and undeveloped areas, plus construction of gas pipeline (see land use for acreage). Impacts dependent on specific location and ecology of the site. Impacts to terrestrial ecology from cooling tower drift are expected. Impacts to aquatic ecology are reduced because the replacement of surface-water cooling by cooling towers reduces thermal discharge and intake impacts on entrainment and impingement of fish, although some impacts still expected for intake of makeup water and discharge of cooling tower blowdown.	MODERATE to LARGE	Impact depends on location and ecology of the site, surface water body used for intake and discharge, and transmission and pipeline routes. Impacts to terrestrial and aquatic ecology similar to but probably larger than those listed for CNP site.
Water use and quality–surface water	SMALL	Uses part of the existing once-through cooling system. 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 the ROW during pipeline construction.	SMALL to MODERATE	Impact depends on volume of water withdrawal and discharge 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 the ROW during pipeline construction.

Table 8-4. (contd)

	CNP Site		Alternate Site	
Impact Category	**Impact**	**Comments**	**Impact**	**Comments**
Water use and quality–groundwater	SMALL	Use of groundwater at CNP is unlikely because the CNP site has adequate surface water available from Lake Michigan.	SMALL to MODERATE	Impact depends on volume of water withdrawn and discharged and the characteristics of the aquifer.
Air quality	MODERATE	Sulfur oxides • 166 MT/yr (163 tons/yr) Nitrogen oxides • 530 MT/yr (522 tons/yr) Particulates (PM_{10}) • 92 MT/yr (91 tons/yr) Carbon monoxide • 112 MT/yr (110 tons/yr) Some hazardous air pollutants. Unregulated CO_2 emissions could contribute to global warming.	MODERATE	Potentially same impacts as the CNP site, although pollution control standards may vary depending on location.
Waste	SMALL	Minimal waste from fuel production. Adequate land area for waste disposal is available at CNP site. Debris would be generated and removed during construction.	SMALL	Same impacts as CNP. 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. Therefore, impacts are expected to be SMALL.	SMALL	Same impacts as the CNP site.
Socioeconomics	SMALL to MODERATE	Up to 1200 construction workers during the peak of the 3-year construction period could create temporary demands on housing and public services. There would be a reduction in workers from 1200 CNP workers to a new plant workforce of 150. Berrien County would experience a reduced demand on socioeconomic resources as well as a loss of tax base and employment, potentially offset by the proximity of the site to South Bend, Indiana.	SMALL to MODERATE	Construction impacts depend on location, but could be greater than the CNP site if the plant is located in an area that is more rural. There would be up to 1200 temporary construction jobs during the peak of a 3-yr construction period. Operation of the plant would result in 150 permanent jobs. Berrien County could experience greater loss of tax base and employment than at the CNP site if the alternate site is outside of Berrien County.

Table 8-4. (contd)

	CNP Site		Alternate Site	
Impact Category	**Impact**	**Comments**	**Impact**	**Comments**
Transportation	SMALL to MODERATE	Transportation impacts associated with construction workers would be MODERATE as 1200 CNP workers and 1200 construction workers would be commuting to the site. Impacts during operation would be SMALL as the workforce is reduced to 150 commuters.	SMALL to MODERATE	Transportation impacts associated with 1200 construction workers and 150 plant workers would be MODERATE and SMALL, respectively.
Aesthetics	MODERATE to LARGE	Aesthetic impact due to addition of plant units, cooling towers, plume stacks, and gas pipeline compressors. Intermittent noise from construction, and commuter traffic and continuous noise from cooling towers and mechanical equipment would result in MODERATE impacts.	MODERATE to LARGE	Impacts would be similar to the CNP site with additional impact from the new 345-kV transmission line that would be needed.
Historic and archaeological resources	SMALL to MODERATE	Some construction would affect previously developed parts of CNP site; cultural resource inventory 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 1050 operating jobs at CNP 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 LARGE	Impacts vary depending on population distribution and makeup at site.

(a) Additional offsite impacts would be associated with gas extraction and distribution.

Land Use

For siting at CNP, 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 plant alternative with a closed-cycle cooling system would use the existing switchyard, offices, and transmission line ROWs. Much of the land that would be used has been previously disturbed. At CNP, the staff assumed that approximately 45 ha (110 ac) would be needed for the plant and associated infrastructure. There would be an additional impact for the construction of 8 km (5 mi) of buried 40-cm (16-in.) gas pipeline to CNP. The pipeline would require an additional 35 to 40 ha (90 to 100 ac) for an easement.

Ecology

At the CNP site, there would be ecological impacts related to habitat loss and cooling tower drift associated with siting of the gas-fired plant. Cooling makeup water and discharge could have aquatic resource impacts. Impacts due to habitat loss would be reduced through the use of previously impacted land. Ecological impacts at an alternate site would depend on the nature of the site and the possible need for a new gas pipeline or transmission lines. Construction of the transmission lines and construction or upgrading of the gas pipeline to serve the plant would be expected to have temporary ecological impacts. Best management practices during construction, such as minimizing soil loss and restoring vegetation immediately after the excavation is backfilled, would help to mitigate these impacts (I&M 2003b). At an alternate site, 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 gas-fired units would include a heat-recovery boiler from which steam would turn an electric generator. Steam would be condensed and circulated back to the boiler for reuse. A natural gas-fired plant with a closed cooling system with cooling towers sited at CNP would require the construction of additional cooling infrastructure, although it is possible that some of the existing intake and discharge structures could be used. Cooling water demands would be reduced in comparison with the once-through cooling system that CNP Units 1 and 2 currently use. Plant discharges would consist mostly of cooling tower blowdown, characterized primarily by an increased temperature and concentration of dissolved solids relative to the receiving water body and intermittent low concentrations of biocides. Treated process waste streams and sanitary waste water may also be discharged. All discharges would be regulated by the State of Michigan. There would be a consumptive use of water due to evaporation from the cooling towers. Construction of the pipeline could cause temporary erosion and sedimentation in streams crossed by the ROW. 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.

The staff assumed that a natural gas-fired plant at an alternate site would use a closed-cycle cooling system with cooling towers, and surface water would be used for cooling makeup water and discharge. Intake and discharge would involve relatively small quantities of water compared to the coal alternative. The impact on 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 CNP site. 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 was characterized in the GEIS as SMALL. The staff also noted in the GEIS that operational water quality impacts would be similar to, or less than, those from other generating technologies.

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 CNP site is unlikely because adequate surface water is available from Lake Michigan and water requirements are less for a closed-cycle system than the current once-through cooling system used for CNP Units 1 and 2. Therefore, impacts at the CNP site are expected to be SMALL. Impacts at an alternate site are expected to be SMALL to MODERATE, depending on site-specific conditions.

Air Quality

Natural gas is a relatively clean-burning fuel. Under the gas-fired alternative, the types of emissions would be similar to those produced under the coal-fired alternative, but in lesser quantities.

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

In 1998, EPA issued a rule requiring 22 eastern states, including Michigan, to revise their state implementation plans to reduce nitrogen oxide emissions. Nitrogen oxide emissions contribute to violations of the national ambient air quality standard (40 CFR 50.9) for ozone. The total amount of nitrogen oxides that can be emitted by each of the 22 states in the year 2007 from May 1 to September 30 is set out at 40 CFR 51.121(e). For Michigan, the amount is 233,388 MT (229,702 tons).

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 CAA.

Section 169A of the CAA 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. EPA issued a new regional haze rule July 1, 1999 (64 FR 35714) (EPA 1999). The rule specifies that for each mandatory Class I area, the State must establish goals that provide for reasonable progress towards achieving natural visibility conditions. The reasonable progress goals must provide for an improvement in visibility for the most impaired days over the period of the implementation plan and ensure no degradation in visibility for the least-impaired days over the same period [40 CFR 51.308(d)(1)]. If a natural gas-fired plant were located close to a mandatory Class I area, additional air pollution control requirements could be imposed.

I&M projects that the following emissions would be produced under the natural gas-fired alternative (I&M 2003b):

Sulfur oxides - 166 MT/yr (163 tons/yr)
Nitrogen oxides - 530 MT/yr (522 tons/yr)
Carbon monoxide - 112 MT/yr (110 tons/yr)
PM_{10} particulates - 92 MT/yr (91 tons/yr)

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

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

Construction of a gas-fired plant would result in temporary fugitive dust. Exhaust emissions would also come from vehicles and motorized equipment used during the construction process.

The amount and type of emissions produced would likely be the same at CNP 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 staff concludes that the overall air-quality impact for a new natural gas-fired plant sited at CNP or at an alternate site would be 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 staff concluded that waste generation from gas-fired power plants would be minimal (NRC 1996). Gas-fired plants produce 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 CNP or at an alternate site.

Human Health

In Table 8-2 of the GEIS, the staff identifies cancer and emphysema as potential health risks from gas-fired plants (NRC 1996). The risk may be attributable to NO_x emissions that contribute to ozone formation, which in turn contribute to health risks. NO_x emissions from any gas-fired plant would be regulated. For a plant sited in 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 health parameter. Overall, the impacts on human health of the natural gas-fired alternative sited at CNP 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 1200 workers (NRC 1996). The staff assumed that construction would take place while Units 1 and 2 continue operation and would be completed by the time they permanently cease operations. During construction, the communities surrounding the CNP site would experience temporary demands on housing and public services. These impacts would be tempered by construction workers commuting to the site from other parts of Berrien County or from other counties. After construction, the communities would be impacted by the loss of jobs. The current CNP Units 1 and 2 workforce (1200 workers) would decline through a decommissioning period. The gas-fired plant would introduce a replacement tax base at CNP or an alternate site and approximately 150 new permanent jobs. This would represent a net loss of 1050 jobs at the CNP site.

In the GEIS (NRC 1996), the staff concluded that socioeconomic impacts from constructing a natural gas-fired plant would not be very noticeable and that the small operational workforce would have the lowest socioeconomic impacts of any nonrenewable technology. Compared to 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 1050 permanent jobs (up to 1200 jobs if an alternate site is chosen outside of Berrien County) may be partially tempered by the proximity of CNP to South Bend, Indiana. For these reasons, socioeconomic impacts associated with construction and operation of a natural gas-fired power plant would be SMALL to MODERATE for siting at CNP or at an alternate site. Depending on other growth in the area, socioeconomic impacts could be noticed, but they would not destabilize any important socioeconomic attribute.

Transportation

Transportation impacts associated with construction include temporary commuter traffic for 1200 construction jobs and a subsequent 150 operating personnel commuting to the plant site and 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 CNP or at an alternate site.

Aesthetics

The turbine buildings (approximately 30 m [100 ft] tall) and exhaust stacks (approximately 38 m [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. Overall, the aesthetic impacts associated with construction and operation of a gas-fired plant at the CNP site are categorized as MODERATE to LARGE.

At an alternate site, the buildings, cooling towers, cooling tower plumes, and the associated gas pipeline compressors would be visible offsite. There would also be a visual impact from a new 345-kV transmission line. The length of the transmission line would be dependent on the site chosen. Aesthetic impacts would be mitigated if the plant were located in an industrial area adjacent to other power plants. 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 on any ground disturbance at CNP or an alternate site, studies would likely be needed to identify, evaluate, and address mitigation of the potential impacts to cultural resources. The studies would likely be needed for all areas of potential disturbance at the proposed plant site and along associated corridors where new construction would occur (e.g., roads, transmission and pipeline corridors, or other ROWs). 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 impacts from subsequent ground-disturbing actions related to physical expansion of the plant site.

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

Environmental Justice

No disproportionately high and adverse environmental impacts on minority and low-income populations have been identified for a natural gas-fired plant at the CNP site. Some impacts on housing availability and prices during construction might occur, and this could disproportionately affect minority and low-income populations. Closure of CNP Units 1 and 2 would result in a decrease in employment of approximately 1050 operating employees, possibly offset by the proximity of the site to South Bend, Indiana. 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. The ability of minority and low-income populations to commute to other jobs outside the Berrien County area could mitigate any adverse impacts.

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

8.2.2.2 Once-Through Cooling System

The environmental impacts of constructing a natural gas-fired generation system at CNP using once-through cooling were considered by the staff. In general, the impacts (SMALL, MODERATE, or LARGE) of this option are similar to 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.

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

Table 8-5. Summary of Environmental Impacts of Natural Gas-Fired Generation at the CNP Site and an Alternate Site Using a Once-Through Cooling System[a]

	CNP Site		Alternate Site	
Impact Category	**Impact**	**Comparison with Closed-Cycle Cooling System**	**Impact**	**Comparison with Closed-Cycle Cooling System**
Land use	MODERATE to LARGE	10 to 12 ha (25 to 30 ac) less land required because cooling towers and associated infrastructure are not needed.	MODERATE to LARGE	10 to 12 ha (25 to 30 ac) less land required because cooling towers and associated infrastructure are not needed.
Ecology	MODERATE to LARGE	Less terrestrial habitat lost and cooling tower impacts eliminated. Increased water withdrawal and thermal discharge, but aquatic impacts would be similar to current CNP operations with regard to entrainment and impingement of fish.	MODERATE TO LARGE	Impact would depend on ecology at the site. No impact to terrestrial ecology from cooling tower drift. Increased water withdrawal and thermal discharge and possible greater impact to aquatic ecology.
Water use and quality–surface water	SMALL to MODERATE	No discharge of cooling tower blowdown. Increased water withdrawal and more thermal load on receiving body of water.	SMALL to LARGE	Impact will depend on the characteristics of the surface water body, volume of water withdrawn, and characteristics of discharge. No discharge of cooling tower blowdown. Increased water withdrawal and more thermal load on receiving body of water.
Water use and quality–groundwater	SMALL	Groundwater use is not likely because the CNP site has adequate surface water available from Lake Michigan.	SMALL	It is unlikely that groundwater would be used for once-through cooling, but could be used for makeup cooling water and sanitary water discharge if surface water sources are not sufficient.
Air quality	MODERATE	No change.	MODERATE	No change.
Waste	SMALL	No change.	SMALL	No change.
Human health	SMALL	No change.	SMALL	No change.
Socioeconomics	SMALL to MODERATE	No change.	SMALL to MODERATE	No change.
Transportation	SMALL to MODERATE	No change.	SMALL to MODERATE	No change.

Table 8-5. (contd)

	CNP Site		Alternate Site	
Impact Category	**Impact**	**Comparison with Closed-Cycle Cooling System**	**Impact**	**Comparison with Closed-Cycle Cooling System**
Aesthetics	MODERATE to LARGE	Reduced aesthetic impact because cooling towers would not be used.	MODERATE to LARGE	Reduced aesthetic impact because cooling towers would not be used.
Historic and archaeological resources	SMALL to MODERATE	Less land impacted, but otherwise no change.	SMALL to MODERATE	Less land impacted, but otherwise no change.
Environmental justice	SMALL to MODERATE	No change.	SMALL to LARGE	No change.

(a) Additional offsite impacts would be associated with gas extraction and distribution.

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 NRC, the submission of the design certification applications indicates continuing interest in the possibility of licensing new nuclear power plants. Recent escalation in prices of natural gas and electricity have made new nuclear power plant construction more attractive from a cost standpoint. Additionally, System Energy Resources, Inc., Exelon Generation 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; Dominion 2003; Exelon 2003). Consequently, construction of a new nuclear power plant at either the CNP site or an alternate site is considered in this section. The staff assumed that the new nuclear plant would have a 40-year lifetime. Consideration of a new nuclear generating plant to replace CNP Units 1 and 2 was not included in the applicant's ER.

NRC has summarized environmental data associated with the uranium fuel cycle in Table S-3 of 10 CFR 51.51. The impacts shown in Table S-3 are representative of the impacts that would be associated with a replacement nuclear power plant built to one of the certified designs, sited at CNP or an alternate site. The impacts shown in Table S-3 are for a 1000-MW(e) reactor and would need to be adjusted to reflect the replacement of the 2161-MW(e) generated by CNP Units 1 and 2. The environmental impacts associated with transporting fuel and waste to and from a light-water cooled nuclear power reactor are summarized in Table S-4 of 10 CFR 51.52. The summary of NRC's findings on NEPA issues for license renewal of nuclear power plants in Table B-1 of 10 CFR Part 51, Subpart A, Appendix B, is also relevant, although not directly applicable, to 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 in Section 8.2.3.2.

In addition to the impacts discussed below for a nuclear plant at either the CNP site or an alternate site, impacts would occur offsite as a result of uranium mining. Impacts of mining 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. 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 for Units 1 and 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.

Land Use

The existing facilities and infrastructure at the CNP site would be used to the extent practicable, limiting the amount of new construction that would be required. Specifically, the staff assumed that a replacement nuclear power plant would use the existing switchyard, offices, and transmission line ROWs. Much of the land that would be used has been previously disturbed. A replacement nuclear power plant at the CNP site would alter approximately 200 to 400 ha (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 CNP 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 site boundaries or CNP Units 1 and 2 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 CNP except for the land needed for a new 345-kV transmission line to connect I&M customers in northern and eastern Indiana and a portion of southwestern 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.

Table 8-6. Summary of Environmental Impacts of New Nuclear Power Generation at the CNP Site and an Alternate Site Using Closed-Cycle Cooling[(a)]

	CNP Site		Alternate Site	
Impact Category	Impact	Comments	Impact	Comments
Land use	MODERATE to LARGE	Requires approximately 200 to 400 ha (500 to 1000 ac) for the plant. Would likely require acquisition of additional land.	MODERATE to LARGE	Same as CNP site plus additional land for transmission line.
Ecology	MODERATE to LARGE	Uses developed and undeveloped areas at current CNP site and additional undeveloped land adjacent to site (see land use for acreage). Impacts dependent on specific location and ecology of site. Impacts to terrestrial ecology from cooling tower drift are expected. Impacts to aquatic ecology are reduced because the replacement of once-through cooling by cooling towers reduces thermal discharge and intake impacts on entrainment and impingement of the fish, although some impacts still expected from intake of makeup water.	MODERATE to LARGE	Impact depends on location and ecology of the site, surface water body used for intake and discharge, and transmission line route. Impacts to terrestrial and aquatic ecology similar to but probably larger than those listed for CNP site.
Water use and quality–surface water	SMALL	Uses existing cooling water intake system. Closed-cycle system would use less water than current CNP once-through system. Discharge of cooling tower blowdown containing increased dissolved solids and intermittent low concentrations of biocides would be released to Lake Michigan.	SMALL to MODERATE	Impact will 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 CNP site has adequate surface water available from Lake Michigan.	SMALL to MODERATE	Impact will depend on the volume of water withdrawn and discharged and the characteristics of the aquifer.

1 **Table 8-6. (contd)**

2

3		CNP Site		Alternate Site	
4 5	Impact Category	Impact	Comments	Impact	Comments
6	Air quality	SMALL to MODERATE	Fugitive emissions and emissions from vehicles and equipment during construction could be MODERATE. Small amount of emissions from diesel generators and possibly other sources during operation similar to current operation of CNP Units 1 and 2.	SMALL to MODERATE	Same impacts as the CNP site.
7	Waste	SMALL	Waste impacts for an operating nuclear power plant are described in 10 CFR 51, Appendix B, Table B-1. Debris would be generated and removed during construction.	SMALL	Same impacts as the CNP site.
8	Human health	SMALL	Human health effects for an operating nuclear power plant are described in 10 CFR 51, Appendix B, Table B-1.	SMALL	Same impacts as the CNP site.
9	Socioeconomics	SMALL to MODERATE	Up to 2500 workers during peak of the 6-year construction period. Operating workforce assumed to be similar to Units 1 and 2; tax base preserved.	SMALL to LARGE	Impacts depend on location. Impacts of up to 2500 temporary construction jobs and 1200 permanent jobs at a rural location could be LARGE. Berrien County could experience loss of tax base and employment if chosen location is outside of the county.
10	Transportation	SMALL to LARGE	Transportation impacts associated with 2500 construction workers in addition to 1200 CNP workers could be MODERATE to LARGE. Transportation impacts of 1200 commuting plant personnel during operation would be the same as current CNP operation, SMALL.	SMALL to LARGE	Impacts depend on location of site. Transportation impacts of 2500 construction workers could be MODERATE to LARGE. Transportation impacts of 1200 commuting plant personnel could be SMALL to MODERATE.
11	Aesthetics	SMALL to MODERATE	Aesthetic impact due to addition of containment buildings, cooling towers, and the plumes from the cooling towers would be SMALL. No exhaust stacks would be needed. 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 CNP site. Impacts would be less if site selected is next to an industrial area. Impacts would be greater if a nonindustrial site is selected. Additional visual impacts would occur from the new transmission line that would be needed.

Table 8-6. (contd)

	CNP Site		Alternate Site	
Impact Category	**Impact**	**Comments**	**Impact**	**Comments**
Historic and archaeological resources	SMALL to MODERATE	Some construction would affect previously developed parts of CNP site; cultural resource inventory 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 and public services may occur during construction. Employment impacts would be similar to the current operation of CNP Units 1 and 2.	SMALL to LARGE	Impacts will vary depending on population distribution and makeup at the site.

(a) Additional offsite impacts would occur as a result of uranium mining. There would be no net change in offsite impacts because the new plant would use the uranium otherwise intended for CNP Units 1 and 2.

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 CNP site would alter ecological resources because of the need to convert approximately 200 to 400 ha (500 to 1000 ac) of land to industrial use (NRC 1996). Some of this land would have been previously disturbed; however, it is likely that additional land would have to be acquired. Impacts on terrestrial ecology could result from cooling tower drift. Impacts to aquatic resources would result from intake of makeup water and the possible entrainment and impingement of fish and blowdown from the circulating water system affecting receiving water quality.

Siting at CNP would have a MODERATE to LARGE ecological impact that would be greater than renewal of the OLs for Units 1 and 2.

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 ecological conditions at the site.

Water Use and Quality

Surface Water. The replacement nuclear plant alternative at the CNP site would likely use cooling water from Lake Michigan. Even though it is possible that some of the existing intake and discharge structures could be used, the construction of additional cooling infrastructure will be needed for the conversion to a closed-cycle system. Plant discharges would consist mostly of cooling tower blowdown, characterized primarily by an increased temperature and concentration of dissolved solids relative to the receiving water body and intermittent low concentration of biocides (e.g., chlorine). Treated process waste streams and sanitary waste water may also be discharged. All discharges would be regulated by the State of Michigan through a permit. There would be consumption of water due to evaporation from the cooling towers. Some erosion and sedimentation would likely occur during construction (NRC 1996). Some impacts to water quality are possible offsite from uranium mining operations. 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 alternate sites. For alternate sites, the impact on the surface water would depend on the volume of water needed for makeup water, the discharge volume, and the characteristics of the receiving body of water. Discharges would be the same as those described above for the CNP site. 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. No groundwater is currently used for operation of CNP Units 1 and 2, and it is unlikely that groundwater would be used for an alternative nuclear power plant sited at CNP. Use of groundwater for a nuclear power plant sited at an alternate site is a possibility if surface-water resources are limited. Any groundwater withdrawal would require a permit from the local permitting authority.

Overall, the impacts to groundwater use and quality from a closed-cycle new nuclear alternative at the CNP 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.

Air Quality

Construction of a new nuclear plant sited at CNP or an alternate site would result in fugitive emissions during the 6-year construction period. Exhaust emissions would also be produced by vehicles and motorized equipment used during the construction process. Construction impacts 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 CNP Units 1 and 2 (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 for a plant sited at CNP or an alternate site are considered SMALL to MODERATE.

Waste

The waste impacts associated with operation of a nuclear power plant are described in Table B-1 of 10 CFR Part 51, Subpart A, Appendix B. In addition, 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 CNP would not alter waste generation. Therefore, the impacts would be SMALL.

Human Health

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

Siting the replacement nuclear power plant at a site other than CNP would not alter human health effects. 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, the 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 CNP site, or CNP Units 1 and 2 would have to be decommissioned before construction begins. During construction, the communities surrounding the CNP 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 Berrien County or from other counties.

The replacement nuclear units are assumed to have an operating workforce comparable to the 1200 workers currently working at CNP Units 1 and 2. The replacement nuclear units would provide a new tax base to offset the loss of tax base associated with decommissioning of CNP Units 1 and 2. For all of these reasons, the appropriate characterization of socioeconomic impacts for replacement nuclear units constructed at CNP would be SMALL to MODERATE; the socioeconomic impacts would be noticeable, but would be unlikely to destabilize socioeconomics in the area.

If a new nuclear power plant were constructed at an alternate site, the communities around the CNP site would experience the impact of CNP Units 1 and 2 operational job loss. 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 1200 workers. In the GEIS (NRC 1996), the staff indicated that socioeconomic impacts at a rural site would be larger than at an urban site because more of the peak construction 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 would be working at the CNP site, in addition to the 1200 workers at the CNP site if additional land is acquired for construction. 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 Units 1 and 2 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 CNP, other associated buildings, cooling towers, and cooling tower plumes would likely be visible in daylight hours over many miles. Natural draft towers could be up to 160 m (520 ft) high. Mechanical draft towers could be up to 30 m (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.

Intermittent noise 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 was blowing in the direction of the listener. Mitigation measures, such as reduced or no use of outside loudspeakers, can be employed to reduce noise impacts to levels that would range 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 to connect to other lines to enable delivery of electricity to eastern and northern Indiana and portions of southern Michigan. 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 alternate site can be categorized as MODERATE to LARGE. The greatest contributor to the aesthetic impact would be the new transmission line.

Historic and Archaeological Resources

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

Historic and archaeological resource impacts must be evaluated on a site-specific basis. The impacts can generally be effectively managed, and as such, the categorization of impacts could vary between SMALL and MODERATE, depending on what resources are present, and whether mitigation is necessary.

Environmental Justice

No disproportionately high and adverse environmental impacts on minority and low-income populations have been identified for a replacement nuclear plant at the CNP site. Some impacts on housing availability and prices during construction might occur, and this could disproportionately affect 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. The proximity of the site to South Bend, Indiana, and the ability of minority and low-income populations to commute to other jobs outside the Berrien County area could mitigate any adverse impacts.

Impacts at other sites would depend upon the site chosen and the nearby population distribution, but are likely to be SMALL to LARGE.

8.2.3.2 Once-Through Cooling System

The environmental impacts of constructing a nuclear power plant at the CNP site using once-through cooling were considered by the staff. In general, the impacts (SMALL, MODERATE, or LARGE) of this option would be similar to 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.

8.2.4 Purchased Electrical Power

If available, purchased power from other sources could potentially obviate the need to renew the CNP Units 1 and 2 OLs. AEP has entered into long-term purchase contracts to ensure firm capacity and energy (I&M 2003b). However, because these purchases have already been considered in the current and future capacity of AEP, it is unlikely that sufficient baseload, firm power supply would be available to replace the capacity of Units 1 and 2 (I&M 2003b).

The two-state region of Indiana and Michigan exported a net 22 TWh of electricity in 1999. Some of this exported power may be a result of purchase contracts, and would therefore prevent the possibility of using this power to replace the energy generated by CNP (I&M 2003b).

Imported power from Canada or Mexico is unlikely to be available for replacement of CNP Units 1 and 2 capacity. In Canada, 60 percent of the country's electrical generation capacity is derived from hydropower (EIA 2004). Canada plans to expand hydroelectric capacity, including large-scale projects (EIA 2004). Canada's nuclear generation is projected to increase from

Table 8-7. Summary of Environmental Impacts of a New Nuclear Power Plant Sited at the CNP Site and an Alternate Site Using a Once-Through Cooling System[(a)]

	CNP Site		Alternate Site	
Impact Category	**Impact**	**Comparison with Closed-Cycle Cooling System**	**Impact**	**Comparison with Closed-Cycle Cooling System**
Land use	MODERATE to LARGE	10 to 12 ha (25 to 30 ac) less land required because cooling towers and associated infrastructure are not needed.	MODERATE to LARGE	10 to 12 ha (25 to 30 ac) less land required because cooling towers and associated infrastructure are not needed.
Ecology	MODERATE to LARGE	Slightly less terrestrial habitat loss and no cooling tower drift. Increased water withdrawal and thermal discharge, but aquatic ecology impacts would be similar to current CNP operations with regards to entrainment and impingement of fish.	MODERATE to LARGE	Impact would depend on ecology at the site. No impact to terrestrial ecology from cooling tower drift. Increased water withdrawal and thermal discharge with possible greater impact to aquatic ecology.
Water use and quality–Surface water	SMALL to MODERATE	No discharge of cooling tower blowdown. Increased water withdrawal and more thermal load on receiving body of water, but similar to current CNP plant.	SMALL to LARGE	Impact will depend on the characteristics of the surface water body, volume of water withdrawn, and characteristics of discharge. No discharge of cooling tower blowdown. Increased water withdrawal and more thermal load on receiving body of water.
Water use and quality–Groundwater	SMALL	Groundwater use is not likely because the CNP site has adequate surface water available from Lake Michigan.	SMALL to MODERATE	It is unlikely that groundwater would be used for a once-through cooling system, but could be used for makeup water and sanitary water discharge.
Air quality	SMALL	No change.	SMALL	No change.
Waste	SMALL	No change.	SMALL	No change.
Human health	SMALL	No change.	SMALL	No change.
Socioeconomics	SMALL to MODERATE	No change.	SMALL to LARGE	No change.
Transportation	SMALL to LARGE	No change.	SMALL to LARGE	No change.
Aesthetics	MODERATE to LARGE	Reduced aesthetic impact because cooling towers would not be used.	MODERATE to LARGE	Reduced aesthetic impact because cooling towers would not be used.

Table 8-7. (contd)

	CNP Site		Alternate Site	
Impact Category	Impact	Comparison with Closed-Cycle Cooling System	Impact	Comparison with Closed-Cycle Cooling System
Historic and archaeological resources	SMALL to MODERATE	Less land impacted, but otherwise no change.	SMALL to MODERATE	Less land impacted, but otherwise no change.
Environmental justice	SMALL to MODERATE	No change.	SMALL to MODERATE	No change.

(a) Additional offsite impacts would occur as a result of uranium mining. There would be no net change in offsite impacts because the new plant would use the uranium otherwise intended for CNP Units 1 and 2.

approximately 10,000 MW (2001) to 15,200 MW in 2020 before reaching a forecasted decline to 12,400 MW in 2025 (EIA 2004). EIA projected that total gross U.S. imports of electricity from Canada and Mexico would gradually increase from 47.6 billion kWh in year 1999 to 68.7 billion kWh in year 2005 and then gradually decrease to 28.6 billion kWh in year 2020 (EIA 2000). It is unlikely that electricity imported from Canada or Mexico would be able to replace the CNP Units 1 and 2 capacity.

If power to replace CNP Units 1 and 2 capacity were to be purchased from sources within the United States or a foreign country, the generating technology would likely be one of those described in this SEIS and in the GEIS (probably coal, natural gas, 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 CNP Units 1 and 2 OLs. 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 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 CNP site for replacement of power generated by CNP Units 1 and 2 is considered in this section.

CNP is located in Michigan, however, most of the power generated by CNP is sold by I&M to customers in Indiana. Power generation in both states was considered in the applicant's ER

(I&M 2003b). Of the units supplying the electric industry's total installed generating capacity, 7.1 percent of the units in Michigan and 3.1 percent of the units in Indiana were oil-fired. 1.1 percent of Michigan's electric industry generation utilization was from oil while 0.7 percent of Indiana's electric industry generation utilization was from oil (I&M 2003b). 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 CNP 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 staff estimated that construction of a 1,000-MWe oil-fired plant would require about 120 acres (NRC 1996). Additionally, operation of an oil-fired plant would have environmental impacts (including impacts on the aquatic environment and air) that would be similar to those from a coal-fired plant (NRC 1996).

8.2.5.2 Wind Power

Wind power by itself is not suitable for large base-load 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 (less than 30 percent) (NRC 1996). Wind power, in conjunction with energy storage mechanisms, might serve as a means of providing base-load power. However, current energy storage technologies are too expensive for wind power to serve as a large base-load generator.

In order for an area to be suitable for current or future wind energy applications, it must be in a region designated wind power Class 3 or higher (DOE 2004a). While Indiana does not have sufficient wind resources for wind energy applications, Michigan has good wind resources along the coastal and offshore areas of lakes Erie, Huron, Michigan, and Superior (PNL 1986). However, the wind power class attenuates rapidly to Class 2 inland from the Great Lakes 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 60,700 ha (150,000 ac) per 1,000 MW(e) for wind power (NRC 1996). The CNP site, at approximately 263 ha (650 ac), is much 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 staff concludes that locating a wind-energy facility on or near the CNP 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 staff noted that by its nature, solar power is intermittent. Therefore, solar power by itself is not suitable for base-load capacity and is not a feasible alternative to license renewal of CNP. The average capacity factor of photovoltaic cells is about 25 percent, and the capacity factor for solar thermal systems is about 25 percent to 40 percent. Solar power, in conjunction with energy storage mechanisms, might serve as a means of providing base-load power. However, current energy storage technologies are too expensive to permit solar power to serve as a large base-load 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 to natural resources (wildlife habitat, land use, and aesthetic impacts) from construction of solar-generating facilities. As stated in the GEIS, land requirements are high–14,000 ha (35,000 ac) per 1000 MW(e) for photovoltaic and approximately 5700 ha (14,000 ac) per 1000 MW(e) for solar thermal systems. Neither type of solar electric system could be located within the CNP site due to area constraints, and both would have large environmental impacts at an alternate site.

Indiana and Michigan receive between approximately 2.8 to 3.3 kWh/m^2 of solar radiation per day, compared to 5.0 to 7.2 kWh/m^2 of solar radiation per day in areas of the western United States, such as California, which are most promising for solar technologies (NRC 1996). 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 CNP Units 1 and 2 OLs. Some solar power may substitute for electric power in rooftop and building applications. Implementation of nonrooftop solar generation on a scale large enough to replace CNP Units 1 and 2 would likely result in LARGE environmental impacts.

8.2.5.4 Hydropower

There are no remaining sites in Indiana or Michigan that would be environmentally suitable for a hydroelectric facility (INEL 1995; INEEL 1998). In Section 8.3.4 of the GEIS, the staff points out that hydropower's percentage of U.S. generating capacity is expected to decline because hydroelectric facilities have become difficult to site as a result of public concern about flooding, destruction of natural habitat, and alteration of natural river courses.

The staff estimated in the GEIS that land requirements for hydroelectric power are approximately 400,000 ha (1 million ac) per 1000 MW(e). Replacement of CNP Units 1 and 2 generating capacity would require flooding more than this amount of land. Due to the lack of suitable sites in the two-state region, and the large land-use and related environmental and ecological resource impacts associated with siting a hydroelectric facility large enough, the staff concludes that local hydropower is not a feasible alternative to CNP Units 1 and 2 OL renewal. Any attempts to site hydroelectric facilities large enough to replace CNP Units 1 and 2 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 Indiana or Michigan for geothermal capacity to serve as an alternative to CNP Units 1 and 2. The staff concludes that geothermal energy is not a feasible alternative to renewal of the CNP Units 1 and 2 OLs.

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; approximately 3,720,000 dry tons/yr are available in Michigan (DOE 2004d). It has been estimated by the National Renewable Energy Laboratory that 1100 kW(h) of electricity can be produced by one dry ton of wood residue. Therefore, 4.1 TWh and 1.9 TWh of electricity can be generated from wood residue in Indiana and Michigan, respectively (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 Indiana and Michigan are adequate, wood energy is not considered as a reasonable alternative to renewal of CNP Units 1 and 2 OLs because of the disadvantages of a 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 process raw municipal solid waste "as is," with little or no sizing, shredding, or separation before combustion.

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

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. EIA projects that 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 will 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), much smaller than needed to replace the 2161 MW(e) of CNP Units 1 and 2.

The initial capital costs for municipal solid-waste plants are greater than for comparable steam-turbine technology at wood-waste facilities. This is due to the need for specialized waste-separation and handling equipment for municipal solid waste (NRC 1996). Furthermore, estimates in the GEIS suggest that the overall level of construction impact from a waste-fired plant should be approximately the same as that for a coal-fired plant. Additionally, waste-fired plants have the same or greater operational impacts (including impacts on aquatic ecology, air, and waste disposal). Some of these impacts would be moderate, but still larger than the environmental impacts of renewal of CNP Units 1 and 2 OLs. Therefore, municipal solid waste would not be a feasible alternative to renewal of the CNP OLs.

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 (e.g., ethanol) or to gas. In the GEIS, the staff points out that none of these technologies has progressed to the point of being competitive on a large scale or of being reliable enough to replace a baseload plant such as CNP Units 1 and 2. For these reasons, such fuels do not offer a feasible alternative to renewal of the CNP Units 1 and 2 OLs.

8.2.5.9 Fuel Cells

Fuel cells work without combustion and its local 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 with 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. It can also be produced from electricity using electrolysis. Phosphoric acid fuel cells are the most mature fuel-cell technology, but they are in only the initial stages of commercialization. Phosphoric acid fuel cells are generally considered first-generation technology. These are commercially available at a cost of approximately $4000 to $4500 per kilowatt 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 (NWPPC 2000). At the present time, however, 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 CNP OLs.

8.2.5.10 Delayed Retirement

I&M has no current plans to retire any existing generating units in the region of CNP and expects to need additional capacity in the near future. I&M concluded in its ER that the environmental impacts of delayed retirement are similar to those for the coal- and gas-fired alternatives (I&M 2003b). For this reason, delayed retirement of other I&M generating units would not be a feasible alternative to renewal of the CNP Units 1 and 2 OLs.

8.2.5.11 Utility-Sponsored Conservation

As a result of conservation and DSM programs, an annual energy savings of approximately 31 GWh and peak demand reductions of 22 MW in winter and 10 MW in summer were achieved by I&M customers by the end of the year 2000 (I&M 2001). The viability of new or expanded DSM programs has decreased in recent years because increased competition in the electric utility industry, mandated energy efficiency standards, and years of customer education programs have made efficiency the normal practice. Therefore, base load forecasts reflect the effects of the utility-sponsored DSM programs. No new recruitment of DSM conservation program participants is projected beyond the year 2004. In total, only a 15-MW demand reduction in winter is estimated for I&M through 2020 (I&M 2001). Therefore, the conservation option by itself is not considered a reasonable replacement for the CNP OL renewal alternative.

8.2.6 Combination of Alternatives

Even though individual alternatives to CNP Units 1 and 2 might not be sufficient on their own to replace CNP Units 1 and 2 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, CNP Units 1 and 2 have a combined net electrical output of 2161 MW(e). For the coal- and natural gas-fired alternatives, the ER assumes three 624-MW(e) units and 4 standard 468-MW(e) units, respectively, as potential replacements for Units 1 and 2 (I&M 2003b). This approach is followed in this SEIS, although it results in some environmental impacts that are somewhat lower than if full replacement capacity were constructed.

There are many possible combinations of alternatives. Table 8-8 contains a summary of the environmental impacts of an assumed combination of alternatives consisting of a natural gas-fired plant with four standard 468-MW(e) units, a 40-MW wind power facility, and 249 MW in purchased power. The staff considered a natural gas-fired plant over a coal-fired plant because a comparison of impacts indicates a coal-fired plant would have greater impacts than a similar-sized gas-fired plant (see Tables 8-2 and 8-4). I&M has incorporated its DSM programs into its normal business operation and no new or expanded conservation programs would be instituted beyond 2004 (Section 8.2.5.11); therefore, DSM is not considered as 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 NRC and the cost of transporting the fuel would be very high.

Operation of a new natural gas-fired plant would result in increased emissions (compared to 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 within the region, nation, or another country as discussed in Section 8.2.4. The environmental impacts associated with purchased power are not shown in Table 8-8.

The staff concludes that it is very unlikely that the environmental impacts of any reasonable combination of generating and conservation options could be reduced to the level of impacts associated with renewal of the CNP OLs.

Table 8-8. Summary of Environmental Impacts of Combination of Alternatives at the CNP Site and an Alternate Site[a]

	CNP Site		Alternate Site	
Impact Category	**Impact**	**Comments**	**Impact**	**Comments**
Land use	MODERATE to LARGE	45 ha (110 ac) for powerblock, offices, roads, and parking areas for gas-fired plant and 2428 ha (6000 ac) of additional land offsite for a wind farm. Additional impact of up to approximately 35 to 40 ha (90 to 100 ac) for easements.	MODERATE to LARGE	84 ha (208 ac) for power-block, offices, roads, and parking areas for gas-fired plant and 2428 ha (6000 ac) for wind farm. 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 developed and undeveloped areas at current CNP site, plus construction of gas pipeline (see land use for acreage). Impacts dependent on specific location and ecology of the site. See Table 8-4 for impacts to terrestrial and aquatic ecology for gas-fired plant. Impacts to ecological resources from wind power development include potential for bird and bat collisions with turbines.	MODERATE to LARGE	Impact depends on location and ecology of the site, surface water body used for intake and discharge, and transmission and pipeline routes. Impacts to terrestrial and aquatic ecology similar to but probably larger than those listed for CNP site.
Water use and quality–surface water	SMALL to MODERATE	Uses part of the existing once-through cooling system. 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	Impact depends on volume of water withdrawal and discharge and characteristics of surface water body. Discharge of cooling water 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 8-8. (contd)

	CNP Site		Alternate Site	
Impact Category	**Impact**	**Comments**	**Impact**	**Comments**
Water use and quality–groundwater	SMALL	Use of groundwater very unlikely because the CNP site has adequate surface water available from Lake Michigan.	SMALL to MODERATE	Impact depends on volume of water withdrawal and discharge and the characteristics of the aquifer.
Air quality	MODERATE	For natural gas-fired units: Sulfur oxides • 166 MT/yr (163 tons/yr) Nitrogen oxides • 530 MT/yr (522 tons/yr) Particulates PM_{10} • 92 MT/yr (91 tons/yr) Carbon monoxide • 112 MT/yr (110 tons/yr) Some hazardous air pollutants. Unregulated CO_2 emissions could contribute to global warming. For wind power, fugitive emissions and emissions from vehicles and equipment during construction.	MODERATE	Potentially same impacts as the CNP site, 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 CNP 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 to be minor.	SMALL	Same impact as the CNP site.

Table 8-8. (contd)

	CNP Site		Alternate Site	
Impact Category	**Impact**	**Comments**	**Impact**	**Comments**
Socioeconomics	SMALL to MODERATE	Approximately 1200 additional workers during the peak of the 3-year construction period, followed by reduction from current CNP Units 1 and 2 workforce of 1200 to slightly more than 150. Impacts during operation would be SMALL.	SMALL to MODERATE	Construction impacts depend on location, but could be greater than the CNP site if location is in a more rural area than CNP. There would be over 1200 temporary construction jobs during the peak of a 3-yr construction period. Operation of the plant and wind farm would result in over 150 permanent jobs. Berrien County could experience a greater loss of tax base and employment than at the CNP site if alternate site is outside of Berrien County.
Transportation	SMALL to MODERATE	Transportation impacts associated with construction workers would be MODERATE as 1200 CNP workers and over 1200 construction workers would be commuting to the site. Impacts during operation would be SMALL as the workforce is reduced to just over 150 commuters.	SMALL to MODERATE	Transportation impacts associated with more than 1200 construction workers and over 150 plant workers would be MODERATE and SMALL, respectively.
Aesthetics	MODERATE to LARGE	Aesthetic impacts due to addition of plant units, cooling towers, plume stacks, gas pipeline compressors, and wind turbines and ancillary facilities. Intermittent noise from construction and commuter traffic, and continuous noise from cooling towers, wind turbines, and mechanical equipment would result in MODERATE impacts.	MODERATE to LARGE	Impacts would be similar to the CNP site with additional impact from the new transmission line that would be needed.

Table 8-8. (contd)

	CNP Site		Alternate Site	
Impact Category	Impact	Comments	Impact	Comments
Historic and archaeological resources	SMALL to MODERATE	Some construction would affect previously developed parts of the CNP site; cultural resource inventory needed to identify, evaluate, and mitigate potential impacts of new plant construction on cultural resources in undeveloped areas of the site and also in additional areas that are needed offsite.	SMALL to MODERATE	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 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 approximately 1050 operating jobs at CNP 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 LARGE	Impacts vary depending on population distribution and makeup at site.

(a) Additional offsite impacts would be associated with gas extraction and distribution.

8.3 Summary of Alternatives Considered

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

The no-action alternative would require the replacement of electrical generating capacity by (1) DSM and energy conservation, (2) power purchased from other electricity providers,

(3) generating alternatives other than CNP Units 1 and 2, 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 CNP Units 1 and 2. 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 CNP Units 1 and 2 OLs.

The staff concludes that the alternative actions, including the no-action alternative, may have environmental impacts 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 October 31, 2003, the Indiana Michigan Power Company (I&M) submitted an application to the U.S. Nuclear Regulatory Commission (NRC) to renew the operating licenses (OLs) for the Donald C. Cook Nuclear Plant (CNP) Units 1 and 2, for an additional 20-year period (I&M 2003a). If the OLs are renewed, State regulatory agencies and I&M 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 OLs are not renewed, then the units must be shut down at or before the expiration of the current OLs, which expire on October 25, 2014, for Unit 1, and December 23, 2017, for Unit 2.

Section 102 of the National Environmental Policy Act (NEPA) (42 USC 4321) 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 10 CFR Part 51. Part 51 identifies licensing and regulatory actions that require an EIS. In 10 CFR 51.20(b)(2), the Commission requires preparation of an EIS or a supplement to an EIS for renewal of a reactor OL; 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 I&M 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 (69 FR 5880 [NRC 2004a]) on February 6, 2004. The staff visited the CNP site in March 2004 and held public scoping meetings on March 8, 2004, in Bridgman, Michigan (NRC 2004b). The staff reviewed the I&M environmental report (ER) (I&M 2003b) and compared it to the GEIS, consulted with other agencies, and conducted an independent review of the issues following the guidance set forth in NUREG-1555, Supplement 1, the *Standard Review Plans for Environmental Reviews for Nuclear Power Plants, Supplement 1: Operating License Renewal* (NRC 2000). The staff also considered the public comments received during the scoping process for preparation of this draft Supplemental Environmental Impact Statement (SEIS) for CNP Units 1 and 2. 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 of this SEIS.

The staff will hold two public meetings in Bridgman, Michigan, in November 2004 to describe the preliminary results of the NRC environmental review and to answer questions to provide members of the public with information to assist them in formulating their comments on this

(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.

draft SEIS. When the comment period ends, the staff will consider and address all of the comments received. These comments will be addressed in Appendix A of the final SEIS.

This draft SEIS includes the NRC staff's preliminary analysis that considers and weighs the environmental impacts 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. It also includes the staff's preliminary recommendation regarding the proposed action.

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

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

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

> ... whether or not the adverse environmental impacts of license renewal are so great that preserving the option of license renewal for energy planning decisionmakers would be unreasonable.

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

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

> The supplemental environmental impact statement for license renewal is not required to include discussion of need for power or the economic costs and economic benefits of the proposed action or of alternatives to the proposed action except insofar as such benefits and costs are either essential for a determination regarding the inclusion of an alternative in the range of alternatives considered or relevant to mitigation. In addition, the supplemental environmental impact statement prepared at the license renewal stage need not discuss other issues not related to the environmental 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 the Council on Environmental Quality guidelines. The following definitions of the three significance levels are set forth in the footnotes to Table B-1 of 10 CFR Part 51, Subpart A, Appendix B:

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

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

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

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

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

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

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

(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 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.

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 staff's consideration of all 92 environmental issues identified in the GEIS. The staff considered the environmental impacts associated with alternatives to license renewal and compared the environmental impacts of license renewal and the alternatives. The alternatives to license renewal that were considered include the no-action alternative (not renewing the OLs for CNP Units 1 and 2) and alternative methods of power generation. These alternatives were evaluated assuming that the replacement power generation plant is located at either the CNP site or some other unspecified location.

9.1 Environmental Impacts of the Proposed Action–License Renewal

I&M and the staff have established independent processes for identifying and evaluating the significance of any new information on the environmental impacts of license renewal. Neither I&M nor the staff has identified information that is both new and significant related to Category 1 issues that would call into question the conclusions in the GEIS. Similarly, neither the scoping process, I&M, nor the staff has identified any new issue applicable to CNP Units 1 and 2 that has a significant environmental impact. Therefore, the staff relies upon the conclusions of the GEIS for all Category 1 issues that are applicable to CNP Units 1 and 2.

I&M's license renewal application presents an analysis of the Category 2 issues that are applicable to CNP Units 1 and 2, plus environmental justice and chronic effects from electromagnetic fields. The staff has reviewed the I&M analysis for each issue and has conducted an independent review of each issue plus environmental justice and chronic effects from electromagnetic fields. Six Category 2 issues are not applicable because they are related to plant design features or site characteristics not found at CNP. Four Category 2 issues are not discussed in this draft SEIS because they are specifically related to refurbishment. I&M (I&M 2003a) 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 CNP Units 1 and 2 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 Donald C. Cook Nuclear Plant Units 1 and 2* (AEC 1973).

Eleven 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 all eleven Category 2 issues and environmental justice, the staff concludes that the potential environmental impacts are of SMALL significance in the context of the standards set forth in the GEIS. In addition, the staff determined that appropriate Federal health agencies have not reached a consensus on the existence of chronic adverse effects from electromagnetic fields. Therefore, no further evaluation of this issue is required. For severe accident mitigation alternatives (SAMAs), the staff concludes that a reasonable, comprehensive effort was made to identify and evaluate SAMAs. Based on its review of the SAMAs for CNP Units 1 and 2, and the plant improvements already made, the staff concludes that sixteen of the candidate SAMAs, addressing five general areas for improvement, are cost-beneficial.

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

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

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

9.1.1 Unavoidable Adverse Impacts

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

The adverse impacts of continued operation identified are considered to be of SMALL significance, and none warrants implementation of additional mitigation measures. The adverse impacts of likely alternatives if CNP Units 1 and 2 cease operation at or before the expiration of the current OLs will not be smaller than those associated with continued operation of these units, 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 the CNP Units 1 and 2 during the current license period was made when the units were built. The resource commitments to be considered in this draft SEIS are associated with continued operation of the units 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. CNP Units 1 and 2 replace a portion of the fuel assemblies in each of the two units during every refueling outage, which occurs on an 18-month cycle.

The likely power generation alternatives if CNP Units 1 and 2 cease operation on or before the expiration of the current OLs will require a commitment of resources for construction of the replacement plants as well as for fuel to run the plants.

9.1.3 Short-Term Use Versus Long-Term Productivity

An initial balance between short-term use and long-term productivity of the environment at the CNP site was set when the units were approved and construction began. That balance is now well established. Renewal of the OLs for CNP Units 1 and 2 and continued operation of the units will not alter the existing balance, but may postpone the availability of the site for other uses. Denial of the application to renew the OLs will lead to shutdown of the units and will alter the balance in a manner that depends on subsequent uses of the site. For example, the environmental consequences of turning the CNP site into a park or an industrial facility are quite different.

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

The proposed action is renewal of the OLs for CNP Units 1 and 2. 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 CNP Units 1 and 2. Chapters 4 through 7 discuss environmental issues associated with renewal of the OLs. 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 OLs), the no-action alternative (denial of the application), alternatives involving nuclear, coal, or gas generation of power at the CNP site and an unspecified alternate site, and a combination of alternatives are compared in Table 9-1. Continued use of a once-through cooling system for CNP Units 1 and 2 is assumed for 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 are SMALL for all impact categories (except for collective offsite radiological impacts from the fuel cycle and from HLW and spent fuel disposal, for which a single significance level was not assigned [see Chapter 6]). The alternative actions, including the no-action alternative, may have environmental 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 I&M (I&M 2003b), (3) consultation with Federal, State, and local agencies, (4) the staff's own independent review, and (5) the staff's consideration of public comments, the preliminary recommendation of the staff is that the Commission determine that the adverse environmental impacts of license renewal for CNP Units 1 and 2 are not so great that preserving the option of license renewal for energy planning decisionmakers would be unreasonable.

Table 9-1. Summary of Environmental Significance of License Renewal, the No-Action Alternative, and Alternative Methods of Generation Using 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	CNP Site	Alternate Site	CNP Site	Alternate Site	CNP Site	Alternate Site	CNP 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	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	MODERATE to LARGE
Water Use and Quality-Surface Water	SMALL	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	SMALL to MODERATE	SMALL	SMALL to MODERATE	SMALL	SMALL to MODERATE	SMALL	SMALL to MODERATE
Air Quality	SMALL	SMALL	MODERATE	MODERATE	MODERATE	MODERATE	SMALL to MODERATE	SMALL to MODERATE	MODERATE	MODERATE
Waste	SMALL	SMALL	MODERATE	MODERATE	SMALL	SMALL	SMALL	SMALL	SMALL	SMALL
Human Health	SMALL[(a)]	SMALL	SMALL	SMALL	SMALL	SMALL	SMALL	SMALL	SMALL	SMALL
Socio-economics	SMALL	SMALL to LARGE	SMALL to MODERATE	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 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 to LARGE	MODERATE to LARGE	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	SMALL to MODERATE
Environmental Justice	SMALL	SMALL to LARGE	SMALL to MODERATE	SMALL to LARGE	SMALL to MODERATE	SMALL to LARGE	SMALL to MODERATE	SMALL to LARGE	SMALL to MODERATE	SMALL to LARGE

(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

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."

Indiana Michigan Power Company (I&M). 2003a. *Application for Renewed Operating Licenses, Donald C. Cook Nuclear Plant Units 1 and 2.* Docket Nos. 50-315 and 50-316. Buchanan, Michigan. October 2003.

Indiana Michigan Power Company (I&M). 2003b. *Applicant's Environmental Report – Operating License Renewal Stage, Donald C. Cook Nuclear Plant Units 1 and 2.* Docket Nos. 50-315 and 50-316. Buchanan, Michigan. October 2003.

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

U.S. Atomic Energy Commission (AEC). 1973. *Final Environmental Statement Related to Operation of Donald C. Cook Nuclear Plant, Indiana and Michigan Electric Company and Indiana and Michigan Power Company.* Docket Nos. 50-315 and 50-316. Washington, D.C. August 1973.

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, Supplement 1: Operating License Renewal.* NUREG-1555, Supplement 1. Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 2004a. "Notice of Intent to Prepare an Environmental Impact Statement and Conduct Scoping Process." *Federal Register*, Vol. 69, pp. 5880-5881.

U.S. Nuclear Regulatory Commission (NRC). 2004b. *Environmental Impact Statement Scoping Process: Summary Report - Donald C. Cook Units 1 and 2, Berrien County, Michigan.* Rockville, Maryland. June 3, 2004.

Appendix A

Comments Received on the Environmental Review

Appendix A

Comments Received on the Environmental Review

Part I - Comments Received During Scoping

On February 6, 2004, the U.S. Nuclear Regulatory Commission (NRC) published a Notice of Intent in the *Federal Register* (69 FR 5880), to notify the public of the staff's intent to prepare a plant-specific supplement to the *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS), NUREG-1437, Volumes 1 and 2, to support the renewal application for the Donald C. Cook Nuclear Plant (CNP) Units 1 and 2 operating licenses (OLs) and to conduct scoping. The plant-specific supplement to the GEIS has been prepared in accordance with the National Environmental Policy Act (NEPA), Council on Environmental Quality (CEQ) guidance, and 10 CFR Part 51. As outlined by NEPA, the NRC initiated the scoping process with the issuance of the *Federal Register* Notice. The NRC invited the applicant; Federal, State, and local government agencies; Native American tribal organizations; local organizations; and individuals to participate in the scoping process by providing oral comments at the scheduled public meetings and/or submitting written suggestions and comments no later than April 6, 2004.

The scoping process included two public scoping meetings, which were held at the Lake Charter Township Hall in Bridgman, Michigan, on March 8, 2004. Approximately 35 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. The meeting transcripts are an attachment to the April 9, 2004, Scoping Meeting Summary. In addition to the comments received during the public meetings, three comment letters were received by the NRC in response to the Notice of Intent.

At the conclusion of the scoping period, the NRC staff and its contractors reviewed the transcripts and all written material to identify specific comments and issues. Each set of comments from a given commenter was given a unique identifier (Commenter ID), so that each set of comments from a commenter could be traced back to the transcript or letter by which the comments were submitted. Specific comments were numbered sequentially within each comment set. Several commenters submitted comments through multiple sources (e.g., afternoon and evening scoping meetings). All of the comments received and the staff responses are included in the CNP Scoping Summary Report dated June 2004.

Table A.1 identifies the individuals who provided comments applicable to the environmental review and the Commenter ID associated with each person's sets 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 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 CNP 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.

Comments applicable to this environmental review and the 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 CNP 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 CNP are not included here. More detail regarding the disposition of general or inapplicable comments can be found in the summary report. The ADAMS accession number for the Scoping Summary Report is ML041560360.

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.

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

Commenter ID	Commenter	Affiliation (If Stated)	Comment Source[a]
CS-A	John Gast	Supervisor, Lake Charter Township	Afternoon Scoping Meeting
CS-B	Chris Siebenmark	State Senator Ron Jelinek's Office	Afternoon Scoping Meeting
CS-C	Mano Nazar	American Electric Power (AEP)	Afternoon Scoping Meeting
CS-D	Michael J. Finissi	AEP	Afternoon Scoping Meeting
CS-E	Richard Grumbir	AEP	Afternoon Scoping Meeting
CS-F	Paul Bailey	Berrien County Sheriff Dept.	Afternoon Scoping Meeting
CS-G	F/Lt. Willie Mays	Michigan State Police	Afternoon Scoping Meeting
CS-H	Aaron Anthony	City of Bridgman	Afternoon Scoping Meeting
CS-I	Craig Massey	Berrien County Health Department	Afternoon Scoping Meeting
CS-J	Kevin Ivers	Bridgman Public School	Afternoon Scoping Meeting
CS-K	Jeff Knowles	Cornerstone Chamber of Commerce	Afternoon Scoping Meeting
CS-L	Bill Downey	Perry Ballard	Afternoon Scoping Meeting
CS-M	Martin Golob	United Way of Southwest Michigan	Afternoon Scoping Meeting
CS-N	Larry Wozniak	Park Inn Hotel	Afternoon Scoping Meeting
CS-O	Mike Green	Harbor Habitat for Humanity	Afternoon Scoping Meeting
CS-P	Bret Witkowski	Berrien County Board of Commissioners	Evening Scoping Meeting
CS-Q	Joseph N. Jensen	AEP	Evening Scoping Meeting
CS-R	Michael J. Finissi	AEP	Evening Scoping Meeting
CS-S	Richard Grumbir	AEP	Evening Scoping Meeting
CS-T	Ron Jelinek	State Senator	Letter (ML040980507)
CS-U	Fred Upton	U.S. Representative	Letter (ML041040389)
CS-V	Kenneth A. Westlake	U.S. Environmental Protection Agency	Letter (ML041120441)

(a) The afternoon and evening transcripts can be found under accession number ML041030060.

Comments in this section are grouped in the following categories:

A.1.1 Aquatic Ecology
A.1.2 Terrestrial Resources
A.1.3 Air Quality
A.1.4 Human Health
A.1.5 Socioeconomics
A.1.6 Uranium Fuel Cycle and Waste Management

A.1 Comments and Responses

A.1.1 Aquatic Ecology

Comment: We are concerned about the amount of organisms pinned against or drawn into D.C. Cook's cooling water systems. Under a final rule signed by U.S. EPA on February 16, 2004, certain power plants with cooling water systems are required to (1) reduce the number of organisms pinned against water intake screens by 80 to 95 percent, and (2) reduce the number of organisms which are sucked into the cooling water system by 60 to 90 percent. The draft SEIS should indicate the applicability of the final rule to D.C. Cook, and the modifications planned by the applicant to comply with the rule (CS-V-2).

Response: *The final rule issued by EPA on February 16, 2004, commonly referred to as the 316(b) Phase II regulations, establishes requirements to minimize adverse effects to fish and shellfish from cooling water intake structures at large power plants. Facilities will have several compliance alternatives to meet the performance standards defined in the final rule. The alternatives include demonstrating that the existing cooling water intake configuration provides adequate protection, selecting additional fish protection technologies (such as screens with fish return systems), and using restoration measures. Additional information regarding the rule can be found at http://www.epa.gov/waterscience/316b/.*

The rule becomes effective sixty (60) days after the date of its publication in the Federal Register *(as of May 5, 2004, the final rule had not yet been published)*[a]*. The rule provides a period of up to approximately 4 years from the effective date of the regulation for facilities to determine the compliance alternative to be pursued, and to complete studies or facility modifications, as necessary. CNP will be subject to the provisions of the final rule and is expected to determine which of the compliance alternatives it will be pursuing following publication of the final rule in the* Federal Register. *The comments relate to Category 2 aquatic ecology issues and were considered in the preparation of the SEIS. Aquatic ecology is*

(a) As discussed in Section 4.1.1, the EPA published the final rule (69FR41575) on July 9, 2004.

discussed in Chapters 2 and 4 of the SEIS.

A.1.2 Terrestrial Resources

Comment: Cook Nuclear Plant occupies only 20 percent of AEP's 650 acres of property and uses the rest of the land as sanctuary for hundreds of birds, plants, and wildlife, including threatened species (CS-B-7).

Comment: Extending the life of a current plant will not have a new impact on the environment. In fact, much of the plants surrounding property is comprised of dunes, forest and wetlands (CS-U-4).

Response: *The comments relate to Category 1 terrestrial resource issues. The comments provide no new information; therefore, the comments will not be evaluated further.*

A.1.3 Air Quality

Comment: Cook Nuclear Plant operates emitting no greenhouse gases, minimizing air pollution, and helping our region achieve its air quality goals with the EPA and Michigan Department of Environmental Quality (CS-B-5).

Comment: Nuclear energy assists the county in achieving the best air quality goals with the EPA and Michigan Department of Environmental Quality (CS-P-3).

Comment: Air pollution is minimized and they emit no greenhouse gases, thus helping to reach the EPA and Michigan Department of Environmental Quality standards (CS-T-4).

Response: *Air quality issues were evaluated in the GEIS and determined to be Category 1 issues. The comments provide no new information, and will therefore not be evaluated further in the SEIS. Air quality is discussed in Chapter 2 of the SEIS.*

A.1.4 Human Health

Comment: Cook Nuclear Plant continuously samples the air, soil, foliage, surface and groundwater at over 20 different monitoring stations to ensure Cook Plant meets or exceeds environmental standards (CS-B-8).

Response: *The comment is related to Category 1 human health issues and provides no new information, and therefore, will not be evaluated further.*

Comment: The draft SEIS should include adequate information about radiological impacts.

During the March 9, 2004, site audit, American Electric Power, the applicant for the operating licenses, provided information from its radiological environmental monitoring program (REMP) for D.C. Cook. As we understand it, the REMP is used to monitor and document radiological impacts to workers, the public, and the environment. Summary information about radiation emissions and emission pathways from D.C. Cook is relevant in determining radiological impacts from the plant's continued operation. Therefore, we suggest that the draft SEIS include current annual summary radiological impact information from the REMP (CS-V-1).

Response: *Radiological impacts on human health (both to the public and to plant workers) are Category 1 issues.*

As stated in the GEIS, radiation doses to members of the public from current operation of nuclear power plants have been examined from a variety of perspectives, and the impacts were found to be well within design objectives and regulations in each instance. Because there is no reason to expect effluents to increase in the period after license renewal, effluent levels during continued operation during the renewal term are expected to be well within regulatory limits. The NRC staff concluded in the GEIS that the significance of radiation exposures to the public attributable to operation after license renewal will be small at all sites and that this is a Category 1 issue.

Occupational doses attributable to normal operation during the license renewal term were also examined from several different perspectives. In the GEIS, an estimate of a 5 to 8 percent increase in doses for the typical plant worker for the renewal period was made based on the slight increase in radioactive inventories that occurs as a plant ages. Even with this increase, the anticipated doses are well below the regulatory limits. Therefore, occupational radiation exposure during the renewed license period meets the standard of small significance and thus is a Category 1 issue.

NRC licensees are required to submit annual reports of the results of their radioactive effluent releases and radiological environmental monitoring programs. I&M submitted its annual radiological environmental operating report for 2003 on April 30, 2004. The report includes a description of the CNP radiological environmental monitoring program, results of environmental sampling for the reporting period, and an evaluation of potential offsite dose consequences resulting from station operation. Copies of the report (Accession no. ML041320632) are available through the NRC's Public Document Room, and can also be obtained by accessing the NRC's Agencywide Documents Access and Management System (ADAMS) at http://www.nrc.gov/reading-rm/adams.html. *The comment relates to Category 1 human health issues and was considered in the preparation of the SEIS. Human health issues are discussed in Chapters 2 and 4 of the SEIS.*

Comment: The SEIS should discuss any planned power uprates at D.C. Cook, and the estimated resulting increases in radiological emissions, spent fuel, and other emissions. Although U.S. NRC's regulations (10 CFR § 51.53(c)(2)) state that an applicant's environmental report need not discuss the demand for power, we think that planned power uprates are reasonably foreseeable actions that contribute to a cumulative radiological impact, under 40 C.F.R. § 1508.7, and therefore should be discussed in U.S. NRC's SEIS (CS-V-3).

Response: *The NRC groups nuclear plant power uprates into 3 categories: (1) "measurement uncertainty recapture" uprates, typically up to about 1.7 percent, (2) "stretch" uprates, typically up to about 7 percent, and (3) "extended" uprates, up to approximately 20 percent. Measurement uncertainty recapture uprates were approved for CNP Unit 1 in 2002 and CNP Unit 2 in 2003. While the NRC staff believes that many licensees will consider power uprates in the future, to date the applicant has not announced any further plans for additional uprating of CNP Units 1 and 2.*

Should I&M pursue further power uprates at CNP, the staff would prepare an environmental assessment and, if determined to be necessary, a supplemental environmental impact statement to evaluate the impacts of the requested uprate. The staff would ensure, as part of that review, that effluent levels during operation at uprated power levels would remain well within regulatory limits. As noted in the response to the previous comment, if effluent levels are maintained within regulatory limits, the significance of radiation exposures to the public attributable to operation during the renewal term are expected to be small. The comment relates to Category 1, to human health issues. The comment provides no new information, and therefore, will not be evaluated further.

A.1.5 Socioeconomics

Comment: Before 9/11 events, Cook Nuclear Visitor's Center for years was one of the Township's destination spots for visitors in educational opportunities. The facility was a showcase for our community (CS-A-3).

Comment: Cook Nuclear contributes approximately $200,000 annually to United Way, with 50 percent matching donations from AEP (CS-B-10).

Comment: As far as our environmental stewardship, the plant was built, what I call, to blend into the surrounding environment. We do not have cooling towers, and we do not have containment domes which stick up above the sand dunes (CS-D-2, CS-R-2).

Comment: As mentioned earlier, we built a nature trail which is tied to our Visitor's Center, which allows the community to go and be one with nature. It's actually a unique experience. Our recycling program, we work with the local Gateway Group, which is a benefit for us in that we recycle paper, and also we benefit the community, as well (CS-D-3, CS-R-3).

Comment: I also want to share that not only are we committed to local environmental, such as the Visitor's Center, supporting the Chikaming Park Township, where we assisted in purchasing some land, but we also do environmental or experimental work with wind generators. And we're also involved in the Bolivia and Belize forest preservation projects (CS-E-2, CS-S-1).

Comment: AEP and D.C. Cook have been partners with the schools for over 30 years. Prior to the 9/11 incident, our students regularly visited the plant, they learned about nuclear power, and they walked the nature trails. We used the Visitor's Center and conference rooms to hold Board of Education retreats and many student recognition events (CS-J-2).

Comment: I'd also like to say they're a cultural leader. Look at Mano. What we find is that of 1,400 employees, you have representatives that come from all across the globe and different parts and different regions of our country. And that cultural impact that you have in our community is critical. Because this is a community that is embracing diverse inclusion, and Cook Nuclear is definitely a leader in that area (CS-K-3).

Comment: We also would like to say that you're a social leader. It's not enough to give money, to give to charitable organizations, but it's employees who lead those organizations who really do truly enhance our quality of life. They're the coaches who made a difference on my son; they are the leaders of churches who bring their accounting skills and their engineering skills to do the right kind of planning. So it's not just the money, but it's the real influx of your talent and your people that make such a world of difference in this area (CS-K-4).

Comment: I think a lot of the success of -- and the support of Cook is due to the Visitor's Center and what it has brought to the area and a lot of the outreach in the community. Much has been said by the other speakers here. But speaking very personally as a family guy, knowing that we have such a facility here, and people who are willing to go out and educate our children about power and about engineering and about all of those things that are available out in the world today, I'm very proud to be a supporter of the Cook Center (CS-L-2).

Comment: I can say unequivocally I've never seen a corporate citizen of the caliber of AEP and the D.C. Cook Plant and the participation in the community. I think it's core that not only do they involve themselves as a corporation philanthropically in many aspects of our community, but they support their employees' involvement, as well, on boards, and as we've heard spoken of earlier today, in the churches, in the teams, in the events in the community. So we see their employees encouraged to participate in the community (CS-M-1).

Comment: And the other thing is, the Welcome Center, it's been talked about a lot. We miss that Welcome Center. They had the trade shows, you know, the different shows every month or so. The vendors would come in from out of town and stay at the hotel. Sometimes out-of-town guests would be there just for the show itself. But it was also a fantastic tourist attraction (CS-N-2).

Comment: We have been the benefactors of their good will. Many of the employees from the Cook Plant have come and helped us construct houses. In fact, on our board of directors our current president is an employee for AEP, and we just appreciate what they've done. In the beginning, 1996, provided some heat pumps for us for our families who needed housing. And then over the years, the plant and the employees have actually helped to construct houses for us, fully funding them.

In fact, our current office is located at 785 East Main Street in downtown Benton Harbor, and that structure was fully funded by AEP. And we appreciate the employees who came out and helped us build it because it created a presence for us in our community. We want to make a statement that we were going to be in town for the long haul, and credibility is really important in Benton Harbor when you create a nonprofit organization. You have to do what you say you're going to do, and we basically needed to gain that credibility over time by constructing houses and being successful at that, and we have done that to date. We've built 22 houses. And I apologize I didn't get the numbers together, but each year AEP has supported us (CS-O-2).

Comment: American Electric Power/Cook Nuclear Plant has continuously been a good corporate partner with Berrien County since 1975 when it began commercial operations (CS-P-1).

Comment: More importantly, the employees of this company have made a strong commitment to their community. In addition to donations of money to charitable and community organizations, employees donate blood and provide many hours of service with the volunteer time they provide to community events, organizations and charities (CS-T-5).

Response: *The comments relate to Category 1 socioeconomic issues and are supportive of license renewal for CNP Units 1 and 2. The comments provide no new information, and therefore, will not be evaluated further.*

--**Comment:** The economic impact of the Cook facility and -- afforded the citizens of this community a stable economic background and growth, as well as the township's single largest employer. The township enjoys municipal water, sanitary, water utilities throughout the township, and one of the lowest millages in the area. Township residents also enjoy a wide range of services provided at no additional cost (CS-A-2).

Comment: Today the Cook Nuclear Plant generates 2.1 million kilowatts of electricity for residences and businesses. It is the third largest employer in Berrien County, providing almost 1,400 AEP and contract jobs, supporting our local, state, and national economies with $90 million in total wages. Cook is a major contributor to our tax base to the tune of almost $14 million in 2001 (CS-B-3).

Comment: Although Cook is not directly located within the jurisdiction of the city of Bridgman, its effects are felt in several ways, particularly there through jobs, job development, support for the service industry with restaurants and service stations and all of that. In addition to those particular items, we were lucky enough to have, after about a 150 loss, when a company moved out of town, to have AEP come in and put their material center within the City of Bridgman. So, in almost every facet of the economic development side of the City of Bridgman, the effect of Cook and AEP can be felt. You've already heard that they're a major employer in the county. Well, if you look at their employment figures, and then you look at our town of 2,400, 2,500 folks, not all of them work there, and I wouldn't mind, by the way, if you had those kind of jobs open, but several of them do, and so we get the support, as well, for the citizens here in the city (CS-H-1).

Comment: Last March we asked our community taxpayers to help support a recreational millage to help fund our community pool. When we first had that idea, we met with representatives from the Cook plant, and they were in support of this millage, and we were very fortunate that it passed. Without their financial support, we would not be able to provide the level of education that we currently offer to our students (CS-J-3).

Comment: With over 1,400 employees, those individuals have partners and spouses, who bring such great skill sets to this area. There are teachers, there are business managers, they work in our hospitals. So, Cook Nuclear supports more than just the direct job base that exists right in this area. The influx of the skills that you have are oftentimes needed and too often overlooked. About a year ago, we had a windstorm and lots of trees were blown over, and some of the horticultural engineering staff here at Cook Nuclear gave advice to residents and neighbors about how to wrap the seedlings so you didn't have to cut them up, you could replant them. And today I think we have more mature trees in the area as a result of one tiny skill set that this facility brings to our area (CS-K-2).

Comment: And from the Chamber of Commerce standpoint, I would close by offering the following thought: Everyone in "Michigan's Great Southwest" embraces this facility, because if you look at development that has occurred since you opened, the quality of development is gravitating towards the Cook Nuclear and not away from it. And so, as a result, people have spoken with their pocketbooks by saying the new golf courses, the new residential areas, the new shopping locations are all there and all invested because they embrace and support and are looking forward to the licensing renewal for the Cook Nuclear facility (CS-K-5).

Comment: We've seen AEP get involved regionally on many levels, most recently with Benton Harbor area schools and rebirth and regrowth program for that community in their education base. As a major employer, yes, they do contribute over $200,000 to the United Way of Southwest Michigan annually, and that is just a portion of the economic impact that they have on the health and human services in our community (CS-M-3).

Comment: I just want to talk about the economic development part of the Cook plant and nuclear plant here. For the last 10 years that our hotel alone, which is the Park Inn in Stevensville, we have taken in income over $800,000 from nuclear plant employees. So, a lot of people who live in town who are permanent residents here, but there's lots of transient business who comes in for the plant. Forty percent of that money is the contractors that come in. The Framatome, guys like that, come in and work from other companies who were hired here. So it's a lot of money spent at hotels, and I'm just one of currently 20 hotels in the area, and that's about 10 percent of our business over the last 10 years. So, it's definitely a good chunk of our business, and we appreciate that tremendously. Also, the hotels that are here, they also have to do – they're eating and they're buying their gas. They don't eat a whole lot of time when they're here working now, they don't do much tourism-type things, but they are spending money other places, too. So, the restaurants also benefit, as well as the gas stations, I know for sure, and the movie theater, maybe on their day off or something like that (CS-N-1).

Comment: The Nuclear Energy Institute research says every nuclear plant job creates one additional job in the surrounding community, and the Cook Plant today generates 2.1 million kilowatts of electricity for millions of people, their residences and businesses, and Cook plant is the third largest employer in Berrien County, providing almost 1,400 AEP and contract jobs, and the Cook plant supports our local, state, and national economies with $90 million in total wages and tax payments over approximately $14 million (CS-P-2).

Comment: Renewing this license is beneficial in many ways to our community. In addition to the amount of electricity the plant generates, it is a major employer in Berrien County. The Plant not only generates 2.1 million kilowatts of electricity, they also support our local school district as well as benefitting our local, state, and national economies with $90 million dollars in wages paid (CS-T-2).

Comment: Since the Cook plant opened in 1975, it has served an important function in our community by providing clean power and good jobs to the community and the region. Today, Cook Nuclear plant generates 2.1 million kilowatts of electricity and is the third largest employer in Berrien County, providing nearly 1400 plant and contract jobs. This makes them a huge contributor to the local economy and tax base. During a time when many other industries have struggled to make ends meet and have laid off hundreds of workers, the Cook Nuclear Plant has provided steady employment to hundreds of families who really need it (CS-U-2).

Response: *The comments relate to Category 2 socioeconomic issues and were considered in the preparation of the SEIS. Socioeconomic issues are discussed in Chapters 2 and 4 of the SEIS.*

A.1.6 Uranium Fuel Cycle and Waste Management

Comment: Cook Nuclear Plant safely stores its used fuels in a highly secure location on Cook Plant property (CS-B-9).

Response: *Uranium fuel cycle and waste management issues were evaluated in the GEIS and determined to be Category 1 issues. The comments provide no new information, and therefore, will not be evaluated further in the SEIS. Uranium fuel cycle and waste management is discussed in Chapters 2 and 6 of the SEIS.*

Part II - Comments Received on the Draft SEIS

(Reserved for comments received on the draft SEIS)

Appendix B

Contributors to the Supplement

Appendix B

Contributors to the Supplement

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

Name	Affiliation	Function or Expertise
	NUCLEAR REGULATORY COMMISSION	
Robert G. Schaaf	Nuclear Reactor Regulation	Project Manager
John R. Tappert	Nuclear Reactor Regulation	Section Chief
Barry Zalcman	Nuclear Reactor Regulation	Technical Monitor
Michael T. Masnik	Nuclear Reactor Regulation	Ecology
William L. Dam	Nuclear Reactor Regulation	Project Manager, Hydrology
Tomeka Terry	Nuclear Reactor Regulation	Socioeconomics, Land Use
Alicia Williamson	Nuclear Reactor Regulation	General Scientist
Jennifer A. Davis	Nuclear Reactor Regulation	Historic and Archaeological Resources
Robert Palla	Nuclear Reactor Regulation	Severe Accident Mitigation Alternatives
Nina Barnett	Nuclear Reactor Regulation	Administrative Support
	ARGONNE NATIONAL LABORATORY[a]	
Kirk E. LaGory		Task Leader
Frederick A. Monette		Radiation Protection
David S. Miller		Hydrology
William S. Vinikour		Aquatic Ecology
Edwin D. Pentecost		Terrestrial Ecology
Timothy Allison		Socioeconomics
William C. Metz		Land Use, Related Federal Programs
Konstance L. Wescott		Cultural Resources, Alternatives
Madonna M. Pence		Technical Editor
Tanya Crum		Administrative Support
	PACIFIC NORTHWEST NATIONAL LABORATORY[b]	
James V. Ramsdell, Jr.		Air Quality, Meteorology
Fred L. Leverenz		Severe Accident Mitigation Alternatives
Bruce E. Schmitt		Severe Accident Mitigation Alternatives
Steve M. Short		Severe Accident Mitigation Alternatives

(a) Argonne National Laboratory is operated for the U.S. Department of Energy by the University of Chicago.
(b) Pacific Northwest National Laboratory is operated for the U.S. Department of Energy by Battelle Memorial Institute.

Appendix C

Chronology of NRC Staff Environmental Review Correspondence Related to the Indiana Michigan Power Company Application for License Renewal of Donald C. Cook Nuclear Plant Units 1 and 2

Appendix C

Chronology of NRC Staff Environmental Review Correspondence Related to the Indiana Michigan Power Company Application for License Renewal of Donald C. Cook Nuclear Plant Units 1 and 2

This appendix contains a chronological listing of correspondence between the U.S. Nuclear Regulatory Commission (NRC) and the Indiana Michigan Power Company (I&M) and other correspondence related to the NRC staff's environmental review, under 10 CFR Part 51, of I&M's application for renewal of the Donald C. Cook Nuclear Plant, Units 1 and 2, operating licenses. 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 Systems (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.

October 31, 2003	Letter from Indiana Michigan Power Company (I&M) to U.S. Nuclear Regulatory Commission (NRC), Donald C. Cook Nuclear Plant, Units 1 and 2, Docket No. 50-315 and 50-316, Application for Renewed Operating Licences (Accession No. ML033070177)
November 4, 2003	Letter from NRC staff to Mr. Mano K. Nazar, I&M, Receipt and Availability of the License Renewal Application for the Donald C. Cook Nuclear Plant, Units 1 and 2 (Accession No. ML033100447)
December 4, 2003	Letter from NRC staff to Mr. Mano K. Nazar, I&M, transmitting Determination of Acceptability and Sufficiency for Docketing, Proposed Review Schedule, and Opportunity for a Hearing Regarding the Application from Indiana Michigan Power Company for Renewal of the Operating Licenses for Donald C. Cook Nuclear Plant, Units 1 and 2 (Accession No. ML033381153)
January 29, 2004	Letter from NRC staff to Mr. Mano K. Nazar, I&M, Notice of Intent to Prepare an Environmental Impact Statement and Conduct Scoping Process for License Renewal for the Donald C. Cook Nuclear Plant, Units 1 and 2 (Accession No. ML040290406)

February 20, 2004	Notice of Public Meeting to Discuss Environmental Scoping Process for the Donald C. Cook Nuclear Plant, Units 1 and 2 License Renewal Application (Accession No. ML040550596)
February 24, 2004	Letter from NRC staff to the Honorable John A. Barrett, Chairperson, Citizen Potawatomi Nation, Oklahoma, Request for Comments Concerning Donald C. Cook Nuclear Plant Operating License Renewal (Accession No. ML040570359)
February 24, 2004	Letter from NRC staff to the Honorable Kenneth Meshigaud, Chairperson, Hannahville Indian Community, Request for Comments Concerning Donald C. Cook Nuclear Plant Operating License Renewal (Accession No. ML040570611)
February 24, 2004	Letter from NRC staff to the Honorable Robert Kewaygoshkum, Chairperson, Grand Traverse Band of Ottawa and Chippewa Indians, Request for Comments Concerning Donald C. Cook Nuclear Plant Operating License Renewal (Accession No. ML040570693)
February 24, 2004	Letter from NRC staff to the Honorable Laura Spurr, Chairperson, Nottawaseppi Huron Pottawatomi, Request for Comments Concerning Donald C. Cook Nuclear Plant Operating License Renewal (Accession No. ML040570762)
February 24, 2004	Letter from NRC staff to the Honorable Lee Sprague, Ogema, Little River Band of Ottawa Indians, Request for Comments Concerning Donald C. Cook Nuclear Plant Operating License Renewal (Accession No. ML040570808)
February 24, 2004	Letter from NRC staff to the Honorable Frank Ettawageshik, President, Little Traverse Bay Bands of Odawa Indians, Request for Comments Concerning Donald C. Cook Nuclear Plant Operating License Renewal (Accession No. ML040570829)
February 24, 2004	Letter from NRC staff to the Honorable David K. Sprague, Chairperson, Match-E-Be-Nash-She-Wish Band of Potawatomi Indians of Michigan, Request for Comments Concerning Donald C. Cook Nuclear Plant Operating License Renewal (Accession No. ML040570836)

February 24, 2004	Letter from NRC staff to the Honorable Floyd E. Leonard, Chief, Miami Tribe of Oklahoma, Request for Comments Concerning Donald C. Cook Nuclear Plant Operating License Renewal (Accession No. ML040570849)
February 24, 2004	Letter from NRC staff to the Honorable Charles Todd, Chief, Ottawa Tribe of Oklahoma, Request for Comments Concerning Donald C. Cook Nuclear Plant Operating License Renewal (Accession No. ML040570857)
February 24, 2004	Letter from NRC staff to the Honorable John Miller, Chairperson, Pokagon Band of Potawatomi Indians of Michigan, Request for Comments Concerning Donald C. Cook Nuclear Plant Operating License Renewal (Accession No. ML040570866)
February 24, 2004	Letter from NRC staff to the Honorable Audrey Falcon, Chief, Saginaw Chippewa Indian Tribe of Michigan, Request for Comments Concerning Donald C. Cook Nuclear Plant Operating License Renewal (Accession No. ML040570873)
March 1, 2004	Letter from NRC staff to Mr. Craig Czarnecki, U.S. Fish and Wildlife Service (FWS) Michigan Field Office, Request for List of Protected Species Within the Area Under Evaluation for the Donald C. Cook Nuclear Plant License Renewal (Accession No. ML040620107)
March 2, 2004	Letter from NRC staff to Mr. Brian Conway, Michigan State Historic Preservation Office, Donald C. Cook Nuclear Plant Operating License Renewal (Accession No. ML040620307)
March 8, 2004	Letter from NRC staff to Mr. Don Klima, Advisory Council on Historic Preservation, Donald C. Cook Nuclear Plant License Renewal Review (Accession No. ML040700576)
March 17, 2004	Letter from the Honorable Ron Jelinek, Michigan State Senate, to NRC, offering support for Donald C. Cook Nuclear Plant license renewal (Accession No. ML040980507)
March 18, 2004	Letter from NRC staff to I&M, Request for Additional Information Regarding Severe Accident Mitigation Alternatives for the Donald C. Cook Nuclear Plant, Units 1 and 2 (Accession No. ML040780568)

March 23, 2004	Letter from Mr. Craig Czarnecki, FWS, to NRC, Endangered Species List Request, Proposed Renewal of Operating Licenses for Donald C. Cook Nuclear Plant, Units 1 and 2 (CNP), Berrien, Cass, and Van Buren Counties, Michigan (Accession No. ML040970270)
March 29, 2004	Letter from the Honorable Fred Upton, United States House of Representatives, providing comments regarding the Donald C. Cook Nuclear Plant license renewal application (Accession No. ML041040389)
April 6, 2004	Letter from Mr. Kenneth Westlake, U.S. Environmental Protection Agency (EPA), Scoping Comments for the Proposed Operating License Renewal of the D.C. Cook Nuclear Plant, Units 1 and 2, Berrien County, Michigan (Accession No. ML041120441)
April 9, 2004	Summary of Public Scoping Meetings to Support Review of the Donald C. Cook Nuclear Plant, Units 1 and 2, License Renewal Application (Accession No. ML041030060)
April 27, 2004	Letter to Honorable Fred Upton, United States House of Representatives, Extension of License Application for Cook Nuclear Plant by American Electric Power (Accession No. ML04106024)
April 29, 2004	Letter from NRC staff to Mr. Scott Pruitt, FWS Indiana Field Office, Request for List of Protected Species Within the Area Under Evaluation for the Donald C. Cook Nuclear Plant License Renewal (Accession No. ML041210186)
May 17, 2004	Letter from I&M to NRC, Response to Request for Additional Information Regarding SAMAs to support the Review of the Donald C. Cook Nuclear Plant, Units 1 and 2, License Renewal Application (Accession No. ML041460449)
May 18, 2004	Letter from Mr. Scott Pruitt, FWS, to NRC, D.C. Cook Nuclear Plant License Renewal, La Porte, St. Joseph, Elkhart, La Grange, Noble, Dekalb, and Allen counties, Indiana (Accession No. ML041470392)
May 28, 2004	Letter from NRC staff to Honorable Ron Jelinek, Michigan State Senate, Acknowledging Receipt of Letter Offering Support for Donald C. Cook Nuclear Plant, Units 1 and 2 License Renewal (Accession No. ML041560239)

June 3, 2004	Environmental Scoping Summary Report Associated with the Staff's Review of the Application by Indiana Michigan Power Company for Renewal of the Operating Licenses for Donald C. Cook Nuclear Plant, Units 1 and 2 (Accession No. ML041560360)
June 4, 2004	Letter from I&M to NRC, Providing Supplemental Information for Donald C. Cook Nuclear Plant Units 1 and 2 Environmental Report - Operating License Renewal Stage (Accession No. ML041670492)
June 30, 2004	Letter from I&M to NRC, Providing Supplemental Information for Donald C. Cook Nuclear Plant Units 1 and 2 Environmental Report - Operating License Renewal Stage-Management of Protected Avian Species (Accession No. ML041900057)
July 6, 2004	Summary of Telephone Conferences between NRC and I&M Regarding SAMAs (Accession No. ML041890376)

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.

Berrien County Economic Development Office, St. Joseph, Michigan.

Berrien County Schools, Berrien Springs, Michigan.

Bridgman Public Schools, Bridgman, Michigan.

Citizen Potawatomi Nation, Shawnee, Oklahoma.

Grand Traverse Band of Ottawa and Chippewa Indians, Suttons Bay, Michigan.

Great Lakes Environmental Research Laboratory, National Oceanic and Atmospheric Administration, Ann Arbor, Michigan.

Hannahville Indian Community Council, Wilson, Michigan.

Lake Charter Township, Bridgman, 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 Pottawatomi Indians, Dorr, Michigan.

Miami Tribe of Oklahoma, Miami, Oklahoma.

Michigan Department of Environmental Quality, Kalamazoo, Michigan.

Michigan Department of Natural Resources, Lansing, Michigan.

Michigan State Historic Preservation Office, Lansing, Michigan.

Nottawaseppi Huron Pottawatomi, 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. Environmental Protection Agency, Region 5, Chicago, Illinois.

U.S. Fish and Wildlife Service, Bloomington, Indiana.

U.S. Fish and Wildlife Service, East Lansing, Michigan.

Appendix E

Indiana Michigan Company's Compliance Status and Consultation Correspondence

Appendix E

Indiana Michigan Power Company Compliance Status and Consultation Correspondence

Correspondence received and sent during the process of evaluation of the application for renewal of the license for Donald C. Cook Nuclear Power Plant (CNP) 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 CNP Units 1 and 2 are listed in Table E-2.

Table E-1. Consultation Correspondence

Source	Recipient	Date of Letter
U.S. Nuclear Regulatory Commission (P.-T. Kuo)	Citizen Potawatomi Nation (J. Barrett)	February 24, 2004[(a)]
U.S. Nuclear Regulatory Commission (P.-T. Kuo)	U.S. Fish and Wildlife Service (C. Czarnecki)	March 1, 2004
U.S. Nuclear Regulatory Commission (P.-T. Kuo)	Michigan State Historic Preservation Office (B. Conway)	March 2, 2004
U.S. Nuclear Regulatory Commission (P.-T. Kuo)	Advisory Council on Historic Preservation (D. Klima)	March 8, 2004
U.S. Fish and Wildlife Service (C. Czarnecki)	U.S. Nuclear Regulatory Commission (P.-T. Kuo)	March 23, 2004
U.S. Nuclear Regulatory Commission (P.-T. Kuo)	U.S. Fish and Wildlife Service (S.E. Pruitt)	April 29, 2004
U.S. Fish and Wildlife Service (S.E. Pruitt)	U.S. Nuclear Regulatory Commission (R. Schaaf)	May 18, 2004

(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 CNP Units 1 and 2

Agency	Authority	Description	Number	Issue Date	Expiration Date	Remarks
NRC	10 CFR Part 50	License to operate	DPR-58 - Unit 1	10/25/74	10/25/14	Operation of Unit 1
NRC	10 CFR Part 50	License to operate	DPR-74 - Unit 2	12/23/77	12/23/17	Operation of Unit 2
FWS	Section 7 of the Endangered Species Act (16 USC 1536)	Consultation	NA		NA	Requires a Federal agency to consult with FWS regarding whether a proposed action will affect endangered or threatened species
USDOT	49 USC 5108	Registration	052703 013 027L	05/28/03	06/30/04	Hazardous materials shipments
MDEQ	Clean Water Act (33 USC Section 1251 et seq.), Michigan Act 451. Public Acts of 1994, as amended, Parts 31 and 41, et. al.	NPDES permit (surface water)	M10005827	09/21/00	10/01/03[(a)]	CNP discharges to Lake Michigan
MDEQ	Clean Water Act (33 USC Section 1251 et seq.), Michigan Act 451. Public Acts of 1994, as amended, Parts 31, et. al.	NPDES permit (stormwater)	Part I.A.10 and 11 of NPDES permit	09/21/00	10/01/03[(a)]	CNP discharges to Lake Michigan
MDEQ	Michigan Act 451. Public Acts of 1994, as amended, Parts 31 and 41, et. al.	Groundwater discharge permit	M00988	09/29/00	09/01/05	CNP discharges to the State of Michigan groundwater and Lake Michigan
MDEQ	Federal Clean Air Act (42 USC 7661, et seq.), IRS Ch.111-1/2, Sec. 1039	Exemption to the Federally enforceable State operating permit	AQD ID B4252	Annually	Annually	Exemption of air emissions from paint shop, boilers, and emergency generators
MDEQ	Michigan Act 451. Public Acts of 1994, as amended, Part 325	Dredging permit	98-12-0414	09/30/98	12/31/03	Dredging near water intake

Table E-2. (contd)

Agency	Authority	Description	Number	Issue Date	Expiration Date	Remarks
MDEQ	Michigan Act 368. Public Acts of 1978, as amended, Part 135	Registration and inspection of radioactive materials	NA	NA	NA	Radioactive materials handling
MDEQ	Michigan Act 451. Public Acts of 1994, as amended, Parts 353 and 325	Critical dunes permit	02-11-0045-P	NA	04/23/04	Security upgrades near critical dunes
MDEQ	Michigan Act 451. Public Acts of 1994, as amended, Parts 353 and 325	Critical dunes permit	02-11-0111-P	NA	12/31/04	North security fence upgrade near critical dunes
MDEQ	Michigan Act 451. Public Acts of 1994, as amended, Part 325	Critical dunes permit	01-11-0069-P	NA	12/31/03	Beach nourishment near critical dunes
MDEQ	Michigan Act 451. Public Acts of 1994, as amended, Part 325	Submerged land permit	98-12-0414-P	NA	12/31/03	Beach nourishment in submerged lands
MDEQ	Michigan Act 451. Public Acts of 1994, as amended, Part 353	Critical dunes permit	94-BR-0321-C	NA	NA	Vegetation control near critical dunes
MDEQ	Michigan Act 451. Public Acts of 1994, as amended, Part 353	Critical dunes permit	03-11-0096-P	NA	05/08/04	Installation of fish avoidance system
Berrien County	Part 91 NREPA - Soil Erosion and Sedimentation Control of Natural Resources and Environmental Protection Act	Soil and erosion permit	3535R	NA	04/16/04	Security upgrades
Berrien County	Part 91 NREPA - Soil Erosion and Sedimentation Control of Natural Resources and Environmental Protection Act	Soil and erosion permit	3448R	NA	10/10/03	North security fence upgrades

Table E-2. (contd)

Agency	Authority	Description	Number	Issue Date	Expiration Date	Remarks
Berrien County	Part 91 NREPA - Soil Erosion and Sedimentation Control of Natural Resources and Environmental Protection Act	Soil and erosion permit	3449R	NA	10/10/03	Construction of beach ramp
Berrien County	Part 91 NREPA - Soil Erosion and Sedimentation Control of Natural Resources and Environmental Protection Act	Soil and erosion permit	3690	NA	08/05/04	Installation of fish avoidance system
Berrien County	Part 91 NREPA - Soil Erosion and Sedimentation Control of Natural Resources and Environmental Protection Act	Soil and erosion permit	3585	NA	09/29/03	Concrete removal in vicinity of dunes
COE	Section 10 of the Rivers and Harbors Act of 1899 (33 USC 403)	U.S. Army Corps of Engineers permit	69-056-004-7	NA	12/31/09	Beach nourishment
	Section 404 of the Clean Water Act (33 USC 1344)					
	Section 103 of the Marine Protection, Research and Sanctuaries Act of 1972 (33 USC 1413)	U.S. Army Corps of Engineers permit	69-056-004-7	NA	12/31/09	Beach nourishment
COE	Section 10 of the Rivers and Harbors Act of 1899 (33 USC 403)	U.S. Army Corps of Engineers permit	03-056-043-1	NA	08/06/04	Installation of fish avoidance system
	Section 404 of the Clean Water Act (33 USC 1344)					
	Section 103 of the Marine Protection, Research and Sanctuaries Act of 1972 (33 USC 1413)					

Table E-2. (contd)

Agency	Authority	Description	Number	Issue Date	Expiration Date	Remarks
SCDHEQ	South Carolina Radioactive Waste Transportation and Disposal Act (S.C. Code of Laws 13-7-110 et seq.)	Radioactive waste transport permit	0055-21-03X	01/01/03	12/31/03	Transportation of radioactive waste in South Carolina
TDEC	Tennessee Code Annotated 68-202-206	License to ship radioactive material	T-M1001-L03	12/23/02	12/31/03	Shipments of radioactive material to processing facility in Tennessee

CFR = Code of Federal Regulations
COE = U.S. Army Corps of Engineers
DOT = U.S. Department of Transportation
FWS = U.S. Fish and Wildlife Service
NRC = U.S. Nuclear Regulatory Commission
EPA = U.S. Environmental Protection Agency
MDEQ = Michigan Department of Environmental Quality
SCDHEC = South Carolina Department of Health and Environmental Control
TDEC = Tennessee Department of Environment and Conservation
USC = United States Code

(a) Renewed application submitted to Michigan Department of Environmental Quality (MDEQ) on March 17, 2003 (I&M 2003); current NPDES permit is valid until a new permit is issued by MDEQ

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

February 24, 2004

The Honorable John A. Barrett, Jr., Chairperson
Citizen Potawatomi Nation
1601 South Gordon Cooper Drive
Shawnee, OK 74801

SUBJECT: REQUEST FOR COMMENTS CONCERNING DONALD C. COOK 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 Indiana Michigan Power Company (I&M) to renew the operating licenses for the Donald C. Cook Nuclear Plant, Units 1 and 2 (CNP), located in Berrien County, Michigan. CNP is in close proximity to lands that may be of interest to the Potawatomi Tribe. 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 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 licenses for CNP Units 1 and 2 will expire in December 2014 and December 2017, respectively. I&M submitted its application for renewal of the CNP operating licenses on November 3, 2003.

The NRC is gathering information for a CNP-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 CNP 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.

The NRC will hold two public scoping meetings for the CNP license renewal supplement to the GEIS on March 8, 2004, at the Lake Charter Township Hall, 3220 Shawnee Road, Bridgman, Michigan 49106-9736. 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 Publicly Available Records component of NRC's Agencywide Documents Access and Management System (ADAMS) under Accession Number ML033070179. ADAMS is accessible at http://www.nrc.gov/reading-rm/adams.html which provides access through the NRC's Public Electronic Reading Room (PERR) link. 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/cook.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; the Bridgman Public Library, 4460 Lake Street, Bridgman, Michigan 49106-9510; and the Maud Preston Palenske Memorial Library, 500 Market Street, St. Joseph, Michigan 49085-1368. 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 website 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 April 6, 2004. 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, September 2004), 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 a final SEIS for CNP is planned for June 2005. If you need additional information regarding the environmental review process, please contact Mr. Robert G. Schaaf, Environmental Project Manager, at 301-415-1312 or by e-mail at rgs@nrc.gov.

Sincerely,

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

Docket Nos.: 50-315 and 50-316

Enclosures: 1. CNP Transmission Line Map
2. CNP Site Layout

cc w/encls.: See next page

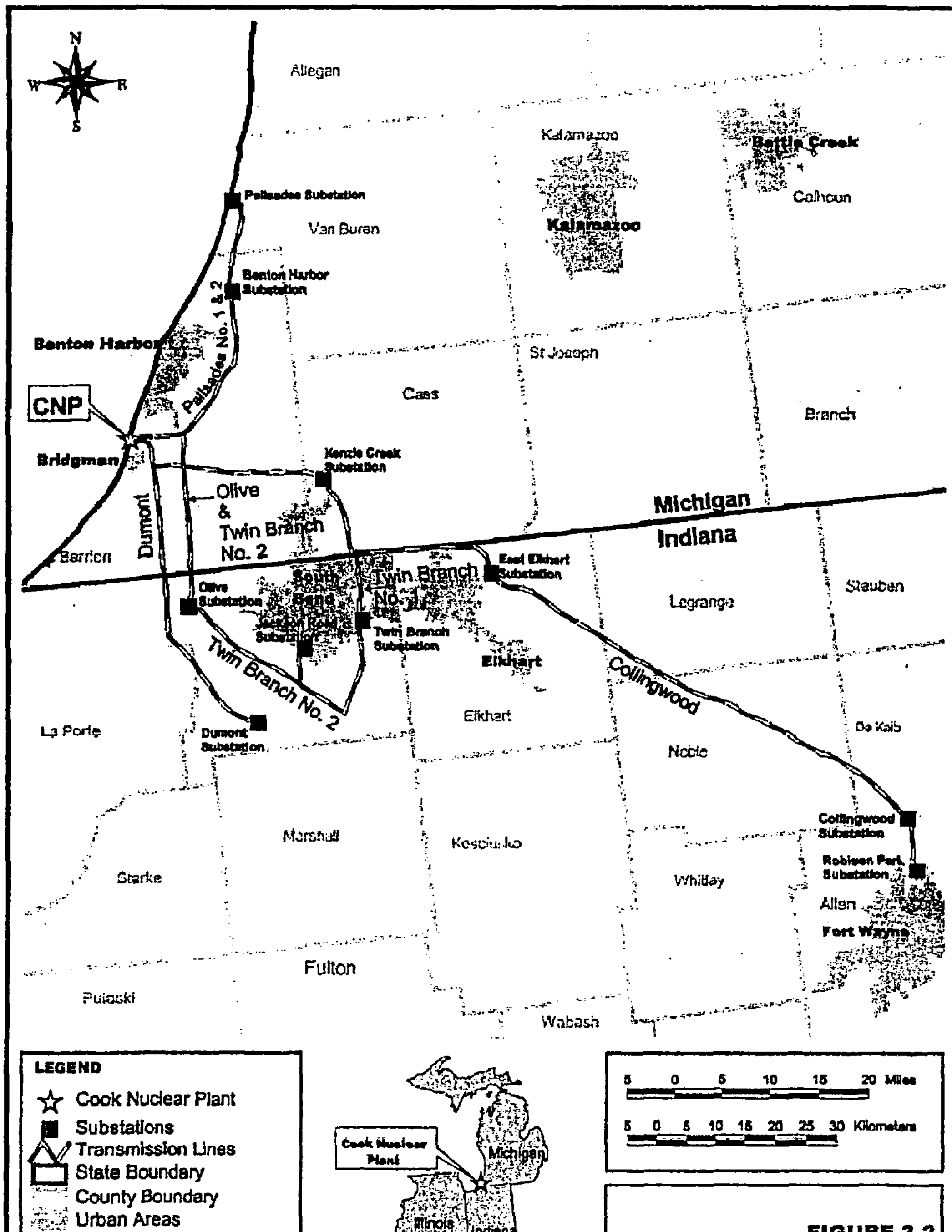


FIGURE 3-2
Transmission System Map

ENCLOSURE 1

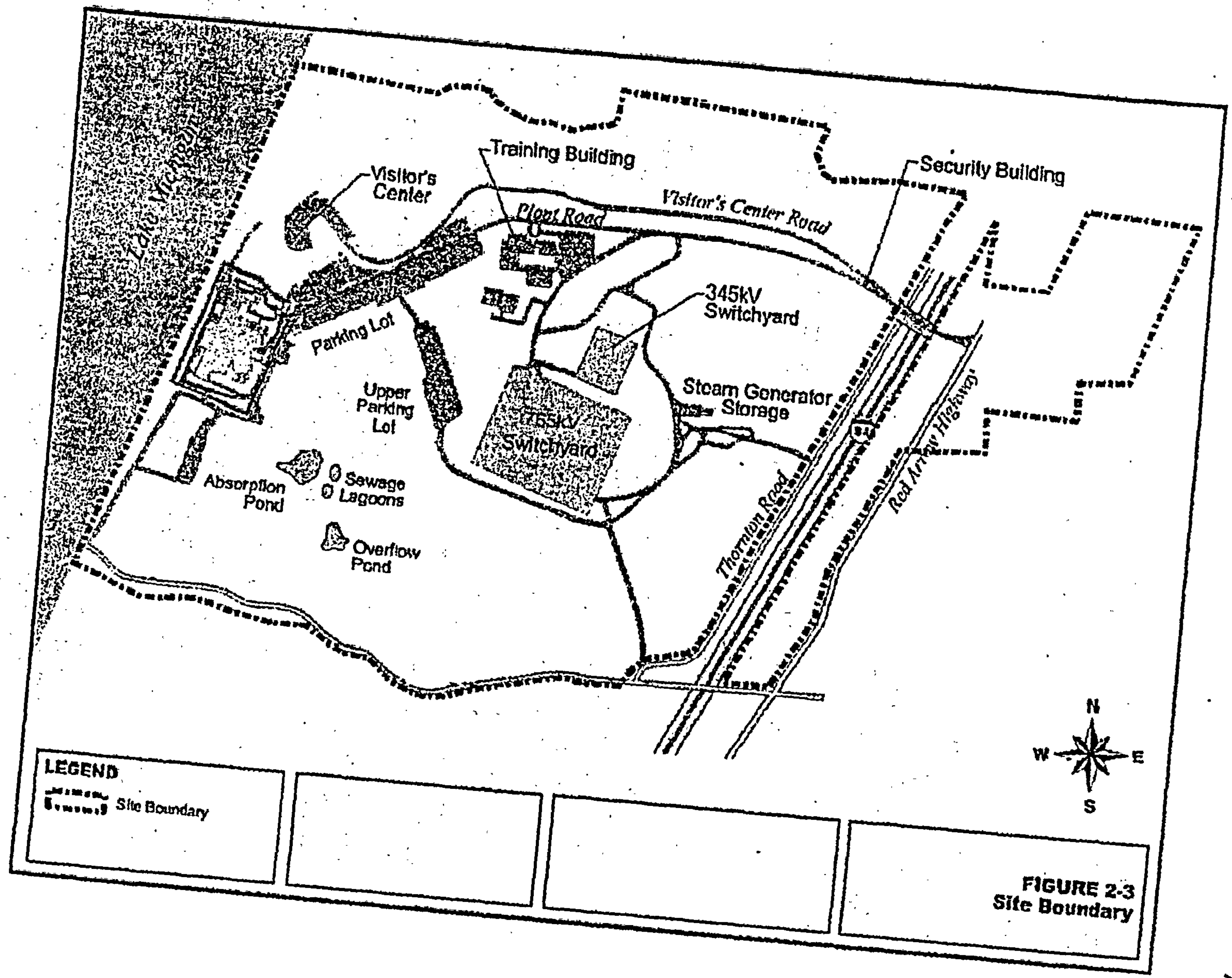


FIGURE 2-3
Site Boundary

ENCLOSURE 2

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

March 1, 2004

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 DONALD C. COOK NUCLEAR PLANT LICENSE RENEWAL

Dear Mr. Czarnecki:

The U.S. Nuclear Regulatory Commission (NRC) is reviewing an application submitted by Indiana Michigan Power Company (I&M) for the renewal of the operating licenses for Donald C. Cook Nuclear Plant, Units 1 and 2 (CNP). CNP is located in Berrien County, Michigan, on the southeastern shoreline of Lake Michigan approximately 55 miles east of Chicago, Illinois, 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 CNP property is characterized by agricultural lands and heavily wooded, rugged sand dunes along the Lake Michigan shoreline. Grand Mere State Park is located about one mile north-northeast of CNP and Warren Dunes State Park is located approximately 3.5 miles south-southwest of the plant.

CNP uses an open-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 20 ft. After circulating through the condensers, the cooling water is discharged through two tunnels that end offshore with high-velocity underwater discharge elbows.

For the specific purpose of connecting CNP to the regional transmission system, there is a total of approximately 408 kilometers (255 miles) of transmission line corridors that occupy approximately 1980 hectares (4,900 acres) of land. These transmission line corridors are being evaluated as part of the SEIS process. The transmission line corridors traverse Berrien, Van Buren, and Cass counties in Michigan; and LaPorte, St. Joseph, Elkhart, LaGrange, Noble, DeKalb, and Allen Counties in Indiana. 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. Six 345-kilovolt (kV) lines connect from the Unit 1 switchyard and a single 765-kV line connects from the Unit 2 switchyard. The switchyards are shown in the enclosed CNP 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 CNP 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 March 8, 2004, at the Lake Charter Township Hall, 3220 Shawnee Road, Bridgman, Michigan. On March 9, 2004, 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 September 2004.

If you have any questions concerning the NRC staff review of this license renewal application, please contact Mr. Robert Schaaf, Environmental Project Manager, at (301) 415-1312 or by e-mail at rgs@nrc.gov.

Sincerely,

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

Docket Nos.: 50-315 and 50-316

Enclosures: 1. CNP Transmission Line Map
2. CNP Site Layout

cc w/encl.: See next page

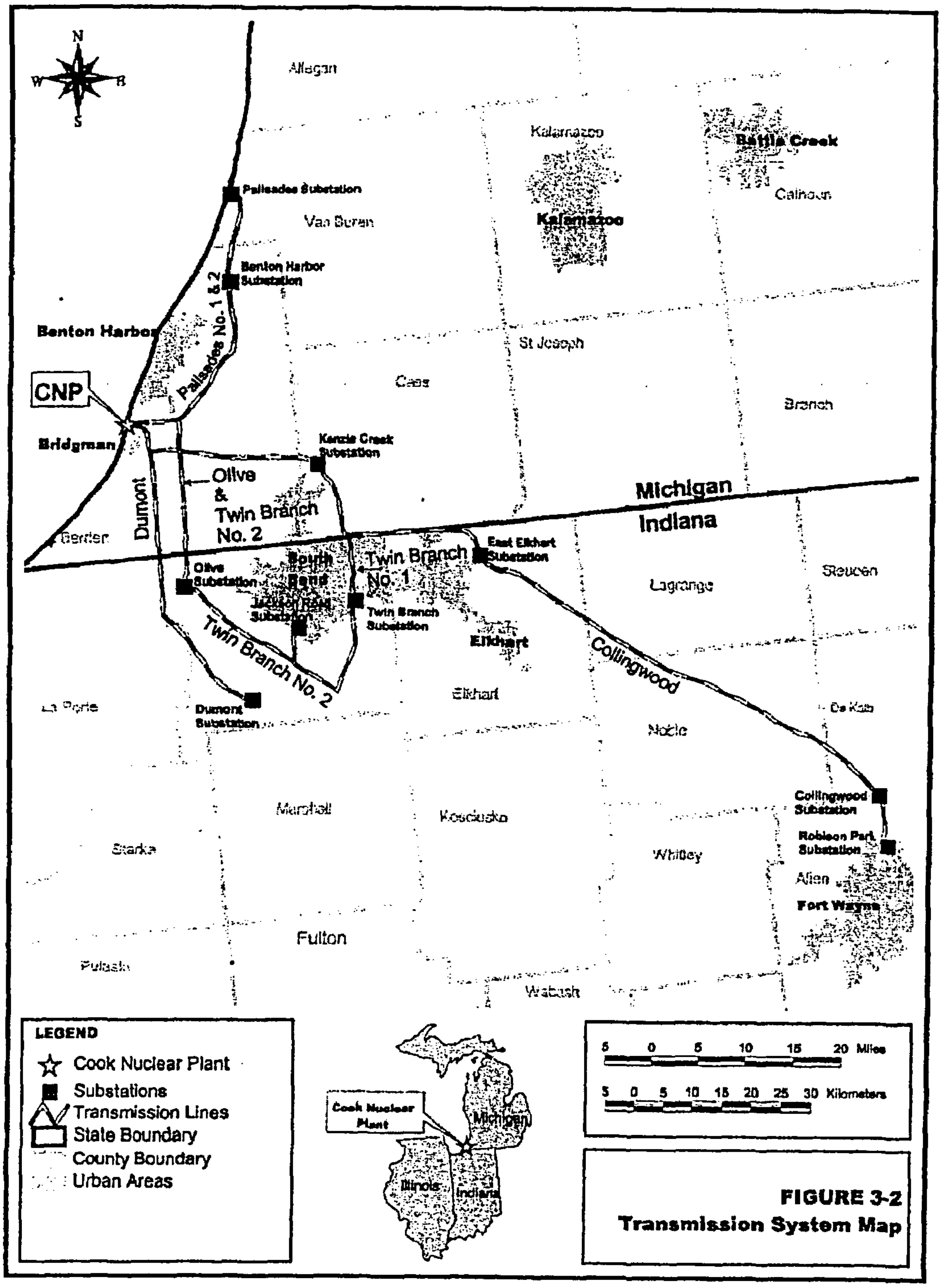
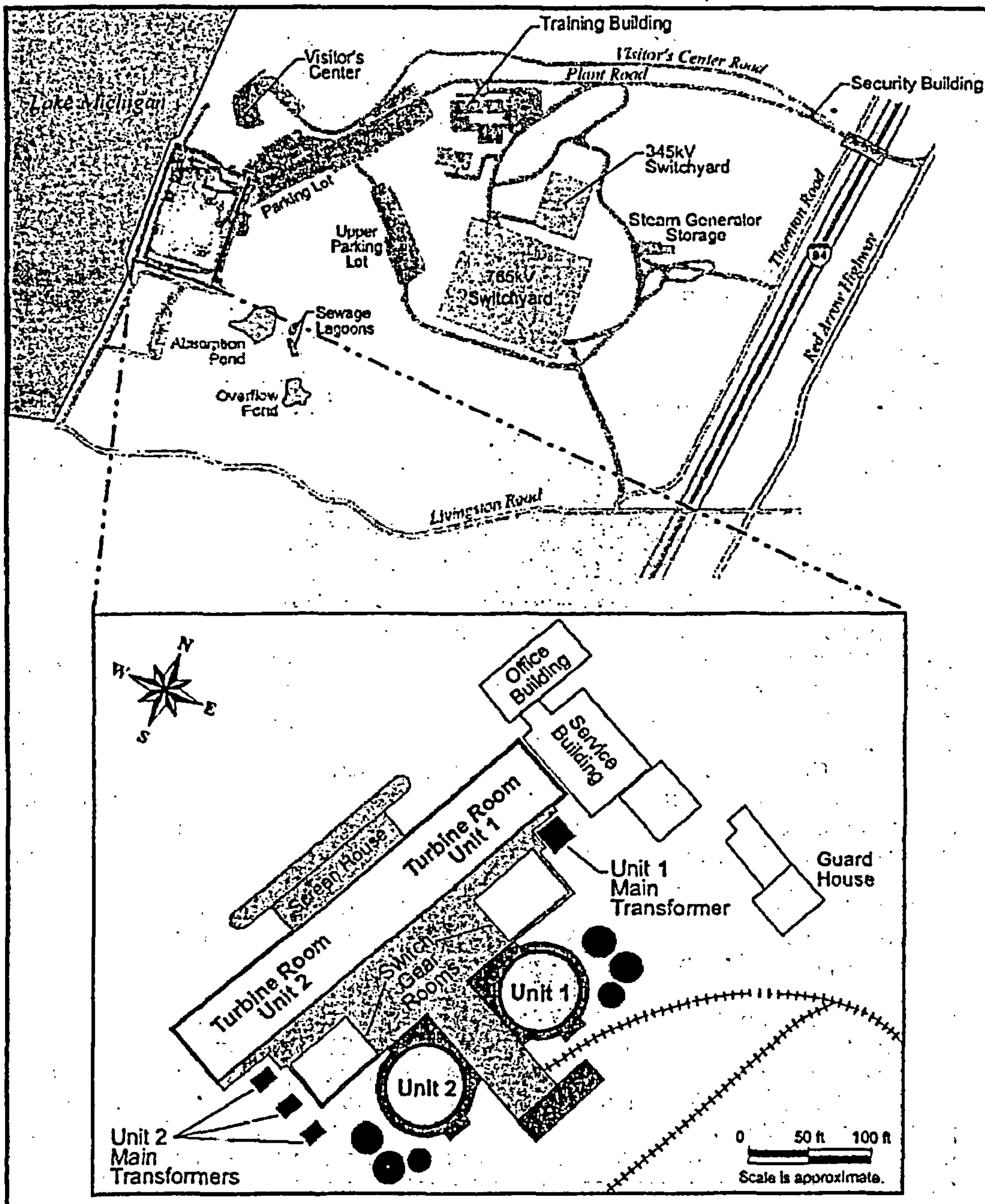


FIGURE 3-2
Transmission System Map

ENCLOSURE 1



LEGEND

+++++++ Railroad Tracks

FIGURE 3-1
D.C. Cook Nuclear Plant
Site Layout

ENCLOSURE 2

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

March 2, 2004

Mr. Brian Conway
Michigan State Historic Preservation Office
Michigan Historical Center
Box 30740
717 W. Allegan Street
Lansing, MI 48909-8240

SUBJECT: DONALD C. COOK NUCLEAR PLANT OPERATING LICENSE RENEWAL APPLICATION REVEIW

Dear Mr. Conway,

The U.S. Nuclear Regulatory Commission (NRC) staff is reviewing an application to renew the operating licenses for the Donald C. Cook Nuclear Plant, Units 1 and 2 (CNP), which is located in Lake Charter Township, Berrien County, Michigan. CNP is owned and operated by the Indiana Michigan Power Company (I&M), a wholly owned subsidiary of American Electric Power. The NRC received an application for license renewal from the I&M on November 3, 2003, pursuant to the NRC requirements at the 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 rules of the NRC 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. A draft SEIS is scheduled for publication in September 2004 and will be provided to you for review and comment.

In the context of the National Historic Preservation Act of 1966, as amended, the Agency official (the Director, Office of Nuclear Reactor Regulation, NRC) has determined that the area of potential effect for a license renewal action is the area at the power plant site and its immediate environs which may be impacted by post-license renewal land-disturbing operations or projected refurbishment activities associated with the proposed action. The area of potential effect 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, potentially have an effect on known or proposed historic sites. This determination is made irrespective of ownership or control of the lands of interest.

While preparing the application, I&M contacted your office by letter dated March 17, 2003. In the letter, I&M stated that it has no plans to alter CNP operations through the license renewal term. I&M further stated that no major expansion of existing facilities is planned, no major structural modifications have been identified for the purpose of supporting license renewal, and no additional land disturbance is anticipated.

B. Conway - 2 -

On March 8, 2004, the NRC will conduct two public NEPA scoping meetings at the Lake Charter Township Hall, 3220 Shawnee Road, Bridgman, Michigian, 49106. You and your staff are invited to attend. The anticipated publication date for the draft SEIS is September 2004. Your office will receive a copy of the draft SEIS for review and comment. If you have any questions or require additional information, please contact the Environmental Project Manager for the CNP license renewal project, Mr. Robert Schaaf at 301-415-1312 or RGS@nrc.gov.

Sincerely,

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

Docket Nos.: 50-315 and 50-316

cc: See next page

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

March 8, 2004

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

SUBJECT: DONALD C. COOK 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 Donald C. Cook Nuclear Plant, Units 1 and 2 (CNP), which is located in Berrien County, Michigan, approximately 55 miles east of Chicago, Illinois, and 50 miles west-southwest of Kalamazoo, Michigan. CNP is operated by the Indiana Michigan Power Company (I&M). The application for renewal was submitted by I&M on October 31, 2003, pursuant to NRC requirements at Title 10 of the *Code of Federal Regulations* Part 54 (10 CFR Part 54). The NRC has established that, as part of the staff review of any nuclear power plant license renewal 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 September of 2004, and will be provided to you for review and comment.

If you have any questions or require additional information, please contact the Environmental Project Manager for the CNP project, Mr. Robert Schaaf at 301-415-1312 or rgs@nrc.gov.

Sincerely,

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

Docket Nos.: 50-315, 50-316

cc: See next page

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:

March 23, 2004

Mr. Pao-Tsin Kuo
Program Director
U. S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Re: *Endangered Species List Request, Proposed Renewal of Operating Licenses for Donald C. Cook Nuclear Plant, Units 1 and 2 (CNP), Berrien, Cass, and Van Buren Counties, Michigan*

Dear Mr. Kuo:

Thank you for your March 1, 2004 request for information regarding federally listed and proposed threatened and endangered species, species of concern, and critical habitat for the renewal of operating licenses for CNP by the U.S. Nuclear Regulatory Commission (NRC). Your request and this response are made pursuant to section 7 of the Endangered Species Act of 1973, as amended (the Act).

We understand that NRC is reviewing an application submitted by Indiana Michigan Power Company (I&M) for licenses renewal for CNP. The proposed action would include the continued use and maintenance of existing plant facilities and transmission lines in several locations in Berrien, Cass and Van Buren Counties, Michigan. The proposed action will not result in new construction or disturbance or change in operations.

Endangered Species Act Comments

Our records indicate that the candidate eastern massasauga rattlesnake (*Sistrurus catenatus catenatus*) may occur in general vicinity of the proposed action areas in southeastern Berrien County. 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.

Candidates that may be proposed and listed in the future are included as advanced notice to federal agencies or their designees. 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.

Eastern massasauga habitat is typically associated with shallow wetland systems. The rattlesnake prefers habitat with open canopy and a sedge or grass ground cover. Sphagnum moss is also often a significant component of the substrate. Appropriate management for massasauga involves maintaining prairie, bog, woodland, and peat ecosystems in a natural state.

A104

The Michigan Department of Natural Resources protects the massasauga rattlesnake through Part 365, Endangered Species Protection, of the Natural Resources and Environmental Protection Act, 1994, PA 451. Please contact the Endangered Species Coordinator of the MDNR at (517)373-1263 with questions concerning the protection of threatened and endangered species under State law. The State law requires permits in advance of any work that could potentially damage, destroy, or displace State-listed species.

This precludes the need for further action on this project as required by section 7 of the Act. If the project is modified or new information about the project becomes available that indicates listed species or critical habitat may be affected in a manner or to an extent not previously considered, you should reinitiate consultation with this office.

We appreciate the opportunity to provide these comments. Please refer any questions directly to Tameka Dandridge of this office at (517) 351-8315 or the above address.

Sincerely,

for Craig A. Czarnecki
Field Supervisor

cc: Michigan Department of Natural Resources, Wildlife Division, Lansing, MI
(Attn: Lori Sargent)

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

April 29, 2004

Mr. Scott Pruitt
Field Supervisor
U.S. Fish and Wildlife Service
Bloomington Ecological Services Field Office
620 South Walker Street
Bloomington, IN 47403

SUBJECT: REQUEST FOR LIST OF PROTECTED SPECIES WITHIN THE AREA UNDER EVALUATION FOR THE DONALD C. COOK NUCLEAR PLANT LICENSE RENEWAL

Dear Mr. Pruitt:

The U.S. Nuclear Regulatory Commission (NRC) is reviewing an application submitted by Indiana Michigan Power Company (I&M) for the renewal of the operating licenses for Donald C. Cook Nuclear Plant, Units 1 and 2 (CNP). CNP is located in Berrien County, Michigan, on the southeastern shoreline of Lake Michigan approximately 55 miles east of Chicago, Illinois, 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 includes an analysis of pertinent environmental issues, including endangered or threatened species and impacts to fish and wildlife. This letter is being submitted under the provisions of the Endangered Species Act of 1973, as amended, and the Fish and Wildlife Coordination Act of 1934, as amended.

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 CNP property is characterized by agricultural lands and heavily wooded, rugged sand dunes along the Lake Michigan shoreline. Grand Mere State Park is located about one mile north-northeast of CNP and Warren Dunes State Park is located approximately 3.5 miles south-southwest of the plant.

CNP uses an open-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 20 ft. After circulating through the condensers, the cooling water is discharged through two tunnels that end offshore with high-velocity underwater discharge elbows.

For the specific purpose of connecting CNP to the regional transmission system, there is a total of approximately 408 kilometers (255 miles) of transmission line corridors that occupy approximately 1980 hectares (4,900 acres) of land. These transmission line corridors are being evaluated as part of the SEIS process. The transmission line corridors traverse LaPorte, St. Joseph, Elkhart, LaGrange, Noble, DeKalb, and Allen Counties in Indiana; and Berrien, Van Buren, and Cass Counties in Michigan. The corridors pass through land that is primarily

S. Pruitt - 2 -

agricultural and forest land. The enclosed transmission line map shows the transmission system that is being evaluated in the SEIS. Six 345-kilovolt (kV) lines connect from the Unit 1 switchyard and a single 765-kV line connects from the Unit 2 switchyard. The switchyards are shown in the enclosed CNP 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 CNP and its associated transmission lines. In addition, please provide any information you consider appropriate under the provisions of the Fish and Wildlife Coordination Act.

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 September 2004.

If you have any questions concerning the NRC staff review of this license renewal application, please contact Mr. Robert Schaaf, Environmental Project Manager, at (301) 415-1312 or by e-mail at RGS@nrc.gov.

Sincerely,

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

Docket Nos.: 50-315 and 50-316

Enclosures: 1. CNP Transmission Line Map
2. CNP Site Layout

cc w/encls: See next page

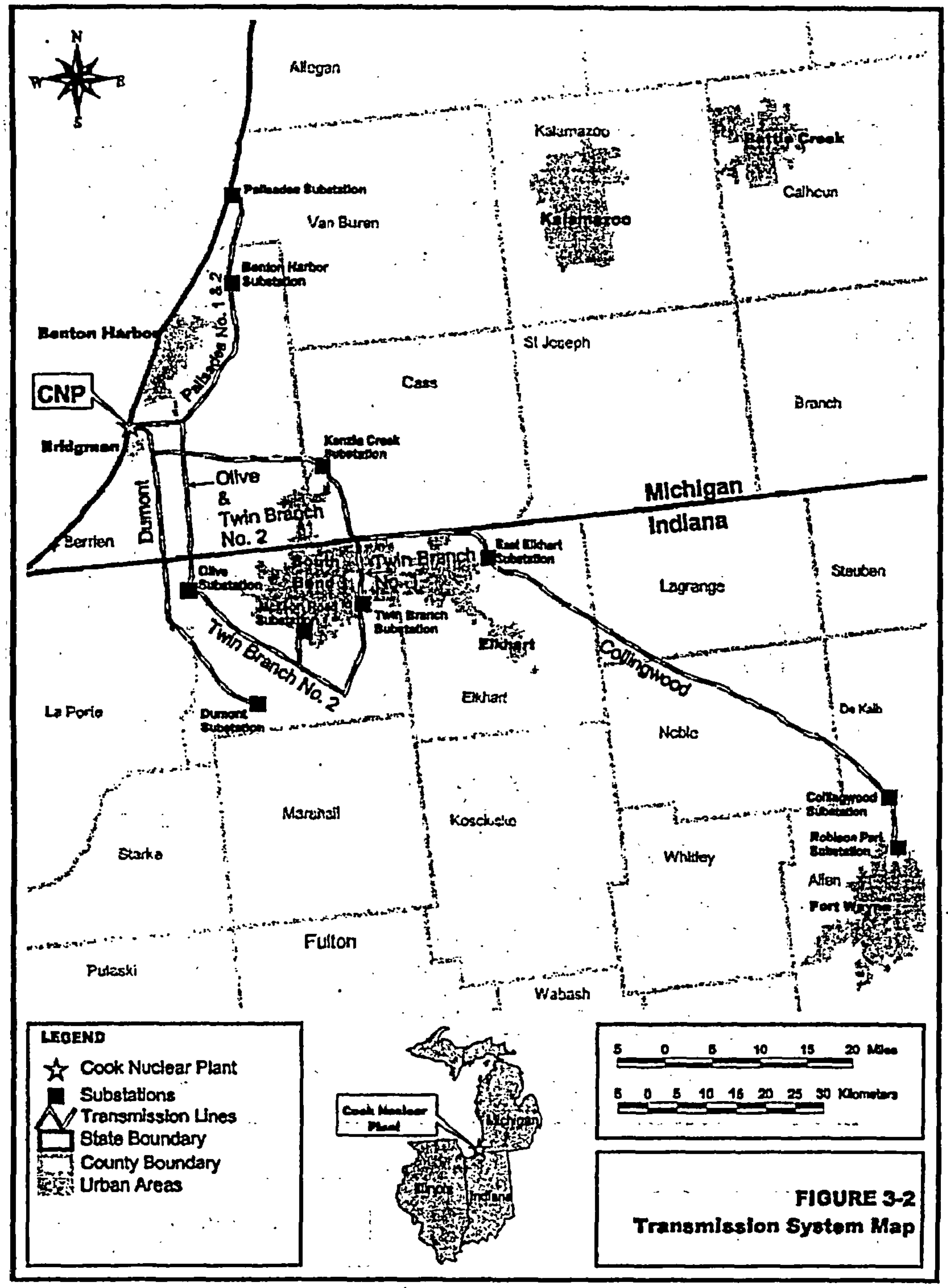


FIGURE 3-2
Transmission System Map

ENCLOSURE 1

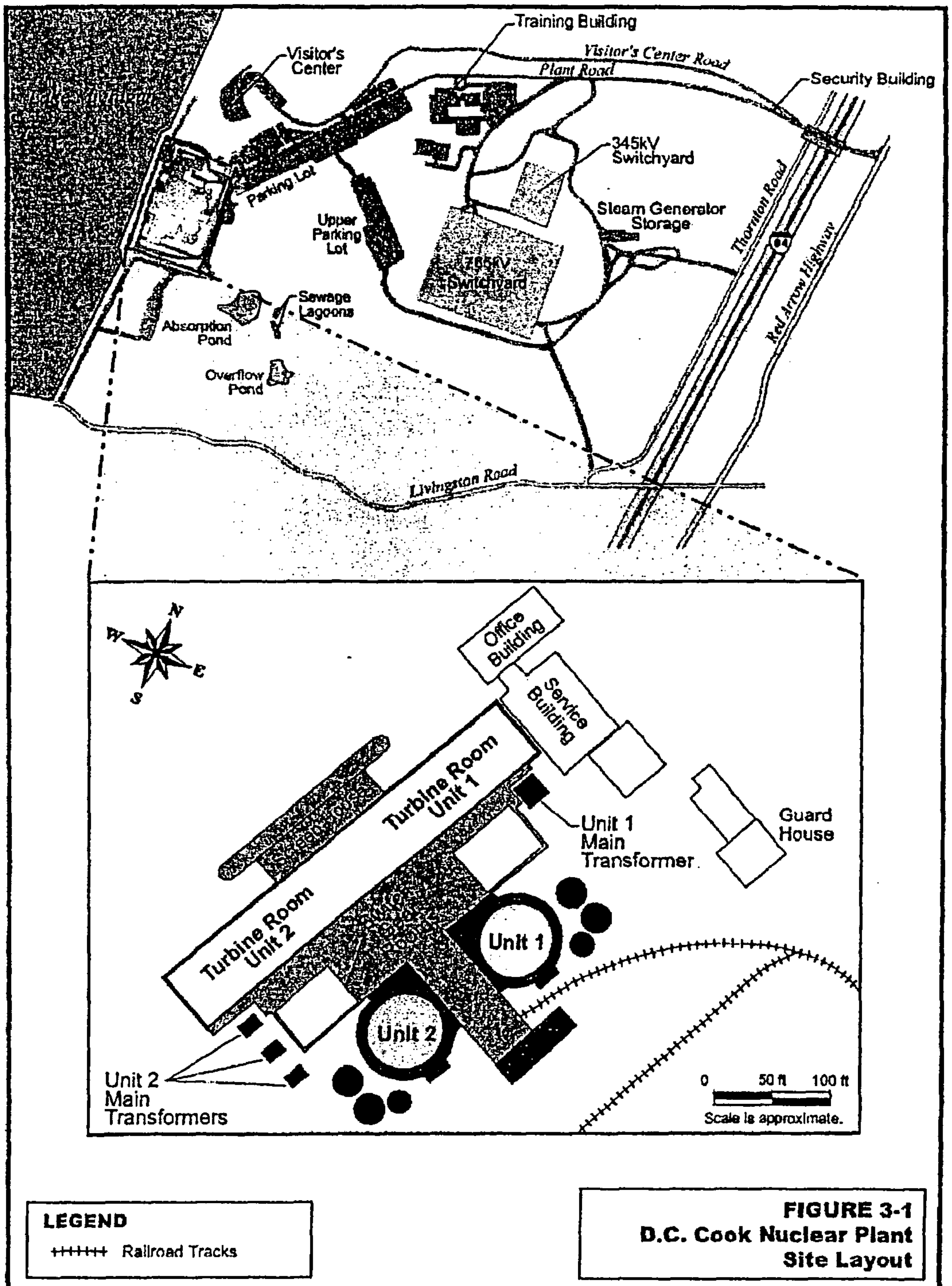


FIGURE 3-1
D.C. Cook Nuclear Plant
Site Layout

ENCLOSURE 2

United States Department of the Interior
Fish and Wildlife Service

Bloomington Field Office (ES)
620 South Walker Street
Bloomington, IN 47403-2121
Phone: (812) 334-4261 Fax: (812) 334-4273
May 18, 2004

Mr. Robert Schaaf
Environmental Project Manager
Division of Regulatory Improvement Programs
Office of Nuclear Reactor Regulation
Nuclear Regulatory Commission
Washington, D.C. 20555-0001

Docket Nos.: 50-315 and 50-316
Project: D.C. Cook Nuclear Plant License Renewal
Locations: LaPorte, St. Joseph, Elkhart, LaGrange, Noble, Dekalb, and Allen Counties, Indiana

Dear Mr. Schaaf:

This responds to Mr. Pao-Tsin Kuo's letter dated April 29, 2004, requesting endangered species lists and other relevant information on the aforementioned project.

These comments have been prepared under the authority of the Fish and Wildlife Coordination Act (16 U.S.C. 661 et. seq.) and are consistent with the intent of the National Environmental Policy Act of 1969, the Endangered Species Act of 1973, and the U. S. Fish and Wildlife Service's Mitigation Policy.

American Electric Power, the owner of the D.C. Cook Nuclear Plant, contacted us in July 2003 requesting endangered species information. We replied by letter of July 24, 2004, a copy of which is enclosed. The endangered species information remains as presented in that letter since no additional species have been listed or proposed as candidates for listing since that time in the counties affected by the transmission lines.

This precludes the need for further consultation on this project as required under Section 7 of the Endangered Species Act of 1973, as amended. If, however, new information on endangered species at the sites becomes available or if project plans are changed significantly, please contact our office for further consultation.

We appreciate the opportunity to comment at this early stage of project planning. If you have any questions, please contact Elizabeth McCloskey at (219) 983-9753 or elizabeth_mccloskey@fws.gov.

Sincerely yours,

Elizabeth S. McCloskey

for Scott E. Pruitt
Supervisor

cc: Christie Kiefer, Environmental Coordinator, Division of Water, Indianapolis, IN

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United States Department of the Interior
Fish and Wildlife Service

Bloomington Field Office (ES)
620 South Walker Street
Bloomington, IN 47403-2121
Phone: (812) 334-4261 Fax: (812) 334-4273

July 24, 2003

Mr. John P. Carlson
Environmental Manager
American Electric Power
Nuclear Generation Group
One Cook Place
Bridgman, Michigan 49106

Project No: D.C. Cook Nuclear Plant License Renewal
Location: LaPorte, St. Joseph, Elkhart, LaGrange, Noble, DeKalb, and Allen Counties, Indiana

Dear Mr. Carlson:

This responds to your letter dated July 18, 2003, requesting our endangered species comments on the aforementioned project. We have reviewed the document *Threatened and Endangered Species Survey Final Field Report* prepared by Tetra Tech NUS, Inc., December 2002.

These comments have been prepared under the authority of the Fish and Wildlife Coordination Act (16 U.S.C. 661 et. seq.) and are consistent with the intent of the National Environmental Policy Act of 1969, the Endangered Species Act of 1973, and the U. S. Fish and Wildlife Service's Mitigation Policy.

As part of the requirements for renewal of operating licenses for the D.C. Cook Nuclear Plant Units 1 and 2, it was necessary for American Electric Power (AEP) to assess the impact of the proposed action (license renewal of the existing electric generating station and transmission lines) on endangered species. Therefore, in 2002, AEP contracted for plant and animal species surveys at the generating station site in Berrien County, Michigan, and along the transmission corridors in Michigan and Indiana. These comments refer only to the Indiana portion of the survey.

No Federally endangered, threatened, or candidate species were observed during the 2002 surveys of the transmission corridors in Indiana.

The project is within the range of the Federally endangered Indiana bat (Myotis sodalis) (statewide), white cat's paw pearly mussel (Epioblasma obliquata perobliqua) (DeKalb County), clubshell mussel (Pleurobema clava) (DeKalb County), Northern riffleshell mussel (Epioblasma torulosa rangiana) (DeKalb County), Mitchell's satyr butterfly (Neonympha mitchelli) (LaPorte and LaGrange Counties), and the threatened bald eagle (Haliaeetus leucocephalus) (statewide) and northern copperbelly water snake (Nerodia erythrogaster neglecta) (St. Joseph County). It is also within the range of the eastern massasauga rattlesnake (Sistrurus catenatus catenatus) (LaPorte, St. Joseph, Elkhart, LaGrange, Noble, and Allen Counties), which has been listed as a candidate for possible future listing as either threatened or endangered. Candidate species are those for which sufficient information on their biological status exists to warrant listing, but for which listing has not yet occurred.

None of the mussel species are known from the streams crossed by the AEP transmission line in DeKalb County. Mitchell's satyr is very localized and is not known under the AEP transmission corridors in LaPorte and LaGrange Counties. The northern copperbelly water snake is also very localized in St. Joseph County and is not known under the AEP transmission corridors in that county. Bald eagles area occasional winter visitors to northern Indiana and have no specific habitats in the vicinity of any of the AEP transmission corridors.

The Indiana bat could be found along any of the streams and woodlands crossed by the transmission lines in the 7 counties during the summer maternity season (April 15 to September 15). Presence or absence could only be determined through mist netting surveys at each potential site; however, the U.S. Fish and Wildlife Service considers this species to be present in suitable habitat unless such surveys indicate its absence. If present, this species is not likely to be adversely effected by activities in these already-cleared corridors if any tree clearing occurs after September 15 and before April 15.

The eastern massasauga may be found in suitable wetland habitats within the AEP transmission corridors in any of the project area counties where it is known to be present, although the small area in Allen County included in the Collingwood corridor is not known to support this species. We know generally where this species occurs within each county since it is not widely distributed. Since we were not provided detailed route maps of the corridors, we cannot state at this time whether or not other counties are also unlikely to contain this species within the corridors. If this species is listed as endangered or threatened in the future, it may to necessary for AEP to determine whether or not this species is present within specific sections of its corridors. The U.S. Fish and Wildlife Service will inform AEP if such listing occurs.

This precludes the need for further consultation on this project as required under Section 7 of the Endangered Species Act of 1973, as amended. However, should new information arise pertaining to project plans or a revised species list be published, it will be necessary for the Federal agency to reinitiate consultation.

If you have not already done so, we request that you provide the information on Indiana endangered species found during this survey to the Indiana Division of Nature Preserves.

Thank you for the opportunity to review this threatened and endangered species survey information. If you have any questions, please call Elizabeth McCloskey at (219) 983-9753.

Sincerely yours,

Elizabeth S. McCloskey
for Scott E. Pruitt Acting
Supervisor

cc: Director, Indiana Division of Nature Preserves, Indianapolis, IN

Appendix F

GEIS Environmental Issues Not Applicable to Donald C. Cook Nuclear Plant Units 1 and 2

Appendix F

GEIS Environmental Issues Not Applicable to Donald C. Cook Nuclear Plant Units 1 and 2

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 10 CFR Part 51, Subpart A, Appendix B, Table B-1, that are not applicable to Donald C. Cook Nuclear Plant (CNP) Units 1 and 2, because of plant or site characteristics.

Table F-1. GEIS Environmental Issues Not Applicable to CNP

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 CNP.
Impacts of refurbishment on surface water use	1	3.4.1	No refurbishment is planned at CNP.
Altered salinity gradients	1	4.2.1.2.2 4.4.2.2	The CNP Units 1 and 2 cooling system does not discharge to an estuary.
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 CNP Units 1 and 2 cooling system does not use makeup water from a small river with low flow.
AQUATIC ECOLOGY (FOR ALL PLANTS)			
Refurbishment	1	3.5	No refurbishment is planned at CNP.

(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 PLANTS WITH COOLING TOWER-BASED HEAT DISSIPATION SYSTEMS)			
Entrainment of fish and shellfish in early life stages	1	4.3.3	This issue is related to heat-dissipation systems that are not installed at CNP Units 1 and 2.
Impingement of fish and shellfish	1	4.3.3	This issue is related to heat-dissipation systems that are not installed at CNP Units 1 and 2.
Heat shock	1	4.3.3	This issue is related to heat-dissipation systems that are not installed at CNP Units 1 and 2.
GROUNDWATER USE AND QUALITY			
Impacts of refurbishment on groundwater use and quality	1	3.4.2	No refurbishment is planned at CNP.
Groundwater use conflicts (potable and service water, and dewatering; plants that use >100 gpm)	2	4.8.1.1 4.8.2.1	CNP Units 1 and 2 use <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	This issue is related to heat-dissipation systems that are not installed at CNP Units 1 and 2.
Groundwater use conflicts (Ranney wells)	2	4.8.1.4	CNP Units 1 and 2 do not have or use Ranney wells.
Groundwater quality degradation (Ranney wells)	1	4.8.2.2	CNP Units 1 and 2 do not have or use Ranney wells.
Groundwater quality degradation (saltwater intrusion)	1	4.8.2.1	CNP Units 1 and 2 use <100 gpm of groundwater and are not located near a saltwater body.
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 CNP Units 1 and 2.
Groundwater quality degradation (cooling ponds at inland sites)	2	4.8.3	This issue is related to heat-dissipation systems that are not installed at CNP Units 1 and 2.

Table F-1. (contd)

ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1	Category	GEIS Sections	Comment
TERRESTRIAL RESOURCES			
Refurbishment impacts	2	3.6	No refurbishment is planned at CNP.
Cooling tower impacts on crops and ornamental vegetation	1	4.3.4	This issue is related to heat-dissipation systems that are not installed at CNP Units 1 and 2.
Cooling tower impacts on native plants	1	4.3.5.1	This issue is related to heat-dissipation systems that are not installed at CNP Units 1 and 2.
Bird collisions with cooling towers	1	4.3.5.2	This issue is related to heat-dissipation systems that are not installed at CNP Units 1 and 2.
Cooling pond impacts on terrestrial resources	1	4.4.4	This issue is related to heat-dissipation systems that are not installed at CNP Units 1 and 2.
AIR QUALITY			
Air quality during refurbishment (nonattainment and maintenance areas)	2	3.2.1	No refurbishment is planned at CNP.
HUMAN HEALTH			
Radiation exposure to the public during refurbishment	1	3.8.1	No refurbishment is planned at CNP.
Occupational radiation exposures during refurbishment	1	3.8.2	No refurbishment is planned at CNP.
Microbial organisms (occupational health)	1	4.3.6	No refurbishment is planned at CNP.
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	This issue is related to heat-dissipation systems that are not installed at CNP Units 1 and 2.
SOCIOECONOMICS			
Public services, education (refurbishment)	2	3.7.4.1	No refurbishment is planned at CNP.
Offsite land use (refurbishment)	2	3.7.5	No refurbishment is planned at CNP.
Aesthetic impacts (refurbishment)	1	3.7.8	No refurbishment is planned at CNP.

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 DC Cook Nuclear Power Station, Units 1 & 2, in Support of License Renewal Application

10 CFR 51.53(c)(3)(ii)(L) 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 Donald C. Cook Nuclear Plant Units 1 & 2; therefore, the remainder of Appendix G addresses those alternatives.

G.1 Introduction

Indiana Michigan Power Company (I&M) submitted an assessment of SAMAs for the Donald C. Cook Nuclear Plant Units 1 & 2 (DC Cook) as part of the ER (I&M 2003). This assessment was based on the most recent DC Cook Probabilistic Risk Assessment (PRA) available at that time, a plant-specific offsite consequence analysis performed using the MELCOR Accident Consequence Code System 2 (MACCS2), and insights from the DC Cook Individual Plant Examination (IPE) (AEP 1992 and AEP 1995). In identifying and evaluating potential SAMAs, I&M considered SAMA analyses performed for other operating plants which have submitted license renewal applications, as well as industry and NRC documents that discuss potential plant improvements, such as NUREG/CR-5630 (NRC 1991), and NUREG/CR-5575 (NRC 1990). I&M identified 194 potential SAMA candidates. This list was reduced to 72 SAMAs by eliminating SAMAs that were not applicable to DC Cook, had already been implemented, or had high implementation costs. I&M assessed the costs and benefits of these 72 SAMAs and concluded that 16 candidate SAMAs could be cost beneficial for DC Cook.

Based on a review of the SAMA assessment, the NRC issued a request for additional information (RAI) to I&M by letter dated March 18, 2004. (NRC 2004a). Key questions concerned: dominant risk contributors at DC Cook, the potential impact of internal fire and seismic events, an assessment of uncertainties, the benefit of some SAMAs to both DC Cook units, and detailed information on some specific candidate SAMAs. I&M submitted additional information by letter dated May 17, 2004 (I&M 2004), including: tables containing the core damage frequency Importance Analysis, tables of source terms by release category, tables of SAMAs which benefit both Units, cost-benefit estimates for screened SAMAs, an uncertainty assessment, tables of sensitivity analysis of revised containment failure probability, and the containment event tree from the October 2003 PRA. I&M's responses addressed the staff's concerns.

I&M identified 16 potential cost-beneficial SAMAs. These 16 SAMAs were grouped into five categories as alternative ways to achieve risk reduction in these categories:

- Minimize consequences of reactor coolant pump (RCP) seal LOCAs
- Minimize consequences of loss of HVAC
- Remove dependance of Distributed Ignition System on AC power
- Minimize consequences of AC bus failures
- Improve recovery from Interfacing Systems Loss of Coolant Accidents (ISLOCA)

The grouping of the SAMAs into these categories allows I&M to compare options to reduce the impact of severe accidents. I&M is conducting additional analyses to allow them to select the specific actions which achieve the most cost-beneficial risk reduction in each category.

Note that one of the cost-beneficial SAMAs involves providing a backup AC power source for the distributed ignition system. The NRC staff is currently evaluating a potential requirement for a similar enhancement as part of the resolution of Generic Safety Issue 189 (GSI-189), "Susceptibility of Ice Condenser and Mark III Containments to Early Failure from Hydrogen Combustion During a Severe Accident."

An assessment of SAMAs for DC Cook is presented below.

G.2 Estimate of Risk for DC Cook

I&M's estimates of offsite risk at DC Cook are summarized in Section G.2.1. The summary is followed by the staff's review of I&M's estimates in Section G.2.2.

G.2.1 I&M's Risk Estimates

The PRA used to form the basis for the risk estimates used in the SAMA analysis is an updated PRA based on the DC Cook Level 1, 2 and 3 PRA models for internal events developed for the DC Cook IPE generic letter response (AEP 1992 and AEP 1995). The Level 1 PRA models were updated in August 2001 (I&M 2001), the Level 2 PRA models were updated in October 2003 (I&M 2003), and the Level 3 Models were updated in October 2003 (TtNUS 2003). The risk from external events is assessed in the Individual Plant Examination for External Events (IPEEE) (AEP 1992).

The baseline core damage frequency (CDF) for the purpose of the SAMA evaluation is approximately 5.0×10^{-5} per year. The CDF is based on the risk assessment for internally-initiated events. Based on the IPEEE model, seismic events contribute a CDF of 3.2×10^{-6} per year, and internal fires a CDF of 3.8×10^{-6} per year. Other external events were found to be insignificant contributors to plant risk. I&M did not include the contribution to risk from external events within the DC Cook risk estimates; however, it did include the potential risk reduction benefits associated with external events by doubling the estimated benefits for internal events. This is discussed further in G.6.2.

The breakdown of CDF by initiating event/accident type is provided in Table G-1. As shown in this table, loss of offsite power, small LOCAs, transients with the Power Conversion System available and loss of Essential Service Water are dominant contributors to the CDF.

Table G-1. DC Cook Core Damage Frequency for Internal Events

Initiating Event	CDF (per year)[a]	Percent Contribution[b]
Single Unit LOSP (LSP)	1.2×10^{-5}	23.2
Small LOCA (SLO)	8.6×10^{-6}	17.1
Dual Units LOSP(DSLP)	7.2×10^{-6}	14.3
Transient with Power Conversion System Available (TRA)	6.6×10^{-6}	13.3
Loss of All ESW to Both Units (ESW4)	6.5×10^{-6}	12.9
Loss of ESW to Unit (ESW2)	2.5×10^{-6}	5.0
Loss of CCW (CCW)	2.3×10^{-6}	4.6
Steamline Break Outside MSIV (SLB-5)	6.5×10^{-7}	1.3
SGTR in Any of 4 Loops(SGR-1; SGR-2; SGR-3; SGR-4)	5.0×10^{-7}	1.0
Breaks Beyond ECCS Capability (VEF)	3.0×10^{-7}	0.6
Steamline Break In Any of 4 Loops (SLB-1; SLB-2; SLB-3; SLB-4)	3.0×10^{-7}	0.6
Transient without Power Conversion System Available (TRS)	2.0×10^{-7}	0.4
Others	$<5.0 \times 10^{-8}$	<0.1
TOTAL CDF	5.0×10^{-5}	100

(a) Unit 1 CDF taken from Table F.2-1 of the ER (I&M 2003). Unit 2 values are similar.
(b) Values based on Unit 1.

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 the 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 2038, emergency response evacuation modeling, and economic data.

In the ER, I&M estimated the dose to the population within 80 km (50 mi) of the DC Cook site to be approximately 42.5 person-rem (Table F.2-8 in the ER). The breakdown of total population dose by containment release mode is summarized in Table G-2.

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

Containment Release Mode	Population Dose (Person-rem per year)	Percent Contribution
Containment Bypass	13.2	31.0
Containment Isolation Failure	<.01	~0.0
Early Containment Failure	9.6	22.6
Late Containment Failure	19.7	46.4
No Containment Failure	~0.0	~0.0
Total	42.5	100

G.2.2 Review of I&M's Risk Estimates

I&M's determination of offsite risk at DC Cook is based on the following three major elements of analysis:

- the DC Cook Level 1, 2, and 3 risk models that form the bases for the IPE and IPEEE submittals,
- the updates of the Level 1, 2, and 3 risk models that have been incorporated into the DC Cook PRA, and
- the MACCS2 analyses performed to translate fission product release frequencies from the level 2 PRA model into offsite consequence measures.

Relevant reviews of each of these analyses provided insight into the acceptability of I&Ms risk estimates for the SAMA analysis, as summarized below.

The staff's review of the DC Cook IPE is described in an NRC report dated September 6, 1996 (NRC 1996). Based on a review of the original IPE submittal (AEP 1992), the staff concluded that the IPE is complete (with regard to IPE guidance) and that the IPE results are reasonable, except for several weaknesses in the application of human reliability modeling. I&M revised their human reliability modeling, and subsequently provided a revised IPE (AEP 1995). Based on the acceptability of the original IPE submittal, the NRC staff did not review the revised submittal.

In response to the staff's request for additional information about changes in the various PRA versions since the IPE, I&M provided additional details (I&M 2004). There have been three revisions of the DC Cook Level 1 PRA since the revised IPE was submitted. A summary of the differences in these versions is provided in Table G-3.

Table G-3. Level 1 PRA Summary

Level 1 PRA Version	Summary of Changes from Prior Version	CDF (per year)
October 1995	Revised IPE, including revised human reliability analysis (HRA) to address NRC questions.	7.14×10^{-5}
May 1996	Updates involving test and maintenance unavailability.	6.36×10^{-5}
August 1997	Conversion of logic models to new fault tree analysis software reducing truncation error.	7.09×10^{-5}
August 2001	Major update incorporating changes to design and operation. Purpose of update was to develop PRA to support management of risk during maintenance activities, and to support the new risk-informed, performance-based regulatory environment. Changes incorporated included: – conversion to new software to better support Safety Monitor implementation • inclusion of new plant-specific data, procedures and/or design changes – revision of treatment of common cause failures – removal of conservative assumptions and simplifications – creation of a dual unit model including inter-unit dependencies (the IPE was a single unit model).	4.9×10^{-5}

The CDF values for DC Cook are comparable to the CDF values reported in the IPEs for other Westinghouse 4-loop plants. As reported in NUREG-1560, the total internal events CDF for these plants range from approximately 3×10^{-6} per year to 2×10^{-4} per year, with an average CDF value of 6×10^{-5} per year. The CDF for DC Cook also compares favorably with that for other ice condenser plants.

The staff considered the peer reviews performed for the DC Cook PRA, and the potential impact of the review findings on the SAMA evaluation. In August 2001, the Level 1 PRA model was reviewed by the Westinghouse Owner's Group (WOG) PRA Peer Review Team. The Peer Review Team concluded that the August 2001 Level 1 PRA model could be used in licensing submittals to the NRC to support positions concerning absolute levels of safety significance, if supported by deterministic evaluations. The results of the review are summarized in the ER (I&M 2003). Among the Facts and Observations (F&Os) from the review, the following could impact the SAMA evaluation:

- The internal flooding analysis should be updated.

- Common cause process could be improved; plant-specific common cause screening should be considered.

- The highly sophisticated single fault tree model used for PRA or Configuration Risk Management quantification requires a high degree of attention to quantification process.

With regard to internal flooding, I&M noted that the CDF for internal flooding events in the IPE is very small (2×10^{-7} per year), and due primarily to a single event. They also cited several conservatisms in the analysis that, if removed, would result in a significant reduction in the CDF for this event. I&M reviewed the set of candidate SAMAs with regard to their potential benefits in internal flooding events. Based on this review and the above considerations I&M concluded that none of the SAMA candidates would provide a significant benefit for internal floods, and that the F&O related to internal flooding would not impact the SAMA analysis.

With regard to the other F&Os, I&M noted that a project to resolve the WOG peer review findings was completed in April 2004 (I&M 2004). This included an upgrade to the PRA to address the peer review comments. The PRA upgrade resulted in a slight reduction in the internal events CDF to 4.3×10^{-5} per year, with the distribution of events leading to core damage only changing slightly. I&M examined the basic event importance measures from the upgraded PRA, and determined that one additional plant-specific SAMA candidate would have been identified if the new model had been used. This additional SAMA candidate is related to electrical switchgear room ventilation, and would be grouped with several additional SAMAs already considered cost beneficial using the August 2001 Level 1 PRA. Based on the information and assessments provided by I&M, the staff concludes that the resolution of the WOG F&Os does not change the DC Cook SAMA analysis as presented in the ER.

Given that the DC Cook PRA has been peer reviewed and the peer review findings were either addressed or judged to have no impact on the SAMA evaluation, that I&M satisfactorily addressed staff questions regarding the PRA, and the DC Cook internal events CDF compares favorably with that for other 4-loop Westinghouse plants, the staff concludes that the PRA models are of sufficient quality to support the SAMA evaluation.

I&M submitted an IPEEE in April 1992 (AEP 1992), in response to Supplement 4 of Generic Letter 88-20. I&M 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. The NRC provided its review of the DC Cook IPEEE in 1998 (NRC 1998). This review was issued after I&M's response to the staff conclusion that the seismic and fire portions of the IPEEE needed further review due to concerns related to seismic response and fragility analysis and fire modeling, detection, and suppression analyses. In their response to these issues, I&M modified the seismic and fire CDFs to 3.2×10^{-6} per year and 3.8×10^{-6} per year, respectively. Other external events were judged to be insignificant contributors to severe accidents at DC Cook. Based on these revisions the staff concluded that I&M's IPEEE met the intent of Supplement 4 to Generic Letter (GL) 88-20.

The IPEEE approach to seismic analysis included extensive seismic walkdowns and modification of the fault trees and event trees from internal event analysis as necessary for external events. The dominant contributors to the seismic CDF are (NRC 1998):

- Auxiliary building (failure of steel columns supporting crane girders)
- Loss of electric power systems
- Turbine-driven auxiliary feedwater (AFW) pump (random failures)
- 250 VDC system
- Reactor protection system (failure of miscellaneous panels)
- Ice condenser
- Initiating events:
  - Loss of offsite power (failure of ceramic insulators)
  - Direct core damage (dominated by containment structural failure due to soil pressure)
  - Steamline/feedline break (failure of secondary piping/supports)
  - Loss of essential service water system (screenhouse failure)
  - Large LOCA (failure of pressurizer support).

The fire analysis used a PRA-based approach in which a screening analysis eliminates all but dominant fire areas. A detailed fault tree and event tree analysis using the IPE models was used to assess the fire CDF due to local or global fires within the areas that survived the screening. I&M conducted two plant walk-downs using a standard checklist, with combustible loading of fire zones being verified. Table G-4 provides the significant fire areas for DC Cook from the IPEEE (NRC 2002):

Table G-4. Significant Fire Areas for DC Cook

Significant Fire Area	CDF (per year)
44S - auxiliary building S - both units	$3.80x10^{-7}$
16 - 1AB diesel generator room -U1	$3.50x10^{-7}$
15 - 1CD diesel generator room-U1	$3.04x10^{-7}$
40B - 4KV CD switchgear room	$1.86x10^{-7}$
53 - U1 control room	$1.81x10^{-7}$
42D - EPS AB battery room	$1.68x10^{-7}$
40A - 4KV AB switchgear room	$1.32x10^{-7}$
41 - engineering safety system & MCC room (& under floor) - U1	$1.12x10^{-7}$
29B - ESW pump PP-1W - U1	$1.07x10^{-7}$
29E - MCC for ESW pumps - U1	$1.07x10^{-7}$
91 - turbine room SE portion - U1	$1.02x10^{-7}$

While the DC Cook IPEEE submittal did not identify any specific seismic or fire related severe accident vulnerabilities, more than 20 minor plant improvements were made in response to the DC Cook seismic IPEEE, primarily related to walk-down findings (ERI 1998).

Although I&M performed a Level 3 PRA in response to the IPE generic letter, the Level 3 portion of the analysis was not included as part of the IPE review, accordingly, the staff reviewed the process used by I&M to extend the containment performance (Level 2) portion of the PRA to an assessment of offsite consequences (essentially a Level 3 PRA) for the SAMA analysis. This included consideration of the source terms used to characterize fission product releases for the applicable containment release category and the major input assumptions used in the offsite consequence analyses. The MACCS2 code was utilized to estimate offsite consequences. Plant-specific input to the code includes the DC Cook reactor core radionuclide inventory, source terms for each release category, emergency evacuation modeling, site-specific meteorological data, and projected population distribution within a 80 km (50 mile) radius for the year 2038. This information is provided in Appendix F of the ER (I&M 2003).

Even though I&M used the NRC-approved MACCS2 code and scaled the reference PWR core inventory for DC Cook plant-specific power level, the staff requested that I&M evaluate the impact on population dose if the core inventory were based on the plant-specific burnup and enrichment. Based on the small impact of the calculated change in baseline dose (an increase of approximately 15 percent in the total costs associated with a severe accident), the staff concludes that the scaling based on the plant-specific power level yields sufficiently accurate and reasonable results for the dose assessment.

I&M characterized the releases for the spectrum of possible radionuclide release scenarios using a set of 8 release categories, defined based on a set of binning rules. The binning rules evaluate the containment top events, each of which represent a major possible event in the containment response to an accident sequence. Each containment end state (CET) from the October 2003 Level 2 analysis was assigned to one the release categories. The binning and assignment of source terms appears to have been performed in a consistent manner; that is, the release category bins generally contain source term categories (STCs) with similar release characteristics and timing and are assigned a source term consistent with these characteristics. The source terms used for the SAMA evaluation are based on the MAAP 4.0.5 computer code. The staff concludes that the assignment of release categories and source terms is consistent with typical PRA practice and acceptable for use in the SAMA analysis.

I&M used site-specific meteorological data, obtained from the plant meteorological tower and processed from hourly measurements for the 1997 calendar year, as input to the MACCS2 code. This data was compared to meteorological data from three previous years to confirm that the data was representative of the DC Cook site. The staff notes that previous SAMA analyses results have shown little sensitivity to year-to-year differences in meteorological data and considers use of the 1997 data in the analysis to be reasonable.

The population distribution the applicant used as input to the MACCS2 analysis was estimated for the year 2038, based on Geographic Information System (GIS) methods with 2000 Census block-group data as inputs. The state projections for the year 2020 county populations were used to extrapolate population to the year 2038. The staff noted a discrepancy in the extrapolation method which mixed estimated and actual population data. I&M performed an evaluation using a more conservative method to extrapolate the population to year 2038. The impact was negligible, and the staff concludes that the year 2038 population used in the analysis is reasonable and acceptable for the purpose of the SAMA evaluation.

The emergency evacuation model was modeled as a single evacuation zone extending out 16 km (10 mi) from the plant. It was assumed that 95 percent of the population would move at an average speed of approximately 0.789 meters per second (1.76 miles/hour) with a delayed start time of 30 minutes, 15-minute initial notification plus 15-minute preparation/mobilization time (I&M 2003). This assumption is conservative relative to the NUREG-1150 study (NRC 1990), which assumed evacuation of 99.5 percent of the population within the emergency planning zone. The evacuation assumptions and analysis are deemed reasonable and acceptable for the purposes of the SAMA evaluation.

Site-specific economic data were specified for each of the 16 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).

I&M did not perform sensitivity analyses for the MACCS2 parameters, such as evacuation and population assumptions. However, sensitivity analyses performed as part of previous SAMA evaluations for other plants have shown that the total benefit of the candidate SAMAs would increase by less than a factor of 1.2 (typically about 20 percent) due to variations in these parameters. This change is small and would not alter the outcome of the SAMA analysis. Therefore, the staff concludes that the methodology used by I&M to estimate the offsite consequences for DC Cook provides an acceptable basis from which to proceed with an assessment of risk reduction potential for candidate SAMAs. Accordingly, the staff based its assessment of offsite risk on the CDF and offsite doses reported by I&M.

G.3 Potential Plant Improvements

The process for identifying potential plant improvements, an evaluation of that process, and the improvements evaluated in detail by I&M are discussed in this section.

G.3.1 Process for Identifying Potential Plant Improvements

I&M's process for identifying SAMAs consisted of reviewing the following sources of information:

- documented insights by I&M staff from results of the DC Cook PRA models (i.e., DC Cook IPE, IPEEE, and subsequent updates to the DC Cook PRA),
- ongoing DC Cook equipment reliability initiatives,
- NRC and industry documentation discussing potential plant improvements (i.e, NRC, 1997c), and

- SAMA analyses in support of original licensing activities for other operating nuclear power plants and advanced light water reactor plants.

Based on this process, an initial set of 194 candidate SAMAs was identified, as reported in Table F.4-1 in Appendix F of the ER. Of the 194 candidate SAMAs, 32 were identified based on plant-specific information and the remaining 162 were identified based on NRC and/or industry documentation. I&M performed an initial qualitative screening of the 194 candidate SAMAs and eliminated 122 from further consideration using the following criteria:

- The SAMA modifies features that are not applicable to DC Cook. For example, some of the identified SAMAs only apply to BWRs. (25 SAMAs eliminated)

- The SAMA has already been implemented at DC Cook, or the DC Cook design meets the intent of the SAMA. (62 SAMAs eliminated)

- The SAMA would involve major plant design and/or structural changes that would clearly be well in excess of the bounding benefit. (35 SAMAs eliminated)

A preliminary cost estimate was prepared for each of the 72 remaining candidates to focus on those that had a possibility of having a net positive benefit.

For the final evaluation, I&M estimated the cost of implementing the SAMA, as described in Section G.5 below, and the associated potential risk reduction and dollar-equivalent benefit, as described in Sections G.4 and G.6 below. If the estimated implementation cost was more than two times the estimated benefit, then the SAMA was not considered to be cost beneficial. The factor of two was used to account for not having an external events PRA and to account for other risk contributors not specifically quantified by the DC Cook-specific PRA models. Of the 72 SAMA candidates, 16 SAMAs were determined to be potentially cost beneficial. These 16 cost-beneficial SAMAs were grouped into five major risk areas as they include alternate means of achieving the same or similar risk reduction in each of these five areas.

G.3.2 Review of I&M's Process

I&Ms efforts to identify potential SAMAs focused on areas associated with internal initiating events. The initial list of SAMAs was based on a broad range of resources, including other plants' SAMAs, generic issues, and DC Cook-specific analyses. The latter focused largely on the plant's PRAs, but also included other insights (e.g., reliability issues).

The staff requested clarification regarding the process used by I&M to identify SAMA candidates from the DC Cook PRA (NRC 2004a). In their response (I&M 2004), I&M provided details on the use of importance measures from the August 2001 Level 1 PRA. Each basic event with a Fussell-Vesely (F-V) importance of greater than 0.5 percent (a total of 146 basic events) was reviewed to identify potential SAMA candidates. Of the 146 events from the importance measure analysis, 34 events were eliminated as having no physical meaning. Of the remaining 112 basic events, 27 represent failure of operator actions, and are grouped under SAMA 172. These 27 human errors were identified from the F-V importance measure list as any human error which has an importance measure equal to or greater than $5x10^{-3}$. I&M identified and grouped the events and confirmed that each major contributor is addressed by one or more SAMA. The staff concludes from this analysis that all dominant events from the PRA were captured in the SAMA analysis.

I&M identified four events from the F-V importance measures that are not represented by a SAMA candidate, but justified their exclusion based on conservative success criteria. Given that these events are not part of the dominant contributors to CDF (RCP cooling and EDGs) and additional I&M arguments that these events are largely the result of conservatisms in the PRA model, the staff accepts that these four events are not important to the SAMA analysis.

I&M identified and evaluated several low cost SAMA candidates. For example, SAMA 67 considered the use of temporary cabling and pre-staged equipment to power selected loads rather than a permanent cross-tie. When estimating costs, the use of automatically actuated, permanently-installed equipment was not generally considered unless timing constraints precluded taking manual operator actions. For most of the SAMA candidates, implementation considered options such as using temporary hose connections and operator actions from outside the control room as alternatives installation of permanent piping (I&M 2004).

Even though the fire and seismic events are about an order or magnitude less than internal events, the staff inquired why I&M did not explicitly consider external events directly in the SAMA study (NRC 2004a). In response (I&M 2004), I&M noted that fire events contribute an additional 7 percent to the CDF, and seismic events an additional 6 percent. I&M indicated that the fire analysis contains significant conservatism, and that a more realistic analysis would result in a significantly lower fire CDF, and even lower benefit from fire-related SAMAs. For seismic events, the dominant contributions are related to building structures. Three of these items were considered in the initial SAMA list. One of these SAMAs was screened out as too costly, and the remaining two SAMAs were eliminated because modifications to improve the seismic capacity of the structures involved were completed subsequent to the IPEEE. The staff accepts I&M's conclusion that there are no cost-beneficial SAMAs relative to these external events.

I&M identified ten SAMA candidates from a review of "reliability issues" at DC Cook. In the ER, these SAMAs are described only in a general fashion. Hence the staff requested additional detail relative how these SAMAs were identified and their importance to risk. I&M explained (I&M 2004) that these candidates were identified by a DC Cook equipment reliability programmatic review. The top 10 reliability issues were included in the list of potential SAMAs. While these SAMAs were not identified via the PRA importance measures many of them correlate to PRA items. Moreover, since the Level 1 PRA utilized plant-specific data for the equipment and events from the "reliability issues" candidate SAMAs, it is expected that the importance measure analyses would properly address these issues.

The staff notes that six SAMA candidates involving procedural or training enhancements were identified from the PRA, but were subsequently screened out on the basis that they were already implemented. This appeared contradictory as it would be expected that if they were implemented, they would not be significant in the PRA. The staff asked for clarification in an RAI (NRC 2004a). In their response (I&M 2004), I&M explained that the six SAMAs eliminated as "already implemented" were identified from either the 1992 IPE submittal and the associated staff evaluation in 1996 or the IPE update in 1995. I&M reported that several of these actions did not have a significant F-V importance measure, while those that do are included in SAMA 172.

The staff notes that the set of SAMAs submitted is not all inclusive, since additional, possibly even less expensive, design alternatives can always be postulated. However, the staff concludes that the benefits of any additional modifications are unlikely to exceed the benefits of the modifications evaluated and that the alternative improvements would not likely cost less than the least expensive alternatives evaluated, when the subsidiary costs associated with maintenance, procedures, and training are considered.

The staff concludes that I&M used a systematic and comprehensive process for identifying potential plant improvements for DC Cook, and that the set of potential plant improvements identified by I&M is reasonably comprehensive and therefore acceptable. This search included reviewing plant improvements considered in previous SAMA analyses and insights from industry documents. While explicit treatment of external events in the SAMA identification process was limited, it is recognized that the absence of external event vulnerabilities reasonably justifies examining primarily the internal events risk results for this purpose.

G.4 Risk Reduction Potential of Plant Improvements

I&M evaluated the risk reduction potential of the 72 SAMAs that were retained from the initial screening. A majority 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.

I&M used model reevaluation to determine potential benefits. The CDF and population dose reductions were estimated using the August 2001 version of the DC Cook PRA. The changes made to the model to quantify the impact of SAMAs were provided by I&M in response to a verbal request (NRC 2004b). Table G-5 provides a summary of the assumptions used to estimate the risk reduction for each of the 72 SAMAs, the estimated risk reduction in terms of percent reduction in CDF and population dose, and the estimated total benefit (present value) of the averted risk. The sixteen cost-beneficial SAMAs are indicated on Table G-5 in bold. The determination of the benefits for the various SAMAs is further discussed in Section G.6.

Several of the SAMAs were judged to have a negligible benefit based on a determination by I&M that both CDF and population dose would be insignificantly impacted by their implementation. In response to an RAI, I&M indicated that while a PRA reevaluation was not necessarily performed for these SAMAs, each was evaluated by I&M and shown to address potential failures or events that are not important contributors to CDF.

The staff has reviewed the bases used by I&M for estimating the risk reduction for the various SAMAs, and concludes that the rationale and assumptions used 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 staff based its estimates of averted risk for the various SAMAs on risk reduction estimates provided by I&M.

Table G-5. SAMA Cost/Benefit Screening Analysis

SAMA[1]	Assumptions	Percent Risk Reduction		Total Benefit ($)	Estimated Cost ($)
		CDF	Population Dose		
5. Provide hardware connections to allow ESW (SW) to cool charging pump seals.	Eliminate charging system CCW dependency. Eliminate RCP seal failures for all loss of ESW and loss of CCW accident sequences.	32.3	15.5	$604,000	$866,000
9. Increase charging pump lube oil capacity.	Same as SAMA 5.	32.3	15.5	$604,000	$866,000
10. Eliminate RCP thermal barrier dependence on CCW, such that loss of CCW does not result directly in core damage.	Eliminate RCP seal failures for SBO, and all loss of ESW and loss of CCW accident sequences. Reduce non-recovery probability for ESW and CCW events by a factor of ten for sequences with AFW success.	38.0	19.8	$738,000	$766,000
12. Create an independent RCP seal injection system, with dedicated diesel.	New system would mitigate SBO, loss of ESW, and loss of CCW. RCP seals remain intact for a sufficient time to allow operator action to initiate the new system. No RCS inventory would be lost through seal leakage. Failure probability for the new system of 0.1.	60.5	49.2	$1,460,000	$2,000,000
13. Create an independent RCP seal injection system, without dedicated diesel.	New system would mitigate loss of ESW and loss of CCW events. Eliminate RCP seal failures for all loss of ESW and loss of CCW accident sequences. No RCS inventory would be lost through seal leakage.	27.7	13.4	$518,000	$1,000,000
17. Add a third CCW pump.	Eliminate all failures of CCW pumps.	4.2	2.6	$87,900	$500,000

		SAMA[1]	Assumptions	Percent Risk Reduction		Total Benefit ($)	Estimated Cost ($)
				CDF	Population Dose		
1	24.	Improve ability to cool RHR heat exchangers.	All failures that result in loss of cooling to RHR or Containment Spray are recovered by operator action with a failure probability of 0.01.	0.2	0.6	$11,400	$70,000
2	**25.**	**Stage backup fans in switchgear rooms.**	**Eliminate all failures of 4kVAC room cooling.**	**1.0**	**0.9**	**$26,600**	**$40,000**
3	**26.**	**Provide redundant train of ventilation to 480V board room.**	**Same as SAMA 25.**	**1.0**	**0.9**	**$26,600**	**>$40,000**
4	**27.**	**Implement procedures for temporary HVAC.**	**Benefits and costs are between those of SAMA 25 and 26.**	**1.0-11.0**	**0.9-11.9**	**$26,600 to $316,000**	**>$40,000 to $252,000**
5	**28.**	**Provide backup ventilation for the EDG rooms, should their normal HVAC supply fail.**	**Eliminate all EDG room ventilation failures.**	**11.0**	**11.9**	**$316,000**	**$252,000**
6	33.	Install an independent method of suppression pool cooling.	Same as SAMA 24.	0.2	0.6	$11,400	$70,000
7	34.	Develop an enhanced drywell spray system.	Eliminate all failures of containment spray injection.	0.0	0.0	Negligible	$90,000
8	35.	Provide a dedicated existing drywell spray system.	Same as SAMA 34	0.0	0.0	Negligible	$90,000
9	**39.**	**Create/enhance hydrogen igniters with independent power supply.**	**Eliminate all failures of hydrogen igniters.**	**0.0**	**7.5**	**$131,000**	**$147,000**

		SAMA[1]	Assumptions	Percent Risk Reduction		Total Benefit ($)	Estimated Cost ($)
				CDF	Population Dose		
1	**40.**	**Create a passive hydrogen ignition system.**	**Same as SAMA 39.**	**0.0**	**7.5**	**$131,000**	**$147,000**
2	41.	Remove commitment to trip air return fans prior to actuating hydrogen igniters.	Eliminate errors of execution for operation of hydrogen igniters.	0.4	0.4	$9,900	$40,000
3	49.	Create other options for reactor cavity flooding (Part b).	Eliminate containment failure for all sequences with dry reactor cavity.	0.0	47.5	$765,000	$2,180,000
4	53.	Use firewater spray pump for CTS.	Same as SAMA 34.	0.0	0.0	Negligible	$90,000
5	**67.**	**Improve bus cross-tie ability between a unit's emergency buses.**	**Failure of power to any single bus is recovered by operator action to align power from another bus with a failure probability of 0.1.**	**2.1**	**4.0**	**$87,400**	**$100,000**
6	68.	Provide alternate battery charging capability.	Eliminate failure of battery chargers and room cooling fans from DC power system models.	1.5	2.7	$59,900	$294,000
7	72.	Create a cross-unit tie for EDG fuel oil.	No change to model based on review of EDG failure data.	0.0	0.0	Negligible	Not Evaluated
8	73.	Develop procedures to repair or change out failed 4KV breakers.	Assign zero value for offsite power non-recovery probability for time periods shorter than six hours.	0.7	2.0	$20,400	$70,000
9	79.	Create a lake water backup for EDG cooling.	Eliminate all cooling water failures from diesel-generator models.	1.1	1.9	$42,800	$140,000

SAMA[1]		Assumptions	Percent Risk Reduction		Total Benefit ($)	Estimated Cost ($)
			CDF	Population Dose		
80.	Use firewater as a backup for EDG cooling.	Same as SAMA 79.	1.1	1.9	$42,800	$140,000
84.	Develop procedures for use of pressurizer vent valves during SGTR sequences.	Eliminate all pressurizer PORV failures in SGTR sequences.	0.4	0.9	$19,000	$90,000
85.	Install a redundant spray system to depressurize the primary system during a SGTR.	Same as SAMA 84.	0.4	0.9	$19,000	$90,000
94.	Install self-actuating CIVs.	Guarantee success of containment isolation.	0.0	0.0	Negligible	$50,000
95.	Install additional instrumentation for ISLOCA sequences.	Eliminate all ISLOCA initiating events.	0.6	5.8	$95,900	$530,000
96.	Increase frequency of valve leak testing.	Same as SAMA 95.	0.6	5.8	$95,900	$530,000
100.	Revise EOPs to improve ISLOCA identification.	Set cognitive failure to recognize ISLOCA events to zero.	0.0	0.0	$1,100	$20,000
101.	**Revise ISLOCA procedure to specifically address the dominant ISLOCA sequence**	**Eliminate operator failure associated with detection and mitigation of ISLOCA events.**	**0.4**	**5.7**	**$92,600**	**$30,000**
103.	Add redundant and diverse limit switch to each CIV.	Same as SAMA 94.	0.0	0.0	Negligible	$50,000

SAMA[1]		Assumptions	Percent Risk Reduction		Total Benefit ($)	Estimated Cost ($)
			CDF	Population Dose		
108.	Implement a digital feedwater upgrade.	Reduce frequency of transient events with feedwater available from 1.3 per year to 0.85 per year. Eliminate all loss of main feedwater events.	4.9	2.9	$100,000	$2,530,000
115.	Provide portable generators to be hooked in to the turbine-driven AFW, after battery depletion.	Same as SAMA 68.	1.5	2.7	$59,900	$294,000
117.	Create ability for emergency connections of existing or alternate coolant inventory.	Benefits and costs will be between those for SAMA 24 and 123.	0.2-0.6	0.6-0.7	$11,400 to $17,400	$70,000
123.	Provide capability for diesel-driven, low pressure vessel makeup.	Eliminate hardware failures of RHR pump train components.	0.6	0.7	$17,400	$70,000
124.	Provide an additional HPSI pump with independent diesel.	New system equivalent to existing high-pressure ECCS (charging pump) trains, with a total system failure probability of 0.1. Preclude core uncovery for eight hours during SBO events.	13.0	9.7	$299,000	$2,000,000
125.	Install independent AC HPSI system.	Same as SAMA 124.	13.0	9.7	$299,000	$2,000,000
126.	Prevent over pressurization of RHR piping by SI system.	No change in model because less conservative success criteria would eliminate this failure mode as a significant contributor to CDF.	0.0	0.0	Negligible	Not Evaluated

		Percent Risk Reduction			
SAMA[1]	Assumptions	CDF	Population Dose	Total Benefit ($)	Estimated Cost ($)
127. Create the ability to manually align ECCS recirculation.	Set the failure probability of valves used to align to ECCS recirculation to zero.	1.5	1.4	$39,200	$100,000
134. Replace two of the four safety injection pumps with diesel-driven pumps.	Same as SAMA 124.	13.0	9.7	$299,000	$2,000,000
139. Create automatic swap-over to implement low pressure pump to HPSI pump piggyback operation during recirculation following REST depletion.	Set the failure probability for all operator actions that model the switch-over to recirculation to zero. Set the failure probability for the signal that actuates automatic switch-over to zero.	2.7	11.8	$221,000	$795,000
141. Replace old air compressors with more reliable ones.	Set the failure probability and maintenance unavailability for all air compressors to zero.	1.4	0.9	$28,600	$110,000
144. Install MG set trip breakers in control room.	Set the failure probability for operator action to manually insert control rods and provide long-term shutdown of the reactor to zero.	1.0	0.2	$15,100	$70,000
145. Add capability to remove power from the bus powering the control rods.	Same as SAMA 144.	1.0	0.2	$15,100	$70,000
149. Install a system of relief valves that prevents any equipment damage from a pressure spike during an ATWS.	Eliminate all failures of pressurizer PORVs.	11.7	12.2	$316,000	$1,090,000

SAMA[1]		Assumptions	Percent Risk Reduction: CDF	Percent Risk Reduction: Population Dose	Total Benefit ($)	Estimated Cost ($)
153.	Create/enhance RCS depressurization ability.	Same as SAMA 149.	11.7	12.2	$316,000	$1,090,000
154.	Make procedural changes only for the RCS depressurization option.	Same as SAMA 149.	11.7	12.2	$316,000	$1,090,000
157.	Install secondary side guard pipes up to the MSIVs.	Set the frequency of steamline break initiating events to zero.	2.2	4.0	$86,800	$700,000
160.	**Provide self-cooled ECCS seals.**	**Eliminate charging system and safety injection CCW dependency. Eliminate RCP seal failures for all loss of ESW and loss of CCW accident sequences.**	**33.1**	**16.3**	**$625,000**	**$866,00**
162.	Make CCW trains separate.	Set logical events to model CCW train cross-tie valves closed.	0.0	0.0	$0	Not Evaluated
163.	Make ICW trains separate.	Same as 162.	0.0	0.0	$0	Not Evaluated
166.	Provide containment isolation design per GDC and SRP.	Same as 94.	0.0	0.0	Negligible	$50,000
167.	Improve RHR sump reliability.	Set the failure probability of recirculation sump to zero.	0.3	0.5	$11,800	$50,000
168.	Provide auxiliary building vent/seal structure.	Eliminate all ISLOCA initiating events.	0.6	5.8	$95,900	$530,000

SAMA[1]		Assumptions	Percent Risk Reduction: CDF	Percent Risk Reduction: Population Dose	Total Benefit ($)	Estimated Cost ($)
169.	Add charcoal filters on auxiliary building exhaust.	Same as SAMA 168.	0.6	5.8	$95,900	$530,000
170.	Add penetration valve leakage control system.	Same as SAMA 94.	0.0	0.0	Negligible	$50,000
171.	Enhance screen wash.	Eliminate the possibility of plugging any system cooled by raw water systems. Set the frequency of loss of main feedwater events to zero.	11.1	6.2	$222,000	$2,540,000
172.	**Enhance training for important operator actions (i.e., those actions with a Fussell-Vesely importance of 5E-03 or greater)**	**Reduce or eliminate the human error probability, depending on specific operator action.**	**0.1-4.8**	**0.0-2.5**	**$900 to $92,600**	**$10,000 to $220,000**
177.	Add protection to prevent tornado damage to REST and penetration rooms.	No change to model because tornado-related accidents are insignificant per IPEEE.	0.0	0.0	Negligible	Not Evaluated
179.	Add protection to prevent tornado damage causing failure of power and upper surge tanks.	Same as SAMA 177.	0.0	0.0	Negligible	Not Evaluated
184.	**Provide a means to ensure RCP seal cooling so that RCP seal LOCAs are precluded for SBO events.**	**Benefits and costs will be within the range of those for SAMAs 5, 9, 10, 12, 13, 17, and 160.**	**27.7-60.5**	**13.4-49.2**	**$518,000 to $1,460,000**	**$766,000 to $2,000,000**

SAMA[1]		Assumptions	Percent Risk Reduction		Total Benefit ($)	Estimated Cost ($)
			CDF	Population Dose		
185	Improve EDG reliability.	Reduce start and run failure probability and maintenance unavailability of diesel generators by a factor of two.	17.5	18.9	$500,000	$3,180,000
186	Improve circulating water screens and debris removal.	Same as SAMA 171.	11.1	6.2	$222,000	$2,540,000
187	Improve reliability of power supplies.	Same as SAMA 108.	4.9	2.9	$100,000	$341,000
188	Improve switchyard and transformer reliability.	Same as SAMA 108.	4.9	2.9	$100,000	$341,000
189	Reduce biofouling of raw water systems.	Same as SAMA 171.	11.1	6.2	$222,000	$2,540,000
190	Improve reliability of main feedwater pumps.	Same as SAMA 108.	4.9	2.9	$100,000	$341,000
191	Establish a preventive maintenance program for expansion joints, bellows, and boots.	No change to model because flood-related accidents are insignificant per IPE.	0.0	0.0	Negligible	Not Evaluated
192	Improve reliability of AFW pumps and valves.	No change to model because AFW pump failures are insignificant per importance measures.	0.0	0.0	Negligible	Not Evaluated
193	Eliminate MSIV vulnerabilities.	No change to model because MSIV failures are not important to risk.	0.0	0.0	Negligible	Not Evaluated

SAMA[1]	Assumptions	Percent Risk Reduction		Total Benefit ($)	Estimated Cost ($)
		CDF	Population Dose		

1 - Cost-beneficial SAMAs are indicated in **bold**. SAMA is considered cost beneficial if the Total Benefit is within a factor of two of the Estimated Cost.

G.5 Cost Impacts of Candidate Plant Improvements

I&M estimated the costs of implementing the 72 candidate SAMAs through the application of engineering judgment, using estimates from other licensee submittals, and development of site-specific cost estimates. Cost estimates for the 16 SAMAs that were determined to be potentially cost beneficial are presented in Table F.4-2 of Appendix F of the DC Cook ER (I&M 2003). Cost estimates for the remaining 56 candidate SAMAs are provided in Table 5 of Attachment 2 in the I&M response to an RAI (I&M 2004). 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. Cost estimates typically included changes to and implementation of procedures, engineering analysis, training, and documentation, in addition to any hardware costs.

The ER discussion of cost estimates did not include how I&M handled the cost and/or benefit of SAMAs that impacted both DC Cook units. I&M responded to a staff RAI (I&M 2004) and identified 19 SAMAs in which the change would benefit both units. Where implementing a SAMA candidate would benefit both units, the costs were shared between both units (i.e., costs were developed on a single unit basis).

The staff reviewed the bases for the applicant's cost estimates. For certain improvements, the staff also compared the cost estimates to estimates developed elsewhere for similar improvements, including estimates developed as part of other licensees' analyses of SAMAs for operating reactors and advanced light-water reactors. As was already mentioned, 56 of the 72 SAMAs were screened from further consideration on the basis that the expected cost of implementation would be much greater than the estimated benefit of the associated risk reduction. Of the 56 SAMAs eliminated from further consideration, 13 were eliminated because implementation of the alternative was determined to have a negligible benefit meaning no matter how low the cost of implementation, the SAMA will never be cost beneficial (and so estimates for the cost of implementation were not developed by I&M for most of these SAMAs). The staff reviewed the estimates for the remaining 43 SAMAs and found them to be consistent with estimates provided in support of analyses for other plants.

It is noted that the estimated implementation cost for SAMA 154 is $1.09M, a value inconsistent with "procedural changes" as described in the Table F.4-2 of Appendix F of the DC Cook ER (I&M 2003). However, in response to an RAI, I&M indicated that procedural change alone would not be practical or effective in reducing risk, and that SAMA 154 could not be implemented without the hardware changes proposed in SAMA 153 (I&M 2004).

The staff concludes that the cost estimates provided by I&M are sufficient and appropriate for use in the SAMA evaluation.

G.6 Cost-Benefit Comparison

I&M's cost-benefit analysis and the staff's review are described in the following sections.

G.6.1 I&M's Evaluation

The methodology used by I&M 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. I&M's derivation of each of the associated costs is summarized below.

<u>Averted Public Exposure (APE) Costs</u>

The APE costs were calculated using the following formula:

APE = Annual reduction in public exposure (Δ person-rem/reactor-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. For the purposes of initial screening, I&M calculated an APE of approximately $916,000 for the 20-year license renewal period, based on an annual reduction in public exposure of 42.5 person-rem, which assumes elimination of all severe accidents.

Averted Offsite Property Damage Costs (AOC)

The AOCs were calculated using the following formula:

AOC = Annual reduction in the mean CDF
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, I&M calculated an annual offsite economic risk of about $64,600 based on the Level 3 PRA analysis. This results in a discounted value of approximately $695,100 for the 20-year license renewal period.

Averted Occupational Exposure (AOE) Costs

The AOE costs were calculated using the following formula:

AOE = Annual reduction in the mean CDF
x occupational exposure per core damage event
x monetary equivalent of unit dose
x present value conversion factor.

I&M 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, which assumes all severe accidents are eliminated, I&M calculated an AOE of approximately $19,000 for the 20-year license renewal period.

Averted Onsite Costs (AOSC)

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. I&M derived the values for AOSC based on information provided in Section 5.7.6 of the regulatory analysis handbook (NRC 1997b).

I&M 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 reduction in the mean CDF
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, I&M calculated an ACC of approximately $579,000 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

I&M based its calculations on a power level of 1,117 MW(e), and scaled up from the 910 MWe reference plant in NUREG/BR-0184 (NRC 1997b). Therefore, I&M applied a power scaling factor of 1,117 MW(e)/910 MW(e) to determine the replacement power costs. For the purposes of initial screening, which assumes all severe accidents are eliminated, I&M calculated an RPC of approximately $483,000 for the 20-year license renewal period.

For the purposes of initial screening, which assumes all severe accidents are eliminated, I&M calculated an AOSC of approximately $1,060,000 for the 20-year license renewal period.

Using the above equations, I&M estimated the total present dollar value equivalent associated with completely eliminating all severe accidents at DC Cook to be about $2.7 million.

I&M's Results

During the initial screening, if the implementation costs were greater than the MAB of $2.7 million, then the SAMA was screened from further consideration. For the final screening evaluation, a more refined look at the costs and benefits was performed for the remaining 72 SAMAs. In this evaluation, the benefits were determined based on the above equations, for the various averted costs together with the estimated annual reductions in CDF and person-rem dose (columns 3 and 4 of Table G-5). If the calculated cost of implementation of the SAMA is greater than the calculated benefit, the SAMA would generally be considered to not be cost beneficial. However, in order to account for the contribution of external events and analysis uncertainties, I&M determined a SAMA to be potentially cost beneficial if the cost of implementation was estimated to be less than two times the calculated benefit. The cost-benefit results for the individual analysis of the 72 SAMA candidates are presented in Table G-5.

I&M identified 16 cost-beneficial SAMAs. These 16 SAMAs were grouped into five areas. This grouping recognizes that some of the SAMAs accomplish the same general result in a different way. For example, six of the SAMAs involve different ways to minimize the impact of RCP seal LOCAs. Moreover, these six items are not independent, that is, implementation of any one would achieve a portion of the benefit of the others. I&M is continuing to study the 16 SAMAs in groups to determine the optimum subset of the 16. The 16 SAMAs are grouped into the following five areas:

- Minimize Consequences of RCP Seal LOCAS

  Provide hardware connections to allow ESW (SW) to cool charging pump seals so as to maintain charging pump seal injection after a loss of CCW (SAMA 5).

  Increase charging pump lube oil sump capacity to increase time before charging pump failure due to lube oil overheating after a loss of CCW (SAMA 9).

  Eliminate RCP thermal barrier dependence on CCW by providing cooling to the thermal barrier heat exchanger so as to prevent loss of RCP seal integrity, such that loss of CCW does not result directly in core damage (SAMA 10).

  Create an independent RCP seal injection system, with dedicated diesel, to add redundancy to RCP seal cooling alternatives in the event of loss of CCW, loss of SW, or SBO (SAMA 12).

Create an independent RCP seal injection system, without dedicated diesel, to add redundancy to RCP seal cooling alternatives in the event of loss of CCW or loss of SW (SAMA 13).

Provide self-cooled ECCS seals that are independent of CCW (SAMA 160).

Provide a means to ensure RCP seal cooling so that RCP seal LOCAs are precluded for SBO events. Options considered included using the CVCS cross-tie, installation of a new independently powered pump, and a temporary connection to provide cooling to the RCP thermal barriers (SAMA 184).

- Minimize Consequences of Loss of HVAC

Stage backup fans in the switchgear rooms to provide alternate ventilation and prevent failure of the electrical switchgear in the event of a loss of switchgear ventilation (SAMA 25).

Permanently install a redundant train of ventilation to the switchgear rooms to improve HVAC system reliability and prevent failure of the electrical switchgear in the event of a loss of ventilation (SAMA 26).

Provide backup ventilation to the EDG rooms to prevent failure of the EDGs in the event of a loss of ventilation (SAMA 28).

Implement enhanced procedures for backup ventilation for the EDG and switchgear rooms in the event of loss of ventilation. This SAMA is included as a bounding case for SAMAs 25, 26, and 28 (SAMA 27).

- Remove Dependance of Distributed Ignition System on AC Power

Create/enhance hydrogen igniters with an independent power supply to reduce the potential for hydrogen detonation as a result of a SBO. Use either a new independent power supply, a non-safety grade portable generator, existing station batteries, or existing AC/DC independent power supplies, such as the security system diesel generator, to provide power to the hydrogen igniters (SAMA 39).

Create a passive hydrogen ignition system to reduce the potential for hydrogen detonation, particularly after a SBO, without requiring electric power (SAMA 40).

- Minimize Consequences of AC Bus Failures

  Improve the bus cross-tie ability between a unit's emergency buses by providing a means to supply power from one emergency bus to another emergency bus within a unit in the event of loss of AC power (SAMA 67).

- Improve Recovery from ISLOCA Events

  Revise the procedures used to respond to ISLOCA events to specifically address the ISLOCA sequence with the frequency that was dominant in Revision 1 of the DC Cook PRA. The specific action is to add to the applicable EOP a step to close motor-operated valves IMO-310 and IMO-320 to stop leakage from failed RHR pump seals (SAMA 101).

  Enhance training for operator actions important to mitigating the impacts of an ISLOCA event (SAMA 172).

None of the remaining SAMAs were judged to be cost beneficial.

G.6.2 Staff Evaluation

The cost-benefit analysis performed by I&M was based primarily on NUREG/BR-0184 (NRC 1997b) and was executed consistent with this guidance.

In order to account for external events and other analysis uncertainties, I&M applied a factor of two margin in assessing whether SAMAs were cost beneficial, i.e., a SAMA was considered to be cost beneficial if the Total Benefit is within a factor of two of the Estimated Cost. The staff questioned the use of a factor of two to account for uncertainties in the evaluation, and requested additional justification (NRC 2004). In response, I&M considered the uncertainties associated with the calculated CDF and the impact other analysis assumptions on the results of the SAMA assessment, as described below.

Information regarding the uncertainty distribution of the internal events CDF is summarized in Table G-6 (I&M 2004). The 95th percent confidence level for internal events CDF is approximately 1.95 times the best estimate CDF. If the 95th percentile values of the CDF were used in the cost-benefit analysis instead of the mean CDF value used in the baseline analysis, the estimated benefits of the SAMAs would increase by about a factor of two (I&M 2004).

Table G-6. Uncertainty in the Calculated CDF for DC Cook

Percentile	CDF (per year)
5th	2.23×10^{-5}
50th	4.27×10^{-5}
mean	4.95×10^{-5}
95th	9.73×10^{-5}

I&M assessed the impact of other factors on the analysis results, such as the contribution of external event initiators that were not explicitly included in the DC Cook risk profile, the use of a 3 percent discount rate as compared to the 7 percent discount rate used in the baseline calculations, the use of a plant-specific core fission product inventory, and additional benefits that would be realized during remainder of the current plant license.

The staff notes that accounting for each of these factors would tend to increase the benefit as compared to the baseline case analysis. However, the calculated benefits used in the baseline analysis are generally over-estimated and therefore conservative, and the implementation costs are generally under-estimated and therefore also conservative. The staff concludes that the use of the factor of two to account for uncertainties, coupled with the fact that the calculated benefits and the estimated implementation costs are generally conservative, provides a reasonable treatment of uncertainties and is adequate for the SAMA evaluation.

The staff concludes that, with the exception of the cost-beneficial SAMAs identified in five different areas, the costs of the SAMAs would be higher than the associated benefits.

Finally, in light of issues raised in a Sandia National Laboratories report concerning the direct containment heating (DCH) issue in ice condenser containments (NRC 2000), the staff requested that I&M provide additional information and evaluations related to the benefit of back-up power to the hydrogen igniter system in DC Cook. This included reevaluating the benefits assuming the conditional containment failure probabilities reported in the Sandia study, providing a breakout of CDF for SBO in terms of the relative contribution from fast-SBO and slow-SBO, and further assessing the benefits of a pre-staged versus portable backup power source for the hydrogen igniters (NRC 2004a). The results of using the conditional containment failure probabilities in the Sandia study showed a substantial increase in the maximum attainable benefit. However, the results did not change the conclusion of I&M's SAMA analysis, since the affected SAMA (SAMA 39) was already identified as a cost-beneficial SAMA in the baseline analysis. The staff notes that the NRC is currently evaluating a potential requirement for a similar enhancement as part of the resolution of GSI-189, "Susceptibility of Ice Condenser and Mark III Containments to Early Failure from Hydrogen Combustion During a Severe Accident."

As a result of I&M's response to the RAIs (I&M 2004), and interactions by telephone (NRC 2004), the staff believes the I&M cost-benefit analysis is reasonable.

G.7 Conclusions

I&M compiled a list of 194 SAMA candidates using the SAMA analyses as submitted in support of licensing activities for other nuclear power plants, NRC and industry documents discussing potential plant improvements, and the plant-specific insights from the DC Cook IPE and current PRA model. An initial screening removed SAMA candidates that: (1) were not applicable at DC Cook due to design differences, (2) had already been implemented at DC Cook, or (3) had implementation costs greater than any possible risk benefit. A risk benefit of $2,700,000 was used, representing the total present dollar value equivalent associated with completely eliminating severe accidents at DC Cook. A total of 122 SAMA items were eliminated, leaving 72 subject to a final evaluation process.

Detailed cost-benefit analyses were conducted for the remaining 72 SAMA candidates, and resulted in identification of 16 candidates that were judged to be cost beneficial (see Table G-5, and Section G.6.1). I&M divided these 16 SAMAs into five areas of risk reduction: (1) minimize consequence of RCP seal LOCAs, (2) minimize consequences of loss of HVAC, (3) remove dependence of distributed ignition system on AC power, (4) minimize consequences of AC bus failures, and (5) improve recovery from ISLOCA. The grouping of the SAMAs into these categories allows I&M to compare options to reduce the impact of severe accidents within each area. I&M is conducting additional analyses to allow them to select the specific actions which achieve the most cost-beneficial risk reduction in each category.

The staff reviewed the I&M 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 I&M are reasonable and sufficient for the license renewal submittal. This is based on I&M's conservative treatment of costs and benefits, including application of a factor of two to account for external events and uncertainties.

The staff concurs with I&M's identification of five areas in which risk can be further reduced in a cost-beneficial manner through the implementation of a subset of the 16 identified cost-beneficial SAMAs. Given the potential for cost-beneficial risk reduction in these five areas, the staff agrees with I&M that further evaluation of these SAMAs by I&M is warranted. However, none of the cost-beneficial SAMAs relate 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.

G.8 References

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Docket No. 50-315 and 50-316

11. ABSTRACT *(200 words or less)*

This draft supplemental environmental impact statement (SEIS) has been prepared in response to an application submitted to the NRC by Indiana Michigan Power Corporation (I&M) to renew the operating license (OL) for Donald C. Cook Nuclear Plant, Units 1 and 2 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 the alternatives to the proposed action, and mitigation measures available for reducing or avoiding adverse impacts. It also includes the staff's preliminary recommendation regarding the proposed action.

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

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