NUREG-1437
Supplement 23

# Generic Environmental Impact Statement for License Renewal of Nuclear Plants

## Supplement 23

Regarding
Point Beach Nuclear Plant Units 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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## Regarding Point Beach Nuclear Plant Units 1 and 2

## Draft Report for Comment

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

## COMMENTS ON DRAFT REPORT

Any interested party may submit comments on this report for consideration by the NRC staff. Comments may be accompanied by additional relevant information or supporting data. Please specify the report number NUREG-1437, Supplement 23, draft, in your comments, and send them by April 13, 2005, to the following address:

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

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# Abstract

The U.S. Nuclear Regulatory Commission (NRC) considered the environmental impacts of renewing nuclear power plant operating licenses (OLs) for a 20-year period in its *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS), NUREG-1437, Volumes 1 and 2, and codified the results in Title 10 of the Code of Federal Regulations (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 Nuclear Management Company, LLC (NMC) to renew the OLs for Point Beach Nuclear Plant Units 1 and 2 (PBNP) for an additional 20 years under 10 CFR Part 54. This draft SEIS includes the NRC staff's analysis that considers and weighs the environmental impacts of the proposed action, the environmental impacts of alternatives to the proposed action, and mitigation measures available for reducing or avoiding adverse impacts. It also includes the staff's preliminary recommendation regarding the proposed action.

Regarding the 69 issues for which the GEIS reached generic conclusions, neither NMC nor the staff has identified information that is both new and significant for any issue that applies to PBNP. 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 PBNP 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 and spent fuel, which were not assigned a single significance level).

Regarding the remaining 23 issues, those that apply to PBNP are addressed in this draft SEIS. With the exception of the chronic effect of electromagnetic fields (for which the magnitude of impact is "uncertain"), 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.

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

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# Executive Summary

By letter dated February 25, 2004, the Nuclear Management Company, LLC (NMC) submitted an application to the U.S. Nuclear Regulatory Commission (NRC) to renew the operating licenses (OLs) for Point Beach Nuclear Plant Units 1 and 2 (PBNP) for an additional 20-year period. If the OLs are renewed, State regulatory agencies and NMC will ultimately decide whether the plant will continue to operate based on factors such as the need for power or other matters within the State's jurisdiction or the purview of the owners. If the OLs are not renewed, then the plants must be shut down at or before the expiration dates of the current OLs, which are October 5, 2010, for Unit 1 and March 8, 2013, for Unit 2.

The NRC has implemented Section 102 of the National Environmental Policy Act (NEPA) (42 United States Code 4321) in Title 10 of the Code of Federal Regulations (CFR) Part 51. In 10 CFR 51.20(b)(2), the Commission requires preparation of an environmental impact statement (EIS) or a supplement to an EIS for renewal of a reactor OL. In addition, 10 CFR 51.95(c) states that the EIS prepared at the OL renewal stage will be a supplement to the *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS), NUREG-1437, Volumes 1 and 2.[(a)]

Upon acceptance of the NMC application, the NRC began the environmental review process described in 10 CFR Part 51 by publishing a notice of intent to prepare an EIS and conduct scoping. The staff visited the PBNP site in June 2004 and held public scoping meetings on June 15, 2004, in Mishicot, Wiscsonsin. In the preparation of this draft supplemental environmental impact statement (SEIS) for PBNP, the staff reviewed the NMC Environmental Report (ER) and compared it to the GEIS; consulted with other agencies; conducted an independent review of the issues following the guidance set forth in NUREG-1555, 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, Part 1, of this SEIS.

The staff will hold two public meetings in Mishicot, Wiscsonsin, in February 2005 to describe the preliminary results of the NRC environmental review, to answer questions, and to provide members of the public with information to assist them in formulating comments on this SEIS. When the comment period ends, the staff will consider and address all of the comments received. These comments will be addressed in Appendix A, Part 2, of the final SEIS.

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

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

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 PBNP OLs) 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 PBNP is replaced. These alternatives are evaluated assuming that the replacement power generation plant is located at either the PBNP site or some other unspecified alternate location.

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

NMC's license renewal application presents an analysis of the Category 2 issues plus environmental justice and chronic effects from electromagnetic fields. The staff has reviewed the NMC analysis for each issue and has conducted an independent review of each issue. Six Category 2 issues are not applicable, because they are related to plant design features or site characteristics not found at PBNP. Four Category 2 issues are not discussed in this draft SEIS, because they are specifically related to refurbishment. NMC has stated that its evaluation of structures and components, as required by 10 CFR 54.21, did not identify any major plant refurbishment activities or modifications as necessary to support the continued operation of PBNP for the license renewal period. In addition, any replacement of components or additional inspection activities are within the bounds of normal plant operation, and are not expected to affect the environment outside of the bounds of the plant operations evaluated in the U.S. Atomic Energy Commission's 1972 *Final Environmental Statement Related to Operation of Point Beach 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. Five of the Category 2 issues and environmental justice apply to both refurbishment and to operation during the renewal term and are only discussed in this draft SEIS in relation to operation during the renewal term. For all 11 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 PBNP, and the plant improvements already made, the staff concludes that none of the candidate SAMAs are cost-beneficial. Although none of the SAMAs appear cost-beneficial in the baseline analysis, the staff concluded that two SAMAs could be cost-beneficial when uncertainties, alternative discount rates, or broader implementation options are taken into account. However, none of these SAMAs relate to adequately managing the effects of aging during the period of extended operation. Therefore, they need not be implemented as part of the license renewal pursuant to 10 CFR Part 54.

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

# Abbreviations/Acronyms

| | |
|---|---|
| ° | degree(s) |
| μm | micrometer(s) |
| | |
| ac | acre(s) |
| AC | alternating current |
| ACC | averted cleanup and decontamination costs |
| ADAMS | Agencywide Document Access and Management System |
| AEC | U.S. Atomic Energy Commission |
| AFW | auxiliary feedwater |
| AOC | averted offsite property damage costs |
| AOE | averted occupational exposure costs |
| AOSC | averted onsite costs |
| APE | averted public exposure |
| AQCR | Air Quality Control Region |
| ATC | American Transmission Company |
| ATWS | anticipated transient without scram |
| AVD | AVD Archaeological Services, Inc. |
| | |
| Bq | becquerel(s) |
| BTU | British thermal unit(s) |
| | |
| C | Celsius |
| CAA | Clean Air Act |
| CCW | component cooling water |
| CDF | core damage frequency |
| CEQ | Council on Environmental Quality |
| CFR | Code of Federal Regulations |
| Ci | curie(s) |
| cm | centimeter(s) |
| CNP | D.C. Cook Nuclear Plant |
| COE | cost of enhancement |
| CST | condensate storage tank |
| cu | cubic |
| CWA | Clean Water Act of 1977 |
| | |
| dB | decibel(s) |
| DBA | design-basis accident |
| DC | direct current |
| DOE | U.S. Department of Energy |

| | |
|---|---|
| DSM | demand-side management |
| ECCS | emergency core cooling system |
| EIA | Energy Information Administration (of DOE) |
| EIS | environmental impact statement |
| ELF-EMF | extremely low frequency-electromagnetic field |
| EOP | emergency operating procedure |
| ESA | Endangered Species Act of 1973 |
| EPA | U.S. Environmental Protection Agency |
| ER | Environmental Report |
| ESRP | *Standard Review Plans for Nuclear Power Plants, Supplement 1: Operating License Renewal* |
| F | Fahrenheit |
| FES | Final Environmental Statement |
| FIVE | fire-induced vulnerability evaluation |
| FNP | James A. Fitzpatrick Nuclear Plant |
| FR | *Federal Register* |
| FSAR | final safety analysis report |
| ft | foot (feet) |
| FWS | U.S. Fish and Wildlife Service |
| GEIS | *Generic Environmental Impact Statement for License Renewal of Nuclear Plants*, NUREG-1437 |
| Gen&SIS | Geographical, Environmental, and Siting Information System |
| GLARC | Great Lakes Archaeological Research Center, Inc. |
| gpd | gallons per day |
| gpm | gallons per minute |
| h | hour(s) |
| ha | hectare(s) |
| HEP | Human Error Probability |
| HLW | high-level waste |
| HRA | human reliability analysis |
| Hz | hertz |
| IGCC | integrated coal gasification combined cycle |
| in. | inch(es) |
| IPE | Individual Plant Examination |
| IPEEE | Individual Plant Examination of External Events |
| ISFSI | independent spent fuel storage installation |

| | |
|---|---|
| ISLOCA | interfacing systems loss-of-coolant accident |
| J | joule(s) |
| kg | kilogram(s) |
| KNPP | Kewaunee Nuclear Power Plant |
| km | kilometer(s) |
| $km^2$ | square kilometer(s) |
| kV | kilovolt(s) |
| kW | kilowatt(s) |
| kWh | kilowatt hour(s) |
| L | liter(s) |
| lb | pound(s) |
| LOCA | loss-of-coolant accident |
| LOSP | loss of offsite power |
| m | meter(s) |
| mA | milliampere(s) |
| MAAP | Modular Accident Analysis Program |
| MACCS2 | MELCOR Accident Consequence Code System 2 |
| MCPPC | Manitowoc County Planning and Park Commission |
| mGy | milligray(s) |
| mi | mile(s) |
| min | minute(s) |
| mph | miles per hour |
| mrad | millirad(s) |
| MRCC | Midwestern Regional Climate Center |
| mrem | millirem(s) |
| MSIV | main steam isolation valve |
| mSv | millisievert(s) |
| MT | metric ton(s) (tonne[s]) |
| MW | megawatt(s) |
| MWd/MTU | megawatt day(s) per metric ton of uranium |
| MW(e) | megawatt(s) electric |
| MWh | megawatt hour(s) |
| MW(t) | megawatt(s) thermal |
| NAS | National Academy of Sciences |
| NEPA | National Environmental Policy Act of 1969 |
| NESC | National Electric Safety Code |

| | |
|---|---|
| ng | nanogram(s) |
| NHPA | National Historic Preservation Act |
| NIEHS | National Institute of Environmental Health Sciences |
| NMC | Nuclear Management Company, LLC |
| NOAA | National Oceanographic and Atmospheric Administration |
| $NO_x$ | nitrogen oxide(s) |
| NPDES | National Pollutant Discharge Elimination System |
| NRC | U.S. Nuclear Regulatory Commission |
| NRHP | National Register of Historic Places |
| | |
| ODCM | Offsite Dose Calculation Manual |
| OL | operating license |
| | |
| PARS | publicly available records |
| PBNP | Point Beach Nuclear Plant Units 1 and 2 |
| pCi | picocurie(s) |
| PCS | Power Conversion System |
| $PM_{10}$ | particulate matter, 10 micrometers or less in diameter |
| ppb | parts per billion |
| ppm | parts per million |
| PRA | Probabilistic Risk Assessment |
| | |
| RAI | request for additional information |
| RCP | *reactor cooling pump* |
| RCS | reactor coolant system |
| rem | roentgen equivalent man |
| RHR | residual heat removal |
| ROW | right-of-way |
| RPC | replacement power costs |
| RWST | refueling water storage tank |
| | |
| s | second(s) |
| SAMA | Severe Accident Mitigation Alternative |
| SAR | safety analysis report |
| SBO | station blackout |
| SEIS | Supplemental Environmental Impact Statement |
| SER | safety evaluation report |
| SGTR | steam generator tube rupture |
| SHPO | State Historic Preservation Office |
| SI | safety injection |
| $SO_2$ | sulfur dioxide |

| | |
|---|---|
| $SO_x$ | sulfur oxide(s) |
| SRV | safety relief valve |
| Sv | sievert(s) |
| SW | service water |
| U.S. | United States |
| USC | United States Code |
| USCB | U.S. Census Bureau |
| USGS | U.S. Geological Survey |
| USDOT | U.S. Department of Transportation |
| WDA | Wisconsin Department of Administration |
| WDNR | Wisconsin Department of Natural Resources |
| WDOT | Wisconsin Department of Transportation |
| WDR | Wisconsin Department of Revenue |
| WDWD | Wisconsin Department of Workforce Development |
| WEPCO | Wisconsin Electric Power Company |
| WHS | Wisconsin Historical Society |
| WPDES | Wisconsin Pollutant Discharge Elimination System |
| yd | yard |
| yr | year |

# 1.0 Introduction

Under the U.S. Nuclear Regulatory Commission's (NRC's) environmental protection regulations in Title 10 of the Code of Federal Regulations (CFR) Part 51, which implement the National Environmental Policy Act (NEPA), renewal of a nuclear power plant operating license (OL) requires the preparation of an environmental impact statement (EIS). In preparing the EIS, the NRC staff is required first to issue the statement in draft form for public comment and then issue a final statement after considering public comments on the draft. To support the preparation of the EIS, the staff has prepared a *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS), NUREG-1437, Volumes 1 and 2 (NRC 1996, 1999).[a] The GEIS is intended to (1) provide an understanding of the types and severity of environmental impacts that may occur as a result of license renewal of nuclear power plants under 10 CFR Part 54, (2) identify and assess the impacts that are expected to be generic to license renewal, and (3) support 10 CFR Part 51 to define the number and scope of issues that 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 Nuclear Management Company, LLC (NMC) operates Point Beach Nuclear Plant Units 1 and 2 (PBNP) in Wisconsin under OLs DPR-24 and DPR-27, which were issued by the NRC. These OLs will expire in October 5, 2010, for Unit 1 and March 8, 2013, for Unit 2. On February 25, 2004, NMC submitted an application to the NRC for renewal of the PBNP OLs for an additional 20 years under the procedures in 10 CFR Part 54. NMC is a *licensee* for the purposes of its current OLs and an *applicant* for the renewal of the OLs. Pursuant to 10 CFR 54.23 and 51.53(c), NMC submitted an Environmental Report (ER) (NMC 2004a) in which NMC analyzed the environmental impacts associated with the proposed license renewal action, considered alternatives to the proposed license renewal action, and evaluated mitigation measures for reducing adverse environmental impacts.

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

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

## 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 PBNP OLs, (3) discuss the purpose and need for the proposed action, and (4) present the status of NMC's compliance with environmental quality standards and requirements that have been imposed by Federal, State, regional, and local agencies that are responsible for environmental protection.

The 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 (SAMAs). Chapter 6 discusses the uranium fuel cycle and solid waste management. Chapter 7 discusses decommissioning, and Chapter 8 discusses alternatives to license renewal. Finally, Chapter 9 summarizes the findings of the preceding chapters and draws conclusions about the adverse impacts that cannot be avoided; the relationship between short-term uses of the human 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 received on the environmental review for license renewal and staff responses. Appendixes B through G, respectively, list the following:

- The preparers of the supplement

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

- The organizations contacted during the development of this SEIS

- NMC's compliance status in Table E-1 (this appendix also contains copies of consultation correspondence prepared and sent during the evaluation process)

- GEIS environmental issues that are not applicable to PBNP

- SAMAs.

## 1.2 Background

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

### 1.2.1 Generic Environmental Impact Statement

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

The GEIS documents the results of the systematic approach that was taken to evaluate the environmental consequences of renewing the licenses of individual nuclear power plants and operating them for an additional 20 years. For each potential environmental issue, the GEIS (1) describes the activity that affects the environment, (2) identifies the population or resource that is affected, (3) assesses the nature and magnitude of the impact on the affected population or resource, (4) characterizes the significance of the effect 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, or LARGE. The definitions of the three significance levels are set forth in the footnotes to Table B-1 of 10 CFR Part 51, Subpart A, Appendix B, as follows:

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

The GEIS assigns a significance level to each environmental issue, assuming that ongoing mitigation measures would continue.

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

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

(2) A single significance level (i.e., SMALL, MODERATE, or LARGE) has been assigned to the impacts (except for collective offsite radiological impacts from the fuel cycle and from high-level waste (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 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 (10 CFR 54.23). 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 51.53(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 PBNP OLs, NMC developed a process to ensure that information not addressed in or available during the GEIS evaluation regarding the environmental impacts of license renewal for PBNP would be properly reviewed before submitting the ER and to ensure that such new and potentially significant information related to renewal of the licenses would be identified, reviewed, and assessed during the period of NRC review. NMC reviewed the Category 1 issues that appear in Table B-1 of 10 CFR Part 51, Subpart A, Appendix B, to verify that the conclusions of the GEIS remained valid with respect to PBNP. This review was performed by personnel from NMC and its support organization who were familiar with NEPA issues and the scientific disciplines involved in the preparation of a license renewal ER.

The NRC staff also has a process for identifying new and significant information. That process is described in detail in *Standard Review Plans for Environmental Reviews for Nuclear Power Plants, Supplement 1: Operating License Renewal* (ESRP), NUREG-1555, Supplement 1 (NRC 2000). The search for new information includes (1) a review of an applicant's ER and the process for discovering and evaluating the significance of new information; (2) a review of records of public comments; (3) a review of environmental quality standards and regulations; (4) coordination with Federal, State, and local environmental protection and resource agencies; and (5) review of the technical literature. New information discovered by the staff is evaluated for significance using the criteria set forth in the GEIS. For Category 1 issues where new and significant information is identified, reconsideration of the conclusions for those issues is limited in scope to the assessment of the relevant new and significant information; the scope of the assessment does not include other facets of the issue that are not affected by the new information.

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

The NRC prepares an independent analysis of the environmental impacts of license renewal and compares these impacts with the environmental impacts of alternatives. The evaluation of the NMC license renewal application began with publication of a notice of acceptance for docketing and opportunity for a hearing in the *Federal Register* (69 FR 19559–19561 [NRC 2004a]) on April 13, 2004. The staff published a notice of intent to prepare an EIS and conduct scoping in the *Federal Register* (69 FR 26624–26626 [NRC 2004b]) on May 13, 2004.

Two public scoping meetings were held on June 15, 2004, in Mishicot, Wisconsin. Comments received during the scoping period were summarized in the *Environmental Impact Statement Scoping Process: Summary Report – Point Beach Nuclear Plant Units 1 and 2, Manitowoc County, Wisconsin* (NRC 2004c) dated September 3, 2004. Comments applicable to this environmental review are presented in Part 1 of Appendix A.

The staff followed the review guidance contained in the ESRP (NRC 2000). The staff and contractors retained to assist the staff visited the PBNP site on June 16 and 17, 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 PBNP were reviewed and are referenced in this report.

A 75-day comment period will begin on the date of publication of the U.S. Environmental Protection Agency Notice of Availability 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 Mishicot, Wisconsin, in February 2005. 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.

This draft SEIS presents the staff's analysis that considers and weighs the environmental impacts of the proposed renewal of the PBNP OLs, 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.

## 1.3 The Proposed Federal Action

The proposed Federal action is renewal of the PBNP OLs. The PBNP site is located on the western shore of Lake Michigan in Manitowoc County, Wisconsin, approximately 48 km (30 mi) southeast of Green Bay and 24 km (15 mi) north-northeast of Manitowoc (NMC 2004a, 2004b).

PBNP has two Westinghouse pressurized water reactors. Each reactor has a design rating to produce a reactor thermal output of 1518.5 megawatts thermal (MW[t]) and to generate 523.8 megawatts electric (MW[e]) of gross electrical power (NMC 2004a). Each unit underwent a low-pressure turbine retrofit modification that increased the unit design output to 537.96 MW(e). In 2003, PBNP underwent a 1.4 percent uprate, which increased the rated thermal output to 1540 MW(t) and increased the gross electrical power to 545 MW(e) (518 MW[e] net). Plant cooling is provided by a once-through cooling water system that withdraws water from Lake Michigan and dissipates heat by discharge back into Lake Michigan. PBNP produces electricity to meet about 250 million customers (NMC 2004a).

The current OL for Unit 1 expires on October 5, 2010, and for Unit 2 on March 8, 2013. By letter dated February 25, 2004, NMC submitted an application to the NRC (NMC 2004b) to renew these OLs for an additional 20 years of operation (i.e., until October 5, 2030, for Unit 1 and March 8, 2033, 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 jurisdiction of the State or the purview of the owners.

Thus, for license renewal reviews, the NRC has adopted the following definition of purpose and need from the GEIS, Section 1.3 (NRC 1996):

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

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

## 1.5 Compliance and Consultations

NMC is required to hold certain Federal, State, and local environmental permits, as well as meet relevant Federal and State statutory requirements. In the PBNP ER (NMC 2004a), NMC provided a list of the authorizations from Federal, State, and local authorities for current operations as well as environmental approvals and consultations associated with renewal of the PBNP OLs. 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 (NMC 2004a) states that NMC is in compliance with applicable environmental standards and requirements for PBNP. The staff also 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. 42 USC 2011, et seq.

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

Nuclear Management Company, LLC. (NMC). 2004a. *Point Beach Nuclear Plant Operating License Renewal Application Environmental Report*. Two Rivers, Wisconsin.

Nuclear Management Company, LLC. (NMC). 2004b. *Application for Renewed Operating Licenses, Point Beach Nuclear Plant Units 1 and 2*. Two Rivers, Wisconsin.

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

U.S. Nuclear Regulatory Commission (NRC). 1999. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants, Main Report, Section 6.3-Transportation, Table 9.1, Summary of Findings on NEPA Issues for License Renewal of Nuclear Power Plants, Final Report.* NUREG-1437, Volume 1, Addendum 1, Washington, D.C.

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

U.S. Nuclear Regulatory Commission (NRC). 2004a. "Notice of Acceptance for Docketing of the Application and Notice of Opportunity for a Hearing Regarding Renewal of License Nos. DPR-24 and DPR-27 for an Additional Twenty-Year Period." *Federal Register*, Vol. 69, No. 71, pp. 19559–19561, Washington, D.C. April 13, 2004.

U.S. Nuclear Regulatory Commission (NRC). 2004b. "Notice of Intent to Prepare an Environmental Impact Statement and Conduct Scoping Process." *Federal Register*, Vol. 69, No. 93, pp. 26624–26626, Washington, D.C. May 13, 2004.

U.S. Nuclear Regulatory Commission (NRC). 2004c. *Environmental Impact Statement Scoping Process: Summary Report – Point Beach Nuclear Plant Units 1 and 2, Manitowoc County, Wisconsin.* Washington, D.C. September 3, 2004.

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

Point Beach Nuclear Plant Units 1 and 2 (PBNP) are located in Manitowoc County, Wisconsin, on the western shore of Lake Michigan. The plant consists of two units. Each unit is a pressurized-water reactor with steam generators producing steam that turns turbines to generate electricity. Plant cooling is provided by a once-through system using water from Lake Michigan. The plant and its environs are described in Section 2.1, and the plant's interaction with the environment is presented in Section 2.2.

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

PBNP is located on the western shore of Lake Michigan approximately 48 km (30 mi) southeast of Green Bay and 24 km (15 mi) north-northeast of Manitowoc (Nuclear Management Company, LLC [NMC] 2004a). The area within 10 km (6 mi) of PBNP includes portions of Manitowoc and Kewaunee counties and is largely rural, characterized by farmland, woods, and small residential communities. The nearest town is Two Creeks, approximately 2 km (1 mi) north-northwest of the site. PBNP is approximately 10 km (6 mi) east-northeast of Mishicot, 13 km (8 mi) north of Two Rivers, and 18 km (11 mi) south of Kewaunee. The Oneida Indian Reservation is located on the western edge of Green Bay approximately 56 km (35 mi) northwest of the plant. The PBNP property covers approximately 510 ha (1260 ac). Structures and parking lots occupy about 28 ha (70 ac). Figures 2-1 and 2-2 show the site location and features within 80 km (50 mi) and 10 km (6 mi), respectively (NMC 2004a).

### 2.1.1 External Appearance and Setting

PBNP is owned by Wisconsin Electric Power Company (WEPCO) and operated by NMC. Site structures include two reactor containments, auxiliary and service buildings, turbine building, office building, switchyard, pump house, cooling water intake and discharge structures, and an independent spent fuel storage installation (ISFSI) (NMC 2004a). Approximately 425 ha (1050 ac) are used for agriculture. The remaining area is a mixture of woods, wetlands, and open areas. The site includes approximately 3 km (2 mi) of continuous frontage on the western shore of Lake Michigan.

The local terrain is gently rolling to flat, with elevations varying from 1.5 to 18 m (5 to 60 ft) above the normal level of Lake Michigan. The land surface slopes gradually toward the lake from higher glacial moraine areas west of the site. Low bluffs face the Lake Michigan shore,

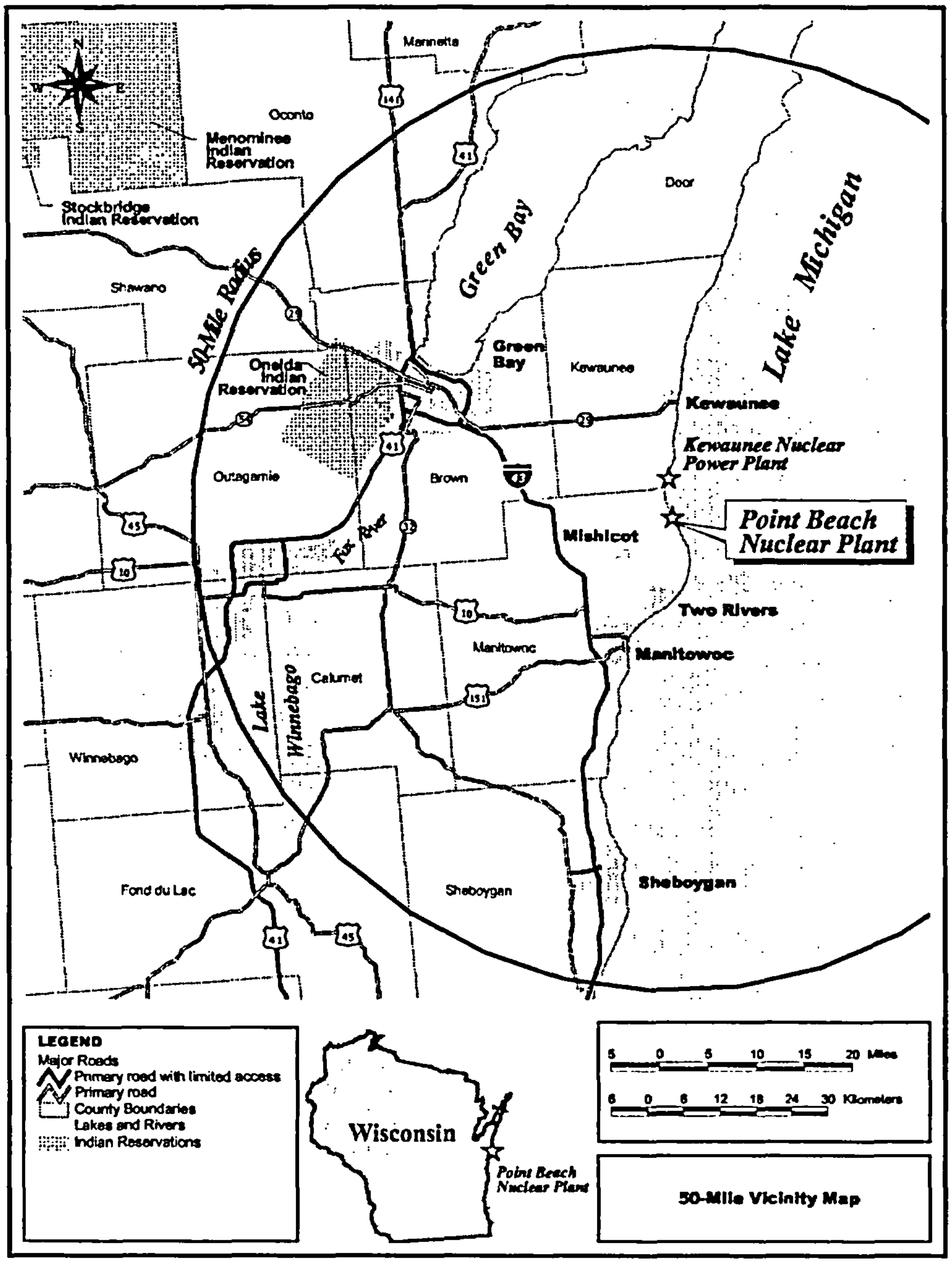


**Figure 2-1.** Location of PBNP, 80-km (50-mi) Region

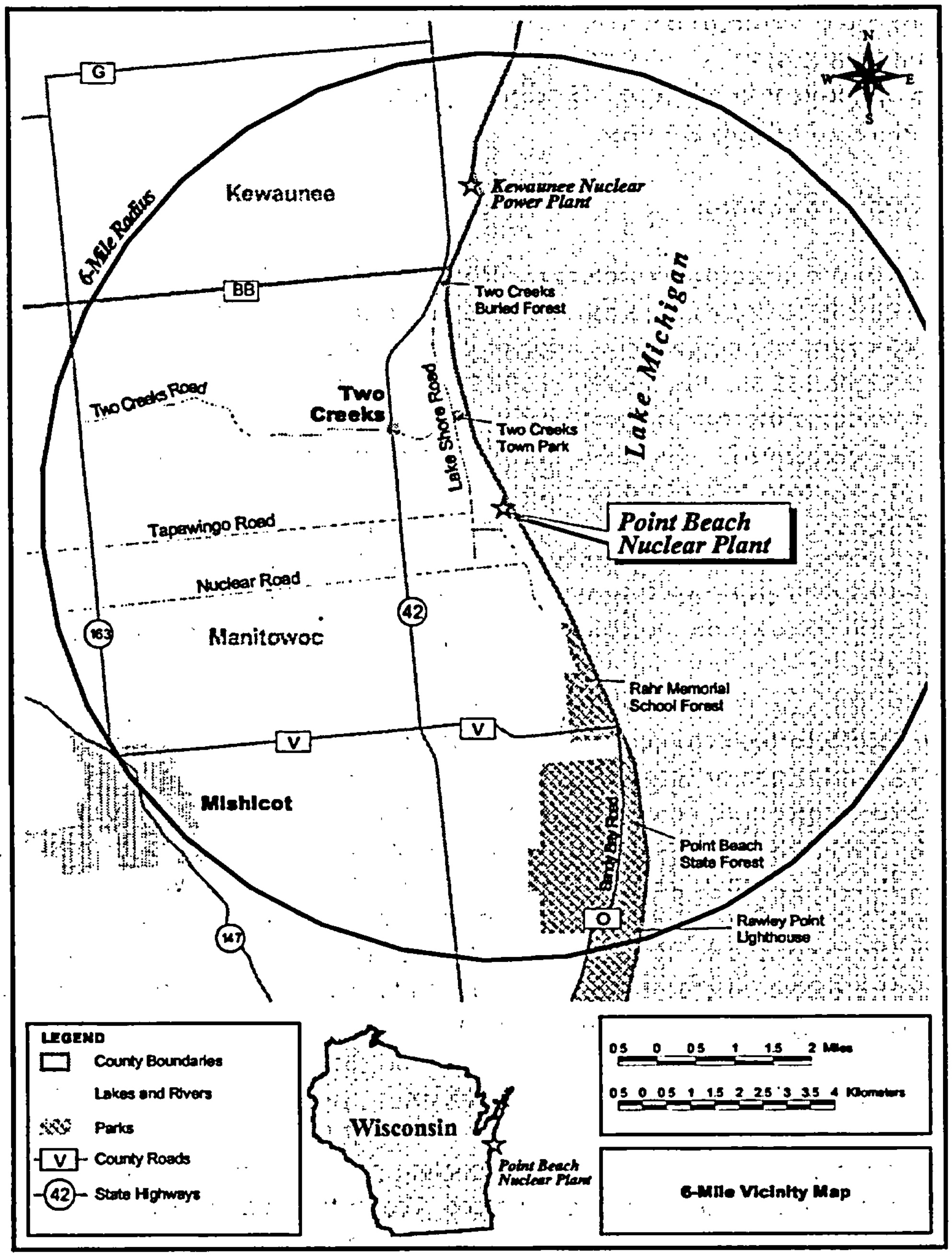


**Figure 2-2.** Location of PBNP, 10-km (6-mi) Region

with evidence of marked erosion near the center of the PBNP site. At this point, the beach is narrow (ranging in width from 6 m to 15 m [20 ft to 50 ft]), with bare mud slopes showing active erosion due to lake storms. Historically, shoreline recession has ranged from 0.8 m to 1.5 m (2.5 ft to 5 ft) per year in this area. NMC has provided riprap to control further recession of the shoreline at the site (NMC 2004a).

### 2.1.2 Reactor Systems

PBNP has two Westinghouse reactors moderated and cooled by pressurized light water. Each unit was originally designed to produce a reactor thermal output of 1518.5 megawatts thermal (MW[t]). All steam and power conversion equipment, including each turbine generator, was originally designed to permit generation of 523.8 megawatts of gross electrical power (MW[e]). Unit 1 achieved commercial operation in December 1970, and Unit 2 achieved commercial operation in October 1972. Since being placed into commercial operation, each unit underwent a low-pressure turbine retrofit modification that increased the unit design output to 538 MW(e). In 2003, PBNP underwent a 1.4 percent uprate which increased the rated thermal output to 1540 MW(t) and increased the gross electrical power to 545 MW(e) (518 MW[e] net). New PBNP fuel is slightly enriched to contain a nominal 5.0 weight percent of uranium-235, with an average burnup for the peak rod of 45,000 megawatt-days per metric ton uranium (NMC 2004a).

The PBNP facility is depicted in Figure 2-3. Each reactor is housed in its own containment structure (labeled "Reactor Structures" in Figure 2-3), together with its primary cooling system, associated steam generators, and circulation system. Each reactor containment structure is a steel lined, reinforced concrete cylinder with a hemispheric dome and a flat reinforced concrete foundation mat. A common gallery containing the principal radioactive waste systems and the control room is located between the two reactor units, which lie north and south of the common gallery in a single structure. The containment structures are enclosed in vinyl coated steel buildings that are colored green and brown to blend in with the Wisconsin countryside (U.S. Atomic Energy Commission [AEC] 1972).

### 2.1.3 Cooling and Auxiliary Water Systems

Lake Michigan is the source of water for the cooling and auxiliary water systems at PBNP, which operates as a once-through cooling plant. Water from Lake Michigan reaches PBNP through a submerged offshore intake. Water returns to Lake Michigan through a surface shoreline discharge. The system removes waste heat from the condensers as well as other plant equipment and discharges water through separate flumes for each unit. At peak capacity, water is circulated at a maximum rate of 22 $m^3/s$ (783 $ft^3/s$) through each condenser and then

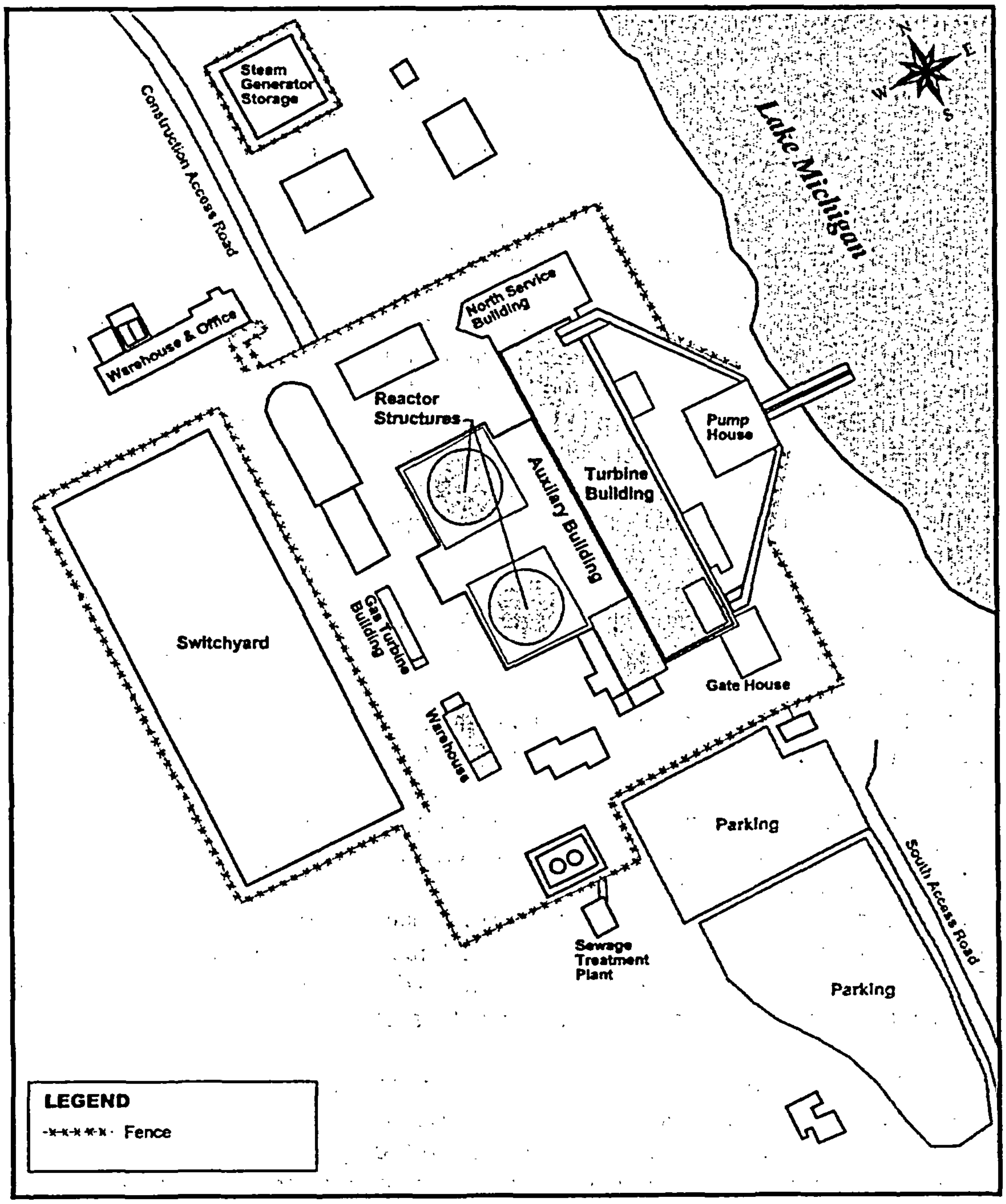


Figure 2-3. PBNP Site Layout

returned to the lake. The water withdrawn for these systems flows first through the offshore intake structure to the forebay, then to the condensers and other equipment. Auxiliary water systems include the service water system and the fire protection system.

Lake water is provided to the forebay through two 4.3-m (14-ft) diameter pipes buried beneath the lakebed. Water enters these pipes at the offshore intake structure. The offshore intake structure is an annulus of steel pilings with limestone blocks between the steel pilings. The cylinder stands upright on the lakebed 533 m (1750 ft) offshore in 6.7 m (22 ft) of water. As originally designed, the offshore intake structure had a top elevation of 2.4 m (8 ft) above water level. However, the original structure attracted a large number of birds during the spring and fall migration and contributed to a number of bird mortalities. In May 2001, the offshore intake structure was reconfigured to address the bird mortality issue. As modified, the offshore intake structure stands approximately 3.4 m (11 ft) tall above the lake floor, has an outside diameter of 34 m (110 ft), and an inside chamber with a diameter of 18 m (60 ft); the offshore intake structure is now completely submerged. The top is covered with a steel superstructure supporting a trash rack made of high-density polyethylene having approximately 18 × 46 cm (7 × 18 in.) openings.

Water enters the chamber through the trash rack as well as through void spaces around the limestone blocks and through 76 cm (30 in.) diameter pipes that penetrate the blocks in a ring 1.5 m (5 ft) above the lakebed. The pipes are covered with 3 x 5 cm (1.2 × 2 in.) bar grating to prevent debris and large fish from entering the intake system. In 1980, the original intake structure was modified to reduce problems with ice formation. Modifications consisted of the installation of four 2 × 2 m (6.5 × 6.5 ft) concrete pipes near the lake bottom in the south half of the intake crib. The pipes are covered with a grating that is hinged for lowering in the winter months (usually December 1 to March 1) to prevent the formation of frazzle ice on the grate and the subsequent restriction of water flow. The modification was also designed to lower the velocity of water approaching the offshore intake structure. Three of the four pipes were retained during the May 2001 modification. A trash rack, bar grates, and traveling screens are located in the forebay, where small debris and trapped fish are collected in baskets and removed before they can enter the circulating water system.

Water circulated through the condensers is discharged to the lake through two steel piling troughs at the lake surface extending in opposite directions (at 30-degree angles from the plant centerline) approximately 61 m (200 ft) out into Lake Michigan. The normal temperature increase over the ambient water temperature at the point of discharge is about 13 °C (23 °F). The momentum of the discharge velocity is sufficient to create a high degree of mixing with the lake water in the immediate vicinity.

The system is designed to control the formation of needle ice within the intake structure during the winter months by use of warm water feedback. The recirculation of heated effluent back through the pump house forebay reduces the net rate of water withdrawal from the lake to 10 $m^3/s$ (353 $ft^3/s$) for each unit (NMC 2004a).

Sodium hypochlorite and various biocides are injected into the cooling water at the pump house forebay to control aquatic nuisances and algal growth. In addition, an electrolytic system continuously adds copper to the service water at a rate of 5 to 10 parts per billion to control biological fouling of the service water.

### 2.1.4 Radioactive Waste Management Systems and Effluent Control Systems

PBNP uses liquid, gaseous, and solid radioactive waste management systems to collect and treat the radioactive materials that are a by-product of PBNP operations. These systems process radioactive liquid, gaseous, and solid effluents to maintain releases within regulatory limits and to maintain levels as low as reasonably achievable before they are released to the environment. The PBNP waste processing systems meet the design objectives of Title 10 Code of Federal Regulations (CFR) Part 50, Appendix I, "Numerical Guides for Design Objective, and Limiting Conditions for Operation to Meet the Criterion 'As Low as is Reasonably Achievable' for Radioactive Material in Light-Water Cooled Nuclear Power Reactor Effluents."

Radioactive material in the reactor coolant is the primary source of gaseous, liquid, and solid radioactive wastes in light-water reactors. 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 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 waste results from treating and separating radionuclides from gases and liquids and from removing contaminated material from various reactor areas. Solid waste also consists of reactor components, equipment, and tools removed from service, as well as contaminated protective clothing, paper, rags, and other trash generated from plant design modifications and operations and routine maintenance activities. Solid waste is shipped to a waste processor for volume reduction before disposal or is sent directly to the licensed disposal facility. Spent resins and filters are dewatered and packaged for shipment to licensed offsite processing or disposal facilities (NMC 2003a).

Fuel assemblies that have exhausted a certain percentage of their fuel and have been removed from the reactor core for disposal contain spent fuel. PBNP currently operates on an 18-month refueling cycle. The spent fuel is currently stored on site in the spent fuel pool in the auxiliary building adjacent to the containment building or in dry cask storage at the onsite ISFSI.

The Offsite Dose Calculation Manual (ODCM) for PBNP describes the methods used for calculating the concentration of radioactive material in the environment and the estimated potential offsite doses associated with liquid and gaseous effluents from PBNP (NMC 2003b). The ODCM also specifies controls for release of liquid and gaseous effluents to ensure compliance with NRC regulations.

#### 2.1.4.1 Liquid Waste Processing Systems and Effluent Controls

Radioactive fluids entering the waste disposal system are collected in tanks for analysis prior to discharge and/or further treatment. Each unit has a steam generator blowdown tank and one reactor coolant drain tank inside each containment. Units 1 and 2 share one laundry and hot shower tank, one chemical tank, one waste hold up tank, two waste condensate tanks, and one waste distillate tank. As the primary means for processing all radioactive liquid waste effluents, the blowdown evaporator system is designed to remove radioactive particulates and gases from radioactive liquid waste and from steam generator blowdown water in the event of primary to secondary leakage. Evaporator bottoms and ion exchange resins are pumped to the primary auxiliary building truck bay for dewatering prior to shipment for disposal. All piping, pumps, and valves carrying the liquid wastes are stainless steel and have provisions to minimize leakage, prevent over-pressurization, and isolate equipment as required for operation and maintenance (NMC 2003a).

All liquid waste components except the reactor coolant drain tank are located in the auxiliary building and any leakage from the tank or piping would be collected in the building sump to be pumped back into the liquid waste system. The building sump and basement volume are sufficient to hold the full volume of a liquid hold up tank without overflowing to areas outside the building. The full volume of either the volume control tank or the waste hold up tank will be contained in the auxiliary building (NMC 2003a).

All liquid wastes are monitored prior to release. The radiation monitoring system monitors the effluent, closing the discharge valve if the amount of radioactive material in the effluent exceeds preset values. These values are established using the methodology described in the ODCM (NMC 2003b).

During 2003, there was a total amount of radioactive material (fission and activation products) of $5 \times 10^9$ Bq (0.16 Ci) and a total amount of tritium of $2.77 \times 10^{13}$ Bq (748 Ci) released from PBNP. These levels are typical of past years and are within regulatory limits (NMC 2000, 2001, 2002). See Section 2.2.7 for a discussion of the calculated doses to the maximally exposed individual as a result of these releases. Absent a change in licensed power levels, NMC does not anticipate any increase in liquid waste releases during the license renewal period.

#### 2.1.4.2 Gaseous Waste Processing Systems and Effluent Controls

PBNP ventilation is designed to maintain gaseous effluents to levels as low as reasonably achievable. This is done by a combination of holdups for decay of short-lived radioactive material, filtration, and monitoring. Gases from the primary containment system are held in decay tanks for up to 45 days prior to release through the auxiliary building ventilation stack. Gases from other areas of the plant, such as the spent fuel pool, radioactive waste handling area, auxiliary building, service building, and chemistry laboratory are filtered and monitored prior to release. The primary release points at PBNP are the auxiliary building vent stack, the Unit 1 and 2 containment purge stacks, and the drumming areas vent stack. These four release points are equipped with shutoff valves that close if the activity levels exceed the alarm set point of the monitor. The basis for the value of the alarm set point is discussed in the ODCM. The unmonitored release point is the exhaust from the turbine building, where airborne radioactive material is not expected. Areas of the plant that could contain low levels of radioactive contaminants in the event of primary to secondary leakage, such as the turbine building, are not provided with high-efficiency particulate air filters or carbon absorber equipment, because releases from these areas are insignificant.

During 2003, the total amount of radioactive material released from PBNP (NMC 2004c) occurred in the following forms:

- Fission and activation gas of $2.682 \times 10^{10}$ Bq (0.894 Ci)

- Iodine of $5.5 \times 10^{6}$ Bq ($1.5 \times 10^{-4}$ Ci)

- Total particulate of $3.2 \times 10^{6}$ Bq ($8.7 \times 10^{-5}$ Ci)

- Total tritium of $7.3 \times 10^{18}$ Bq (61.5 Ci).

These releases are typical of past years (NMC 2000, 2001, 2002). See Section 2.2.7 for a discussion of the calculated doses to the maximally exposed individual as a result of these releases. Absent a change in licensed power levels, NMC does not anticipate any increase in gaseous waste releases during the license renewal period.

#### 2.1.4.3 Solid-Waste Processing

The solid-waste system at PBNP is designed to package and/or solidify radioactive waste for shipment to an approved offsite burial facility. Solid waste consists of chemical laboratory samples, spent resins, used filter cartridges, radioactively contaminated hardware, and compacted wastes such as rags, paper, and clothing.

Spent resins from the demineralizers, filter cartridges, and the concentrates from the evaporators are packaged and stored on site until shipment for offsite disposal. Miscellaneous materials such as paper, plastic, wood, and metal are collected and shipped off site for vendor supplied volume reduction (i.e., incineration, supercompaction, metal melt, decontamination, etc.) followed by disposal.

Spent resins from the chemical and volume control system and other system demineralizers are flushed to a shielded, lined, stainless steel storage tank located in the auxiliary building basement. When the tank is full, the resin is dewatered and liquids from the dewatering operation are sent to the waste hold up tank. Following resin dewatering, the tank and its shield are transferred by the seismically qualified auxiliary building crane to the truck access area or to the new-fuel storage area where the resin is sluiced to a disposable cask liner. When the disposable liner is full, the liner is dewatered to meet disposal site criteria. The disposable liner is then shipped off site for disposal at a suitable burial site or stored until shipment for offsite burial.

Dry active waste is stored in SeaLand containers in designated locations in the outside yard portion of the radiation control area before shipment. Also, boxes loaded with dry active waste are stored in the outside yard area of the radiation control area before shipment. Routine surveys and inspections are performed to verify container integrity (NMC 2003a).

Spent fuel is currently stored on site in the spent fuel pool in the auxiliary building adjacent to the containment building or in dry cask storage at the onsite ISFSI (NMC 2004b).

Disposal and transportation of solid waste are performed in accordance with the applicable requirements of 10 CFR Parts 61 and 71, respectively. There have been no releases to the environment from radioactive solid wastes generated at PBNP (State of Wisconsin 2003, 2004a).

The total amount of radioactive material shipped for disposal in 2003 was $6.5 \times 10^{12}$ Bq (175.3 Ci) (NMC 2004c). These shipments are representative of the shipments made in the past several years (NMC 2000, 2001, 2002). Absent a change in licensed power levels, NMC does not anticipate any increase in radioactive waste shipments during the license renewal period.

### 2.1.5 Nonradioactive Waste Systems

Various nonradioactive wastewater management and disposal activities are conducted at PBNP. They include collection, treatment, and disposal of the following principal effluents:

sanitary waste, demineralizer regeneration neutralization tank discharge, steam generator blowdown, reverse osmosis reject wastewater, microfiltration unit backwash, water treatment plant backwash, potable water treatment system filter backwash, heating system condensate, and wastewater from various sumps and floor drains.

After the appropriate treatment processes, the wastewater streams are discharged to Lake Michigan and monitored and regulated according to Wisconsin Pollutant Discharge Elimination System (WPDES) permit number WI-0000957-07-0 administered by the Wisconsin Department of Natural Resources (WDNR) (WDNR 2004a).

Sanitary wastewater is treated in an onsite treatment system. The effluent is commingled with other wastewater and subsequently discharged with the cooling-water discharges. Waste liquid sludge is hauled off site for disposal. Land application of sludge is considered as an alternative disposal method. However, no land application has occurred in the last 6 years. The sludge is taken to the Green Bay or Manitowoc wastewater treatment plants for disposal.

A wastewater retention pond previously used for low-volume process wastewater and treated sanitary waste effluent was abandoned in 2002. The site was restored to its pre-excavation grades and planted with native plant species (GeoSyntec Consultants 2002). A vacuum fabric filter system is now used for treating the wastewater and sanitary waste. The vacuum fabric filter system removes suspended solids to provide final clarification prior to discharge.

All nonradioactive solid waste is disposed of using licensed disposal methods appropriate for the waste types. Hazardous, nonradioactive waste is regulated under the Resource Conservation and Recovery Act administered by the WDNR, which classifies PBNP as a "large quantity generator," with U.S. Environmental Protection Agency (EPA) Identification No. WID093422657. Hazardous wastes generated on the PBNP site, such as contaminated soil and other materials, paints, oils, solvent wastes, outdated chemical products, and corrosive reagents, are managed and disposed of by shipping off site in accordance with applicable rules and regulations. In 2003, approximately 32.2 MT (35.5 tons) of hazardous waste were generated at PBNP (We Energies 2004a).

Nonradioactive and nonhazardous waste materials such as excess dirt and debris from past construction activities, including clean soil, broken pavement, and building materials, have been collected at an onsite spoil pile at the PBNP site. The spoil pile is established and maintained in conformance with the applicable requirements of the WDNR. The pile is stabilized by years of natural vegetative growth. A visual inspection of the pile occurs annually to check for erosion as part of the Storm Water Pollution Prevention Plan.

### 2.1.6 Plant Operation and Maintenance

Maintenance activities conducted at PBNP include inspection, testing, and surveillance to maintain the current licensing basis of the plant and ensure compliance with environmental and safety requirements. Certain activities can be performed while the reactor is operating, but some activities require that the plant be shut down. Long-term outages are scheduled for refueling and for certain types of repairs or maintenance, such as replacement of a major component. NMC refuels PBNP on a nominal 18-month, staggered schedule. During refueling outages, which last from 30 to 40 days, site employment increases above the 740 permanent workforce by 300 temporary workers (NMC 2004a).

The final safety analysis report (NMC 2003a) regarding the effects of aging on systems, structures, and components was included as part of the PBNP application for renewal of its operating license (OL), in accordance with 10 CFR Part 54. Chapter 3 and Appendix B of the PBNP license renewal application (NMC 2004b) describe the programs and activities that will manage the effects of aging during the license renewal period. NMC expects to conduct activities related to the management of aging effects during normal plant operation, or refueling and other outages, but plans no outages specifically for the purpose of refurbishment. NMC does not plan to add additional full-time staff (nonoutage workers) at PBNP during the period of the renewed license.

### 2.1.7 Power Transmission System

In its Environmental Report (ER), the applicant identified three 345-kilovolt (kV) transmission lines that connect PBNP to the power grid (NMC 2004a). A fourth 345-kV line connects the Kewaunee Nuclear Power Plant (KNPP) to the substation at PBNP. Currently the four lines are owned and maintained by the American Transmission Company (ATC). The transmission lines are described below and each corridor's characteristics are shown in Table 2-1.

**Table 2-1.** PBNP Transmission Line Rights-of-Way

| Substation | Rights-of-Way | Number of Lines | kV | Approximate Length | | Approximate Width | | Approximate Area | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | km | (mi) | m | (ft) | ha | (ac) |
| Granville | L-111 | 1 | 345 | 32.0 | 20.0 | 67 | 220 | 210 | 530 |
| Arcadian | L-121 | 1 | 345 | 29.0 | 18.0 | 67 | 220 | 190 | 480 |
| North Appleton | L-151 | 1 | 345 | 47.5 | 29.7 | 67 | 220 | 320 | 790 |
| PBNP | Q-303 | 1 | 345 | 9.0 | 5.6 | 67 | 220 | 61 | 150 |

Source: NMC 2004a

Line L-111 connects to the Granville substation via a previously existing line. The tie point is in the southwest quadrant of Section 16, Franklin Township. The length of the line is 32 km (20 mi) (NMC 2004a).

Line L-121 connects to the Arcadian substation via a previously existing line. The tie point is in the southwest quadrant of Section 9, Franklin Township. The length of the line is 29 km (18 mi) (NMC 2004a).

Line L-151 connects to the North Appleton substation via a previously existing line. The tie point is in the northwestern quadrant of Section 7, Wrightstown Township. The length of the line is 47.5 km (29.7 mi) (NMC 2004a).

Line Q-303 runs 9.0 km (5.6 mi) north to the substation at KNPP (NMC 2004a).

Each right-of-way (ROW) is 67 m (220 ft) wide. Figure 2-4 shows the transmission system for PBNP. For the specific purpose of connecting PBNP to the power grid, ATC has a total of 118 km (73.3 mi) of transmission lines occupying approximately 791 ha (1955 ac) of easement (NMC 2004a). The ROWs pass through land that is primarily rolling hills covered in forest and farmland. These ROWs pass through rural areas with low population densities. The lines cross numerous State and Federal highways, including Wisconsin Highways 42 and 147 and Interstate 43. ROWs that pass through farmland generally continue to be managed as such. ATC plans to maintain these lines indefinitely as they are an integral part of the larger transmission system. These transmission lines are expected to remain a permanent part of the regional transmission system after decommissioning of PBNP.

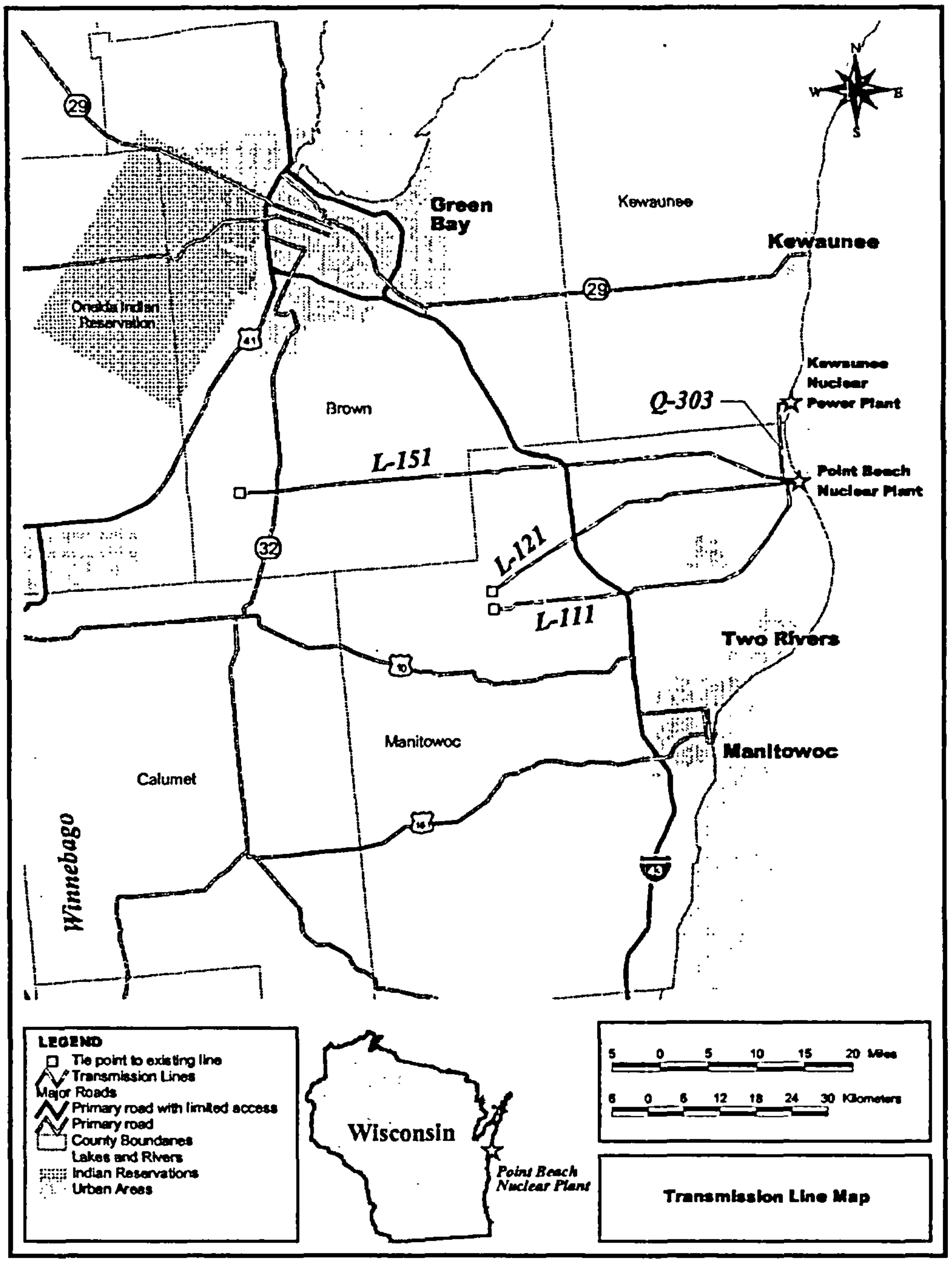


**Figure 2-4.** PBNP Transmission Lines

The transmission lines were designed and constructed in the late 1960s and early 1970s in accordance with then existing *Wisconsin Electrical Code* and industry standards. ATC implements a ROW inspection and maintenance program to ensure that the transmission facilities continue to conform to design standards. ATC manages transmission line ROWs using a wire zone/border zone concept. The wire zone is directly below the transmission lines, where the vegetation is primarily low-growing forbs and grasses. The border zone extends from the wire zone to the edge of the ROW, where woody species less than 5 m (15 ft) tall provide a transition to the surrounding habitats (ATC 2004).

The maintenance and inspection program uses aerial patrols to check for encroachments, broken conductors, broken or leaning structures, and signs of tree burning. Any of these conditions could be evidence of clearance problems. Additionally, ground inspections are performed to further examine clearance at questionable locations, observe the integrity of structures, and identify dead or diseased trees that might fall on the lines. Problems that are found are brought to the attention of the appropriate organization for corrective action. ATC has a vegetation management program for trimming and clearing tall trees that may impinge upon the conductors (ATC 2004b). The program also involves removing invasive plants from the ROW. The specific clearing activities implemented are dependent upon the type and amount of vegetation in a given area and are modified as needed for sensitive habitats and stream crossings. Vegetation management activities may include tractor mowing, manual chainsaw clearing, and application of herbicides by a State licensed, commercial applicator. Trimming is usually performed every 5 to 7 years, depending on the growth rates of vegetation in a given area.

ATC recognizes that transmission line ROWs provide ancillary compatible uses including wildlife habitat, biodiversity corridors, recreation, and aesthetics. ATC practices a vegetation management program that utilizes physical, chemical, and biological treatments to promote stable, diverse, low-growing plant communities in a way that promotes wildlife habitat and reduces environmental impacts.

## 2.2 Plant Interaction with the Environment

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

### 2.2.1 Land Use

PBNP is situated on the western shore of Lake Michigan in Manitowoc County, Wisconsin, approximately 48 km (30 mi) southeast of Green Bay and 24 km (15 mi) north-northeast of the city of Manitowoc. Lake Michigan is the second largest of the Great Lakes by volume at 4900 $km^3$ (nearly 4 billion acre-feet) and third largest by area, covering approximately 57,800 $km^2$ (22,300 $mi^2$) (Environment Canada 1995). Major tributaries of Lake Michigan include the Fox-Wolf, Grand, and Kalamazoo rivers. Two small creeks are located within the PBNP site boundaries and drain to the north and south. One of the creeks discharges into the lake about 457 m (1500 ft) north of the site, while the other discharges near the center of the site. During the spring, water often ponds in shallow depressions because of the poor drainage characteristics of the soil, due largely to a high clay content.

The PBNP site boundary includes 3.2 km (2 mi) of continuous frontage on Lake Michigan. Low bluffs face the shoreline with evidence of marked erosion near the center of the site. At this point, the beach is narrow, ranging in width from 6 m to 15 m (20 ft to 50 ft). The bluff faces are bare mud slopes and show active erosion during storm events. It is estimated that the shoreline is receding at a rate of approximately 0.8 m to 1.5 m (2.5 ft to 5 ft) per year. To counter this erosion, NMC has placed riprap along the most sensitive stretches (NMC 2004a).

The plant site boundary encompasses approximately 510 ha (1260 ac) (NMC 2004a), all owned by WEPCO. Within the plant site boundary, there are nine leases totaling approximately 425 ha (1050 ac) issued to local farmers. The land subject to the leases is used primarily for grain crops, but some is allowed to remain uncultivated or stand fallow. The balance of land within the site boundary is a combination of open space, woods, and wetlands. The developed portion of the site resides primarily along the shoreline, but there are some ancillary structures, notably the ISFSI. The zoning of the PBNP site is exclusively agricultural (Manitowoc County Planning and Park Commission [MCPPC] 2004).

Originally, there were several residences on the land that is now occupied by the PBNP site. Only one of these former residences still stands, but it is unoccupied. It is occasionally used for training purposes by the plant's security forces. There are no other residential structures on the plant site itself.

The area within 10 km (6 mi) of PBNP includes portions of Manitowoc and Kewaunee counties and is largely rural, characterized by farmland, woods, and small residential communities. Zoning of the land adjacent to the plant site is agricultural with the exception of the Town of Two Creeks which has a small area zoned for both residential and business. The nearest residential community to the PBNP is the Town of Two Creeks, approximately 1.6 km (1 mi) north-northwest of the site (Figure 2-2). Other nearby communities include the village of Mishicot (approximately 10 km [6 mi] west-southwest of the plant), the city of Two Rivers (13 km [8 mi] to the south) and Kewaunee (18 km [11 mi] to the north). The largest metropolitan area within 80 km (50 mi) is the city of Green Bay, located 48 km (30 mi) to the northwest. Approximately 81 percent of the plant's workforce resides in Manitowoc County, with the majority living in the cities of Manitowoc and Two Rivers.

### 2.2.2 Water Use

Lake Michigan is the source of water for cooling and auxiliary water systems at PBNP. PBNP uses a once-through condenser cooling system with a submerged offshore intake and a surface shoreline discharge. The withdrawal rate from the lake through each condenser is 22 $m^3/s$ (783 $ft^3/s$), or approximately $1.33 \times 10^6$ L/min (350,000 gpm). Water is then returned to the lake with minimal or no net loss.

In addition, domestic-quality water for drinking and sanitary purposes is withdrawn from groundwater by five active domestic supply wells at PBNP having an average flow rate of about 24 L/min (6.5 gpm), or 35,000 L/day (9300 gpd). PBNP is not connected to a municipal water supply system.

### 2.2.3 Water Quality

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 Lake Michigan ecosystem still exist that result in fish consumption advisories, beach closures, and impairment of aquatic organisms and wildlife.

The water quality of Lake Michigan has been degraded by industrial, municipal, agricultural, navigational, and recreational water users for more than 150 years. Although major point sources of pollutants have been curtailed since the enactment of the Clean Water Act (CWA), the lake continues to receive pollutants such as polychlorinated biphenyls and mercury from the atmosphere. 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 (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 and 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 been made (e.g., reduction of point source pollutants entering the basin and protection and restoration of wetlands) but notes that other areas still need improvement (e.g., deposition of toxic air pollutants in the watershed and nonpoint source pollutants). The *Lake Michigan Lakewide Management Plan* is one of the most comprehensive sources of information available on the current state of health of the Lake Michigan ecosystem (EPA 2000).

In accordance with the Federal Water Pollution Control Act (also known as the CWA), the water quality of plant effluent discharges is regulated through the National Pollutant Discharge Elimination System (NPDES). WDNR is the agency delegated by the EPA to issue discharge permits in Wisconsin. PBNP wastewater discharges to Lake Michigan are regulated and monitored under WPDES permit number WI-0000957-07-0 administered by the WDNR (WDNR 2004a). The current permit was issued July 7, 2004, and is due to expire June 30, 2009.

The permit contains effluent limitations necessary to ensure that the water-quality standards for Lake Michigan are met. The current permit requires monitoring of discharge streams from the condenser cooling water, deicing line for the water intake crib (during winter), demineralization regeneration neutralization tank, steam generator blowdown, sewage treatment plant effluent, liquid sludge line from sanitary wastewater treatment system, low-volume wastewater (from sumps, drains, and backwash), plant process wastewater, and microfiltration unit backwash from the plant. Monitoring requirements and discharge limitations exist for flow, pH, suspended solids, oil and grease, biochemical oxygen demand, total residual chlorine, and whole effluent toxicity for the discharge streams as applicable. The current permit requires monitoring and reporting of PBNP discharges to Lake Michigan, but the permit does not have any thermal water-quality standards for compliance. The permit also requires a study of the cooling-water intake to assess any potential adverse impacts and notes that where applicable the best technology available must be implemented to prevent the impingement and entrainment of fish and aquatic life. Any new regulations promulgated by the EPA or the State would be reflected in future permits (WDNR 2004a).

### 2.2.4 Air Quality

PBNP is located near the Town of Two Creeks on the western shore of Lake Michigan in Manitowoc County, Wisconsin. Overall, the ground surface at the PBNP site is gently rolling to flat with elevations varying from 1.5 m to 18 m (5 ft to 60 ft) above the level of Lake Michigan. The climate of the region is influenced by the west-to-east flow of storms along the northern portion of the country and from the southwest to the Great Lakes. Lake Michigan influences the wind and temperature regimes in the vicinity of PBNP. The site is well ventilated with infrequent calms. Prevailing winds during spring and summer are onshore lake breezes. Beginning in the summer, a flow from the south-southwest appears that is reinforced in the fall by offshore flows from west-southwest and west-northwest. During winter the flow is from the northwest through south-southwest (NMC 2003a).

The average annual temperature is 7.2 °C (45 °F), with an average daytime winter temperature of –1.7 °C (29 °F) and an average daytime summer temperature of 25 °C (77 °F). The maximum monthly average daily temperature is 26.4 °C (79.6 °F) (July) and the minimum monthly average daily temperature is –11.8 °C (10.8 °F) (January) (Midwestern Regional Climate Center [MRCC] 2003).

Average total annual precipitation is about 71 cm (28 in.) per year with 55 percent falling in the months of May through September. For the period of 1971 to 2000, rainfall ranged from a monthly average high of 9.47 cm (3.73 in.) in August, to a monthly average low of 3.15 cm (1.24 in.) in February (MRCC 2003). Average annual snowfall is about 114 cm (45 in.) per year with a maximum of 38 cm (15 in.) in 24 hours occurring in January 1947. Ice storms are infrequent in this region of Wisconsin (MRCC 2003).

Tornadoes occur in the state, but the only one that caused major property damage and injury to people occurred in 1959 in Green Bay, 48 km (30 mi) northwest of the site. Based on statistics for the 30 years from 1954 through 1983 (Ramsdell and Andrews 1986), the probability of a tornado striking the site is expected to be about $4.0 \times 10^{-4}$ per year.

Average wind speeds at the site are approximately 16 km/h (10 mph). Wind power potential is generally rated on a scale of 1 through 7. Areas suitable for wind turbine applications have a rating of 3 or higher. The western shore of Lake Michigan, which forms the eastern edge of Wisconsin, has an annual average wind power rating of class 3. This rating is due primarily to the prevailing westerly winds. Eastward moving storm systems are responsible for the easterly winds that flow off the lake during the winter and late autumn. Thus, on the annual average, the wind power potential on the western shore is less than on the eastern shore but still reflects the influence of Lake Michigan. Lake breezes, which are maximized in the spring, also contribute to the wind power potential along this shoreline (Elliot et al. 1987).

The PBNP site is located within the Lake Michigan Intrastate Air Quality Control Region (AQCR), formerly known as the Menominee-Escanaba (Michigan)-Marinette (Wisconsin) Interstate Air Quality Control Region (40 CFR 81.67). This AQCR comprises the territorial areas encompassed by the following Wisconsin counties: Brown, Calumet, Door, Fond du Lac, Green Lake, Kewaunee, Manitowoc, Marinette, Marquette, Menominee, Oconto, Outagamie, Shawano, Sheboygan, Waupaca, Waushara, and Winnebago.

The Lake Michigan Intrastate AQCR is currently in attainment for all air-quality criteria pollutants, with the exception of ozone. The AQCR was previously in attainment with the 1-hour ozone standard. In 1997, the EPA revised the national standard for ground-level ozone from 1-hour "peak" standard of 0.12 ppm to an 8-hour "average" standard of 0.08 ppm. This new standard is commonly referred to as the 8-hour standard and was upheld by the U.S. Supreme Court in February 2001. In April 2004, the EPA published the 8-hour ozone nonattainment designations and announced that the 1-hour standard will be phased out. The EPA designated Manitowoc County as a "basic" nonattainment area, with attainment to be achieved no later than June 2009 (EPA 2004a). The EPA indicated that areas designated as "basic" must comply with the more general nonattainment requirements of the Clean Air Act (CAA) (EPA 2004b). This change in attainment status for Manitowoc County will not significantly affect the ongoing operations of PBNP. Over time, continued nonattainment may increase the likelihood that additional emission controls will be required for stationary sources. Any such new controls would employ demonstrated cost-effective technologies and would only minimally impact plant operations. Kewaunee County, immediately north of Manitowoc County, is also designated as a "basic" nonattainment area for ozone, whereas the Sheboygan and Milwaukee-Racine areas to the south are "moderate" nonattainment areas with respect to the 8-hour ozone standard. There are no Class I Federal areas, in which visibility is an important value designated in 40 CFR Part 81, within 160 km (100 mi) of the PBNP site.

Diesel engines, boilers, a gas turbine, and other activities and facilities associated with the PBNP site emit various nonradioactive air pollutants to the atmosphere. Air emissions from these sources are subject to the terms and conditions of a CAA Title V air pollution control operation permit issued by the WDNR Air Management Program (Permit Number 436034500-F10).

The air permit includes limits on emissions of particulate matter and opacity for all of the permitted sources of nonradioactive air emissions. The combustion turbine may not be operated more than 228.83 hours per month, as determined by the average over any 12 consecutive months. There are no significant changes proposed for nonradioactive air emissions from the PBNP site during the license renewal period, and there are no significant changes proposed to the limits and conditions of the air permit.

### 2.2.5 Aquatic Resources

The principal aquatic resource in the vicinity of PBNP is Lake Michigan, which is the source and receiving body for the PBNP Units 1 and 2 cooling systems. The PBNP site lies on the western shore of Lake Michigan and occupies approximately 3 km (2 mi) of Lake Michigan shoreline (NMC 2004a). At the site, low bluffs face the Lake Michigan shore with evidence of marked erosion near the center of the PBNP site. At this point the beach is narrow (ranging in width from 6 to 15 m [20 to 50 ft]) with bare mud slopes showing active erosion. Historically, shore recession has ranged from 0.8 to 1.5 m (2.5 to 5 ft) per year in this area. NMC has provided riprap to control further recession of the shoreline at the site (NMC 2004a). The transmission lines associated with PBNP cross several streams and rivers including Kriwanek Creek, Devils River, Branch River, Neshota River, West Twin River, and East Twin River (AEC 1972). Transmission line ROW maintenance activities in the vicinity of stream and river crossings include procedures to avoid impacts to existing waterway channels and shorelines (including maintaining buffer zones at stream and river crossings and, as appropriate, using hand cutting at sensitive habitats and wetlands, using established waterway crossings, and not using herbicides unless approved for aquatic use) (ATC 2004a, ATC 2004b, NRC 2004). This is also discussed in section 2.1.7.

Lake Michigan is used for a variety of purposes, including commercial and recreational boating, sport and commercial fishing, and tourism. The major changes and modifications that have had the greatest effect on aquatic resources of Lake Michigan include: (1) lakefront industrial, urban, and residential developments; (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 experience profound changes because of development, impacts of invasive species, and pollution. Overall, the status of Lake

Michigan habitats, including open water, wetlands, coastal shore, and tributaries, is mixed to deteriorating (EPA 2002). The WDNR has prepared an integrated plan to guide the management of sport and commercial fisheries in the Wisconsin waters of Lake Michigan (WDNR 2004b).

Some fish cannot be sold commercially because of high levels of polychlorinated biphenyls (PCBs), mercury, or other substances (Fuller et al. 1995). Mercury is a growing concern in fish in Lake Michigan and its tributary streams (EPA 2002). Wisconsin has published health advisories governing the consumption of fish, including those from Lake Michigan waters. Mercury and PCBs are the two main contaminants that account for the fish advisories in Wisconsin (WDNR 2004c). For the Wisconsin waters of Lake Michigan, advisories are provided for rainbow smelt (*Osmerus mordax*), Chinook salmon (*Oncorhynchus tshawytscha*), coho salmon (*O. kisutch*), rainbow trout (*O. mykiss*), brown trout (*Salmo trutta*), lake trout (*Salvelinus namaycush*), lake whitefish (*Coregonus clupeaformis*), bloater (*C. hoyi*), and yellow perch (*Perca flavescens*). Depending on fish species and size, the advisories range from no more than one meal a week (e.g., rainbow trout) to do not eat (e.g., lake trout over 69 cm [27 in.]). Women of childbearing years, nursing mothers, and children under age 15 are cautioned to space their fish meals according to the advisories. Additional advisories are provided for other fish species for Wisconsin's inland waters, the Mississippi River, Green Bay, and Lake Superior (WDNR 2004c).

Despite the multiple competing uses of Lake Michigan, the overall fish biodiversity 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 6.6 million kg (14.6 million lb) of fish annually (EPA 2002). Lake whitefish is the primary commercial species. Lake whitefish and lake trout comprise the tribal fisheries (Stein et al. 2003). Some commercial fishing is also done for bloater, rainbow smelt, and yellow perch (Madenjian et al. 2004; Hasz 2004). The 2003 commercial catches for the Wisconsin waters of Lake Michigan were: lake whitefish - 600,104 kg (1,323,002 lb); bloater - 571,086 kg (1,259,029 lb) (includes marketable and unmarketable bloaters caught incidental to targeted rainbow smelt harvests); rainbow smelt - 46,075 kg (101,578 lb); and yellow perch - 8669 kg (19,111 lb) (for the 2002/2003 harvest year in Green Bay, commercial harvest of yellow perch in the rest of Lake Michigan has been closed since September, 1996) (Kroeff 2004; Peeters 2004; Hogler and Surendonk 2004; Hasz 2004; Hirenthota 2004). The yellow perch population density in Lake Michigan has declined dramatically since the early 1990s, with its age structure shifting towards older fish due to limited recruitment (WDNR 2004b). The commercial fishery for the introduced alewife (*Alosa pseudoharengus*) was closed in 1991 and has not reopened (Madenjian et al. 2002).

The number of fish caught by sport fishing within the Wisconsin waters of Lake Michigan (including Green Bay) in 2003 were: lake trout - 23,881; rainbow trout - 48,548; brown trout - 23,654; coho salmon - 50,625; Chinook salmon - 317,619, northern pike (*Esox lucius*) - 3344; smallmouth bass (*Micropterus dolomieu*) - 19,253; yellow perch - 156,321; and walleye (*Stizostedion* vitreum) - 22,806 (Eggold 2004).

The top level predators of Lake Michigan are currently dominated by introduced species of trout and salmon. The native burbot (*Lota lota*) and lake trout (the original top predators in Lake Michigan) have been recovering due to sea lamprey (*Petromyzon marinus*) control (Madenjian et al. 2004). Burbot abundance increased throughout the 1980s and 1990s, peaking in 1997, but numbers have declined in recent years (Madenjian et al. 2004). Lake trout have also increased in abundance, but numbers are maintained by stocking programs rather than by natural reproduction. About 2.4 million yearling lake trout are annually stocked 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). Current efforts to restore the lake trout to Lake Michigan focus on stocking a variety of lake trout strains in offshore refuges that offer protection from fishing (NMC 2004a).

Alewife, rainbow smelt, bloater, deepwater sculpin (*Myoxocephalus thompsoni*), and slimy sculpin (*Cottus cognatus*) constitute the bulk of the forage biomass in Lake Michigan (Eshenroder et al. 1995; Madenjian et al. 2004). 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), which is equivalent to about 16.5 billion adult alewives (Madenjian et al. 2004). There is now a major effort to manage the non-native alewife population because of its importance as the major prey for introduced salmonids. The 2003 lake-wide biomass of bloater, rainbow smelt, deepwater sculpin, and slimy sculpin were estimated at 20,682 metric tons (22,798 tons), 1386 metric tons (1528 tons), 32,787 metric tons (36,141 tons), and 2385 metric tons (2629 tons), respectively (Madenjian et al. 2004). The biomass of Lake Michigan forage fish, taken as a group, increased from the 1970s to the late 1980s, peaked in 1989, and appears to have declined steadily since 1989. The overall decline in forage fish biomass over the 1990s is due primarily to the decline in the bloater (Madenjian et al. 2004).

Fish species reported from the PBNP site area include rainbow trout, brook trout (*Salvelinus fontinalis*), lake trout, coho salmon, Chinook salmon, round whitefish (*Prosopium cylindraceum*), lake whitefish, bloater, lake herring or cisco (*Coregonus artedi*), alewife, gizzard shad (*Dorosoma cepedianum*), rainbow smelt, trout-perch (*Percopsis omiscomaycus*), fathead minnow (*Pimephales promelas*), spottail shiner (*Notropis hudsonius*), black bullhead (*Ameiurus melas*), longnose sucker (*Catostomus catostomus*), white sucker (*C. commersoni*), ninespine stickleback (*Pungitius pungitius*), bluegill (*Lepomis macrochirus*), yellow perch, and slimy sculpin (AEC 1972; WEPCO 1976). The habitats most suitable for reproduction by the Great Lakes fish community (i.e., coastal wetlands, bedrock, sandy beach-dunes, and bluffs; Wei et al. 2004) do not occur in the immediate vicinity of PBNP.

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, alewife, and white perch [*Morone americana*]), ship ballast (e.g., Asiatic clam [*Corbicula fluminea*], zebra mussel [*Dreissena polymorpha*], spiny water flea [*Bythotrephes longimanus*, formerly known as *B. cederstroemi*], and round goby [*Neogobius melanostomus*]), or as intentionally introduced species (e.g., common carp

[*Cyprinus carpio*], rainbow smelt, and various salmonids) (EPA 2002; Peeters 1998). Bait and pet releases have also contributed to the introduction of invasive species. About 10 percent of the invasive species have resulted in significant economic costs and/or ecological harm (WDNR 2003a). The presence of invasive species, coupled with increased loss of nearshore wetlands and tributary habitats, precludes the possibility for full restoration of the original fish community of Lake Michigan (WDNR 2004b). The WDNR (2003a) has developed a comprehensive management plan to prevent further introductions of invasive species and to control existing populations of aquatic nuisance species.

In the mid-1960s, American and Canadian fish and game agencies began stocking trout and salmon species into the Great Lakes to control alewife and rainbow smelt numbers and to improve the sport fishery. The non-native salmonids that have been 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, sockeye salmon [*Oncorhynchus nerka*], chum salmon [*O. keta*], cutthroat trout [*O. clarkii*], cherry salmon [*O. masou*], and pink salmon [*O. gorbuscha*]); and Arctic species (Arctic charr [*Salvelinus alpinus*]) (Crawford 2001).

Many of the introduced trout and salmon flourished, and by the 1970s, Lake Michigan fishermen were landing many large trout and salmon. Catch rates peaked in the mid-to-late 1980s, and then leveled off, as alewife numbers declined (Crawford 2001). Since the mid-1970s, salmonid stocking in Lake Michigan has involved the brook trout, brown trout, lake trout, rainbow trout/steelhead, Chinook salmon, coho salmon, and splake (hybrid between lake trout and brook trout). Among these species, only the lake trout was released to reestablish a reproducing population. The other species were stocked to provide a put-grow-take sport fishery and to control alewives. However, sustainable reproduction of lake trout has not occurred and natural reproduction of brown trout has been limited. Significant reproduction does occur for rainbow trout, Chinook salmon, and coho salmon (Eshenroder et al. 1995). Nearly 14.5 million trout and salmon are stocked annually in Lake Michigan (Eshenroder et al. 1995). About 70 percent of the Great Lakes trout and salmon fishery is dependent upon fish stocking (MDNR 2004). Atlantic salmon have not been stocked in the lake since 1989 (Bronte and Schuette 2002). Tiger trout (hybrid between brook trout and brown trout) were stocked in the Wisconsin waters of Lake Michigan from 1974 through 1977. Their stocking was discontinued due to poor returns (WDNR 2003b).

Currently, the only major objective for salmonid stocking is the development and maintenance of recreational fisheries (Crawford 2001). Salmonid spawning in a number of streams on the Wisconsin shoreline of Lake Michigan is not conducive to natural reproduction because the stream temperatures are too high for survival of trout fingerlings, and heavy sediment loads smother eggs (WDNR 2003b). The stocking of salmonids may have resulted in the introduction of some non-native fish diseases and parasites to the Great Lakes and caused genetic alteration of native salmonids through hybridization and introgression and/or through declines in the abundance of native salmonids (brook trout and lake trout). Also, stocked salmonids may present a direct threat to native and non-native forage fish and invertebrates, while placing competitive pressure upon native fish species for food and habitat resources (Crawford 2001). Nevertheless, the lake whitefish has made a recovery in the northern waters of Lake Michigan since salmonid stocking began (Eshenroder et al. 1995).

Because of concern that alewife and rainbow smelt populations in Lake Michigan were not adequate to support the booming populations of trout and salmon, fisheries managers in states bordering Lake Michigan began to reduce the stocking rates of Chinook salmon in 1999. This appears to have allowed alewife and rainbow smelt populations to stabilize, while improving the growth and overall health of trout and salmon.

In 2003, salmonid stockings into the Wisconsin waters of Lake Michigan (including its tributary streams) were: brook trout - 23,877; brown trout - 1,080,538; Chinook salmon -1,614,700; coho salmon - 540,145; lake trout - 724,774; steelhead - 758,275; and splake - 22,086. The numbers stocked in the Manitowoc and Kewaunee County area were: brook trout - none; brown trout - 216,672; Chinook salmon - 488,718; coho salmon - 229,621; lake trout - 119,950; steelhead - 402,927; and splake - none (Burzynski 2004).

The native fish species of Lake Michigan have been affected by the introduced aquatic species, most notably the sea lamprey and alewife. The sea lamprey, first discovered in Lake Michigan in 1936, contributed to the collapse of top predator populations (e.g., lake trout and burbot) by the late 1940s (Eshenroder et al. 1995). Combined with overfishing, the sea lamprey contributed to the extirpation of the longjaw cisco (*Coregonus alpanae*), deepwater cisco (*C. johannae*), and blackfin cisco (*C. nigripinnis*) from Lake Michigan (Fuller et al. 2004). 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).

Declines in predator species allowed the alewife, which invaded Lake Michigan in 1949, to proliferate and further disrupt native aquatic food webs (Eshenroder et al. 1995). By 1967, the alewife made up about 85% of the fish biomass of the lake (Peeters 1998). The population explosion of alewives contributed to the decline of native fishes such as the bloater, emerald shiner (*Notropis atherinoides*), lake whitefish, lake herring, deepwater sculpin, spoonhead sculpin (*Cottus ricei*), and yellow perch (Eshenroder et al. 1995; Peeters 1998; Madenjian et al. 2002; Fuller et al. 2004).

Alewives are easily stressed and, during peak population levels, can be subject to 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 in the spring (Eshenroder et al. 1995). In the 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 previous 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 the nearshore waters during the spawning season. The alewife spawning season generally occurs from late May to early August, peaking in June and July (Jude 1995).

Native to the Atlantic coastal region, the white perch invaded the Great Lakes in 1950 (WDNR 2004d). It preys on eggs of walleye and other species (including its own), zooplankton, macroinvertebrates, and minnows. The white perch may compete with yellow perch, emerald shiner, and spottail shiner for food resources (Fuller 2003).

The round goby first began appearing 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 riprap (Manz 1998). It has a long spawning season (e.g., 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 (Great Lakes Science Center 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 biota has been ascribed to the round goby invasion (Madenjian et al. 2002). The ruffe (*Gymnocephalus cernuus*) has also made its way into Lake Michigan. 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 in the phytoplankton and zooplankton communities of Lake Michigan may be occurring as a result of contaminants, nutrients, and invasive species such as the spiny water flea and zebra mussel (EPA 2002). For example, phytoplankton abundance and production in nearshore waters of Lake Michigan have been decreasing since 1970, probably due to reduction in phosphorus loadings (Madenjian et al. 2002). Makarewicz et al. (1994) examined trends in phytoplankton abundance in Lake Michigan from 1983 to 1992 (and, to a limited extent, historical trends) and related them to "top-down mediated changes" observed in the fish and zooplankton communities. Bacillariophyta (diatoms) dominated spring samples in all years but one (1989), making up 69 percent to 95 percent of total algal biomass. Depending on the composition of the zooplankton community, summer phytoplankton samples were dominated by diatoms, Chlorophyta (green algae), Chrysophyta (yellow-green or yellow-brown algae), and Pyrrhophyta (dinoflagellates). The presence of the large-bodied zooplankton (e.g., *Daphnia* spp.) resulted in increasing abundance of colonial and filamentous algae; while low numbers of *Daphnia* spp. were associated with an increasing abundance of small, unicellular phytoplankton. Makarewicz et al. (1994) also noted that large zooplankton (e.g., large cladocerans, calanoid copepods, and cyclopoid copepods) became more abundant in 1983 through 1985 after a sharp decline in the abundance of the planktivorous alewife in 1982 and 1983.

The introduction of the spiny water flea caused a significant decline in three native species of *Daphnia* (Lehman 1991). Another non-native cladoceran, the fishhook water flea (*Cercopagis pengoi*), has also invaded the Great Lakes (WDNR 2004e). These species compete with planktivorous larval fish for food and have been implicated as a factor in the decline of alewives in Lakes Erie, Huron, Michigan, and Ontario (Liebig and Benson 2004), and their spiny tails make it difficult for them to be eaten by young fishes (WDNR 2004e). However, they are a food source for larger yellow perch, white perch, walleye, white bass (*Morone chrysops*), alewife, bloater, Chinook salmon, emerald shiner, spottail shiner, rainbow smelt, lake herring, lake whitefish, and deepwater sculpin (Liebig and Benson 2004). Another invasive water flea, *Daphnia lumholtzi*, also has head and tail spines that make it difficult for young fish to consume. This protection can allow it to potentially replace native species of *Daphnia* (WDNR 2003a).

The Lake Michigan substrate in the area of PBNP site is characterized by coarse, shifting sand and gravel overlying hard clay. The substrate is not favorable for the growth of rooted vegetation (AEC 1972).

The macroinvertebrate community in the PBNP site area was described as "depauperate" due to the substrates being characterized by coarse, shifting sand and gravel overlying hard clay, which limits its suitability for macroinvertebrate colonization. Amphipods (e.g., *Diporeia* spp.), opossum shrimps (i.e., *Mysis relicta*), oligochaetes (aquatic worms), sphaeriids (fingernail clams), and chironomids (midge larvae) dominated the macroinvertebrate community near the PBNP site (AEC 1972; WEPCO 1976). Since the early 1970s, nearshore benthic communities in Lake Michigan have undergone dramatic changes as a result of reductions in nutrient loads (phosphorus) and the establishment of the zebra mussel. Higher nutrient loads in the 1950s and 1960s were associated with higher productivity and densities of amphipods, oligochaetes, and sphaeriids (Nalepa et al. 1998). Lower nutrient loads, the result of changes mandated by the CWA and NPDES programs that reduced point and nonpoint source pollutants in the 1970s and 1980s, produced declines in oligochaetes and sphaeriids throughout southern Lake Michigan.

The zebra mussel, a non-native and invasive species, has had an important effect on Lake Michigan's aquatic communities by consuming zooplankton and phytoplankton, fundamentally altering food webs and displacing native mussels. The first zebra mussel was discovered in Lake Michigan in May 1988, in Indiana Harbor at Gary, Indiana. By 1990, adult zebra mussels had been found at multiple sites in southern Lake Michigan, and by 1992 ranged along the eastern and western shoreline in the southern two-thirds of the lake, as well as in Green Bay and Grand Traverse Bay (Fleischer et al. 2001). Zebra mussels appeared in the immediate vicinity of PBNP by 1991 (Lee 1991).

Because they are capable of filtering up to 1 L/day (0.3 gpd) per adult (Lei 1993), and are present in high densities (up to several thousand per square meter), zebra mussels remove large numbers of phytoplankton and zooplankton from the water column. As a consequence, water clarity increases, and plankton populations tend to decline precipitously. Secondary impacts can be positive (increased water clarity and increased light transmissivity allow submerged aquatic vegetation to become established in deeper waters) or negative (some species of fish and waterfowl feed heavily on zebra mussels, which bioconcentrate contaminants) (Schloesser et al. 1996).

Zebra mussels displace native clams and mussels by interfering with their feeding, growth, reproduction, and respiration, often directly by attaching to the clam or mussel. Hundreds of zebra mussels may attach to a single large unionid. Because zebra mussels also have a high reproductive potential, they often move (or are carried) into an area and can eliminate native unionid mussels within two to four years (Schloesser et al. 1996). Zebra mussels can also 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 lakewide population declines of *Diporeia* spp. are 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 (*Aplodinotus grunniens*), rock bass (*Ambloplites rupestris*), yellow perch, and other benthivorous fish species consume large numbers of gammarid amphipods, crayfish, zebra mussels, and other benthic macroinvertebrates (Stewart et al. 1998a, 1998b).

The zebra mussel presents a potential serious biofouling problem at power plants. They can accumulate on the inside of intake tunnels; intake cribs; and screenhouse walls, floors, trash racks, and out-of-service traveling screens. Zebra mussels are controlled at PBNP by a number of methods: chlorination (e.g., sodium hypochlorite) of the condensers; continuous copper ion injection; and a formulation of the aquatic herbicide endothall (a registered molluscicide known as EVAC). Limitations on these biocides are provided in the WPDES permit (WDNR 2004a). The cooling water system is described in section 2.1.3.

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 through competition for food resources; while *Echinogammarus ischnus* may become an important food item for many fish species (Nalepa et al. 2001).

Although not technically aquatic organisms, waterfowl are often found in the vicinity of PBNP, especially during their seasonal migrations. During September 1990, carcasses of double-crested cormorants (*Phalacrocorax auritus*) were discovered in the screenwash from the traveling water screens and in the forebay of the plant. The intake structure originally extended 2.4 m (8 ft) above the water surface. Double-crested cormorants are abundant in the area during spring and fall migrations and are attracted to schools of fish in the vicinity of, and within, the intake structure. They would enter the interior of the intake structure to feed, and because they must run along the surface for a substantial distance to become airborne, they were unable to fly out of the intake structure (NMC 2004a). After several failed attempts to reduce or eliminate mortality of cormorants, the intake structure was redesigned in May 2001, and placed below the water surface to eliminate any further mortality (NMC 2004a).

No Federally-listed threatened or endangered aquatic species occur in Lake Michigan in the vicinity of PBNP (We Energies 2004b; NMC 2004a). Four state-listed aquatic species potentially occur in Lake Michigan within the PBNP site area or within some of the waterbodies crossed by the transmission lines associated with PBNP. The following provides a discussion of these state-listed aquatic species.

The monkeyface (*Quadrula metanevra*), a freshwater mussel species, is listed as threatened in Wisconsin. It inhabits medium-to-large rivers in gravel or mixed sand and gravel substrates (WDNR 2003c). It has declined due to habitat destruction and water pollution. Locks and dams may have also limited access of host species to the mussel's habitat (WDNR 2003c). Reported hosts include the green sunfish (*Lepomis cyanellus*), bluegill, and sauger (*Stizostedion canadense*) (NatureServe 2004). The monkeyface is known from the Branch River, which is crossed by one of the transmission lines associated with PBNP.

The lake sturgeon (*Acipenser fulvescens*) is listed as a species of special concern in Wisconsin. Wisconsin has one of the largest self-sustaining lake sturgeon populations in the world (WDNR 2003d), with the largest concentration occurring in Green Bay (WDNR 2004b). Two Lake Michigan tributaries, the Manitowoc and Milwaukee Rivers, do not currently support remnant lake sturgeon populations, but offer suitable habitat for reproduction. In 2003, stocking of early life stages of lake sturgeon were conducted in these rivers (WDNR 2004b). 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; Lake Michigan Technical Committee 2002). The lake sturgeon inhabits low- and moderate-gradient big rivers and lakes. Preferred substrates include firm sand, gravel, or rock. In the Great Lakes, lake sturgeon lives in shoal water (NatureServe 2004). The lake sturgeon may migrate as far as 125 to 400 km (78 to 250 mi) between non-spawning and spawning habitats (NatureServe 2004). 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 preyed upon by common carp, suckers, catfish, and other sturgeons (NatureServe 2004). The lake sturgeon preys upon invertebrates such as leeches, snails, small clams, and aquatic insects (NatureServe 2004). In the Wisconsin portion of the Lake Michigan basin, the lake sturgeon occurs in Green Bay, Lake Michigan, the Menominee River upstream to White Rapids Dam, the Fox River upstream to Lake Puckaway, and the Wolf River upstream to Shawano. It is uncommon to rare in the Wisconsin portion of Lake Michigan (WDNR 2003d). A lake sturgeon management plan has been developed for Wisconsin (WDNR 2003d).

The redfin shiner (*Lythrurus umbratilis*) is listed as threatened in Wisconsin. It usually occurs in turbid waters at depths of 10 to 152 cm (4 to 60 in.) over silt, gravel, and rubble substrates in pool areas of low-gradient, medium-sized streams. However, it requires clear water during spawning, which may account for its limited occurrence. They spawn in nests and nesting territories of sunfish species (WDNR 2003e). The redfin shiner schools near the surface and feeds on filamentous algae, macrophytes, and aquatic and terrestrial invertebrates (WDNR 2003e). The redfin shiner is known from the West Twin River watershed, which is crossed by the transmission lines associated with PBNP.

The greater redhorse (*Moxostoma valenciennesi*) is listed as threatened in Wisconsin. It inhabits medium- to large-sized rivers, reservoirs, and large lakes at depths <1 m (3 ft) (WDNR 2003f). The greater redhorse prefers clear water with substrates of clean sand, gravel, or boulders. Spawning beds consist of gravel with mixtures of sand and rubble in moderate to swift currents. The range and abundance of the greater redhorse have declined due to siltation, pollution, and other habitat degradation (NatureServe 2004). The eggs of the greater redhorse are preyed upon by yellow perch and American eels (*Anguilla rostrata*) (NatureServe 2004). Molluscs, aquatic insects, and crustaceans are its main diet, although it also consumes some plant material (NatureServe 2004). However, it is now known to be more common than previously thought in Wisconsin, accounting for its change in status from state-endangered to state-threatened (WDNR 2003f). The greater redhorse occurs in some of the streams and rivers crossed by the PBNP transmission lines (e.g., Branch River, Neshota River, East Twin River, and West Twin River; NMC 2004a).

### 2.2.6 Terrestrial Resources

The PBNP site is located on 510 ha (1260 ac) on the western shore of Lake Michigan (NMC 2004a). The site and surrounding area consist primarily of agricultural land and forest. Approximately 42 ha (104 ac) of the property are devoted to industrial use. The site consists of land leased for farming and woodlots up to 19 ha (47 ac) in size. The woodlots occupy a total of about 40 ha (100 ac), making up about 9 percent of the PBNP property. The plant communities forming the overstory include a variety of trees such as quaking aspen (*Populus tremuloides*), American beech (*Fagus grandifolia*), Canadian hemlock (*Tsuga canadensis*), and maple (*Acer* spp.) (AEC 1972). The woodlots are maintained in a natural state and provide food, cover, and nesting sites for a variety of wildlife.

The terrestrial wildlife that occurs at PBNP and surrounding areas is typical of that found in similar habitats throughout Wisconsin (AEC 1972). Common mammals include white-tailed deer (*Odocoileus virginianus*), eastern cottontail rabbit (*Sylvilagus floridanus*), northern raccoon (*Procyon lotor*), gray fox (*Urocyon cinereoargenteus*), eastern gray squirrel (*Sciurus carolinensis*), eastern chipmunk (*Tamias striatus*), and masked shrew (*Sorex cinereus*). Upland birds that occur on the property include ring-necked pheasant (*Phasianus colchicus*), wild turkey (*Meleagris gallopavo*), American goldfinch (*Carduelis tristis*), eastern bluebird (*Sialia sialia*), blue jay (*Cyanocitta cristata*), and eastern meadowlark (*Sturnella magna*). Several waterfowl also occur there, including the Canada goose (*Branta canadensis*), the wood duck (*Aix sponsa*), and the double-crested cormorant (*Phalacrocorax auritus*). Additionally, the site is occupied by several common amphibians and reptiles such as the tiger salamander (*Ambystoma tigrinum*), northern leopard frog (*Rana pipiens*), American toad (*Bufo americanus*), and the painted turtle (*Chrysemys picta*).

The PBNP property contains about 3 km (2 mi) of Lake Michigan shoreline. The shoreline consists of mostly narrow, bare beaches ranging from 6 to 15 m (20 to 50 ft) wide that extend from the water's edge to low bluffs created by years of erosion. Riprap has been placed along the edges of the bluffs to reduce erosion, which had been occurring at the rate of 0.8 m to 1.5 m (2.5 ft to 5 ft) per year (AEC 1972). The shoreline on the PBNP property does not contain any sand dunes. NMC protects species that require beach habitat by restricting unauthorized public access to the Lake Michigan beach area of the PBNP site with a line of boulders at the north and south boundaries, buoy markers off the shoreline to mark restricted waters, and 24-hour surveillance by security personnel (We Energies 2004b). Additional protections have been implemented for the Federally-endangered piping plover (*Charadrius melodus*) (We Energies 2004d).

No Federally or State-listed threatened or endangered species of terrestrial wildlife are known to occur at the PBNP site or associated transmission line ROWs (NMC 2004a; We Energies 2004b). Three Federally-listed threatened or endangered species have been recorded in Manitowoc County: the bald eagle (*Haliaeetus leucocephalus*), piping plover (*Charadrius melodus*), and dune (or Pitcher's) thistle (*Cirsium pitcheri*) (WDNR 2004f). The dwarf lake iris (*Iris lacustris*), also a Federally-listed species, has been recorded in Brown County, through which a portion of the L-151 transmission line ROW traverses. Table 2-2 presents those Federally and State-listed species that have been recorded in Brown and Manitowoc counties and could potentially occur on the PBNP site or transmission line ROWs if suitable habitat were available.

**Table 2-2.** Terrestrial Species Listed as Endangered or Threatened by the FWS That Occur or Potentially Occur Within the PBNP Site or the Associated Transmission Line Rights-of-Way

| Scientific Name | Common Name | Federal Status[(a)] | State Status[(a)] |
|---|---|---|---|
| **Birds** | | | |
| *Haliaeetus leucocephalus* | bald eagle | T | S |
| *Charadrius melodus* | piping plover | E | E |
| **Plants** | | | |
| *Cirsium pitcheri* | dune (or Pitcher's) thistle | T | T |
| *Iris lacustris* | dwarf lake iris | T | T |

(a) E = endangered, T = threatened, S = Wisconsin species of special concern.
Sources: WDNR 2004f, 2004g, 2004h, 2004i, 2004j

The bald eagle is Federally-listed as threatened in the lower 48 states (FWS 2004b). This species is a large raptor that is found along the coastline around lakes and rivers. Eagles generally nest in tall trees or on cliff faces near water and away from human disturbance. No bald eagle nesting occurs on the PBNP site, and no bald eagles have been observed to forage in the vicinity of the plant (We Energies 2004b). The transmission lines associated with PBNP extend for the most part to the west, away from Lake Michigan and bald eagle foraging habitat.

The piping plover is Federally listed as endangered in the Great Lakes region. Great Lakes piping plovers breed along sparsely vegetated beaches, cobble pans, and sand spits along the shoreline. The FWS defines their essential breeding habitat as greater than 7 m (23 ft) wide beach, greater than 0.4 km (0.25 mi) of shoreline length, dune area of 1.95 ha (4.82 ac), patches of cobble or degree cover, and areas of beach with up to 50 percent of vegetation cover (FWS 2003). The nearest stretch of shoreline that is designated as critical breeding habitat is at Point Beach State Forest, approximately 5 km (3 mi) to the southeast, where about 13 km (8 mi) of shoreline have been designated as suitable, although no records of breeding at that location exist (FWS 2001). Portions of the shoreline managed by PBNP also appear to be suitable nesting habitat (We Energies 2004d). In October 2004, We Energies commissioned a habitat study of the shoreline. The study showed that the habitat, although not optimal, could support piping plover nesting (We Energies 2004d). The only breeding plovers known within Wisconsin in recent years have been along the shores of Lake Superior (WDNR 2004g).

The dune (or Pitcher's) thistle is Federally listed as threatened over its entire range (FWS 2004b). The preferred site for the dune (or Pitcher's) thistle is an area between a sandy beach and a fully vegetated dune next to the shorelines of the Great Lakes (WDNR 2004b).

The primary threats to the species are disturbance through recreational activities (all terrain vehicle use, trampling, etc.) and overstory encroachment (NatureServe 2004). No suitable habitat for this species has been identified at the PBNP site or along associated transmission line ROWs.

The dwarf lake iris is Federally listed as threatened over its entire range (FWS 2004b). The dwarf lake iris is endemic to the northern shores of Lake Michigan and Lake Huron. This species is found in association with the Niagara Escarpment, a limestone formation that extends from the Door Peninsula to the north of PBNP through Michigan and Ontario to New York. In Wisconsin, the dwarf lake iris is found on the northwestern shore of Lake Michigan and the eastern shore of Green Bay in Brown and Door counties (WDNR 2004b). The primary threat to this species is habitat degradation due to overstory encroachment (NatureServe 2004). This species apparently thrives with frequent natural disturbance, does not appear to be detrimentally impacted by human disturbance, and is reported to do well in old field conditions (NatureServe 2004). The dwarf lake iris has not been recorded at the PBNP site or along associated transmission line ROWs.

The only terrestrial State-listed threatened or endangered species believed to occur in the vicinity of PBNP transmission lines is the snow trillium (*Trillium nivale*) (WDNR 2004j, 2004k). Populations are known to occur in mesic forests in the Kriwanek Creek drainage, which is crossed by line L-121, and the Devil's Creek drainage, which is crossed by line L-151. However, this species is not recorded as occurring in these transmission line ROWs.

### 2.2.7 Radiological Impacts

NMC conducts an annual radiological environmental monitoring program in and around the PBNP site. An environmental monitoring program was initiated before plant operations began in 1970. Through this program, radiological impacts to employees, the public, and the environment are monitored, documented, and compared to the appropriate standards. The objectives of the radiological environmental monitoring program are the following:

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

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

Radiological releases are summarized in the Annual Monitoring Reports (e.g., NMC 2004c). The limits for all radiological releases are specified in the PBNP ODCM (NMC 2003b); these limits are designed to meet Federal standards and requirements.

Because land in the area is used primarily for farming and dairy operations, environmental components, such as soil and vegetation, are sampled to detect changes in radiological conditions at the base of the terrestrial food chain for animals. Because dairy farming is a major industry in the area, milk produced in the area is also sampled. Air particulate samples and thermoluminescent dosimeters at various locations provide the means to detect significant changes in environmental radioactivity that would result from plant releases to the atmosphere.

Locations for terrestrial radiological sampling emphasize monitoring around the site boundary and at various other points out to a distance of approximately 8 km (5 mi). A single sampling location well beyond a distance of approximately 16 km (10 mi) is used to provide an estimate of background levels.

Aquatic samples, such as lakewater, algae, and shoreline sediment, are collected from Lake Michigan locations both north and south of the wastewater discharge point and analyzed for radioactivity.

For 2003, WEPCO assessed doses to the maximally exposed individual from gaseous and liquid effluents at several locations based on actual liquid and gaseous effluent release data. In all cases, doses were well below the limits as defined in the ODCM and the EPA radiation standards in 40 CFR Part 190 (NMC 2003b). A breakdown of the calculated maximum dose to an individual located at the PBNP boundary from liquid and gaseous effluents released during 2003 is summarized as follows:

- The total body dose from liquid effluents at the site discharge was $8 \times 10^{-5}$ mSv (0.008 mrem), which is about 0.14 percent of the 0.06 mSv (6 mrem) dose design objective specified in 10 CFR Part 50, Appendix I. The critical organ dose due to the liquid effluents at the site discharge was $8 \times 10^{-5}$ mSv (0.008 mrem). This dose was about 0.04 percent of the 0.20 mSv (20 mrem) dose design objective (NMC 2004c).

- The air dose from noble gases in gaseous effluents was $3.4 \times 10^{-8}$ mSv ($3.45 \times 10^{-4}$ mrad) gamma, which is 0.002 percent of the 0.2 mGy (20 mrad) gamma dose design objective, and $1.27 \times 10^{-6}$ mGy ($1.27 \times 10^{-4}$ mrad) beta, which is 0.03 percent of the 0.4 mGy (40 mrad) beta dose design objective (NMC 2004c).

- The critical organ dose from gaseous effluents due to iodine-131, iodine-133, tritium, and particulates with half-lives greater than 8 days was $3.12 \times 10^{-4}$ mSv (0.03 mrem), which is 0.1 percent of the 0.3 mSv (30 mrem) dose design objective (NMC 2004c).

Absent a change in licensed power levels, NMC does not anticipate any increase in radiological impacts during the license renewal period.

## 2.2.8 Socioeconomic Factors

The staff reviewed the ER (NMC 2004a) and information obtained from county, city, school district, and local economic development staff. The following sections describe the housing market, public services, offsite land use, visual aesthetics and noise, demography, and economy in the region surrounding the PBNP site.

### 2.2.8.1 Housing

NMC employs a nuclear related permanent workforce of approximately 740 employees and an additional 231 contract employees at PBNP. Approximately 81 percent of the employees live in Manitowoc County. The remaining 19 percent are distributed across 12 counties, with numbers ranging from 1 to 73 employees per county (NMC 2004a). Given the predominance of employees living in Manitowoc County, and the absence of the likelihood of significant socioeconomic effects in other counties, the focus of this analysis is Manitowoc County, particularly the city of Manitowoc, the city of Two Rivers, the Town of Two Creeks, and the village of Mishicot (79 percent of the PBNP employees live in these municipalities).

The PBNP reactors are each on an 18-month refueling cycle. During refueling outages, nuclear related site employment increases above the 740 permanent workforce by approximately 300 workers for temporary duty (30 to 40 days) (NMC 2004a). Most of these temporary contractor employees are assumed to be located in the same geographic areas as the permanent PBNP staff. These work force numbers are within the GEIS estimated range of 200 to 900 additional workers per reactor outage.

Table 2-3 shows an overview of occupied and unoccupied housing units available in Mishicot, Two Creeks, Manitowoc, Two Rivers, and Manitowoc County for 1990 and 2000, the last year for which data are available. The county as a whole had a vacancy rate slightly greater than 5 percent. The vacancy rates in specific communities varied from 5 to 9 percent and showed similar trends from 1990 to 2000.

Table 2-3. Housing Units and Occupied Housing Units for Manitowoc County and Municipalities during 1990 and 2000

| | Total Units | | Occupied Units | | Percent of Units Occupied | |
|---|---|---|---|---|---|---|
| | 1990 | 2000 | 1990 | 2000 | 1990 | 2000 |
| Mishicot | 503 | 614 | 488 | 582 | 97.02 | 94.79 |
| Two Creeks | 164 | 202 | 148 | 184 | 90.24 | 91.09 |
| Manitowoc (City) | 13,729 | 15,007 | 13,145 | 14,235 | 95.75 | 94.86 |
| Two Rivers | 5414 | 5547 | 5164 | 5221 | 95.38 | 94.12 |
| Manitowoc County | 31,843 | 34,651 | 30,112 | 32,721 | 94.56 | 94.43 |

Source: Wisconsin Department of Administration (WDA) 2004a

### 2.2.8.2 Public Services

- **Water Supply**

Within Manitowoc County, municipal water is largely supplied by municipal or village water utilities. PBNP is not connected to a local utility and pumps groundwater for its own use. The primary municipal water suppliers in Manitowoc County are listed in Table 2-4 along with their average daily output and maximum capacities.

The total daily use shown here is 10.6 million gpd for the entire county. This closely agrees with U.S. Geological Survey (USGS) estimates of 10.44 million gpd of surface-water use and 1.05 million gpd groundwater use for Manitowoc County (USGS 2002).

**Table 2-4.** Manitowoc County Public Water Suppliers and Capacities

| Water Supplier | Average Daily Use (gpd) | Maximum Daily Capacity (gpd) |
|---|---|---|
| Cleveland Waterworks | 120,000 | 1,150,000 |
| Kellnersville Waterworks | 320,000 | 500,000 |
| Kiel Waterworks | 415,000 | 2,660,000 |
| Manitowoc Waterworks | 8,000,000 | 11,000,000 |
| Maribel Waterworks | 25,000 | 720,000 |
| Mishicot Waterworks | 150,000 | 1,200,000 |
| Reedsville Waterworks | 45,000 | 1,000,000 |
| St. Nazianz Waterworks | 60,000 | 1,000,000 |
| Two Rivers Waterworks | 1,300,000 | 4,000,000 |
| Valders Waterworks | 120,000 | 1,440,000 |
| Whitelaw Waterworks | 55,000 | 720,000 |
| **Total** | **10,610,000** | **25,390,000** |

Source: NMC 2004a

- **Education**

In 2000, approximately 14,369 students attended schools in the districts located near the PBNP site. The region's school districts do not track the number of PBNP employees' children enrolled. Table 2-5 shows the total enrollment for students in the PBNP vicinity.

**Table 2-5.** School District Enrollment in Manitowoc County and Communities near PBNP

| District | Pre-Kindergarten | Grades K–6 | Grades 7–12 |
|---|---|---|---|
| Manitowoc | 2285 | 3670 | 3695 |
| Mishicot | 360 | 705 | 69 |
| Two Rivers | 755 | 1470 | 1360 |

- **Transportation**

The region within an 80-km (50-mi) radius of PBNP is served by Interstate 43, which runs north-south near the lake front in southern Manitowoc County. At the city of Manitowoc, Interstate 43 turns inland to Green Bay. The region is also served by Canadian National rail lines connecting to Neenah to the west and Milwaukee to the south. A rail line runs part of the way from Manitowoc to Green Bay. The Manitowoc County airport is located on the northern edge of the city of Manitowoc.

State Route 42 runs north-south from Two Rivers to Kewaunee and passes about 1.6 km (1 mi) to the west of PBNP. It is used by most employees coming from Two Rivers, Manitowoc, or Mishicot to access the plant. From Mishicot, employees reach State Route 42 via County Road V. Employees access the plant by turning east off State Route 42 onto Nuclear Road and traveling approximately 2.4 km (1.5 mi) to the plant entrance (Figure 2-2).

Traffic counts for State Route 42 and County Road V are shown in Table 2-6 . The State does not make level of service determinations in rural nonmetropolitan areas unless it has been deemed necessary. The Wisconsin Department of Transportation (WDOT) has not calculated level of service determinations for either of the roads listed (WDOT 2002).

**Table 2-6.** Traffic Counts for State Route 42 and County Road V

| Route No. | Location | AADT |
|---|---|---|
| State Route 42 | North of County Road V | 3800 |
| | South of County Road V | 3700 |
| County Road V | East of State Route 42 | 330 |
| | West of State Route 42 | 1200 |

AADT = Annual average daily traffic volumes for 2002.
Source: WDOT 2002

#### 2.2.8.3 Offsite Land Use

PBNP is situated in northern Manitowoc County close to the Kewaunee County line. Both of these counties are on the western shore of Lake Michigan, and both are largely rural with a heavy dependence upon agriculture. Manitowoc County maintains information on land use, which is derived from aerial photographs and periodically updated.

Land use in Manitowoc County is predominantly agricultural; approximately 58 percent of its land area is devoted to agriculture. Of the remainder, much of the land is undeveloped woodland, wetland, or land not used for crops; only 7 percent is classified as urban or developed (Table 2-7). The approximately 1400 farms within the county cover a total of $1.05 \times 10^5$ ha ($2.6 \times 10^5$ ac), averaging 75 ha (186 ac) per farm. Of the 1400 farms, approximately 375 are dairy farms with 45,300 cows. Manitowoc County ranks 5th in Wisconsin and 27th in the United States in milk production. Other crops in the county include alfalfa

(26,000 ha [64,200 ac]), corn (24,700 ha [61,000 ac]), oats (3035 ha [7500 ac]), barley (4450 ha [11,000 ac]), soybeans (8500 ha [21,000 ac]), and snap beans (1950 ha [4800 ac]). Total farm and farm-related employment accounts for approximately 20 percent of the total county employment (University of Wisconsin 2004).

**Table 2-7.** Land Use in Manitowoc County, 1999

| Land Use | Hectares | Acres | Percent of Total |
|---|---|---|---|
| Agriculture | 89,416 | 220,953 | 58.0 |
| Buildings | 10,617 | 26,235 | 6.9 |
| Non-Cropland | 15,088 | 37,284 | 9.8 |
| Non-Metallic Mining | 684 | 1690 | 0.4 |
| Roads | 3412 | 8432 | 2.2 |
| Surface Water | 1750 | 4326 | 1.1 |
| Wetlands | 376 | 930 | 0.3 |
| Woodlands | 32,921 | 81,352 | 21.3 |
| **Total** | **154,264** | **381,202** | **100.0** |

Source: Yanda 2004

Kewaunee County is also heavily dependent on agriculture. Of the $80 million generated from agriculture in Kewaunee County, approximately $65 million is generated from dairy farms. There are around 970 farms in the county, of which 318 are dairy farms. The average size of a farm is approximately 73 ha (181 ac). Other agricultural crops include corn, alfalfa, soybeans, small grains, and vegetables. Approximately 2300 jobs are related to agriculture, which represents approximately 20 percent of the county total (University of Wisconsin 2004).

A few industrial areas are located south of the PBNP site in the towns of Two Rivers and Manitowoc and to the west in the Fox River Valley. KNPP is the nearest industrial site, located approximately 8 km (5 mi) north of PBNP. KNPP is a single unit 535-MW(e) pressurized water reactor located on approximately 367 ha (908 ac).

The Point Beach State Forest is located approximately 4.8 km (3 mi) of the PBNP site and offers fishing, boating, hiking, camping, and picnicking. The Rahr Memorial School Forest is located 1.6 km (1 mi) south of the plant and offers a wide range of educational and outdoor activities. Two Creeks Town Park is located north of the PBNP site and also provides some lakeside recreation. The Two Creeks Buried Forest unit of the Ice Age National Scientific Reserve is located approximately 3.2 km (2 mi) north of the plant. This reserve is affiliated with the National Park Service and provides public access to remnants of a buried forest.

In an effort to decrease urban sprawl, the State established a statute outlining the development of farmland preservation areas. The MCPPC prepared the *Manitowoc County Farmland Preservation Plan* in 1981 (currently undergoing revision) to provide guidance to the communities within the county in their efforts to guide future growth and protect valuable farmlands (MCPPC 1981). This plan qualifies lands designated as "restrictive agriculture" for tax credits and makes it difficult to change the zoning of the land from agriculture to another designation.

There are 18 towns in Manitowoc County. Land-use planning and city growth are managed at the town or city level and not at the regional or county level. Many of the communities use zoning to direct the extent and nature of growth. Zoning has remained relatively unchanged since the preparation of the *Manitowoc County Farmland Preservation Plan*. The area around the PBNP site has remained zoned for agriculture, and no significant industrial, business, or residential development has occurred near the site boundaries.

#### 2.2.8.4 Visual Aesthetics and Noise

PBNP is located in Manitowoc County on the western shore of Lake Michigan. The local terrain is gently rolling to flat, with elevations varying from 1.5 to 18 m (5 to 60 ft) above the normal level of Lake Michigan. The land surface slopes gradually toward the lake from higher glacial moraine areas west of the site. However, higher ground adjacent to the lake diverts the drainage to the north and south.

The site occupies an area of approximately 510 ha (1260 ac), all owned by WEPCO. Structures and parking lots occupy approximately 28 ha (70 ac). Of the balance, approximately 425 ha (1050 ac) are divided among nine leases and used for agriculture. The crops grown on the leased land are primarily grain crops and include corn, soybeans, and wheat. The remainder of the site consists of woods, wetlands, and open space. The site includes approximately 3.2 km (2 mi) of shoreline on Lake Michigan (NMC 2004a).

Structures at PBNP include two reactor containment buildings; associated auxiliary, service, turbine, and office buildings; a switchyard; a pump house; and cooling-water intake and discharge structures. The largest of the structures (the reactor containment buildings) are approximately 19 m (63 ft) high. The plant is visible from State Highway 42 for several miles in either direction but is not a prominent feature to the residents of the Town of Two Creeks. From the lake, the plant is visible for many miles to the north and south, as is KNPP located 8 km (5 mi) to the north. The PBNP reactor containment structures are encased in vinyl coated steel buildings that are colored to blend with the green and brown Wisconsin countryside (AEC 1972).

The PBNP transmission line ROWs occupy approximately 1344 ha (3321 ac) (NRC 1996) and run through rural, agricultural land. From PBNP, three of the transmission lines run east-west and connect the plant to the existing State power grid. The fourth line connects PBNP to KNPP 8 km (5 mi) to the north. While the transmission line towers are typically at or slightly above the level of the wooded areas, which helps obscure them from populated areas, they are very visible in open and agricultural areas. In a few locations, the towers are visible to the residents of Two Creeks. The transmission lines in open areas are visible for several miles from roadways and for a much shorter distance when the ROWs run through wooded areas.

Noise from operations at the PBNP site is barely noticeable, except very close to the reactor containment vessels. While some noise may reach the leased lands which are located within the site boundary, no noise from normal plant operations reaches the residential areas around the Town of Two Creeks.

### 2.2.8.5 Demography

In 2000, the population of Wisconsin was approximately 5.36 million (U.S. Census Bureau [USCB] 2004). Table 2-8 shows the population for Manitowoc County and selected municipalities. From 1990 to 2000, Wisconsin had an average annual growth rate of approximately 1.0 percent. The average annual growth rate of Manitowoc County during the same period was 0.3 percent (USCB 2004). Wisconsin and Manitowoc County are both projected to grow relatively slowly over the next 30 years. (As shown in Table 2-9, a projected average annual growth rate for Wisconsin as a whole of 0.6 percent, versus 0.3 percent for Manitowoc County.)

**Table 2-8.** Population of Manitowoc County and Selected Municipalities

| | Total Population | | | |
|---|---|---|---|---|
| **Municipality or County** | **1970** | **1980** | **1990** | **2000** |
| Two Creeks | 580 | 489 | 466 | 551 |
| Mishicot | 938 | 1503 | 1296 | 1422 |
| Manitowoc (City) | 33,430 | 32,547 | 32,521 | 34,053 |
| Two Rivers | 13,732 | 13,354 | 13,030 | 12,639 |
| Manitowoc County | 82,294 | 82,918 | 80,421 | 82,887 |

Source: WDA 2004b

Table 2-9. Population Projections for Wisconsin and Manitowoc County

| Year | Wisconsin [a] | Manitowoc County [b] |
|---|---|---|
| 2000 | 5,363,715 | 82,893 |
| 2005 | 5,563,896 | 84,574 |
| 2010 | 5,751,470 | 86,307 |
| 2015 | 5,931,386 | 88,055 |
| 2020 | 6,110,878 | 89,860 |
| 2025 | 6,274,867 | 90,821 |
| 2030 | 6,415,923 | 91,327 |

(a) Based on 0.6 percent annual growth (WDA 2004c)
(b) Based on 0.3 percent annual growth (WDA 2004d)

- **Transient Population**

There is little transient population for agriculture in the vicinity of PBNP. Almost all of the laborers on farms in the area are believed to be residents in the area. Seasonal migrant labor plays little or no role in field agriculture in the PBNP region.

- **Agricultural Labor**

Although this is an agricultural region, agriculture employs a relatively small fraction of the workforce in the communities near PBNP and within Manitowoc County, as shown in Table 2-10.

#### 2.2.8.6 Economy

Although much of the land use in the region is agricultural, only a very small portion of the population is actually employed in agricultural occupations, as shown in Table 2-10. The majority of the population is employed in production, managerial, and office occupations.

**Table 2-10.** Occupations in Nearby Municipalities and Manitowoc County

| Occupations | Mishicot | Manitowoc (City) | Two Rivers | Manitowoc County |
|---|---|---|---|---|
| Management, Professional, and Related Occupations | 182 | 4011 | 1357 | 10,448 |
| Service Occupations | 133 | 2639 | 862 | 5793 |
| Sales and Office Occupations | 146 | 3866 | 1194 | 8880 |
| Farming, Fishing, and Forestry Occupations | 10 | 96 | 36 | 820 |
| Construction, Extraction, and Maintenance Occupations | 80 | 1450 | 549 | 4264 |
| Production, Transportation, and Material Moving Occupations | 191 | 4640 | 2271 | 12,748 |

Source: WDA 2004e

Within Manitowoc County, the median household income is $43,286 per year (USCB 2000). During the first six months of 2004, the unemployment rate ranged between 6.7 and 9.8 percent (Table 2-11). For comparison, the unemployment rate for Wisconsin ranged from 4.8 to 6.5 percent during the same period (Wisconsin Department of Workforce Development [WDWD] 2004).

**Table 2-11.** Unemployment Rates for Manitowoc County in 2004

| | Employed | Unemployed | Unemployment Rate |
|---|---|---|---|
| January | 43,955 | 4000 | 9.1 |
| February | 44,051 | 4302 | 9.8 |
| March | 43,969 | 4093 | 9.3 |
| April | 43,568 | 3206 | 7.4 |
| May | 43,723 | 2936 | 6.7 |
| June | 44,680 | 3065 | 6.9 |

Source: WDWD 2004

In Wisconsin, public utilities are exempt from local property taxation and, instead, are taxed by the State. Public utilities pay gross revenue taxes to the State in lieu of property taxes. Gross revenue taxes paid by utilities become part of the State's general purpose revenue, which goes to fund the Wisconsin Shared Revenue Program, which provides the largest aid payment for municipalities and is an important source of revenue for counties.

The shared revenue program has several separate payment types, including a utility payment. Only shared revenue utility payments are distributed to counties and municipalities based on the presence of an electric utility facility. The other payments are distributed based on a formula that is independent of utility valuation or location (Wisconsin Department of Revenue [WDR] 2003a). The utility payment consists of three components: net book value, spent nuclear fuel storage, and the minimum payment (WDR 2003a). The minimum payment component does not apply to PBNP. The formulas and rules controlling the net book value and spent nuclear fuel storage components are slightly different for counties and municipalities. The rules for counties are the following:

> Utility. The utility payment consists of three components: (a) A payment based on the net book value of qualifying property of electric and gas utilities. For property in towns, the county received 6 mills on the net book value. For property in villages or cities, the county received 3 mills. *The total value of qualifying property for payment purposes in a* municipality (the basis on which county payments are calculated) may not exceed $125 million per utility company or for a jointly owned power plant. Payments could also not exceed $100 per capita. (b) A payment of $50,000 to counties in which spent nuclear fuel was stored. (c) If a county had a generating plant having a rated capacity of 200 megawatts or more, the payment could not be less than $75,000 (WDR 2003a).

The rules for municipalities are the following:

> Utility. The utility payment consisted of three components: (a) A payment based on the net book value (original cost less depreciation) of qualifying property (production plants, substations, and general structures, excluding land) of electric and gas utilities. For property in towns, the town received 3 mills on the net book value. For property in villages or cities, the village or city received 6 mills. The total value of qualifying property for payment purposes in a municipality could not exceed $125 million per utility company or for *a jointly owned power plant. Payments could also not exceed $300 per capita.* (b) A payment of $50,000 to municipalities in which spent nuclear fuel was stored. If the nuclear fuel storage facility was located within one mile of another municipality, the municipality where the fuel was stored received $40,000 and the nearby municipality received $10,000. (c) If a municipality had a generating plant having a rated capacity of 200 megawatts or more, the payment could not be less than $75,000.

Note that the shared revenue formula changed to a megawatt based payment for plants put into operation or repowered after January 1, 2004. However, this does not apply to PBNP. The Town of Two Creeks and Manitowoc County are the recipients of the shared revenue utility payments attributable to PBNP. Tables 2-12 and 2-13 list the total tax revenues of the Town of Two Creeks and Manitowoc County and the shared revenue utility payments from the State. As is presented in the tables, the shared revenue utility payments attributable to PBNP represent approximately 14 to 20 percent (excluding the 1999 payment) of the tax revenues of Two Creeks. The shared revenue utility payments attributable to PBNP represent approximately 1.4 to 2.0 percent of the total tax revenues of Manitowoc County.

**Table 2-12.** Total Tax Revenues and Shared Revenue Utility Payments for the Town of Two Creeks

| Year | Total Tax Revenues[a, b, c] | Shared Revenue Utility Payment on behalf of PBNP[d] | Percent of Total Tax Revenues |
|---|---|---|---|
| 1996 | $982,600[a] | $190,100 | 19.3 |
| 1997 | $1,026,300 | $191,900 | 18.7 |
| 1998 | $937,200 | $193,400 | 20.1 |
| 1999 | $270,500[e] | $194,600 | 72.0 |
| 2000 | $1,420,800 | $194,600 | 13.7 |
| 2001 | $881,800 | $216,500 | 24.5 |
| 2002 | $933,100 | $217,100 | 23.3 |

(a) Data for 1996 through 2000 from NMC 2004a
(b) Data for 2001 from WDR 2003b
(c) Data for 2002 from WDR 2004
(d) Calculated based on WDR 2003a
(e) The Town of Two Creeks' 1999 interest income was negative due to market fluctuations.

**Table 2-13.** Total Tax Revenues and Shared Revenue Utility Payments for Manitowoc County

| Year | Total Tax Revenues[a, b, c] | Shared Revenue Utility Payment on behalf of PBNP[d] | Percent of Total Tax Revenues |
|---|---|---|---|
| 1996 | $40,129,000 | $800,000 | 2.0 |
| 1997 | $41,556,900 | $800,000 | 1.9 |
| 1998 | $47,112,400 | $800,000 | 1.7 |
| 1999 | $51,694,700 | $800,000 | 1.5 |
| 2000 | $55,931,600 | $800,000 | 1.4 |
| 2001 | $67,044,000 | $800,000 | 1.2 |
| 2002 | $57,966,000 | $800,000 | 1.4 |

(a) Data for 1996 through 2000 from NMC 2004a
(b) Data for 2001 from WDR 2003b
(c) Data for 2002 from WDR 2004
(d) Calculated based on WDR 2003a

## 2.2.9 Historic and Archaeological Resources

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

### 2.2.9.1 Cultural Background

Wisconsin was last glaciated beginning about 25,000 years ago. The glaciers reached their greatest extent 14,000 to 16,000 years ago, and the last glacial advance (the Two Rivers, or Valderan) dates to about 12,400 years ago. The topography of Wisconsin is strongly influenced by glacial and postglacial geological deposits. These landforms affected the pattern of human use and settlement. Until about 12,000 to 14,000 years ago, all of northern and eastern Wisconsin was buried by ice sheets. By about 12,000 years ago, the glaciers had retreated and exposed most of the current area of Wisconsin. The western shore of postglacial Lake Michigan, however, continued to expand and retreat for the next several thousand years (Illinois State Museum 2004) in a complex manner dictated by impoundment of water against the retreating ice, new outlets opening up as the ice retreated, and a rebounding of the land surface (isostatic uplift) as the weight of the glacial ice was removed.

- **Native American Prehistory**

The distribution of Paleo-Indian remains, the earliest known prehistoric tradition, in Wisconsin correlates with the last stages of glacial activity and the fluctuating lake levels (R. Mason 1997). Paleo-Indians are believed to have exploited newly opened postglacial environments and to have been organized in small mobile hunting societies (R. Mason 1997). In general, early Paleo-Indian groups appear to have been more numerous in southern Wisconsin than in the north where glacial conditions persisted longer (R. Mason 1997). Paleo-Indian groups hunted large, now extinct megafauna, such as mastodon, mammoth, and caribou, that lived on the lush vegetation that colonized postglacial soils (R. Mason 1997). By the later Paleo-Indian period, the levels of the Great Lakes may have been significantly lower than present. Paleo-Indian sites of this period may now be submerged several hundred feet below the current surface (R. Mason 1997). The later Paleo-Indian sites, while retaining a basic hunting orientation, used woodworking tools that reflect the increasing forestation of the previously glaciated land. Late Paleo-Indian sites are widespread and continue to reflect small mobile populations. Instead of megafauna, the species hunted during the later period included deer, caribou, bison, turtle, beaver, and other small mammals (R. Mason 1997).

With the onset of warmer climatic conditions, a further shift in subsistence patterns becomes obvious. Beginning sometime between 10,000 and 7500 years ago, Archaic Tradition populations consisting of small groups of hunters and gatherers living in caves, rock shelters, along rivers, and around lakes and wetlands, replaced the older Paleo-Indian Tradition. Archaic peoples may have been direct descendants of Paleo-Indians or may represent a migration of people from the south (Stoltman 1997). These hunter-gatherers subsisted on fish, wild plants, nuts, acorns, and modern game animals such as elk and deer (Stoltman 1997). Settlement appears to have been sparse; small mobile groups, relying on diverse hunting and gathering subsistence, seem to have been the typical pattern (Stoltman 1997). At least one extensive Archaic local Wisconsin quarry site is known; however, stone tool materials from neighboring Illinois are also found at Archaic sites (Stoltman 1997). By about 4000 to 6000 B.C., Archaic sites were more widely distributed throughout Wisconsin. Drier, warmer conditions with a rise in herbaceous species characterize this period. Archaic tool assemblages expand to include fishing gear, ground stone plant processing tools, axes, and copper tools (Stoltman 1997). Copper artifacts (such as harpoons, axes, adzes, chisels, knives, and drills) are widely found in eastern Wisconsin and in Manitowoc County (Stoltman 1997). Beginning about 2500 years ago, the Woodland Tradition replaced the Archaic Tradition across most of Wisconsin (Stoltman 1997).

The Red Ochre Complex, an elaborate ceremonial burial complex distributed widely across the Midwest and the Great Lakes areas, serves as a marker of the transition between the preceding Archaic Tradition and the subsequent Woodland Tradition. Because information about the complex is largely limited to burial sites, its connections to the Archaic and Woodland Traditions remains uncertain (Stevenson et al. 1997). Use of copper for ornaments increased; evidence of fishing and wild rice harvesting exists. Toward the end of the Red Ochre period, mounds and Woodland pottery are found in association with the sites (Stevenson et al. 1997).

By about 2500 years ago, the presence of pottery marks the beginning of early Woodland Tradition in Wisconsin. Typically, the Woodland Tradition is characterized by a transition from subsistence based on hunting and gathering to one based more heavily on horticulture. Use of bows and arrows and pottery and construction of effigy mounds, many of which were in the form of animals and humans, are hallmarks of the Woodland Tradition. As the Woodland Tradition developed, cultivation became more prominent in the economy, and increasingly settled village sites became more common (Stevenson et al. 1997).

The middle Woodland occupation (roughly 1500 to 2200 years ago) has distinctive characteristics that include construction of conical burial mounds and evidence of widespread interaction throughout central and eastern North America. The characteristics of this network, called the Hopewell Interaction Sphere, include elaborate ceremonialism, extensive trade of exotic manufactured items and raw materials, and large mound construction. The Hopewell influence in Wisconsin appears to consist of a veneer of ceremonialism on a traditional way of life that was otherwise largely unchanged (Stevenson et al. 1997).

Late Woodland sites (occupied 700 to 1600 years ago) show a decline in Hopewellian ceremonialism but continue the tradition of mound construction, primarily in form of animal and human shapes, in the southern half of Wisconsin. Burials are associated with some, but not all, mounds (Stevenson et al. 1997). Cultivation of corn became increasingly prominent, and villages became more permanent (Stevenson et al. 1997).

An exception to the typical Woodland Tradition is the intrusion of a few Middle Mississippian sites in Wisconsin about 1000 years ago. These sites are related to the development of planned permanent towns and ceremonial sites in Iowa, Minnesota, Missouri, and Illinois, particularly the site of Cahokia. Hierarchical structure, extensive trade networks, and intensive agriculture characterized these societies. Several sites in south-central Wisconsin represent a northern extension of Mississippian culture. Aztalan, a palisaded village containing four platform mounds and a series of dwellings, is the best known of these sites in Wisconsin (Goldstein and Freeman 1997). The relationship of such sites with the surrounding Woodland Tradition is unclear, and the influence of the Mississippian culture on Woodland culture in Wisconsin appears to have been transitory (Green 1997).

The transition from Woodland Tradition to later cultures is poorly understood. About 1000 years ago, overlapping the late Woodland and Mississippian traditions, sites referred to as the Oneota culture, recognized by distinctive pottery styles, appear in the archaeological record. Permanent villages, some fortified, were established; subsistence was based on corn, beans, squash, aquatic resources, and a variety of wild plants and game. Hunting and gathering, probably on a seasonal basis, supplemented the basic agricultural economy (Overstreet 1997). Differences between Oneota and existing Woodland cultures may have been one of degree, rather than kind. The origin of Oneota groups is a subject of debate. They may have migrated into Wisconsin from the south or developed out of an interaction of late Woodland Tradition with Mississippian culture at such sites as Aztalan (Overstreet 1997). Late Woodland and Oneota communities may have coexisted in several areas of Wisconsin for a period of time. Expanding Mississippian culture in Wisconsin may have forced Oneota populations out of areas of eastern Wisconsin. Following the collapse of Mississippian influence, Oneota communities returned to the abandoned areas, and by about 700 years ago, they were the predominant culture in most of southern Wisconsin (Overstreet 1997).

During the later period of Oneota culture, villages were concentrated in several areas, such as the Fox River valley in eastern Wisconsin. Subsistence patterns appear to have remained relatively constant throughout Oneota history until the onset of European contact (circa 1600 to 1650). Oneota settlements in eastern Wisconsin were abandoned by the time of French contact. The causes for this rapid depopulation may include disease, warfare, or out-migration (Overstreet 1997). The Ho-Chunk (formerly Winnebago) Indians are commonly believed to be descendants of Oneota populations, but the archaeological evidence is weak.

At the time of the first European contact (1600 to 1650), eastern Wisconsin was occupied by several Native American groups (Ho-Chunk, Potawatomi, Menominee, and Chippewa).

Disruption of Native American communities in eastern North America by ecological shifts (Cronon 1983), societal collapse, disease, and dislocation by European settlers created waves of population shifts as these tribal groups pushed north and westward (Bragdon 2001). Wisconsin tribal groups, responding to these pressures, shifted their areas of use around Wisconsin, Michigan, and other areas of the Midwest.

- **Historic Period**

During the first half of the 17th century, Iroquoian Huron Indians controlled trade across the northern Great Lakes and restricted French incursions into the western Great Lakes area. Between 1648 and 1650, other Iroquoian groups, under pressure because of declining reserves of fur bearing animals, attacked the Huron villages causing a mass exodus of Hurons to the north and west. Huron camps between the Door Peninsula and southern Lake Michigan are evidence of this migration. With the collapse of the Huron control of Great Lakes trade, northern Wisconsin was opened to European intrusion, Iroquois raids, and large-scale migrations of refugees.

"Some places were literally emptied of people, and areas receiving them experienced crowding, confusion, and disruption of old ways. Villages were established with mixed populations as older patterns of interrelationship were abandoned....The wars of the Iroquois additionally drove many refugees into Wisconsin from the southern end of Lake Michigan, and people whose former homes were as far east as Ohio sought refuge here, most before any reliable historic records were kept of their movements" (C. Mason 1997).

The first European known to have visited the area was Jean Nicolet, a French explorer, who reached Green Bay in 1634. Green Bay was subsequently established as the first French fur trading settlement, and a number of other trading posts were established during the late 1600s and 1700s. Between 1665 and 1728, French Jesuits established missions in conjunction with the trading posts and in various parts of the Green Bay/Fox River area (C. Mason 1997). French influence continued until the end of the French and Indian War. As the French withdrew from the western Great Lakes, items of British manufacture replaced French trade goods in Native American communities (C. Mason 1997). Throughout the historic period, Wisconsin Native American societal structures and ecological conditions were disrupted. Native economies were supplanted or supplemented by an emphasis on hunting for the fur trade. European trade goods increasingly replaced traditional tools and utensils.

The United States acquired ownership of the northern Midwest at the close of the American Revolution, but de facto control remained with the British until the War of 1812. By 1825, the United States had confirmed the rights of three Native American groups (Menominee, Potawatomi, and Ho-Chunk) to land in eastern Michigan (Wisconsin Historical Society [WHS] 2000). However, as a result of later treaties that ceded land to the United States, some tribal groups with ancestral interests in Wisconsin were forced to move to Iowa, Michigan, Kansas, and Oklahoma or were resettled in much smaller reservations (Great Lakes Inter-Tribal Council 2003). During the 1820s and 1830s, the Oneida and Mohican Indians of New York negotiated various treaties with Menominee and Ho-Chunk tribes and with the Federal government for land on the western shore of Lake Michigan. Groups of Oneida and Mohicans began to relocate to that area and were eventually settled on small reservations south of Green Bay.

Wisconsin was sparsely settled by Europeans prior to becoming a U.S. territory. Lead mining drew the first wave of Euro-American immigrants to southwestern Wisconsin in the 1820s. In 1834 Wisconsin was surveyed and opened to Euro-American settlers. The fur trade, which had been a lucrative enterprise from the time of French influence, declined rapidly in the 1830s, and by the time of the Civil War, logging, especially in the heavily forested northern areas, had become the primary industry. Initially loggers floated white pine logs down the rivers to sawmill towns. As the supply of pines was exhausted, railroads were constructed to haul the next most desirable species (maple and other hardwoods that would sink when waterlogged) to the mills (Birmingham et al. 1997). Wood product industries developed to exploit Wisconsin's forests. In eastern Wisconsin, a substantial tanning industry developed based on the availability of "tanbark" derived from large stands of hemlock that grew in that area. A number of tanneries were located in the area of Two Rivers. The village of Two Creeks, located directly north of PBNP, was founded by Guido Pfister who established the Pfister (later Pfister and Vogel) Leather Company there in 1861 (Wojta 1945). Pfister acquired rights to about 607 ha (1500 ac) of hemlock forest along the shores of Lake Michigan between Two Creeks and the current location of PBNP. The Two Creeks tanning industry flourished for about 20 years, but was finally abandoned and moved to Milwaukee in 1882 (Spevacek 1985). The primary factor in the decline of the tanning industry was the massive loss of local hemlock and tanbark as a result of the Peshtigo fires of 1871 (Vogl 1986).

The village of Two Creeks (variously named Rowley, Nero, or East Two Creeks) was the largest community in the immediate vicinity of PBNP from 1861 to 1920. Initially established for the Pfister Leather Company, the town developed a substantial shipping industry. Tanned hides and leather goods, farm products, and wood products were shipped from Two Creeks to other Great Lakes ports (Spevacek 1985). This commercial activity persisted after the closure of the Pfister and Vogel Leather Company. In 1918, under severe drought conditions, a fire destroyed nine buildings in the village. As a result of the extensive destruction, East Two Creeks was abandoned, and what remained of the community relocated west of the original lakeshore location.

Although the tanning industry was short lived, eastern Wisconsin developed an extensive fishing and shipbuilding industry, with a major center in the city of Manitowoc during the 1800s and 1900s. Dairy farming also became a significant enterprise. Logging continued to be a significant industry through the 1920s. Drawn by its natural resources and economic opportunities, immigrants from many areas of Europe (Scandinavia, northern and eastern Europe, and the British Isles) and the eastern United States settled in Wisconsin. The rich ethnic diversity of its people is reflected in the architecture and industries of its farms (WHS 1996), churches, and villages. Between 1836 and 1850 (2 years after statehood), the population of Wisconsin increased from less than 12,000 people to 305,000 (State of Wisconsin 2004b).

- **Native American Tribes**

There are 11 Federally recognized Native American tribes resident in Wisconsin. There are six groups of Chippewa (Bad River Band of the Lake Superior Chippewa, Lac Courte Oreilles Band of Lake Superior Chippewa Indians, Lac du Flambeau Band of Lake Superior Chippewa Indians, St. Croix Chippewa Indians, Sakaogon Chippewa Community, and the Red Cliff Band of Lake Superior Chippewa Indians); the Ho-Chunk (formerly Winnebago) Nation; the Forest County Potawatomi Community; the Oneida Tribe of Indians; the Menominee Indian Tribe; and the Stockbridge Munsee Community (formerly Stockbridge Munsee Community of Mohican Indians) (Bureau of Indian Affairs 2002). In addition to Native American groups resident in Wisconsin, three other groups of Potawatomi (Hannahville Indian Community, Michigan; Citizen Potawatomi Nation, Oklahoma; Prairie Band of Potawatomi Nation, Kansas) have cultural interests in Manitowoc and Kewaunee counties (National Park Service 2004).

#### 2.2.9.2 Historic and Archaeological Resources at PBNP Site

During the development of the final environmental statement (FES) (AEC 1972), archaeological site file searches were conducted at the WHS to identify cultural resources that might be present at PBNP. The FES reported that an "Indian burial site" was located north of the plant but was not disturbed by construction. A number of farm buildings of unknown history were reported to have been razed.

In 1993, the Great Lakes Archaeological Research Center, Inc. (GLARC) conducted a field inventory of approximately 16 ha (40 ac) that was proposed for use as an ISFSI facility. They also examined the sites files, archives, and maps maintained by the WHS. No prehistoric or historic sites were located during the field inventory. GLARC also noted three prehistoric campsites and one historic Euro-American site within 3.2 km (2 mi) of the project area (GLARC 1993).

In the course of preparing this SEIS, the WHS records of historic properties were examined. As of August 2004, a number of historic properties within Manitowoc and Kewaunee counties have been listed on the National Register of Historic Places (NRHP), 10 in Kewaunee County

(WHS 2004a) and 19 in Manitowoc County (WHS 2004b). The nearest, the Rawley Point Light Station, falls within a 10-km (6-mi) radius of PBNP. In addition to sites listed on the NRHP, the WHS records list more than 170 additional historic buildings in Manitowoc County that are of historical interest. None of these are in the immediate vicinity of PBNP.

Local histories indicate that the first houses built in Two Creeks township were located within the PBNP site boundaries. The first house was built in 1842, and the second in 1847 (Wojta 1945). County plat maps of Two Creeks township show the presence of structures and a north-south road within the PBNP site boundaries as early as 1872 to 1878. A pier at the northern boundary of the PBNP site is also shown on county maps from the 1870s (Snyder et al. 1878). A standing fisherman's shed built about 1948 is also located within the PBNP site boundaries. The fishing shed has been evaluated for significance under the National Historic Preservation Act and is not recommended for inclusion on the NRHP (We Energies 2004c).

Records at the WHS identify a number of prehistoric and historic sites in the vicinity of the PBNP site and three sites located within the PBNP site boundary. A cultural resources field investigation of the leased farmlands within the PBNP site has recently been completed (AVD Archaeological Services, Inc. [AVD] 2004). In addition to the sites identified in the WHS records, this investigation found prehistoric and historic artifacts at 19 locations: 15 isolated artifacts, one prehistoric lithic artifact scatter, and three historic artifact scatters. One of the historic scatters is associated with a nearby residence. Another historic scatter is probably associated with a nearby foundation and possible grave site, and the third historic scatter is also associated with a foundation. AVD recommended that the four artifact scatters be avoided during any future land disturbance (AVD 2004). Alternatively, additional evaluations could be conducted to determine if these sites were eligible for the NRHP. Unless construction is planned at the isolated artifact locations, no further investigation was recommended (AVD 2004).

In addition to the known sites within the PBNP site boundaries, the surrounding areas (within approximately 10 km [6 mi] of the plant site) are known to contain 25 archaeological sites. The majority of these are prehistoric campsites and villages, most of them of unknown cultural affiliation. Other campsites and villages in this area have been attributed to the Woodland Tradition. Other sites within this area include one prehistoric Native American and two Euro-American cemeteries, a shipwreck (the Pathfinder), and a French trading post/landing site dating to the 1700s. The landing site, reported to be that of Jean (variously Jacques) Vieau is located north of the plant site. The historic village of Two Creeks, although not listed in the WHS site records, also lies due north of the PBNP site.

In addition to cultural resources, a portion of the Two Creeks Buried Forest unit of the Ice Age National Scientific Reserve, a paleontological resource, is exposed near the plant site. Its extent within and beneath the plant site has not been documented. The buried forest contains preserved remains of a periglacial forest that was buried by the last glacial advance over Wisconsin. Cultural resources are not likely to be associated with the buried forest unit.

### 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 PBNP OLs. 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.

As discussed in the NMC ER (NMC 2004a), KNPP is located on the western shore of Lake Michigan in Kewaunee County, approximately 8 km (5 mi) north of the PBNP site. KNPP is a single unit, 535-MW(e) pressurized-water reactor with a thermal power rating of 1650 MW. The KNPP site consists of approximately 367 ha (908 ac), jointly owned by Wisconsin Public Service Corporation and Alliant Energy. Under an arrangement similar to that of PBNP, NMC holds the OL for KNPP and is responsible for plant operation and maintenance. At KNPP, a maximum of 1.6 million L/min ($4.2 \times 10^5$ gpm) of cooling water and up to 95,000 L/min (25,000 gpm) of water for in-plant use are drawn from and discharged to Lake Michigan as a once-through system. Groundwater from an onsite well is used for potable and sanitary water. Studies conducted of the hydrologic characteristics of this portion of Lake Michigan indicate that the discharge heat of KNPP does not interact with the discharge heat of PBNP (Wisconsin Public Service Corporation 1972).

NMC conducts a radiological surveillance program on and in the vicinity of KNPP. A total of 17 parameters are measured, including four air samples (e.g., airborne particulates), nine terrestrial samples (e.g., well water), and four aquatic samples (e.g., fish). Radionuclide concentrations from the surveillance program are compared to levels measured at control locations and in preoperational studies. These comparisons indicated only background level radioactivity in all samples collected in the year 2000.

PBNP has a 20-MW, oil-fired combustion turbine used for spinning reserve, alternate power supply during plant blackouts, and peaking purposes. The combustion turbine is fully capable of operating independent of the remainder of the plant. PBNP operates the combustion turbine pursuant to Chapter 285 of the Wisconsin Statutes and the plant's air pollution control operation permit issued under the CAA by the WDNR.

NRC is required under Section 102(c) of the National Environmental Policy Act 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, including the Biological Assessment, is included in Appendix E.

## 2.3 References

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

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

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

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

40 CFR Part 81. Code of Federal Regulations, Title 40, *Protection of the 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."

Clean Air Act of 1970. 42 USC 7491, et seq.

Clean Water Act (CWA). 1977. 33 USC 1326, et seq.

American Transmission Company (ATC). 2004a. *Transmission Line Right-of-Way Forestry Specification*. ATC Operating Instruction. May 1, 2004.

American Transmission Company (ATC). 2004b. *Vegetation Management Philosophy and Standards*. ATC Operating Instruction No. 02-04. May 1, 2004.

AVD Archaeological Services Inc. (AVD). 2004. *A Phase I Archaeological Survey at the Point Beach Nuclear Power Plant in Manitowoc County, Wisconsin*. Report No. 104284. Union Grove, Wisconsin. September 2004.

Birmingham, R. A., J. H. Broihahn, and D. J. Cooper. 1997. "Historic Period, Euro-Americans." *The Wisconsin Archaeologist*, Vol. 78, Numbers 1 and 2, pp. 320–349.

Bragdon, K. J. 2001. *The Columbia Guide to American Indians of the Northeast.* Columbia University Press, New York.

Bronte, C.R., and P.A. Schuette. 2002. *Summary of Trout and Salmon Stocking in Lake Michigan 1976-2001.* Great Lakes Fishery Commission, Lake Michigan Committee Meeting, Duluth, Minnesota. March 21-22, 2002.

Bronte, C.R., J. Jonas, M.E. Holey, R.L. Eshenroder, M.L. Toneys, P. McKee, B. Breidert, R.M. Claramunt, M.P. Ebener, C.C. Krueger, G. Wright, and R. Hess. 2003. *Possible Impediments to Lake Trout Restoration in Lake Michigan.* Great Lakes Fishery Commission, Ann Arbor, Michigan. http://www.glfc.org/lakecom/lmc/ltrestore.pdf (Accessed January 12, 2004).

Burzynski, T. 2004. Wisconsin's Lake Michigan Salmonid Stocking Program. PUB-FH-828 2004. Wisconsin Department of Natural Resources, Milwaukee, Wisconsin. http://www.dnr.state.wi.us/org/water/fhp/fish/lakemich/Stocking%20summary%202003.pdf (Accessed November 12, 2004).

Bureau of Indian Affairs. 2002. "Indian Entities Recognized and Eligible To Receive Services From the United States Bureau of Indian Affairs." *Federal Register,* Vol. 67, No. 134, pp. 46328–46333. Washington, D.C. July 12, 2002.

Crawford, S.S. 2001. *Salmonine Introductions to the Laurentian Great Lakes: An Historical Review and Evaluation of Ecological Effects. Executive Summary.* Canadian Special Publication of Fisheries and Aquatic Sciences. http://www.uoguelph.ca/~scrawfor/research/research_greatlakes/research_greatlakes_fisheries/research_greatlakes_fisheries_issues_/research_greatlakes_fisheries_issueas_salmon_monograph.shtml (Accessed February 24, 2004).

Cronon, W. 1983. *Changes in the Land: Indians, Colonists, and the Ecology of New England.* Hill and Wang, New York.

Department of Fisheries and Oceans Canada (DFO). 2004. "The Alewife." Department of Fisheries and Oceans Canada, Ottawa, Ontario, Canada. http://www.dfo-mpo-gc.ca/zone/underwater_sous-marin/gasparea/alewife-gaspareau_e.htm (Accessed July 14, 2004).

Eggold, B. 2004. *Sportfishing Effort and Harvest. Lake Michigan Management Reports.* Wisconsin Department of Natural Resources, Milwaukee, Wisconsin. http://www.dnr.stste.wi.us/org/water/fhp/fish/lakemich/Great%20Lakes%Fishery%20Commission%20Report%202004.pdf (Accessed November 11, 2004).

Elliott, D. L., C. G. Holladay, W. R. Barchet, H. P. Foote, and W. F. Sandusky. 1987. *Wind Energy Resource Atlas of the United States.* DOE/CH 10093-4, U.S. Department of Energy, Washington, D. C.

Environment Canada. 1995. *The Great Lakes: An Environmental Atlas and Resource Book (Third Edition). Factsheet 1.* Jointly produced by the Government of Canada and the U.S. Environmental Protection Department. http:www.on.ec.gc.ca/great-lakes-atlas.html (Accessed December 4, 2003).

Eshenroder, R.L., M.E. Holey, T.K. Gorenflo, and R.D. Clark, Jr. 1995. "Fish-Community Objectives for Lake Michigan." *Great Lakes Fishery Commission Spec. Pub 95-3.* http://www.glfc.org/pubs/SpecialPubs/Sp95_3.pdf (Accessed January 25, 2004).

Fleischer, G.W., T.J. DeSorcie, and J.D. Holuszko. 2001. "Lake-wide Distribution of Dreissena in Lake Michigan, 1999." *Journal of Great Lakes Research*, Vol 72, pp. 252-257.

Fuller, P. 2003. *Morone americana (Gmelin 1789).* U.S. Geological Survey (USGS), Center for Aquatic Resource Studies, Gainesville, Florida. http://nas.er.usgs.gov/queries/SpFactSheet.asp?speciesID=777 (Accessed February 25, 2004).

Fuller, P., and A. Benson. 2003. *Neogobius melanostomus (Pallas 1814).* U.S. Geological Survey (USGS), Center for Aquatic Resource Studies, Gainesville, Florida. http://nas.er.usgs.gov/queries/SpFactSheet.asp?speciesID=713 (Accessed February 23, 2004).

Fuller, K., H. Shear, and J. Witting, eds. 1995. *The Great Lakes - An Environmental Atlas and Resource Book.* Government of Canada and U.S. Environmental Protection Agency. http://www.epa.gov/glnpo/atlas/index.html (Accessed February 25, 2004).

Fuller, P., L. Nico, and E. Maynard. 2004. *Petromyzon marinus.* Nonindigenous Aquatic Species Database, Gainesville, Florida. http://nas.er.usgs.gov/queries/SpFactSheet.asp?speciesID=836 (Accessed November 23, 2004).

GeoSyntec Consultants. 2002. "Abandonment Plan: Wastewater Retention Pond, Point Beach Nuclear Plant." Prepared by GeoSyntec Consultants for Wisconsin Electric-Wisconsin Corporation. Chicago, Illinois. February 2002.

Goldstein, L., and J. Freeman. 1997. "Aztalan – A Middle Mississippian Village." *The Wisconsin Archaeologist*, Vol. 78, Numbers 1 and 2, pp. 223–248.

Great Lakes Archaeological Research Center (GLARC). 1993. *Phase I Archaeological Reconnaissance of a Proposed Storage Site at the Point Beach Power Plant, Manitowoc County, Wisconsin.* GLARC Project 93-069, Milwaukee, Wisconsin. August 1993.

Great Lakes Inter-Tribal Council. 2003. *Native Wisconsin, Official Guide to Native American Communities in Wisconsin.* Great Lakes Inter-Tribal Council, Inc. Lac du Flambeau, Wisconsin.

Great Lakes Science Center. 2003. *Great Lakes Issues - Round Goby.* U.S. Geological Survey (USGS), Great Lakes Science Center, Ann Arbor, Michigan. http://www.glsc.usgs.gov/research/greatlakesissues.asp?ID=3 (Accessed February 24, 2004).

Green, W. 1997. "The Middle Mississippian Peoples." Wisconsin Archaeology, Chapter 8. The Wisconsin Archaeological Society, The Wisconsin Archaeologist, Vol. 78, Numbers 1 and 2, pp. 202–222.

Hasz, J. 2004. *Yellow Perch - Southern Green Bay. Lake Michigan Management Reports.* Wisconsin Department of Natural Resources, Peshtigo, Wisconsin. http://www.dnr.stste.wi.us/org/water/fhp/fish/lakemich/Great%20Lakes%Fishery%20Commission%20Report%202004.pdf (Accessed November 11, 2004).

Hirenthota, P. 2004. *Yellow Perch - Lake Michigan. Lake Michigan Management Reports.* Wisconsin Department of Natural Resources, Milwaukee, Wisconsin. http://www.dnr.stste.wi.us/org/water/fhp/fish/lakemich/Great%20Lakes%Fishery%20Commission%20Report%202004.pdf (Accessed November 11, 2004).

Hogler, S., and S. Surendonk. 2004. *Smelt Withdrawal By the Commercial Trawl Fishery. Lake Michigan Management Reports.* Wisconsin Department of Natural Resources, Mishicot, Wisconsin. http://www.dnr.stste.wi.us/org/water/fhp/fish/lakemich/Great%20Lakes%Fishery%20Commission%20Report%202004.pdf (Accessed November 11, 2004).

Horvath, T.G., K.M. Martin, and G.A. Lamberti. 1999. "Effect of Zebra Mussels, *Dreissena polymorpha*, on Macroinvertebrates in a Lake-outlet Stream." *American Midland Naturalist*, Vol. 142, pp. 340-347.

Illinois State Museum. 2004. *The Retreat of Glaciers in the Midwestern U.S.* http://www.museum.state.il.us/exhibits/larson/glacier_maps.html (Accessed August 3, 2004).

Jude, D.J. 1995. *Impact on Aquatic Organisms of Increased Heat Input to the Thermal Discharge of the Donald C. Cook Nuclear Plant, Southeastern Michigan.* Center for Great Lakes and Aquatic Sciences, University of Michigan, Ann Arbor, Michigan. December 1995.

Kroeff, T. 2004. *Status of the Commercial Chub Fishery and Chub Stocks. Lake Michigan Management Reports.* Wisconsin Department of Natural Resources, Sturgeon Bay, Wisconsin. http://www.dnr.stste.wi.us/org/water/fhp/fish/lakemich/Great%20Lakes%Fishery%20Commission%20Report%202004.pdf (Accessed November 11, 2004).

Lee, D.M. 1991. Letter from D.M. Lee, Water Quality Engineer, Wisconsin Electric Power Company, Milwaukee, Wisconsin to B. E. Barbieur, Wisconsin Department of Natural Resources, Madison, Wisconsin. Subject: "WPDES Permit No. WI-0000957 Point Beach Nuclear Plant Zebra Mussel Control." December 3, 1991.

Lei, J. 1993. *Estimation of Filtration Rate of Zebra Mussels.* Technical Note ZMR-4-06. U.S. Army Engineer Waterways Experiment Station, Vicksburg, Mississippi. http://sgnis.org/publicat/papers/zmr_4_06.pdf (Accessed November 23, 2004).

Lehman, J.T. 1991. "Causes and Consequences of Cladoceran Dynamics in Lake Michigan: Implications of Species Invasion by *Bythotrephes*." *J. Great Lakes Res.*, Vol. 17, pp. 437-445.

Liebig, J., and A. Benson. 2004. *Bythotrephes longimanus.* Nonindigenous Aquatic Species Database, Gainesville, Florida. http://nas.er.usgs.gov/queries/SpFactSheet.asp?speciesID=162 (Accessed November 23, 2004).

Madenjian, C.P., G.L. Fahnenstiel, T.H. Johengen, T.F. Nalepa, H.A. Vanderploeg, G.W. Fleischer, P.J. Schneeberger, D.M. Benjamin, E.B. Smith, J.R. Bence, E.S. Rutherford, D.S. Lavis, D.M. Robertson, D.J. Jude, and M.P. Ebener. 2002. "Dynamics of the Lake Michigan Food Web, 1970-2000." *Canadian Journal of Fisheries and Aquatic Sciences*, Vol. 59, pp. 736-753.

Madenjian, C.P., T.J. Desorcie, and J.D. Holuszko. 2004. *Status and Trends of Prey Populations in Lake Michigan, 2003.* Great Lakes Fishery Commission, Lake Michigan Committee Meeting, Ypsilanti, Michigan. March 24, 2004.

Makarewicz, J.C., T. Lewis, and P. Bertram. 1994. *Epilimnetic Phytoplankton and Zooplankton Biomass and Species Composition in Lake Michigan, 1983 to 1992.* U.S. Environmental Protection Agency, Great Lakes National Program, Chicago, Illinois. http://www.epa.gov/glnpo/monitoring/plankton/mich83-92/index.html (Accessed November 23, 2004).

Manitowoc County Planning and Park Commission (MCPPC). 1981. *Manitowoc County Farmland Preservation Plan.* Manitowoc, Wisconsin.

Manitowoc County Planning and Park Commission (MCPPC). 2004. *Town of Two Creeks 2022 Comprehensive Land Use Plan, Draft.* Manitowoc, Wisconsin.

Manz, C.H. 1998. "The Round Goby: An Example of the 'Perfect' Invader?" *Illinois Natural History Survey Reports*, Nov-Dec 1998. http://www.inhs.uiuc.edu/chf/pub/surveyreports/nov-dec98/goby.html (Accessed February 24, 2004).

Marsden, J.E., and M.A. Chotkowski. 1995. "The Round Goby Invades Lake Michigan." *Illinois Natural History Survey Reports*, Nov-Dec 1995. http://www.inhs.uiuc.edu/chf/pubs/surveyreports/nov-dec95/gobies.html (Accessed February 24, 2004).

Mason, C. I. 1997. "The Historic Period in Wisconsin Archaeology, Native Peoples." *The Wisconsin Archaeologist*, Vol. 78, Numbers 1 and 2, pp. 293–319.

Mason, R. J. 1997. "The Paleo-Indian Tradition." *The Wisconsin Archaeologist*, Vol. 78, Numbers 1 and 2, pp. 78–110.

Michigan Department of Natural Resources (MDNR). 2004. *Overview of Michigan's Fish Hatchery System.* Michigan Department of Natural Resources, Ann Arbor, Michigan. http://www.michigan.gov/dnr/0,1607,7-153-10364_28277--,00.html (Accessed February 26, 2004).

Midwestern Regional Climate Center (MRCC). 2003. *Historical Climate Data, Precipitation Summary.* http://www.aos.wisc.edu/%7Esco/stations/475017.html (Accessed August 25, 2004).

Nalepa, T. F., D. J. Hartson, D. C. Fanslow, G. A. Lang, and S. J. Lozano. 1998. "Declines in Benthic Macroinvertebrate Populations in Southern Lake Michigan, 1980-1993." *Canadian Journal of Fisheries and Aquatic Sciences*, Vol. 55, pp. 2402-2413.

Nalepa, T. F., D. W. Schloesser, S. A. Pothoven, D. W. Hondorp, D. L. Fanslow, M. L. Tuchman, and G. W. Fleischer. 2001. "First Finding of the Amphipod *Echinogammarus ischnus* and the Mussel *Dreissena bugensis* in Lake Michigan." *Journal of Great Lakes Research*, Vol. 27, pp. 384-391.

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

National Park Service. 2004. *Native American Consultation Database.* Query for Manitowoc County, WI. Updated 5/11/2004. http://www.cast.uark.edu/other/nps/nacd/ (Accessed August 4, 2004).

NatureServe. 2004. *NatureServe Explorer: An Online Encyclopedia of Life (Web Application). Version 3.1.* NatureServe, Arlington, Virginia. http://www.natureserve.org/explorer (Accessed April 27, 2004).

Nuclear Management Company, LLC (NMC). 2000. *Point Beach Nuclear Plant Annual Monitoring Report 1999.* Two Rivers, Wisconsin. April 2000.

Nuclear Management Company, LLC (NMC). 2001. *Point Beach Nuclear Plant Annual Monitoring Report 2000.* Two Rivers, Wisconsin. April 2001.

Nuclear Management Company, LLC (NMC). 2002. *Point Beach Nuclear Plant Annual Monitoring Report 2001.* Two Rivers, Wisconsin. April 2002.

Nuclear Management Company, LLC (NMC). 2003a. *Point Beach Nuclear Plant Units 1 & 2 Final Safety Analysis Report* (FSAR). Two Rivers, Wisconsin. June 2003.

Nuclear Management Company, LLC (NMC). 2003b. *Point Beach Nuclear Plant Offsite Dose Calculation Manual, Revision 15.* Two Rivers, Wisconsin. June 30, 2003.

Nuclear Management Company, LLC (NMC). 2004a. *Point Beach Nuclear Plant Operating License Renewal Application Environmental Report.* Two Rivers, Wisconsin. February 26, 2004.

Nuclear Management Company, LLC (NMC). 2004b. *Application for Renewed Operating Licenses, Point Beach Nuclear Plant Units 1 and 2.* Two Rivers, Wisconsin. February 26, 2004.

Nuclear Management Company, LLC (NMC). 2004c. *Point Beach Nuclear Plant Annual Monitoring Report 2003.* Two Rivers, Wisconsin, April 2004.

Overstreet, D. F. 1997. "Oneota Prehistory and History." *The Wisconsin Archaeologist,* Vol. 78, Numbers 1 and 2, pp. 250–296.

Peeters, P. 1998. "Into Lake Michigan's Waters. Exotic Fish Took Hold by Many Routes." *Wisconsin Natural Resources Magazine,* June/July, 1998.

Peeters, P. 2004. *Status of the Lake Whitefish Population. Lake Michigan Management Reports.* Wisconsin Department of Natural Resources, Sturgeon Bay, Wisconsin. http://www.dnr.stste.wi.us/org/water/fhp/fish/lakemich/Great%20Lakes%Fishery%20Commission%20Report%202004.pdf (Accessed November 11, 2004).

Ramsdell, J. V., and G. L. Andrews. 1986. *Tornado Climatography of the Contiguous United States.* NUREG/CR-4461, Nuclear Regulatory Commission, Washington, D.C.

Ray, W.J., and L.D. Corkum. 1997. "Predation of Zebra Mussels by Round Gobies, *Neogobius melanostomus.*" *Environmental Biology of Fishes*, Vol. 50, pp. 267-273.

Schloesser, D. W., T. F. Nalepa, and G. L. McKie. 1996. "Zebra Mussel Infestation of Unionid Bivalves (Unionidae) in North America." *American Zoologist* 36, pp. 300-310.

Snyder, Van Vechten & Co. 1878. *Map of Manitowoc County. Historical Atlas of Wisconsin, 1878.* Milwaukee, WI. David Rumsey Map Collection. http://www.davidrumsey.com/ (Accessed August 6, 2004).

Spevacek, C. J. 1985. "The History of the Village of East Two Creeks." *Manitowoc County Historical Society, Occupational Monograph 55.* Manitowoc, Wisconsin.

State of Wisconsin. 2003. *Environmental Radioactivity Survey, Point Beach-Kewaunee, 2002.* Madison, Wisconsin.

State of Wisconsin. 2004a. *Environmental Radioactivity Survey, Point Beach-Kewaunee, 2003.* Madison, Wisconsin.

State of Wisconsin. 2004b. *Highlights of History in Wisconsin. Blue Book 2003-2004: 684–730.* Wisconsin State Legislature. http://www.legis.state.wi.us/lrb/bb/684-730.pdf (Accessed August 4, 2004).

Stein, R.A., M.E. Gaden, and C.I. Goddard. 2003. *Protecting and Restoring the Great Lakes Fishery.* Great Lakes Fishery Commission, Ann Arbor, Michigan. http://www.senate.gov/!epw/108th/Stein_082503.pdf (Accessed December 18, 2003).

Stevenson, K. P., R. F. Boszhardt, C. R. Moffat, P. H. Salkin, T. C. Pleger, J. L. Theler, and C. M. Arzigian. 1997. "The Woodland Tradition." *The Wisconsin Archaeologist*, Vol. 78, Numbers 1 and 2, pp. 140–201.

Stewart, T.W., J.G. Miner, and R.L. Lowe. 1998a. "Quantifying Mechanisms for Zebra Mussel Effects on Benthic Macroinvertebrates: Organic Matter Production and Shell-Generated Habitat." *Journal of the North American Benthological Society*, Vol. 17, pp. 81-95.

Stewart, T.W., J.G. Miner, and R.L. Lowe. 1998b. "Macroinvertebrate Communities on Hard Substrates in Western Lake Erie: Structuring Effects of *Dreissena*." *Journal of Great Lakes Research*, Vol. 24, pp. 868-879.

Stoltman, J. B. 1997. "The Archaic Tradition." *The Wisconsin Archaeologist*, Vol. 78, Numbers 1 and 2, pp. 112–139.

U.S. Atomic Energy Commission (AEC). 1972. *Final Environmental Statement Related to Operation of Point Beach Nuclear Plant Units 1 and 2.* Docket Nos. 50-266 and 50-301. Washington, D.C.

U.S. Census Bureau (USCB). 2000. *Profile of Selected Economic Characteristics: 2000.* Census 2000 Summary File 4 (SF4), Table DP-3 for Manitowoc County, Wisconsin. http://factfinder.census.gov/ (Accessed July 30, 2004).

U.S. Census Bureau (USCB). 2004. *Wisconsin QuickFacts.* http://quickfacts.census.gov/qfd/states/55000.html (Accessed July 30, 2004).

U.S. Environmental Protection Agency (EPA). 2002. *Lake Michigan Lakewide Management Plan (LaMP) 2002.* U.S. Environmental Protection Agency, Chicago, Illinois. http://www.epa.gov/glnpo/lakemich/lm02/index.html (Accessed February 25, 2004).

U.S. Environmental Protection Agency (EPA). 2004a. Letter from M. Leavitt, EPA Administrator, to Wisconsin Governor J. Doyle designating areas of Wisconsin in nonattainment of the 8-hour ozone standard. April 15, 2004. http://www.epa.gov/region5/air/8hours/R5Wisconsin.pdf (Accessed November 24, 2004).

U.S. Environmental Protection Agency (EPA). 2004b. Fact Sheet: Clean Air Act Ozone Rules of 2004. Final Rule Designating and Classifying Areas Not Meeting the National Ambient Air Quality Standard For 8-Hour Ozone. http://www.epa.gov/ozonedesignations/finrulefs.htm (Accessed November 24, 2004).

U.S. Fish and Wildlife Service (FWS). 2001. "Endangered and Threatened Wildlife and Plants; Final Determination of Critical Habitat for the Great Lakes Breeding Population of the Piping Plover." *Federal Register*, Vol. 60, No. 88, pp.22938–22969. Washington, D.C., May 7, 2001.

U.S. Fish and Wildlife Service (FWS). 2003. *Recovery Plan for the Great Lakes Piping Plover (Charadrius melodus)*. Region 3, Fort Snelling, Minnesota. September 2003.

U.S. Fish and Wildlife Service (FWS). 2004. Letter from J. Smith, Field Supervisor, Green Bay Field Office, to A. J. Cayia, Site Vice President, Point Beach Nuclear Plant, Nuclear Management Company. No Subject. February 26, 2004.

U.S. Geological Survey (USGS). 2002. *Water Use in Wisconsin.* Open file report 02-356. http://wi.water.usgs.gov/pubs/publist0604.html (Accessed July 1, 2004).

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

U.S. Nuclear Regulatory Commission (NRC). 2004. *Note to File: Docketing of Material Sent in Support of the Point Beach Nuclear Plant Units 1 and 2 Environmental Review and License Renewal Application.* Washington, D.C.

University of Wisconsin Sea Grant Institute (UWSGI). 2001a. *Fish of Lake Michigan.* University of Wisconsin Sea Grant Institute, Madison, Wisconsin. http://www.seagrant.wisc.edu/greatlakesfish/LakeMichFishIndex.html (Accessed April 28, 2004).

University of Wisconsin Sea Grant Institute (UWSGI). 2001b. *Alewife Watch 2001.* University of Wisconsin Sea Grant Institute, Madison, Wisconsin. http://www.seagrant.wisc.edu/outreach/fisheries/Alewife/alewife.html (Accessed July 14, 2004).

University of Wisconsin Sea Grant Institute (UWSGI). 2002. *Why Are the Alewives Dying?* University of Wisconsin Sea Grant Institute, Madison, Wisconsin. http://www.seagrant.wisc.edu/greatlakesfish/alewifenews.html (Accessed July 14, 2004).

University of Wisconsin. 2004. *University of Wisconsin—Cooperative Extension Website for Manitowoc County Agricultural Statistics.* http://www.uwex.edu/ces/cty/manitowoc/ag/stats.html (Accessed July 31, 2004).

Vogl, W. 1986. "Forest Fires in Manitowoc County—1871." *Manitowoc County Historical Society, Occupational Monograph 58.* Manitowoc, Wisconsin.

We Energies. 2004a. *WDNR Consolidated Reporting System 2003 Hazardous Waste Report Certification.* Milwaukee, Wisconsin. January 2004.

We Energies. 2004b. Letter from N. Cutright, Senior Terrestrial Ecologist, to G. Van Middlesworth, Site Vice President, Nuclear Management Company. No Subject. May 12, 2004.

We Energies 2004c. Letter from S. Schumacher, Environmental Specialist, to J. DeRose, Wisconsin Historical Society. Subject: "Determination of Eligibility of the Biel Fishing Shed Located on the Point Beach Nuclear Power Plant Property, Two Rivers, Manitowoc." September 1, 2004.

We Energies. 2004d. *Piping Plover Habitat on We Energies' Property Near the Point Beach Nuclear Plant.* Milwaukee, Wisconsin. October 13, 2004.

Wei, A., P. Chow-Fraser, and D. Albert. 2004. "Influence of Shoreline Features on Fish Distribution in the Laurentian Great Lakes." *Canadian Journal of Fisheries and Aquatic Sciences*, Vol. 61, pp. 1113-1123.

Wisconsin Department of Administration (WDA). 2004a. *Selected Housing Unit Information For Wisconsin Counties And Municipalities: April 1, 1990 And April 1, 2000.* http://www.doa.state.wi.us/pagesubtext_detail.asp?linksubcatid=379 (Accessed June 30, 2004).

Wisconsin Department of Administration (WDA). 2004b. *Total Population Of Wisconsin Counties And Municipalities: 1970–2000 Census Counts.* http://www.doa.state.wi.us/pagesubtext_detail.asp?linksubcatid=379 (Accessed June 30, 2004).

Wisconsin Department of Administration (WDA). 2004c. *Wisconsin Population Projection Tables: 2000–2030.* http://www.doa.state.wi.us/pagesubtext_detail.asp?linksubcatid=105 (Accessed July 26, 2004).

Wisconsin Department of Administration (WDA). 2004d. *Population Projections for Wisconsin Counties by Age and Sex: 2000–2030.* http://www.doa.state.wi.us/pagesubtext_detail.asp?linksubcatid=105 (Accessed July 26, 2004).

Wisconsin Department of Administration (WDA). 2004e. *Number of Males and Females by Occupation for the Employed Civilian Population 16 Years and Over for Wisconsin Counties and Municipalities: April 1, 2000.* http://www.doa.state.wi.us/pagesubtext_detail.asp?linksubcatid=379 (Accessed June 4, 2004).

Wisconsin Department of Natural Resources (WDNR). 2003a. *Wisconsin's Comprehensive Management Plan to Prevent Further Introductions and Control Existing Populations of Aquatic Invasive Species.* Wisconsin Department of Natural Resources, Madison, Wisconsin. http://www.dnr.state.wi.us/org/water/w,/GLWSP/exotics/compstateansplanfinal10903.pdf (Accessed November 11, 2004).

Wisconsin Department of Natural Resources (WDNR). 2003b. *Lake Michigan Trout and Salmon Frequently Asked Questions.* Wisconsin Department of Natural Resources, Madison, Wisconsin.
http://www.dnr.state.wi.us/org/water/fhp/fish/faq/troutsalmon.htm
(Accessed November 12, 2004).

Wisconsin Department of Natural Resources (WDNR). 2003c. *Monkeyface Quadrula metanevra (Raf.).* Wisconsin Department of Natural Resources, Madison, Wisconsin.
http://www.dnr.state.wi.us/org/land/er/invertebrates/mussels/monkeyface.htm
(Accessed November 24, 2004).

Wisconsin Department of Natural Resources (WDNR). 2003d. *The Wisconsin Lake Sturgeon Management Plan.* Wisconsin Department of Natural Resources, Madison, Wisconsin. http://dnr.wi.gov/org/water/fhp/fish/sturgeon/Index.htm (Accessed November 11, 2004).

Wisconsin Department of Natural Resources (WDNR). 2003e. *Redfin Shiner (Lythrurus umbratilis).* Wisconsin Department of Natural Resources, Madison, Wisconsin.
http://www.dnr.state.wi.us/org/land/er/factsheets/fish/Rdfshn.htm
(Accessed November 24, 2004).

Wisconsin Department of Natural Resources (WDNR). 2003f. *Greater Redhorse (Moxostoma valenciennesi).* Wisconsin Department of Natural Resources, Madison, Wisconsin.
http://www.dnr.state.wi.us/org/land/er/factsheets/fish/Grtred.htm
(Accessed November 22, 2004).

Wisconsin Department of Natural Resources (WDNR). 2004a. WPDES Permit, effective July 1, 2004. WI-0000957-07-0. Madison, Wisconsin. July 1, 2004.

Wisconsin Department of Natural Resources (WDNR). 2004b. *Lake Michigan Integrated Fisheries Management Plan 2003-2013.* Administrative Report No. 56. Wisconsin Department of Natural Resources, Madison, Wisconsin.
http://www.dnr.state.wi.us/org/water/fhp/fish/lakemich/LMIFMP%202003-2013.pdf
(Accessed November 11, 2004).

Wisconsin Department of Natural Resources (WDNR). 2004c. *Choose Wisely. A Health Guide for Eating Fish in Wisconsin.* PUB-FH-824 2004. Wisconsin Department of Natural Resources, Madison, Wisconsin. http://dnr.wi.gov/org/water/fhp/fish/pages/consumption/choosewisely04.pdf (Accessed November 11, 2004).

Wisconsin Department of Natural Resources (WDNR). 2004d. *White Perch (Morone americana).* Wisconsin Department of Natural Resources, Madison, Wisconsin. http://www.dnr.state.wi.us/org/water/wm/GLWSP/exotics/whiteperch.html (Accessed November 12, 2004).

Wisconsin Department of Natural Resources (WDNR). 2004e. *Spiny Waterflea (Bythotrephes cederstroemi) and Fishhook Waterflea (Cercopagis pengoi).* Wisconsin Department of Natural Resources, Madison, Wisconsin. http://www.dnr.state.wi.us/org/water/wm/GLWSP/exotics/spiny.html (Accessed November 12, 2004).

Wisconsin Department of Natural Resources (WDNR). 2004f. *WDNR–Natural Heritage Inventory On-line Database.* http://www.dnr.state.wi.us/org/land/er/nhi/NHI_ims/onlinedb.htm (Accessed August 3, 2004).

Wisconsin Department of Natural Resources (WDNR). 2004g. *Piping Plover* (*Charadrius melodus*). http://www.dnr.state.wi.us/org/land/er/factsheets/birds/PLOVER.HTM (Accessed August 3, 2004).

Wisconsin Department of Natural Resources (WDNR). 2004h. *Dune Thistle* (*Cirsium pitcheri*). http://www.dnr.state.wi.us/org/land/er/factsheets/birds/THISTLE.htm (Accessed August 3, 2004).

Wisconsin Department of Natural Resources (WDNR). 2004i. *Dwarf Lake Iris* (*Iris lacustris*). http://www.dnr.state.wi.us/org/land/er/factsheets/birds/dwarf.htm (Accessed August 3, 2004).

Wisconsin Department of Natural Resources (WDNR). 2004j. *Wisconsin Natural Heritage Inventory Natural Community Descriptions.* http://www.dnr.state.wi.us/org/land/er/communities/descriptions.htm (Accessed August 3, 2004).

Wisconsin Department of Natural Resources (WDNR). 2004k. *Snow Trillium, Dwarf White Trillium* (*Trillium nivale*). http://www.dnr.state.wi.us/org/land/er/factsheets/birds/snwtril.htm (Accessed August 3, 2004).

Wisconsin Department of Revenue (WDR). 2003a. *Municipal and County Aid (State Shared Revenues).* http://www.dor.state.wi.us/report/s.html#shared (Accessed July 29, 2004).

Wisconsin Department of Revenue (WDR). 2003b. *County and Municipal Revenues and Expenditures 2001.* Bulletin No. 101, February 2003. http://www.dor.state.wi.us/report/r.html#revenues (Accessed July 29, 2004).

Wisconsin Department of Revenue (WDR). 2004. *County and Municipal Revenues and Expenditures 2002.* Bulletin No. 102, February 2004. http://www.dor.state.wi.us/report/r.html#revenues (Accessed July 29, 2004).

Wisconsin Department of Transportation (WDOT). 2002. *Manitowoc County Annual Average Daily Traffic.* http://www.dot.wisconsin.gov/travel/counts/manitowoc.htm (Accessed July 13, 2004).

Wisconsin Department of Workforce Development (WDWD). 2004. *LMI -- Local Area Unemployment Statistics (LAUS) 2004.* http://www.dwd.state.wi.us/lmi/laus_view_current.htm#T (Accessed July 27, 2004).

Wisconsin Electric Power Company (WEPCO). 1976. Point Beach Nuclear Plant Final Report on Intake Monitoring Studies Performed by Wisconsin Electric Power Company in Fulfillment of Condition of Wisconsin Pollution Discharge Elimination System Permit No. WI-0000957. Wisconsin Electric Power Company, Milwaukee, Wisconsin. June 1, 1976.

Wisconsin Electric Power Company (WEPCO). 1991. Letter from D. Lee to B. Barbieur, WDNR. Subject: "WPDES Permit No. WI-0000957, Point Beach Nuclear Plant Zebra Mussel Control Plan." December 3, 1991.

Wisconsin Historical Society (WHS). 1996. *The Farm Landscape.* Compiled by P. L. Beedle. Edited by G. M. Gyrisco. Wisconsin Historical Society, Madison, Wisconsin.

Wisconsin Historical Society (WHS). 2000. *Mapping Wisconsin History: Teacher's Guide and Student Materials. Native American Treaty Lands 1825.* http://www.wisconsinstories.org/2001season/native/map/nj_map_1825.html (Accessed August 4, 2004).

Wisconsin Historical Society (WHS). 2004a. *Wisconsin National Register of Historic Places. Kewaunee County.* http://www.wisconsinhistory.org/hp/register/search.asp?cnty=KE (Accessed August 6, 2004).

Wisconsin Historical Society (WHS). 2004b. *Wisconsin National Register of Historic Places. Manitowoc County.* http://www.wisconsinhistory.org/hp/register/search.asp?cnty=MN (Accessed August 6, 2004).

Wisconsin Public Service Corporation. 1972. *Kewaunee Nuclear Power Plant Environmental Report: Operating License Stage.* Green Bay, Wisconsin. December 1972.

Wojta, J. F. 1945. *A History of the Town of Two Creeks, Manitowoc County, Wisconsin.* Privately published. Available at Lester Public Library, Two Rivers, Wisconsin.

Yanda, M., Geographic Information Systems Coordinator, Manitowoc County, Wisconsin. 2004. Email correspondence documenting transmittal of land use cover inventory to W. Rued, Lawrence Livermore National Laboratory. June 1, 2004.

# 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 off-site radiological impacts from the fuel cycle and from high-level waste and spent fuel disposal).

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

For issues that meet the three Category 1 criteria, no additional plant-specific analysis is required 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 Point Beach Nuclear Plant Units 1 and 2 (PBNP) because they are related to plant design features or site characteristics not found at PBNP are listed in Appendix F.

The potential environmental impacts of refurbishment actions would be identified, and the analysis would be summarized within this section, if such actions were planned. Nuclear Management Company, LLC (NMC) indicated that it has performed an evaluation of structures and components pursuant to Title 10 of the Code of Federal Regulations (CFR) 54.21 to identify activities that are necessary to continue operation of PBNP 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 (NMC 2004).

**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, NMC stated that the replacement of these components and the additional inspection activities are within the bounds of normal plant component replacement and inspections; therefore, they are not expected to affect the environment outside the bounds of plant operations as evaluated in the final environmental statement (U.S. Atomic Energy Commission 1972). In addition, NMC's evaluation of structures and components as required by 10 CFR 54.21 did not identify any major plant refurbishment activities or modifications necessary to support the continued operation of PBNP 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."

Nuclear Management Company, LLC. (NMC). 2004. *Point Beach Nuclear Plant Operating License Renewal Application Environmental Report.* Two Rivers, Wisconsin. February 2004.

U.S. Atomic Energy Commission. 1972. *Final Environmental Statement Related to Operation of Point Beach Nuclear Plant Units 1 and 2.* Dockets No. 50-266 and 50-301, Washington, D.C.

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

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

# 4.0 Environmental Impacts of Operation

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

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

(2) A single significance level (i.e., SMALL, MODERATE, or LARGE) has been assigned to the impacts (except for collective offsite radiological impacts from the fuel cycle and from high-level waste [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 related to operation during the renewal term that are listed in Table B-1 of Title 10 of the Code of Federal Regulations (CFR) Part 51, Subpart A, Appendix B, and are applicable to the Point Beach Nuclear Plant Units 1 and 2 (PBNP). Section 4.1 addresses issues applicable to the PBNP cooling system. Section 4.2 addresses issues related to transmission lines and onsite land use. Section 4.3 addresses the radiological impacts of normal operation, and Section 4.4 addresses issues related to the socioeconomic impacts of normal operation during the renewal term. Section 4.5 addresses issues related to groundwater use and quality, while Section 4.6 discusses the impacts of renewal-term operations on threatened and endangered species. Section 4.7 addresses potential new information that was raised during the scoping period, and Section 4.8 discusses cumulative

(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.

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 PBNP because they are related to plant design features or site characteristics not found at PBNP are listed in Appendix F.

## 4.1 Cooling System

Category 1 issues in Table B-1 of 10 CFR Part 51, Subpart A, Appendix B, that are applicable to the PBNP cooling system operation during the renewal term are listed in Table 4-1. Nuclear Management Company, LLC (NMC) stated in its Environmental Report (ER) (NMC 2004a) that it is not aware of any new and significant information associated with the renewal of the PBNP operating licenses (OLs). The staff has not identified any significant new information during its independent review of the NMC ER (NMC 2004a), the staff's site visit, the scoping process, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts related to these issues beyond those discussed in the GEIS. For all of 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.

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

| ISSUE – 10 CFR Part 51, Subpart A, Appendix B, Table B-1 | GEIS Sections |
|---|---|
| SURFACE WATER QUALITY, HYDROLOGY, AND USE (FOR ALL PLANTS) | |
| Altered current patterns at intake and discharge structures | 4.2.1.2.1; 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 |

**Table 4-1.** (contd)

| ISSUE – 10 CFR Part 51, Subpart A, Appendix B, Table B-1 | GEIS Sections |
|---|---|
| AQUATIC ECOLOGY (FOR ALL PLANTS) | |
| 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 |

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 NMC ER, the staff's site visit, the scoping process, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts of 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.

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

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

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

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

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

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

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

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

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

  The staff has not identified any significant new information during its independent review of the NMC ER, the staff's site visit, the scoping process, 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 NMC ER, the staff's site visit, the scoping process, or its evaluation of other available information including the Wisconsin Pollutant Discharge Elimination System (WPDES) permit for PBNP, or discussion with the Wisconsin Department of Natural Resources (WDNR 2004a). 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 NMC ER, the staff's site visit, the scoping process, its evaluation of other available information including the WPDES permit for PBNP, or discussion with the WPDES compliance office (WDNR). 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 NMC ER, the staff's site visit, the scoping process, its evaluation of other available information including the WPDES permit for PBNP, or discussion with the WDNR. 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 NMC ER, the staff's site visit, the scoping process, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts of 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 NMC ER, the staff's site visit, the scoping process, or its evaluation of available information. Therefore, the staff concludes that there are no impacts of accumulation of contaminants in sediments or biota during the renewal term beyond those discussed in the GEIS.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

- 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 NMC ER, the staff's site visit, the scoping process, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts of noise during the renewal term beyond those discussed in the GEIS.

The Category 2 issues related to cooling system operation during the renewal term that are applicable to PBNP 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 PBNP 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 (FOR PLANTS WITH ONCE-THROUGH AND COOLING POND HEAT-DISSIPATION SYSTEMS)** | | | |
| Entrainment of fish and shellfish in early life stages | 4.2.2.1.2; 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 NMC ER (NMC 2004a); visited the PBNP site; and reviewed the applicant's WPDES Permit No. WI-0000957-07-0 (Table E-2, Appendix E), effective on July 1, 2004, and in force until June 30, 2009 (WDNR 2004a).

Section 316(b) of the Clean Water Act of 1977 (CWA) requires that the location, design, construction, and capacity of the cooling-water intake structure 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.

On July 9, 2004, the U.S. Environmental Protection Agency (EPA) published a final rule in the *Federal Register* (EPA 2004) addressing cooling-water intake structures at existing power plants 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 and establishes 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, implemented through National Pollutant Discharge Elimination System (NPDES) (or equivalent state) 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 (or equivalent state) permit. Licensees may be required as part of the permit renewal to alter the intake structure, redesign the cooling system, modify station operation, or take other mitigation measures as a result of this regulation. The new performance standards are designed to significantly reduce entrainment losses due to water withdrawals associated with cooling water intake structures used for power production. Any site-specific mitigation would result in less impact from entrainment during the license renewal period.

Condenser cooling water is withdrawn from Lake Michigan through two, 4.3-m (14-ft) diameter pipes buried beneath the lakebed. Water enters these pipes at the offshore intake structure, a cylinder of steel pilings filled with limestone blocks that stands upright on the lakebed approximately 530 m (1750 ft) offshore in 6.7 m (22 ft) of water (NMC 2004a). At peak capacity, water is circulated at a maximum rate of 22 $m^3/s$ (783 cfs) for each unit.

As a condition of an earlier WPDES permit, the applicant was required to perform a one-year intake monitoring study to determine potential impacts to the environment caused by the cooling-water intake system (WEPCO 1976). Forty-nine entrainment samples were collected between April 15 and October 31, 1975. It was estimated that 2,082,525 fish larvae were entrained at PBNP during the study period. Among these, 20 percent (416,505) were alewife (*Alosa pseudoharengus*), 61 percent (1,270,340) were rainbow smelt (*Osmerus mordax*), 17 percent (354,029) were sculpin (probably slimy sculpin [*Cottus cognatus*] based on impingement collections), and two percent (41,651) were longnose sucker (*Catostomus catostomus*). Additionally, an estimated 4,661,410 fertilized alewife eggs were entrained (WEPCO 1976).

To interpret the impacts of entrainment on the fish community of Lake Michigan, entrainment losses must be compared to the distribution, abundance, and life history of the species that occur near the PBNP and assess the associated impacts on individual fish populations and community structure.

Entrainment of fish eggs can be compared to the production of eggs per fish. For example, an individual alewife produces between 10,000 to 12,000 eggs (Scott and Crossman 1973).

Therefore, the 4.66 million alewife eggs entrained in 1975 (WEPCO 1976) would be equivalent to the egg production output of only 388 to 460 gravid females. Levels of egg entrainment at PBNP would be expected to be relatively low as the habitats in the plant vicinity are not preferred spawning habitat (e.g., coastal wetlands, bedrock, sandy beach-dunes, or bluffs; Wei et al. 2004). In contrast, egg entrainment (comprised mostly of alewives) at D.C. Cook Nuclear Plant (CNP), which is located on the eastern shore of Lake Michigan in an area of extensive sandy beach-dune habitat, ranged from 743.2 million to 7.0 billion eggs per year between 1975 and 1982 (Noguchi et al. 1985).

Natural mortality of alewife larvae has been shown to be in excess of 90 percent (WEPCO 1976). Therefore, of the 416,505 alewife larvae entrained at PBNP during 1975, it could be assumed that only 41,650 would have survived to be age I alewives. In 1972, there were about 10 billion age I alewives in Lake Michigan. Therefore, loss of alewife larvae due to entrainment at PBNP represents only a small fraction of one percent of the standing crop of alewives in Lake Michigan (WEPCO 1976). Annual mortality for older alewives is 40 to 60 percent (DFO 2004). Using the more conservative 60 percent mortality rate, an expected 25,000 alewife larvae would have been lost due to entrainment at PBNP. This is a very small percentage of the billions of adult alewives that occur in Lake Michigan (i.e., 16.5 billion in 2003; [Madenjian et al. 2004]).

Using similar assumptions, the 1,270,340 rainbow smelt larvae entrained in 1975 would equate to 127,034 age I rainbow smelt. It was conservatively estimated that nearly 60 million age I rainbow smelt occurred in Lake Michigan in 1974 (WEPCO 1976). Therefore, entrained rainbow smelt larvae at PBNP would have been only 0.2 percent of this amount.

In the early 1970s, there was an estimated 100 to 200 million sculpins (all species combined) beyond the larval stage in Lake Michigan (WEPCO 1976). Therefore the 354,029 sculpin larvae entrained at PBNP during 1975 would equate to a small fraction of one percent of the lakewide sculpin population (assuming a 90 percent larval mortality rate). Overall, larval entrainment losses at PBNP during 1975 represent a very small percentage of the lakewide production for the alewife, rainbow smelt, and slimy sculpin. Furthermore, as long as discharge temperatures do not exceed 37.8°C (100°F) some degree of entrainment survival can be expected (LaJeone and Monzingo 2000).

Macroinvertebrates entrained between April 15 and October 31, 1975, included the amphipod *Diporeia* spp. and the opossum shrimp *Mysis relicta* (WEPCO 1976). Approximately 14 million *Diporeia* spp. and 10 million *Mysis relicta* were entrained during this period. *Diporeia* spp. densities near PBNP at the 7.3 (24-ft) contour were estimated at about 1.2 million/ha (3 million/ac), while at deeper depths they have been estimated at densities of 14 million/ha (35 million/ac) (WEPCO 1976).

No significant phytoplankton mortality from thermal and physical stresses associated with entrainment was observed during the early years of plant operations. Zooplankton mortality varied from 8 to 19 percent of entrained organisms (AEC 1972). This level of entrainment mortality would not have a significant impact on the nearshore zooplankton community in the area of the PBNP.

Based on its review of the WEPCO (1976) study, the WDNR determined that the location and operation of the PBNP intake had minimal environmental impact as a result of entrainment (WDNR 1978).

The current WPDES permit for PBNP takes into account the new EPA 316(b) requirements for once-through cooling systems. The permit requires the applicant to conduct a study of the cooling-water intake for potential adverse environmental impacts in accordance with Section 316(b) of the CWA. The proposal for the study is due to WDNR on December 31, 2004, with the comprehensive demonstration study due in 2007 (AEC 1972; WDNR 2004a). Any requirements resulting from the water intake study would be reflected in future WPDES permits. Under the conditions of the current WPDES permit, the location and operation of the intake will continue to have minimal environmental impact.

The staff considered mitigation measures for the continued operation of PBNP. Based on its assessment to date, the staff expects that the measures in place at PBNP (i.e., an offshore intake located where there are no bays or points to act as fish nurseries or other attracting features [except for the limestone blocks of the intake structure itself]; and the intake structure constructed in a location devoid of unique spawning habitat [NMC 2004a; Wei et al. 2004]) provide adequate mitigation for impacts related to entrainment. The acoustic fish-deterrent system installed in 2003 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 NMC ER (NMC 2004a), visited the PBNP site, and reviewed the applicant's WPDES Permit No. WI-0000957-07-0 (Table E-2, Appendix E), effective on July 1, 2004, and in force until June 30, 2009 (WDNR 2004a).

Condenser cooling water is withdrawn from Lake Michigan through two, 4.3-m (14-ft) diameter pipes buried beneath the lakebed. Water enters these pipes at the offshore intake structure, a cylinder of steel pilings filled with limestone blocks that stands upright on the lakebed approximately 530 m (1750 ft) offshore in 6.7 m (22 ft) of water (NMC 2004a). At peak capacity, water is circulated at a maximum rate of 22 $m^3/s$ (783 cfs) for each unit. Bar grates and eight traveling screens with 0.95-$cm^2$ (0.38-$in.^2$) mesh are located in the forebay, where debris and impinged fish can be removed before they enter the cooling-water system.

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 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 and establishes 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 (or equivalent state) 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 (or equivalent state) permit. Licensees may be required as part of the permit 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 from impingement during the renewal period.

As a condition of an earlier WPDES permit, the applicant was required to perform a one-year intake monitoring study (March 1, 1975, to February 29, 1976) to determine potential impacts to the environment caused by the cooling-water intake system (WEPCO 1976). Further impingement studies were carried out from 2001 to 2003. The results of these studies are summarized below.

During a one-year period between March 1, 1975, and February 29, 1976, an impingement study was conducted at PBNP. Over 313,000 fish from 31 species (including one hybrid trout) were collected in 88 twenty-four hour impingement samples that were generally obtained every fourth day of plant operation (WEPCO 1976). Total estimated impingement for the year was 1,056,724 fish, with numbers of fish impinged monthly ranging from 113 (March, 1975) to

467,869 (June, 1975). Except for alewife and rainbow smelt, all species were impinged infrequently or in low numbers. Therefore, an impingement summary for most species is more readily evaluated by species groups. The total number of alewives and rainbow smelts impinged during the year was: alewife - 886,394 (83.88 percent), and rainbow smelt - 161,389 (15.27 percent); both species comprising 99.15 percent of all fish impinged. The total number of the other fish groups impinged were: forage fishes - 7285 (0.69 percent); salmonids - 468 (0.04 percent); game and food fishes - 979 (0.09 percent); and rough fishes - 209 (0.02 percent) (WEPCO 1976).

The number of impinged alewives represented only about 0.003 percent of the Lake Michigan alewife population and 0.009 percent of the annual lakewide mortality of alewives during the early 1970s; and only 0.005 percent of the adult alewives in Lake Michigan in 2003 (WEPCO 1976; Madenjian et al. 2004). In addition, most of the impinged alewives were assumed to be dead or dying individuals associated with the annual spring die-off (WEPCO 1976). At two coal-fired power plants located at Lake Erie, more than 73 percent of the impinged fishes (excluding gizzard shad [*Dorosoma cepedianum*]) was comprised of dead or terminally ill fishes whose condition was not a result of impingement. Seventy-seven percent of the total impinged fishes at these plants were gizzard shad. Most of them exhibited the typical symptoms associated with natural winter and spring mortality (White et al. 1987). Therefore, impinged fish, including most of the alewives at PBNP, cannot be considered wholly the result of plant-induced impingement mortality.

The estimated 161,389 rainbow smelt impinged at PBNP during the 1975 to 1976 study had an equivalent weight of 973 kg (2145 lb) (WEPCO 1976). In comparison, the 2003 commercial catch of rainbow smelt for the Wisconsin waters of Lake Michigan totaled 46,075 kg (101,578 lb) (Hogler and Surendonk 2004); and the lake-wide biomass of rainbow smelt was estimated at 1386 metric tons (1528 tons [1,386,000 kg or 3,369,240 lbs]) (Madenjian et al. 2004). By weight, the impinged rainbow smelt only represent 2.1 percent and 0.07 percent of the commercial and lake-wide biomass, respectively, of rainbow smelt.

Excluding alewife and rainbow smelt, 12 species comprised the forage group. The slimy sculpin was the most numerous of these, and would account for the prevalence of sculpin larvae collected in the entrainment samples (discussed in Section 4.1.1). Among the other forage species impinged, the more numerous included gizzard shad and ninespine stickleback (*Pungitius pungitius*) (WEPCO 1976).

Most of the salmon and trout species (salmonids) that occur in the Wisconsin waters of Lake Michigan were found in impingement samples. These included rainbow trout (*Oncorhynchus mykiss*), brown trout (*Salmo trutta*), brook trout (*Salvelinus fontinalis*), lake trout (*S. namaycush*), tiger trout (hybrid brook trout and brown trout, no longer stocked in the Wisconsin waters of Lake Michigan), Chinook salmon (*tshawytscha*), and coho salmon (*O. kisutch*). The total impingement for the trout and salmon species were 452 and 16, respectively. 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). The impinged salmonids were equated to a loss of only 56 salmonids, or 0.013 percent, of the recreational catch of 1974. This was based on an estimate that 12 percent of the stocked salmonids were caught by fishermen (WEPCO 1976). In 2003, the sport fishery catch for salmonids (lake trout, rainbow trout, brown trout, coho salmon, and Chinook salmon) in the Wisconsin waters of Lake Michigan totaled 464,327 (Eggold 2004). The 468 salmonids estimated to have been impinged in the WEPCO (1976) study are only 0.1 percent of this total.

The game and food fishes collected in impingement samples included three coolwater species (bloater [*Coregonus hoyi*], lake whitefish [*C. clupeaformis*], and round whitefish [*Prosopium cylindraceum*]) and six warmwater species (northern pike [*Esox lucius*], channel catfish [*Ictalurus punctatus*], largemouth bass [*Micropterus salmoides*], bluegill [*Lepomis macrochirus*], and yellow perch [*Perca flavescens*]). As only a total of 979 individuals of these species were impinged (WEPCO 1976), their loss would have an insignificant effect on the Lake Michigan populations of these species.

The rough fishes impinged at PBNP included common carp (*Cyprinus carpio*), white sucker (*Catostomus commersoni*), and longnose sucker. As only 209 individuals were impinged (WEPCO 1976), their loss would not be considered significant.

Generally, immature fish were more prevalent in the impingement samples (WEPCO 1976). This is attributed to: (1) the greater relative abundance of younger fish, (2) juvenile fish of some species may concentrate in nearshore waters, and (3) immature fish are weaker swimmers than adults. Impinged fish smaller than 15 cm (6 in.) could potentially pass through the openings in the screenwash collection basket and be returned to the lake. However, the intake screens are cleaned either on a regular schedule (e.g., every shift change) or when a pressure differential value is exceeded across the screens due to fouling. The extended period of time the fish remain on the intake screens, in addition to the high-pressure spray water during the screen cleaning process, would result in a potentially high mortality rate to the impinged fish. Larger fish retained with other debris collected in the screenwash collection basket are not returned to the lake. Therefore, there is no impingement survival for larger fish.

Based on its review of the WEPCO (1976) study, the WDNR determined that the location and operation of the PBNP intake had minimal environmental impact as a result of impingement (WDNR 1978). None of the State-listed fish species that may occur near PBNP (discussed in Section 2.2.5) were collected in the impingement samples.

In 2003, NMC installed a permanent fish deterrent system around the intake structures to reduce fish, particularly alewife, impingement. This system makes use of high-frequency sound

(125 kHz) to minimize the influx of fish into the intake structures. The decision to add a fish-deterrent system was based in part on an unusual event at Unit 2 on June 27, 2001, when an influx of thousands of alewives caused a reduction in intake water levels. The clogged intake screens reduced water levels in the plant circulating water pump bay area that supplies cooling water to the plant. Some of the traveling water screens were severely damaged by the weight of the fish. Fish baskets were ripped off, and some screens were bowed. The condenser water boxes and condensate coolers were partially plugged with fish. The volume of fish removed from the forebay, the condenser water boxes, and the condensate coolers following the June 27, 2001, event was estimated at 4500 kg (10,000 lb). Another large influx of alewives into the forebay occurred on July 3, 2001. Approximately 1700 kg (3800 lb) of fish were removed from the forebay during this event. A third event occurred on July 7, 2001, with approximately 1300 kg (3000 lb) of fish removed from the forebay (WEPCO 2000; NMC 2001). NMC attributed these incursions to several factors, predominately the attraction of alewives to the warm water discharge. There was exceptionally cold lake water that summer. This suggested that, at some point, the discharge plume may have drifted over the intakes (NMC 2001). There was an estimated 42,876 metric tons (47,262 tons) of alewives in Lake Michigan in 2003 (Madenjian et al. 2004). The loss of the alewives due to this unusual impingement event was insignificant relative to the lakeside population levels. The fish deterrent system used at PBNP is identical to the system currently in use at the James A. Fitzpatrick Nuclear Plant (FNP) (Ross et al. 1993) on Lake Ontario and at CNP located on the eastern shore of Lake Michigan near Bridgman, Michigan. The system has a minimum sound pressure of 170 dB at about 10 m (10.8 ft) from the intake and 190 dB at 1 m (3 ft) from the intake (Ross et al. 1993).

Operation of the fish-deterrent system at the FNP decreased fish densities near the intake 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). Since the system was installed at PBNP, NMC staff have anecdotally observed avoidance behavior by schools of alewife.

After the modification of the intake (i.e., change from a partially above- to below-water structure), NMC recorded birds and fish recovered from the trash basket associated with the screen-wash system for the traveling screens from 2001 to 2003. NMC reported these results to the U.S. Fish and Wildlife Service (FWS) (NMC 2002, 2003a, 2004b). The following summarizes the results from those reports.

In the June 1, 2001, to December 31, 2003 monitoring program (NMC 2002, 2003a, 2004b), fish larger than 15 cm (6 in.) contributed to a greater percentage of impinged fish than what was found in the previous investigation by WEPCO (1976). This was due to the fact that only fish retained in the screen-wash basket were analyzed, rather than all fishes impinged. As a result, a greater percentage of the collected fish were salmonids, larger game and food fish species, and larger rough fish species; with a low prevalence of smaller forage fish. During the course of the study, 110 salmonids, 288 game and food fish, 932 rough fish, 62 unidentifiable fish, and 226 other fish (i.e., 195 alewives <15 cm [<6 in.], 27 unidentifiable fish <15 cm [<6 in.], and four unidentifiable forage fish >15 cm [>6 in.]) were collected. About 20 percent of the fish from the salmonid, game and food fish, and rough fish groups could not be identified to species. Among those that could be identified, the major species collected were: lake trout (salmonid group), burbot (*Lota lota*) and lake whitefish (*Coregonus clupeaformis*) (food and game group), and freshwater drum (*Aplodinotus grunniens*) and suckers (no species named) (rough fish group) (NMC 2002, 2003a, 2004b). Based on commercial, recreational, or lake-wide populations for the fish caught during the impingement monitoring study (Section 2.2.5), the low number of fish impinged would have a negligible impact on the Lake Michigan fish community.

No double-crested cormorants were collected in the June 1, 2001, to December 31, 2003 impingement samples (NMC 2002, 2003a, 2004b). A total of 33 birds were collected. These were primarily gull species.

The current WPDES permit for PBNP takes into account the new EPA 316(b) requirements for once-through cooling systems. The permit requires the applicant to conduct a study of the cooling-water intake for potential adverse environmental impacts in accordance with Section 316(b) of the CWA. The proposal for the study is due to WDNR on December 31, 2004, with the "comprehensive demonstration study" due in 2007 (WDNR 2004a). Any requirements resulting from the water intake study would be reflected in future WPDES permits. Under the conditions of the current WPDES permit, the location and operation of the intake will continue to have minimal environmental impact.

The staff considered mitigation measures for the continued operation of PBNP. Based on the assessment to date, the staff expects that the measures in place at PBNP (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 limestone blocks of the intake structure]; and the intake structure constructed in a location devoid of unique spawning habitat [AEC 1972; NMC 2004a; Wei et al. 2004]) provide mitigation for impacts related to impingement. The acoustic fish-deterrent system installed in 2003 also reduces fish impingement, especially for species such as alewife. The staff concludes that the potential impacts of impingement of fish and shellfish in the early life stages into the cooling water intake system are SMALL, and further mitigation measures should not be warranted.

### 4.1.3 Heat Shock

For plants with once-through cooling systems, the effects of heat shock are listed as a Category 2 issue and require plant-specific evaluation before license renewal. The NRC considers impacts on fish and shellfish that result from heat shock to be a Category 2 issue because of continuing concerns about thermal discharge effects and the possible need to modify thermal discharges in the future in response to changing environmental conditions (NRC 1996). Information to be considered includes (1) the type of cooling system (whether once-through or cooling pond) and (2) evidence of a CWA Section 316(a) variance or equivalent State documentation. To perform this evaluation, the staff reviewed the NMC ER (NMC 2004a); visited the PBNP site; reviewed the applicant's 316(a) demonstration submitted to the WDNR; and reviewed the applicant's WPDES Permit No. WI-0000957-07-0 (Table E-2, Appendix E), effective on July 1, 2004, and in force until June 30, 2009 (WDNR 2004a).

Section 316(a) of the CWA establishes a process whereby applicants can obtain facility-specific thermal discharge limits (CWA 1977). Based on the thermal studies it conducted in 1975, WEPCO submitted an application to WDNR for exemption from thermal standards (equivalent to a CWA Section 316[a] demonstration). WDNR approved the exemption from the thermal standards, and the current WPDES permit, WI-0000957-07-0, does not contain thermal effluent limitations. However, the applicant is required to monitor the temperature daily at the discharge and report these data on a yearly basis (WDNR 2004a).

As described in Section 2.1.3, PBNP has a once-through heat-dissipation system that uses water from Lake Michigan for condenser cooling. Water is circulated through the condensers and returned to the lake through two steel piling troughs extending in opposite directions (at a 30-degree angle from plant centerline) approximately 61 m (200 ft) out into Lake Michigan. The average temperature differential between the intake and discharge was 16°C (29°F), with a maximum of 19°C (34°F). During the winter de-icing period, the ambient Lake Michigan water temperature is about 0.6°C (33°F). Highest intake temperature during the January-February, 1976, period was 15.6°C (60°F) indicating that the maximum theoretical increase in intake temperatures due to de-icing was 15°C (27°F), with an average influent temperature of 7.8°C (46°F), giving a routine temperature increase of 7.2°C (13°F) (WEPCO 1976). A predictive model was used to estimate the extent of the thermally-affected zones for varying temperatures and weather conditions. The applicant estimated that the total surface area enclosed within the 0.6°C, 1.1°C, 2.8°C, 5.6°C, and 8.3°C (1°F, 2°F, 5°F, 10°F, and 15°F) isotherms would be 1781 ha, 465 ha, 146 ha, 8 ha, and 2.4 ha (4400 ac, 1150 ac, 360 ac, 20 ac, and 6 ac), respectively, when both units are operating. Out to depths of 6 m (20 ft), the temperature field would probably extend to the bottom. Beyond a depth of 6 m (20 ft), as depth increases, the thermal plume would be expected to become progressively shallower and confined to the surface layer. This would extend to the limit of stability of the thermal plume which is generally accepted as the 0.6°C (1°F) isotherm (AEC 1972). Lake Michigan has a surface area of 5.78 million ha (14.28 million ac), so any thermal influence of PBNP on aquatic species would be very localized.

Any thermal plume impacts can be considered to be very localized due to the small maximum plume size relative to that within the nearshore areas of northwestern Lake Michigan. Also, discharges are located within a relatively featureless sandy substrate that has 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; and (3) no substantial unique spawning grounds occur in the plant area (AEC 1972; NMC 2004a, Wei et al. 2004). Also, local currents are sufficiently strong that the substrate is continually scoured resulting in relatively turbid waters that are not attractive to fish species as a spawning area (AEC 1972).

The PBNP 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. Fish and other biota are constantly exposed to large, natural fluctuations of water temperatures, especially during upwellings and downwellings which are a common feature in the nearshore zone to which aquatic biota have adapted (Jude 1995). The inshore waters in the PBNP area reach an annual maximum of 14.4 to 20.6°C (58 to 69°F) (AEC 1972). Thus the thermal discharge temperature at the point of discharge during summer would normally range as high as 30.6 to 36.7°C (87 to 98°F), with a predicted maximum of 39.4°C (103°F). Generally, the maximum plume temperature differential would be within the tolerance range for most warmwater species (Talmage and Opresko 1981). Furthermore, the thermal plume encompassed by the 0.6 to 2.8°C (1 to 5°F) isotherms are sufficiently large that fishes would not be abruptly exposed to higher temperature differentials that could be potentially harmful. Coldwater species, such as salmonids, would be able to avoid adverse temperatures. Also, no strong currents or physical obstruction are present that would force fish to remain in areas of potentially harmful water temperatures (AEC 1972).

The WDNR is in the process of developing thermal effluent rules based on water quality. It is likely that the current discharge will need to be evaluated against these new rules. This evaluation will be covered under the WPDES permitting process, and NMC will comply with any additional applicable permit requirements regarding thermal discharge that may be imposed in the future.

The staff reviewed the available information, including that provided by the applicant, the staff's site visit, the WPDES permit, the 316(a) demonstration, 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 are SMALL, and further mitigation measures should not be warranted.

## 4.2 Transmission Lines

The NMC ER (NMC 2004a) describes four transmission lines that connect PBNP with the transmission system (Figure 2-4 and Table 2-1). These transmission line rights-of-way (ROW) cover approximately 791 ha (1955 ac) over a total length of approximately 117 km (73 mi). Tree trimming is normally required only every 5 to 7 years, depending on vegetation growth rates in a given area. Clearing activities are dependent upon the types and amount of vegetation in the ROWs. Clearing may include tractor mowing, manual chainsaw clearing, and application of herbicides by a State-licensed, commercial applicator.

Category 1 issues in 10 CFR Part 51, Subpart A, Appendix B, Table B-1, that are applicable to transmission lines from PBNP are listed in Table 4-3. The applicant stated in its ER that it is not aware of any new and significant information associated with the renewal of the PBNP OLs. The staff has not identified any significant new information during its independent review of the ER (NMC 2004a), the staff's site visit, the scoping process, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts related to these issues beyond those discussed in the GEIS. For all of those issues, the staff concluded in the GEIS that the impacts are SMALL, and additional plant-specific mitigation measures are not likely to be sufficiently beneficial to be warranted.

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

| ISSUE – 10 CFR Part 51, Subpart A, Appendix B, Table B-1 | GEIS Sections |
|---|---|
| TERRESTRIAL RESOURCES | |
| Power line right-of-way management (cutting and herbicide application) | 4.5.6.1 |
| Bird collisions with power lines | 4.5.6.2 |
| Impacts of electromagnetic fields on flora and fauna (plants, agricultural crops, honeybees, wildlife, livestock) | 4.5.6.3 |
| Flood plains and wetland 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. (For each issue below, the "NMC ER" refers to NMC 2004a.)

- 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 NMC ER, the staff's site visit, the scoping process, consultation with the FWS and the WDNR, or its evaluation of other information. Therefore, the staff concludes that there are no impacts of power line right-of-way maintenance during the renewal term beyond those discussed in the GEIS.

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

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

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

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

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

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

- 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 NMC ER, the staff's site visit, the scoping process, 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 NMC ER, the staff's site visit, the scoping process, 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 rights-of-way. Based on information in the GEIS, the Commission found that

> Ongoing use of power line right of ways 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 NMC ER, the staff's site visit, the scoping process, or its evaluation of other information. Therefore, the staff concludes that there are no impacts of power line rights-of-way on land use during the renewal term beyond those discussed in the GEIS.

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

**Table 4-4.** Category 2 and Uncategorized Issues Applicable to PBNP 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 1996), the staff found that it was not possible to determine the significance of the electric shock potential without a review of the conformance of each nuclear plant transmission line with National Electrical Safety Code (NESC) criteria (NESC 1997). 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.

In its supplement to the ER for operating Point Beach Unit 2 (WEPCO 1971), WEPCO (the operator prior to NMC) identified three 345-kilovolt (kV) transmission lines that were built to connect PBNP to the electric grid. A fourth 345-kV transmission line was constructed by Wisconsin Public Service Corporation to connect the Kewaunee Nuclear Power Plant (KNPP) to the substation at PBNP (see Section 2.1.7 for additional details). WEPCO and the Wisconsin Public Service Corporation have since transferred ownership of their transmission lines to the American Transmission Company (ATC). These lines are approximately 118 km (73 mi) long and occupy approximately 791 ha (1955 ac) of easement. The transmission lines were designed and constructed in the late 1960s and early 1970s in accordance with the Wisconsin Electrical Code and industry guidance that was current when the lines were built (NMC 2004a).

NMC performed an analysis to demonstrate that the four transmission lines at PBNP are in compliance with the NESC 5-mA, electric-field-induced current limit (NMC 2004a). NMC's analysis of these transmission lines began by identifying the limiting case road crossing for each line. The limiting case is the configuration along each line where the potential for induced-current shock would be greatest. Once the limiting case was identified, NMC calculated the electric field strength for each transmission line, then calculated the induced current.

NMC calculated electric field strength and induced current using a computer code called ACDCLINE (Version 3.0) (Electric Power Research Institute 1992). The results of this computer program have been field verified through actual electric field measurements by several utilities. The input parameters included the design features of the limiting case scenario, the NESC requirement that line sag be determined at 48.9 °C (120 °F) conductor temperature, and the maximum vehicle size under the lines. The maximum size vehicle was modeled as a tractor-trailer truck.

The analysis determined that none of the transmission lines has the capacity to induce more than 5 mA, the NESC limit of electric field-induced current, in a tractor-trailer truck parked beneath the lines. Therefore, the PBNP transmission line designs conform to the NESC provisions for preventing electric shock from induced current (NMC 2004a).

NMC's assessment under 10 CFR Part 51 concludes that electric shock is of small significance for PBNP transmission lines. Due to the small significance of the issue, mitigation measures, such as installing warning signs at road crossings or increasing clearances, are not warranted. This conclusion would remain valid into the future, provided there are no changes in line use, voltage, current, and maintenance practices and no changes in land use under the lines – conditions over which the ATC has control.

The staff has reviewed the available information, including that provided by the applicant, the staff's site visit, public comments, and other public sources. Using this information, the staff evaluated the potential impacts for electric shock resulting from operation of PBNP and associated transmission lines. The staff considered the cumulative impacts of past, current, and foreseeable future actions at the site regardless of which agency (Federal or non-Federal) or person undertakes such other actions. It is the staff's conclusion that the potential impacts for electric shock during the renewal term are SMALL.

### 4.2.2 Electromagnetic Fields – Chronic Effects

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

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

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

This statement is not sufficient to cause the staff to change its position with respect to the chronic effects of electromagnetic fields. The staff considers the GEIS finding of "uncertain" still appropriate and will continue to follow developments on this issue.

## 4.3 Radiological Impacts of Normal Operations

Category 1 issues in 10 CFR Part 51, Subpart A, Appendix B, Table B-1, that are applicable to PBNP in regard to radiological impacts are listed in Table 4-5. NMC stated in its ER (NMC 2004a) that it is not aware of any new and significant information associated with the renewal of the PBNP OLs. The staff has not identified any significant new information during its independent review of the NMC ER, the staff's site visit, the scoping process, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts related to these issues beyond those discussed in the GEIS. For these issues, the staff concluded in the GEIS that the impacts are SMALL, and additional plant-specific mitigation measures are not likely to be sufficiently beneficial to be warranted.

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

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

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

- Radiation exposures to the 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 NMC ER, the staff's site visit, the scoping process, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts of radiation exposures to the public during the renewal term beyond those discussed in the GEIS.

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

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

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

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

## 4.4 Socioeconomic Impacts of Plant Operations During the License Renewal 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 4-6. NMC stated in its ER (NMC 2004a) that it is not aware of any new and significant information associated with the renewal of PBNP OLs.

The staff has not identified any new and significant information during the staff's independent review of the NMC ER, the staff's scoping process, the staff's site visit, or the staff's evaluation of other available information. Therefore, the staff concludes that there are no impacts related to these issues beyond those discussed in the GEIS (NRC 1996). For these issues, the staff concluded in the GEIS that the impacts are SMALL and that additional plant-specific mitigation measures are not likely to be sufficiently beneficial to be warranted.

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

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

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

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

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

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

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

  > Only impacts of small significance are expected.

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

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

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

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

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

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

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

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

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

| ISSUE – 10 CFR Part 51, Subpart A, Appendix B, Table B-1 | GEIS 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

To determine housing impacts, the applicant chose to follow Appendix C of the GEIS (NRC 1996), which presents a population characterization method that is based on two factors, "sparseness" and "proximity" (GEIS, Section C.1.4 [NRC 1996]). Sparseness measures population density within 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, and a matrix is used to rank the population category as low, medium, or high (GEIS, Table C.1 and Figure C.1 [NRC 1996]).

The staff examined population densities within specified distances from the PBNP site, employing the NRC's Geographical, Environmental, and Siting Information System (Gen&SIS) to analyze the 2000 census data (NRC 2004b). As derived from the 2000 U.S. Census Bureau (USCB) information, 94,536 people live within 32 km (20 mi) of PBNP and 757,469 people live within 80 km (50 mi) of PBNP. This equates to a population density of 75 persons/km$^2$

(195 persons/mi$^2$) within an 80-km (50-mi) radius (note that this is accounted for by the fact that PBNP is located on Lake Michigan, so only a portion of the area within an 80-km (50-mi) radius is land area). The largest city within 80 km (50 mi) is Green Bay, Wisconsin, with a population of 102,313 (USCB 2000a).

All or parts of 12 counties and the city of Green Bay are located within 80 km (50 mi) of PBNP. Approximately 81 percent of the employees live in Manitowoc County. The remaining 19 percent are distributed across 12 counties, with numbers ranging from 1 to 73 employees per county. According to the GEIS sparseness and proximity matrix, PBNP ranks as Category 4 in terms of sparseness (i.e., greater than or equal to 46 persons/km$^2$ [120 persons/mi$^2$] within 32 km [20 mi]), and Category 3 in terms of proximity (i.e., one or more cities with 100,000 or more persons and less than 73 persons/km$^2$ [190 persons/mi$^2$] within 80 km [50 miles]). According to the GEIS, the sparseness and proximity scores identify PBNP as being located in a high-population area.

Housing impacts are a Category 2 issue (10 CFR Part 51, Subpart A, Appendix B, Table B-1). In 10 CFR Part 51, Subpart A, Appendix B, Table B-1, the NRC states that impacts on housing availability are expected to be of SMALL significance at plants located in high-population areas where growth-control measures that limit housing development are not in effect. PBNP is located in a high-population area, and Manitowoc County is not subject to growth-control measures.

SMALL impacts result when no discernible change in housing availability occurs, changes in rental rates and housing values are similar to those occurring Statewide, and no housing construction or conversion is required to meet new demand (NRC 1996). NMC anticipates that the actual number of new employees will be no more than two during the license renewal term. NMC does not plan any new refurbishment activity as part of the license renewal process; therefore, employment is not anticipated to change in the area as result of license renewal. Thus, NMC concludes that there are no impacts to housing from license renewal activities (NMC 2004a).

However, to establish an upper bound on possible increased employment during the license renewal term, the GEIS assumes that no more than 60 additional permanent workers might be needed at each unit during the license renewal period to perform routine maintenance and other activities related to license renewal. Hiring of these additional 60 employees could result in 40 indirect jobs, or an increased demand for a total of 100 housing units. This demand could be met from within Manitowoc County, which currently has approximately 1800 vacant units available. However, in light of the relatively high unemployment rate in the county, it is probable that most of these jobs would be filled by current county residents.

The staff has reviewed the available information, including that provided by the applicant, the staff's site visit, the scoping process, discussions with other agencies, and other public sources. Using this information, the staff evaluated the potential housing impacts resulting from operation of PBNP during the license renewal term. The staff concluded that the potential housing impacts during the renewal term are SMALL and mitigation is not warranted.

### 4.4.2 Public Services: Public Utility Impacts During Operations

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

PBNP obtains its water supply from private wells, and does not use water from local water suppliers (NMC 2004a). Consequently, the plant itself would have no impact on local water supplies. The maximum total capacity of all the water suppliers in Manitowoc County is approximately 53 million L/day (14 million gpd) greater than the current average daily use, or about 2.5 times the current use (Table 2-4). For individual water suppliers, the capacity ranges from 1.5 to 10 times the current use. There is ample additional capacity to supply any potential increase in demand due to license renewal.

The staff has reviewed the available information, including that provided by the applicant, the staff's site visit, the scoping process, discussions with other agencies, and other public sources. Using this information, the staff evaluated the potential impacts of increased water use resulting from the potential increase in employment. NMC assumes that no more than one or two additional employees will be needed to support PBNP operations during the renewal term. It is the staff's conclusion that the potential impacts of increased water use resulting from the potential increase in employment during the renewal term are SMALL. No additional mitigation efforts would be warranted.

### 4.4.3 Offsite Land Use During Operations

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

Sections 3.7.5 and 4.7.4 of the GEIS define the magnitude of land-use changes as a result of plant operation during the license renewal term as follows:

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

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

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

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

Manitowoc County and the Town of Two Creeks receive Shared Utility Payments because PBNP is located within their jurisdictions. Table 2-12 shows that the Town of Two Creeks received between $190,100 and $217,100 per year between 1996 and 2002, which corresponded to between 13.7 and 72 percent of the town's budget. Note that the 72 percent occurred in 1999, which was an anomalous year. Except for 1999, the highest portion of the town's budget provided by PBNP revenues was 24.5 percent. Table 2-13 shows that Manitowoc County has received approximately $800,000 per year between 1996 and 2002, which constituted between 1.2 and 2.0 percent of the county budget.

For the Town of Two Creeks, these revenues represent a significant portion of its budget (between 13.7 and 24.5 percent), and are expected to continue through the renewal period. These revenues constitute only a very small portion of the budget of Manitowoc County, and would not be expected to influence offsite development whether or not the PBNP operating license is renewed. Using NRC's criteria, PBNP's Shared Utility Payments have a MODERATE to LARGE impact on the Town of Two Creeks. However, NMC does not anticipate refurbishment or major construction during the license renewal period, and, therefore, does not anticipate any increase in the assessed value of PBNP due to refurbishment-related improvements, nor any related tax-increase-driven changes to offsite land use and development patterns (NMC 2004a). PBNP will continue to be a significant source of revenue for the Town of Two Creeks. However, despite having this income source since the plant was constructed, the Town of Two Creeks has experienced relatively little land use change over the past several decades. The Town of Two Creeks does not currently have a land use plan, but does use zoning to preserve it's rural character. In addition, no new major land use changes are planned for the Town of Two Creeks (NMC 2004a). For these reasons, NMC does not anticipate changes to local land use and development patterns as a result of license renewal.

NMC has identified that no more than one or two additional employees would be needed to support PBNP operations during the license renewal term, which is well below the assumption in the GEIS. This additional staffing is within normal employment variances at PBNP (NMC 2004a). In Section 3.7.5 of the GEIS (NRC 1996), the staff found that if plant-related population growth is less than five percent of the study area's total population, then offsite land-use changes would be SMALL. This is especially pertinent 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 80 km (50 mi). In the case of PBNP, population growth will be less than five percent of the county's total population, and Manitowoc County has established patterns of residential and commercial development guided by local comprehensive plans. In addition, there is a population density of 75 persons/km$^2$ (195 persons/mi$^2$) within an 80-km (50-mi) radius, and there is an urban area (Green Bay) with a population of over 100,000 within 80 km (50 mi). Consequently, the staff concludes that population changes resulting from license renewal are likely to result in SMALL offsite land-use impacts.

The staff evaluated the potential impacts of offsite land use resulting from operation of PBNP. Because NMC does not anticipate refurbishment activities, the population growth related to license renewal of PBNP is expected to be relatively small, and there would be no new tax impacts on local land use, the staff's concludes that the potential impacts of tax revenue changes resulting from license renewal are likely to result in SMALL offsite land-use impacts.

### 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 SEIS.

Employees access PBNP primarily via State Route 42. Assuming an upper bound of 60 new employees to be hired during the license renewal period, the traffic on State Route 42 would increase approximately 1.6 percent. During refueling events, approximately 300 additional personnel are employed at PBNP. This could increase the traffic on State Route 42 by 8 percent, which will have a negligible impact on the free flow of traffic.

The staff has reviewed the available information, including that provided by the applicant, the staff's site visit, the scoping process, discussions with other agencies, and other public sources. Using this information, the staff evaluated the potential impacts to transportation service resulting from operation of PBNP. It is the staff's conclusion that the potential impacts to transportation service during the renewal term are SMALL and no mitigation efforts are warranted.

### 4.4.5 Historic and Archaeological Resources

The National Historic Preservation Act (NHPA) requires that Federal agencies take into account the effects of their undertakings on historic properties (16 USC 470 et seq.). The historic preservation review process, mandated by Section 106 of the NHPA, is outlined in regulations issued by the Advisory Council on Historic Preservation in 36 CFR Part 800. Renewal of a nuclear power plant OL is an undertaking that could potentially affect historic properties within the area of effect. Therefore, according to the NHPA, the NRC is to make a reasonable effort to identify historic properties in the areas of potential effects. If no historic properties are present or affected, the NRC is required to notify the State Historic Preservation Officer (SHPO) before proceeding. If it is determined that historic properties are present, the NRC is required to assess and resolve possible adverse effects of the undertaking.

Prior to submitting its license renewal application to the NRC, NMC requested information from the Wisconsin SHPO about potential impacts of continued plant operation (NMC 2003b). NMC initially concluded that there should be no impacts or minimal impacts to cultural resources because it anticipated that there would be little refurbishment or change in operations. In its response, in a letter dated January 6, 2004, the SHPO stated that cultural resources would need to be identified first to conclude that there were no adverse impacts (Wisconsin Historical Society 2004). The SHPO further noted that the fishing shed, described in Section 2.2.9.2, would need to be evaluated for eligibility for the National Register of Historic Places (NRHP). The PBNP site, but not necessarily the area within direct plant control, contains leased farm lands and the SHPO noted that "continued plowing of a significant archaeological site may lead to the destruction of the site." Consequently, NMC initiated activities to identify the cultural resources that may be effected, to examine the architectural significance of the fishing shed, and to conduct surveys of the leased farm lands.

NMC (NMC 2004c) forwarded available information from its contractor, AVD Archaeological Services, Inc. (AVD), to the SHPO to provide additional historical context for the fishing shed. In a letter dated March 11, 2004, the SHPO responded to NMC that additional evaluation was needed and also suggested that an archaeological survey be completed or that NMC enter into a programmatic agreement with the SHPO (Wisconsin Historical Society 2004). Subsequently, an architectural historian was engaged by NMC to examine the fishing shed for significance under the NHPA; as a result of this examination NMC did not recommend the shed for inclusion on the NRHP (We Energies 2004c).

NMC's contractor, AVD, conducted further examinations to inventory cultural remains on leased farmlands outside the area of direct plant control. Approximately 45 ha (112 ac) were not inventoried. This land was not inventoried because it was either designated as part of the cropland reserve program, which is set aside for natural revegetation, or it was too heavily vegetated to survey. This area comprises 440 ha (1085 ac), or approximately 86 percent of the PBNP site. Four artifact scatters within the surveyed area were recommended for avoidance or, in the event that avoidance is not possible, for additional evaluation. NMC stated that these recommendations would be implemented for any future construction in those areas (We Energies 2004a). Agricultural activities can be expected to continue in those areas during the period of license renewal, therefore, some continued disturbance and soil loss at these four artifact scatters is possible. The four scatters appear to be limited in size and complexity. The remaining PBNP site area has either been heavily disturbed by construction of the plant and ancillary facilities or consists of second-growth wooded areas.

NMC maintains an internal procedure entitled "Control of Excavation" (NP 8.4.19) that establishes reviews to be conducted prior to excavation. As a result of interactions with the Wisconsin SHPO, proposed revisions to this procedure set criteria for preliminary cultural resource reviews. In addition, the proposed revisions provide for monitoring (to be conducted during excavation), and must include observations for cultural resources. Work will be stopped if unanticipated historic or prehistoric archaeological remains are encountered. We Energies' review of excavations includes consultation with the SHPO prior to disturbance of known or suspected cultural resources. The SHPO would be notified immediately upon the discovery of unanticipated cultural resources as well. By implementing its environmental review procedure, the licensee would take care during normal ground-disturbing operations and maintenance to ensure that historic properties are not inadvertently impacted. When modified, these procedures would ensure that cultural resources are protected through the period of the renewed license.

Major refurbishment of PBNP is not anticipated during the license renewal period; consequently, it is not expected that currently undeveloped portions of the site will be used for operations during the renewal period. No change in the amount or type of ground-disturbing activities is expected at the PBNP site, the leased lands, or in conjunction with transmission line maintenance. Operation of PBNP, as outlined in NMC's application for license renewal, would protect undiscovered historic or archaeological resources on the site because the undeveloped natural landscape and vegetation would remain undisturbed and access to the site would remain restricted.

It is the staff's conclusion that adverse impacts on identified historic properties are minimal. This conclusion is based on the staff's cultural resources analyses and consultation with the SHPO; NMC's conclusions that major refurbishment activities or changes in type or amount of ground disturbance will not be undertaken during the license renewal period; NMC's recommendation that the fishing shed is not eligible for the NRHP; the limited size and complexity of the artifact scatters; and the protection afforded to the other known archaeological site, which is in a cropland reserve program and is not expected to be disturbed. Therefore, potential impacts on historic and archaeological resources are expected to be SMALL, and no additional mitigation is warranted. Based on the further examinations conducted by NMC, the proposed revisions to procedures governing land-disturbing activities, and measures to notify the SHPO, the staff concludes that it is unnecessary at this time to enter into a cultural resources programmatic agreement with the SHPO to protect cultural resources.

### 4.4.6 Environmental Justice

Environmental justice refers to a Federal policy requiring Federal agencies to 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 of 1969. 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, Revision 1, *Procedural Guidance for Preparing Environmental Assessments and Considering Environmental Issues* (NRC 2004c). In 2004, the Commission issued a final "Policy Statement on the Treatment of Environmental Justice Matters in NRC Regulatory and Licensing Actions" (69 FR 52040).

The scope of the review as defined in NRC guidance (NRC 2004c) includes identification of impacts on minority and low-income populations, the location and significance of any

(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 2004c).

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 purposes of the staff's review, a minority population exists in a census block group[a] if the percentage of each minority and aggregated minority category within the census block group exceeds the corresponding percentage of minorities in the State of which it is a part by 20 percent, or if the 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 in a census block group within the area of study exceeds the percentage of low-income population in the State of which it is a part by 20 percent, or if the percentage of low-income population within a census block group is at least 50 percent.

The staff examined the geographic distribution of minority and low-income populations within 80 km (50 mi) of the PBNP site, employing Gen&SIS to analyze the 2000 census data (NRC 2004b). The staff supplemented its analysis with field inquiries to county planning departments and municipal officials.

Within an 80-km (50-mi) radius of PBNP, there are 567 block groups. Based on the NRC criteria, and using the population of Wisconsin as the comparative population, the staff made the following determinations:

(1) No populations of Native Hawaiian or other Pacific Islander, other single minorities, or multiracial minorities exist in the geographic area.
(2) American Indian or Alaskan Native minority populations exist in five block groups. These populations are located in Brown and Outagamie counties and are associated with the Oneida reservation.
(3) Asian minority populations exist in a single block group located in Brown County.
(4) Black minority populations exist in a single block group also located in Brown County.
(5) The Gen&SIS database did not identify any block groups with Hispanic populations that exceeded the 20-percent criterion.

The "greater than 50 percent" criterion did not apply to any block group.

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(a) A census block group is a combination of census blocks, which are statistical subdivisions of a census tract. A census block is the smallest geographic entity for which the USCB collects and tabulates decennial census information. A census tract is a small, relatively permanent statistical subdivision of counties delineated by local committees of census data users in accordance with USCB guidelines for the purpose of collecting and presenting decennial census data. Census block groups are subsets of census tracts (USCB 2001).

Figure 4-1 shows the locations of block groups that meet the criteria for minority populations.

NRC guidance defines "low-income" by using USCB statistical poverty thresholds (NRC 2004c). A block group is considered to be low income if the following criteria are satisfied:

(1) The low-income population of the census tract or environmental impact site exceeds 50 percent, or
(2) The percentage of households below the poverty level in an environmental impact area is significantly greater (typically at least 20 percentage points) than the low-income population percentage in the geographic area chosen for comparative analysis.

According to the USCB, 5.6 percent of households in Wisconsin have incomes below the poverty level (USCB 2000b).

Based on the "more than 20 percentage points" criterion, eight block groups contain a low-income population. All are found in Brown County. Figure 4-2 shows their locations.

After identifying the locations of minority and low-income populations, the staff evaluated 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 2004c), air, land, and water resources within approximately 80 km (50 mi) of the PBNP site were examined. Within that area, a few potential environmental impacts could affect human populations, but all of these impacts were considered SMALL for the general population.

The pathways through which the environmental impacts associated with PBNP license renewal can affect human populations are discussed in each associated section of this report. During the staff's review of the information, including that provided by the applicant, the staff's site visit, the scoping process, discussions with other agencies, and other public sources, the staff found no unusual resource dependencies or practices, such as subsistence agriculture, hunting, or fishing, through which minority and/or low-income populations could be disproportionately highly and adversely affected. In addition, the staff did not identify any location-dependent disproportionately high and adverse impacts that would affect these minority and low-income populations. The staff's conclusion is that potential offsite impacts from PBNP to minority and low-income populations during the renewal term are SMALL, and no special mitigation measures would be warranted.

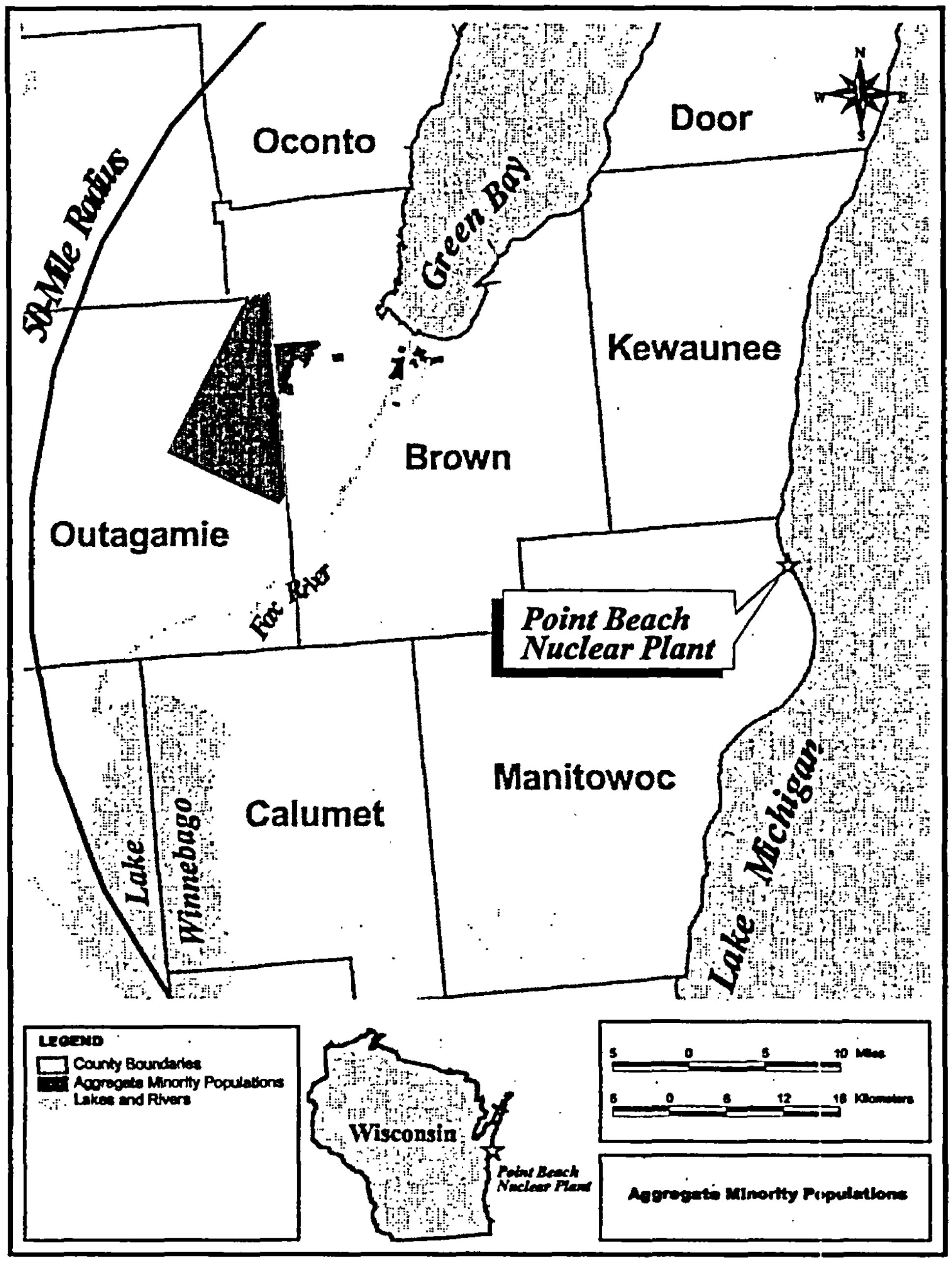


**Figure 4-1.** Geographic Distribution of Minority Populations (Shown in Shaded Areas) Within 80 km (50 mi) of PBNP Based on Census Block Group Data(a)

(a) Note: Some of the census block groups extend into open water.

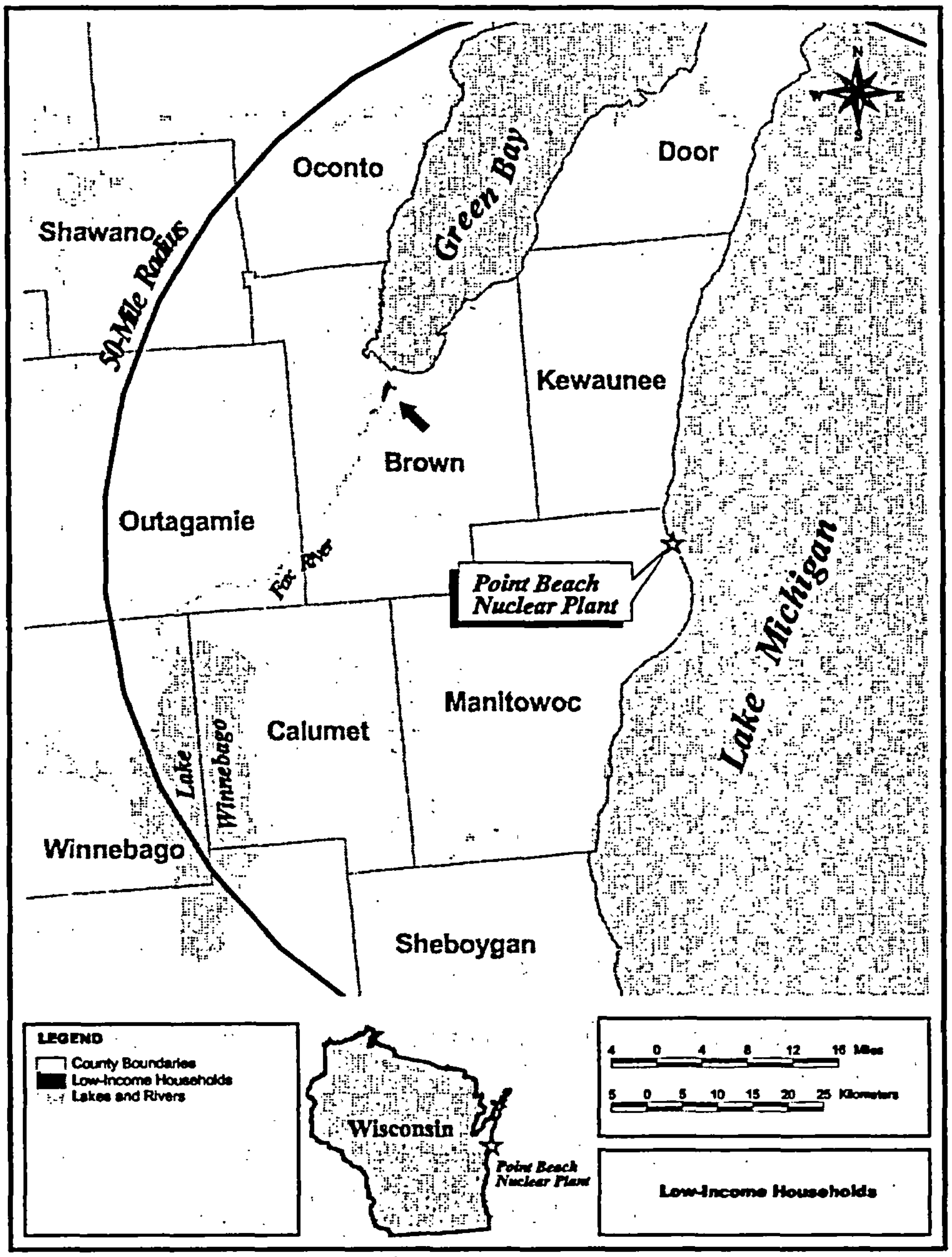


**Figure 4-2.** Geographic Distribution of Low-Income Populations (Shown in Shaded Areas) Within 80 km (50 mi) of the PBNP Site Based on Census Block Group Data [(a)]

(a) Note: Some of the census block groups extend into open water.

## 4.5 Groundwater Use and Quality

The Category 1 issue in 10 CFR Part 51, Subpart A, Appendix B, Table B-1, that is applicable to PBNP groundwater use and quality is listed in Table 4-8. NMC stated in its ER that it is not aware of any new and significant information associated with the renewal of the PBNP OLs (NMC 2004a). The staff has not identified any significant new information related to groundwater use and quality resulting from operations at PBNP during its independent review of the NMC ER (NMC 2004a), the staff's site visit, the scoping process, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts related to this issue beyond those discussed in the GEIS. For these issues, the GEIS concluded 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 Issue 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 and the GEIS conclusions, as codified in Table B-1, 10 CFR Part 51, follows.

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

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

  As discussed in Section 2.2.2, PBNP groundwater use is less than 380 L/min (100 gpm). The staff has not identified any significant new information during its independent review of the NMC ER, the staff's site visit, the scoping process, or its evaluation of other available information. Therefore, the staff concludes that there are no groundwater use conflicts during the renewal term beyond those discussed in the GEIS.

There are no Category 2 issues related to groundwater use and quality for PBNP.

# 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 4-9.

**Table 4-9.** 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 threatened or endangered species in the vicinity of the PBNP site is discussed in Sections 2.2.5 and 2.2.6.

The staff initiated informal consultation with the FWS (NRC 2004a) and the National Marine Fisheries Service of the National Oceanic and Atmospheric Administration (NRC 2004d) by letter requesting information on species protected under the Endangered Species Act of 1973 (ESA) that occur in the vicinity of the PBNP site and its associated transmission line ROW. The FWS responded by letter (FWS 2004) indicating no known occurrences of Federally listed threatened or endangered species, proposed species, candidate species, or designated or proposed critical habitat on the PBNP site. The FWS also noted that beach habitat near PBNP could be suitable nesting habitat for piping plover (*Charadrius melodus*) at some time in the future. Three other potentially occurring Federally listed species were identified by NRC staff.

## 4.6.1 Aquatic Species

The staff has reviewed the information provided by the applicant and public information and has contacted the FWS and the WDNR. No Federally listed threatened or endangered aquatic species occur in Lake Michigan in the vicinity of the PBNP site (We Energies 2004b), and no Federally listed threatened or endangered species occur in the streams crossing the transmission line ROWs in the vicinity of the PBNP site.

### 4.6.2 Terrestrial Species

There are no Federally listed threatened or endangered terrestrial species known to occur at the PBNP site or associated transmission line ROWs (NMC 2004a; We Energies 2004b). There are four Federally listed threatened or endangered terrestrial species that have been identified as potentially occurring in the vicinity of PBNP and its associated transmission lines. Three species have been recorded in Manitowoc County: the bald eagle (*Haliaeetus leucocephalus*), the piping plover, and the dune (or Pitcher's) thistle (*Cirsium pitcheri*) (WDNR 2004b). The dwarf lake iris (*Iris lacustris*), also a Federally listed species, has been recorded in Brown County, which is traversed by a PBNP transmission line.

The staff has reviewed the information provided by the applicant, the FWS, the WDNR, the scoping process, and other public information sources. No Federally-listed threatened or endangered terrestrial species have been reported to occur on the PBNP site or within the associated transmission line ROWs. Four Federally-listed terrestrial species have the potential to occur at the PBNP site or along associated transmission line ROWs. The staff has evaluated the potential impact likely to result from operation of the PBNP for an additional 20 years during the renewal term and has documented its conclusions in a biological assessment (BA) transmitted to the FWS by letter dated November 22, 2004 (Appendix E). In its BA, the staff concluded that license renewal for PBNP may affect, but is not likely to adversely affect, the bald eagle and the piping plover and will have no effect on the dune (or Pitcher's) thistle or dwarf lake iris.

### 4.6.3 Conclusions

No Federally listed aquatic species occur in Lake Michigan in the vicinity of PBNP. No Federally listed aquatic species occur in streams or rivers traversed by PBNP transmission line ROWs. Therefore, license renewal will have no effect on any Federally-listed aquatic species. Four Federally listed terrestrial species have the potential to occur at the PBNP site or along associated transmission line ROWs. An assessment of the potential impacts to these species (bald eagle, piping plover, dune [or Pitcher's] thistle, and the dwarf lake iris) was conducted by the staff and documented in a BA submitted to the FWS (Appendix E). The staff's determination is that license renewal for the PBNP may affect, but is not likely to adversely affect, the bald eagle and the piping plover, and will have no effect on the dune (or Pitcher's) thistle or dwarf lake iris.

Based on this information, the staff concludes that the potential impacts of continued operation of the PBNP and its associated transmission line ROWs for an additional 20 years during the renewal term on threatened or endangered species are SMALL. During the course of its evaluation, the staff considered mitigation measures for continued operation of the PBNP.

Based on this evaluation, the staff expects that measures in place at the PBNP and its associated transmission line ROWs are appropriate (as described in a BA submitted to the FWS [Appendix E]), and no additional mitigation measures are 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. The staff has not identified significant new information on environmental issues listed in 10 CFR Part 51, Subpart A, Appendix B, Table B-1, related to operation during the renewal term. Processes for identification and evaluation of new information are described in Section 1.2.2.

## 4.8 Cumulative Impacts of Operations During the Renewal Term

The staff considered potential cumulative impacts during the evaluation of information applicable to each of the potential impacts of operations of PBNP during the renewal term. The impacts of the proposed license renewal are combined with other past, present, and reasonably foreseeable actions to determine whether cumulative impacts exist. 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, and through the 20-year license renewal term. The geographical area to be evaluated 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 the impacts of other past, present, and reasonably foreseeable future actions 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 PBNP cooling system is primarily the western portion of Lake Michigan within an 80-km (50-mi) radius of PBNP. As described in Section 4.1, the staff found no new and significant information indicating that the conclusions regarding any of the Category 1 issues related to the PBNP cooling system are inconsistent with the conclusions in the GEIS (NRC 1996). Additionally, the staff has determined that none of the Category 2 issues related to the PBNP cooling system are likely to have greater than a SMALL impact on local water quality or 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. The following physical and chemical stresses have impacted Lake Michigan: 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 to fish communities caused by habitat modification and development, overfishing, and nonnative species introductions have been reviewed for the period from the 1800s to 1970 (Wells and McLain 1973) and from 1970 to 2000 (Madenjian et al. 2002). Disruptions in the native fish community (primarily caused by introduction of the sea lamprey [*Petromyzon marinus*] and alewife [*Alosa pseudoharengus*]), coupled with habitat alterations and degradation, contributed to the decline of important commercial and sport fisheries by the end of the 1950s. The alewife is believed to have contributed to the extinction of three deepwater cisco (*Coregonus*) species and the suppression of burbot (*Lota lota*), emerald shiner (*Notropis atherinoides*), lake herring (*Coregonus artedi*), yellow perch (*Perca flavescens*), deepwater sculpin (*Myoxocephalus thompsoni*), and spoonhead sculpin (*Cottus ricei*). The alewife has recently been implicated as a possible factor inhibiting the success of lake trout (*Salvelinus namaycush*) reproduction, as alewives have been observed eating lake trout fry (Eshenroder et al. 1995). In the 1960s, programs to extend control of sea lamprey, stocked trout, and salmon (*Oncerhynchus*) 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). The primary management challenges will be to keep the salmonid community in balance with the 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).

The potential exists 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 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 cooling-water needs of PBNP under all conditions. As discussed in the NMC ER, KNPP is located on the western shore of Lake Michigan in Kewaunee County, approximately 8 km (5 mi) north of the PBNP site. Studies conducted of the hydrologic characteristics of this portion of Lake Michigan indicate that the discharge heat of KNPP does not interact with the discharge heat of PBNP (Wisconsin Public Service Corporation 1972). The staff, while preparing this assessment, assumed that other industrial, commercial, or public installations could be located in the general vicinity of the PBNP site prior to the end of PBNP operations. The discharge of water to Lake Michigan from these facilities would be regulated by the WDNR. 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 the WPDES permit minimizes PBNP's cumulative impacts on aquatic resources. Continued operation of PBNP will require renewed discharge permits from the WDNR, which will address cumulative water-quality objectives.

The staff also considered cumulative impacts to threatened or endangered aquatic species. As discussed in Section 2.2.5, there are no Federally listed threatened or endangered aquatic species known to occur in the offshore areas associated with the PBNP site (NMC 2004a). For these reasons, the staff has determined that the continued operation of PBNP will not contribute to a regional cumulative impact to these species, regardless of whether other actions occur that could have adverse impacts.

Therefore, the staff concludes that the SMALL impacts of PBNP cooling system operations, including entrainment and impingement of fish and shellfish, heat shock, impacts on threatened or endangered species, or any of the cooling system related Category 1 issues, are not contributing to an overall decline in water quality, 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 PBNP would be SMALL, and that no mitigation measures are warranted.

### 4.8.2 Cumulative Impacts Resulting from Continued Operation of the Transmission Lines

The continued operation of the electrical transmission facilities connecting PBNP to the transmission grid 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. The staff considered potential cumulative impacts to terrestrial resources (such as wildlife populations and the size and distribution of habitat areas), aquatic resources (such as wetlands, floodplains, and stream crossings), and both the acute and chronic effects of electromagnetic fields. For the purposes of this analysis, the geographic area that encompasses the past, present, and foreseeable future actions that could contribute to adverse cumulative effects is the area that contains the transmission lines associated with the PBNP site. As described in Section 4.2, the staff found no new and significant information indicating that the conclusions regarding any of the Category 1 issues related to the PBNP transmission lines are inconsistent with the conclusions in the GEIS.

As discussed in Section 4.6, ATC implements a ROW inspection and maintenance program for transmission lines associated with PBNP using vegetation management procedures that are protective of wildlife and habitat resources over all of its ROWs (ATC 2004). None of the management procedures are expected to alter wetland or floodplain hydrology or adversely affect vegetation characteristics of these or other habitats. The ATC maintenance procedures also 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 during the license renewal term.

There are no known or planned activities within the 80-km (50-mi) radius area of consideration that could potentially produce additional impacts associated with transmission lines. Therefore, the staff has determined that the cumulative impacts of the continued operation of the PBNP transmission lines would be SMALL, and that no mitigation measures are warranted.

### 4.8.3 Cumulative Radiological Impacts

The EPA and NRC established radiological dose limits for protection of the public and workers from both acute and long-term exposure to radiation and radioactive materials. These dose limits are codified in 40 CFR Part 190 and 10 CFR Part 20. As described in Section 2.2.7, the public and occupational doses resulting from operation of PBNP are well below regulatory limits, and as described in Section 4.3, the impacts of these exposures are SMALL. For the purposes of this analysis, the geographical area considered is the area included within an 80-km (50-mi) radius of the PBNP site (Figure 2-1).

EPA regulations at 40 CFR Part 190 limit the dose to members of the public from all sources in the nuclear fuel cycle, including nuclear power plants, fuel fabrication facilities, waste disposal facilities, and transportation of fuel and waste. In addition, as stated in Section 2.2.7, NMC has conducted a radiological environmental monitoring program around the PBNP site since before operations began in 1970. This program measures radiation and radioactive materials from all sources, including PBNP.

NMC also conducts a radiological surveillance program on and in the vicinity of KNPP, which is located on the western shore of Lake Michigan in Kewaunee County, approximately 8 km (5 mi) north of the PBNP site. Radionuclide concentrations from the surveillance program are compared to levels measured at control locations and in preoperational studies.

The NRC would regulate any future actions associated with PBNP that could contribute to cumulative radiological impacts. Therefore, the staff has determined that the cumulative radiological impacts of continued operation of PBNP would be SMALL, and that additional mitigation is not warranted.

### 4.8.4 Cumulative Socioeconomic Impacts

The continued operation of PBNP is not likely to result in significant cumulative impacts for any of the socioeconomic impact measures assessed in Section 4.4 (public services, housing, and offsite land use) 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 PBNP site, socioeconomic impacts resulting from PBNP license renewal would not produce an incremental change in any of the impacts identified. 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 PBNP, and no new incremental sources of or changes to plant related tax payments are expected that could influence land use by fostering considerable growth. The impacts of license renewal on transportation and environmental justice would also be SMALL. The staff identified the locations of minority and low-income populations, and evaluated 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 2004c), air, land, and water resources within approximately 80 km (50 mi) of the PBNP site were examined. Within that area, a few potential environmental impacts could affect human populations, but all of these impacts were considered SMALL for the general population. There are no reasonably foreseeable scenarios that would alter these conclusions in regard to cumulative impacts.

Based on the archaeological surveys conducted to date at the PBNP site (discussed in Section 4.4.5) and the very small likelihood that significant undiscovered cultural resources exist 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 ground-disturbing activities, at the plant site (or along existing transmission line ROWs) are planned for the license renewal period (NMC 2004a). Therefore, continued operation of PBNP would likely protect any cultural resources present within the PBNP 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. The staff therefore determined that the contribution to a cumulative impact on cultural resources by continued operation of PBNP during the license renewal period is considered SMALL.

Therefore, the staff has determined that the cumulative socioeconomic impacts of continued operation of PBNP would be SMALL, and that additional mitigation is not warranted.

### 4.8.5 Cumulative Impacts on Groundwater Use and Quality

As discussed in Section 2.2.2, water for drinking and sanitary purposes at PBNP is withdrawn from groundwater by five active onsite domestic supply wells having an average flow rate of about 24 L/min (6.5 gpm), or 35,000 L/day (9300 gpd). PBNP groundwater use is not expected to increase significantly during the license renewal period.

As discussed in Section 4.5, the impact of current plant operations and groundwater withdrawals on the aquifer is SMALL, and the staff did not identify any significant new information to indicate the possibility of groundwater use conflicts during the renewal term beyond those discussed in the GEIS. There are no known current or planned projects requiring groundwater withdrawals in the vicinity of PBNP that, if implemented in addition to license renewal, would potentially cause an adverse impact on groundwater use and quality. Therefore, the staff has determined that the cumulative impacts of continued operation of PBNP on groundwater use and quality during the license renewal period would be SMALL, and that no mitigation measures are warranted.

### 4.8.6 Conclusions Regarding Cumulative Impacts

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

## 4.9 Summary of Impacts of Operations During the Renewal Term

Neither NMC nor the staff is aware of information that is both new and significant related to any of the applicable Category 1 issues associated with the PBNP 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 10 Category 2 issues applicable to PBNP operation during the renewal term and for environmental justice and chronic effects of electromagnetic fields. For all 10 issues and environmental justice, the staff concluded that the potential environmental impact of renewal term operations of PBNP would be of SMALL significance in the context of the standards set forth in the GEIS and that additional mitigation would not be warranted. In addition, the staff determined that a consensus has not been reached by appropriate Federal health agencies regarding chronic adverse effects from electromagnetic fields. Therefore, the staff did not conduct an evaluation of this issue. Finally, the staff has considered potential cumulative impacts resulting from PBNP operation during the license renewal term, and has determined that the cumulative impacts of continued operation of PBNP during the license renewal term would be SMALL.

## 4.10 References

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

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

36 CFR Part 800. Code of Federal Regulations, Title 36, *Parks, Forests, and Public Property,* Part 800, "Protection of Historic and Cultural Resources."

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

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

American Transmission Company (ATC). *ATC Operating Instruction: Vegetation Management Philosophy and Standards.* May 1, 2004.

Bronte, C.R., and P.A. Schuette. 2002. *Summary of Trout and Salmon Stocking in Lake Michigan 1976-2001.* Great Lakes Fishery Commission, Lake Michigan Committee Meeting, Duluth, Minnesota. March 21-22, 2002.

Clean Water Act. 1977. 33 USC 1326, et seq. (Also known as the Federal Water Pollution Control Act of 1977).

Council on Environmental Quality (CEQ). 1997. *Environmental Justice: Guidance Under the National Environmental Policy Act.* Executive Office of the President, Washington, D.C.

Department of Fisheries and Oceans Canada (DFO). 2004. "The Alewife." Department of Fisheries and Oceans Canada, Ottawa, Ontario, Canada. http://www.dfo-mpo-gc.ca/zone/underwater_sous-marin/gasparea/alewife-gaspareau_e.htm (Accessed July 14, 2004).

Dunning, D.J., Q.E. Ross, P. Geoghegan, J.J. Reichle, J.K. Menezes, and J.K. Watson. 1992. "Alewives Avoid High-Frequency Sound." *North American Journal of Fisheries Management*, Vol. 12, pp. 407-416.

Eggold, B. 2004. Sportfishing Effort and Harvest. Lake Michigan Management Reports. Wisconsin Department of Natural Resources, Milwaukee, Wisconsin. http://www.dnr.stste.wi.us/org/water/fhp/fish/lakemich/Great%20Lakes%Fishery%20Commission%20Report%202004.pdf (Accessed November 11, 2004).

Endangered Species Act of 1973 (ESA). 16 USC 1531, et seq.

Electric Power Research Institute. 1992. *TL Workstation Code Version 2.3, Volume 7: ACDCLINE Manual.* EPRI EL-6420. June 1992.

Eshenroder, R. L., M. E. Holey, T. K. Gorenflo, and R. D. Clark, Jr. 1995. *Fish-Community Objectives for Lake Michigan.* Great Lakes Fishery Commission Spec. Pub. 95-3. http://www.glfc.org/pubs/SpecialPubs/Sp95_3.pdf (Accessed January 25, 2004).

Executive Order 12898. "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations." *Federal Register*, Vol. 59, No. 32, Washington, D.C. February 16, 1994.

Francis, G. R., J. J. Magnuson, H. A. Regier, and D. R. Talhelm. 1979. *Rehabilitating Great Lakes Ecosystems.* Great Lakes Fishery Commission Tech. Report No. 37. http://www.glfc.org/pubs/TechReports?Tr37.pdf (Accessed April 27, 2004).

Fuller, K., H. Shear, and J. Witting, eds. 1995. *The Great Lakes – an Environmental Atlas and Resource Book.* Government of Canada and U.S. Environmental Protection Agency. http://www.epa.gov/glnpo/atlas/index.html (Accessed February 25, 2004).

Hogler, S., and S. Surendonk. 2004. *Smelt Withdrawal By the Commercial Trawl Fishery. Lake Michigan Management Reports.* Wisconsin Department of Natural Resources, Mishicot, Wisconsin. http://www.dnr.stste.wi.us/org/water/fhp/fish/lakemich/Great%20Lakes%Fishery%20Commission%20Report%202004.pdf (Accessed November 11, 2004).

Jude, D.J. 1995. *Impact on Aquatic Organisms of Increased Heat Input to the Thermal Discharge of the Donald C. Cook Nuclear Plant, Southeastern Michigan.* Center for Great Lakes and Aquatic Sciences, University of Michigan, Ann Arbor, Michigan. December 1995.

LaJeone, L.J., and R.G. Monzingo. 2000. "316(b) and Quad Cities Station, Commonwealth Edison Company." *Environmental Science & Policy*. Vol. 3, Suppl. 1, pp. 313-322.

Madenjian, C. P., G. L. Fahnenstiel, T. H. Johengen, T. F. Nalepa, H. A. Vanderploeg, G. W. Fleischer, P. J. Schneeberger, D. M. Benjamin, E. B. Smith, J. R. Bence, E. S. Rutherford, D. S. Lavis, D. M. Robertson, D. J. Jude, and M. P. Ebener. 2002. "Dynamics of the Lake Michigan Food Web, 1970–2000." *Canadian Journal of Fisheries and Aquatic Sciences*, Vol. 59, pp. 736–753.

Madenjian, C.P., T.J. Desorcie, and J.D. Holuszko. 2004.. *Status and Trends of Prey Populations in Lake Michigan, 2003*. Great Lakes Fishery Commission, Lake Michigan Committee Meeting, Ypsilanti, Michigan. March 24, 2004.

Maes, J., A.W.H. Turnpenny, D.R. Lambert, J.R. Nedwell, A. Parmentier, and F. Ollevier. 2004. "Field Evaluation of a Sound System to Reduce Estuarine Fish Intake Rates at a Power Plant Cooling Water Inlet." *Journal of Fish Biology*, Vol. 64, pp. 938-946.

National Electrical Safety Code (NESC). 1997. Institute of Electrical and Electric Engineers. New York, New York.

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

National Historic Preservation Act of 1966 (NHPA). 16 USC 470, et seq.

National Institute of Environmental Health Sciences (NIEHS). 1999. *NIESH Report on Health Effects from Exposure to Power Line Frequency and Electric and Magnetic Fields*. Publication No. 99-4493. Research Triangle Park, North Carolina.

NatureServe. 2004. *NatureServe Explorer: an Online Encyclopedia of Life*. Version 3.1, NatureServe, Arlington, Virginia. http://www.natureserve.org (Accessed November 9, 2004).

Noguchi, L.S., D.L. Bimber, H.T. Tin, P.J. Mansfield, and D.J. Jude. 1985. "Field Distribution and Entrainment of Fish Larvae and Eggs at the Donald C. Cook Nuclear Power Plant, Southeastern Lake Michigan, 1980-1982." *Special Report No. 116 of the Great Lakes Research Division*. Great Lakes and Marine Waters Center, The University of Michigan, Ann Arbor, Michigan.

Nuclear Management Company, LLC (NMC). 2001. Letter from A. Cayia, Site Vice President, to E. Spoon, Special Agent, U.S. Fish and Wildlife Service. No Subject. July 19, 2001.

Nuclear Management Company, LLC (NMC). 2002. Letter from A. Cayia, Site Vice President, to E. Spoon, Special Agent, U.S. Fish and Wildlife Service. Subject: "Point Beach Nuclear Plant Fish and Bird Report for June 1, 2001, through December 31, 2001." January 14, 2002.

Nuclear Management Company, LLC (NMC). 2003a. Letter from A. Cayia, Site Vice President, to E. Spoon, Special Agent, U.S. Fish and Wildlife Service. Subject: "Point Beach Nuclear Plant Fish and Bird Report for January 1, 2002, through December 31, 2002." January 14, 2003.

Nuclear Management Company, LLC (NMC). 2003b. Letter from A. J. Cayia, Site Vice President, Point Beach Nuclear Plant, to S. Banker, State Historical Society of Wisconsin. Subject: "License Renewal Application for Point Beach Nuclear Plant, Request for Information on Historical/Archeological Resources." December 22, 2003.

Nuclear Management Company, LLC (NMC). 2004a. *Point Beach Nuclear Plant Operating License Renewal Application Environmental Report.* Two Rivers, Wisconsin.

Nuclear Management Company, LLC (NMC). 2004b. Letter from A. Cayia, Site Vice President, to E. Spoon, Special Agent, U.S. Fish and Wildlife Service. Subject: "Point Beach Nuclear Plant Fish and Bird Report for January 1, 2003, through December 31, 2003." January 15, 2004.

Nuclear Management Company, LLC (NMC). 2004c. Letter from G. D. Van Middlesworth, Site Vice President, Point Beach Nuclear Plant, to R. Dexter, State Historical Society of Wisconsin. Subject: "Case# 03-1046 License Renewal: Point Beach Nuclear Plant." March 2, 2004.

Ricciardi, A., and H. J. MacIsaac. 2000. "Recent Mass Invasion of the North American Great Lakes by Ponto-Caspian Species." *Trends in Ecology & Evolution*, Vol. 15, pp. 62–65.

Ricciardi, A., and J. B. Rasmussen. 1998. "Predicting the Identity and Impact of Future Biological Invaders: A Priority for Aquatic Resource Management." *Canadian Journal of Fisheries and Aquatic Sciences*, Vol. 55, pp. 1759–1765.

Ross, Q.E., D.J. Dunning, R. Thorne, J.K. Menezes, G.W. Tiller, and J.K. Watson. 1993. "Response of Alewives to High-Frequency Sound at a Power Plant Intake on Lake Ontario." *North American Journal of Fisheries Management*, Vol. 13, pp. 291-303.

Ross, Q.E., D.J. Dunning, J.K. Menezes, M.K. Kenna, Jr., and G. Tiller. 1996. "Reducing Impingement of Alewives with High-Frequency Sound at a Power Plant Intake on Lake Ontario." *North American Journal of Fisheries Management*, Vol. 16, pp. 291-303.

Scott, W.B., and E.J. Crossman. 1973. *Freshwater Fishes of Canada.* Bulletin 184. Fisheries Research Board of Canada, Ottawa.

Talmage, S.S., and D.M. Opresko. 1981. *Literature Review: Response of Fish to Thermal Discharges.* EPRI EA-1840, Research Project 877, ORNL/EIS-193. Prepared by Oak Ridge National Laboratory, Oak Ridge, Tennessee for Electric Power Research Institute, Palo Alto, California.

U.S. Atomic Energy Commission (AEC). 1972. *Final Environmental Statement Related to Operation of Point Beach Nuclear Plant Units 1 and 2.* Docket Nos. 50-266 and 50-301. Directorate of Licensing, Washington, D.C.

U.S. Census Bureau (USCB). 2000a. *County and City Data Book: 2000,* Table C-1. http://www.census.gov/statab/www/ccdb.html (Accessed July 30, 2004).

U.S. Census Bureau (USCB). 2000b. *Profile of Selected Economic Characteristics: 2000* for Wisconsin. http://factfinder.census.gov/servlet/QTTable?_bm=y&-context=qt&-reg=DEC_2000_SF4_U_DP3:001&-qr_name=DEC_2000_SF4_U_DP#&-ds_name=DEC_2000_SF$_U&-CONTEXT=qt&-tree_id=404&-all_geo_types=N&-redoLog=tru&-geo_id=0400US55&-format=&-_lang=en (Accessed November 1, 2004).

U.S. Census Bureau (USCB). 2001. *Decennial Division Management Glossary.* http//www.census.gov/dmd/www/glossary.html (Accessed July 26, 2004).

U.S. Environmental Protection Agency (EPA). 2004. "National Pollutant Discharge Elimination System – Final Regulations to Establish Requirements for Cooling Water Intake Structures at Phase II Existing Facilities: Final Rule." *Federal Register,* Vol. 69, No. 131, pp. 41575–41693. Washington, D.C. July 9, 2004.

U.S. Fish and Wildlife Service (FWS). 2004. Letter from J. Smith, U.S. Fish and Wildlife Service, to Nuclear Regulatory Commission. Subject: "Response to the May 5, 2004, NRC Staff Letter Requesting Information Regarding Threatened and Endangered Species in the Vicinity of the PBNP." August 5, 2004.

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

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

U.S. Nuclear Regulatory Commission (NRC). 2004a. Letter from NRC to J. Smith, U.S. Fish and Wildlife Service. Subject: "Request List of Protected Species Within the Area under Evaluation for License Renewal of Point Beach Nuclear Plant." Accession No. ML041280306. May 5, 2004.

U.S. Nuclear Regulatory Commission (NRC). 2004b. Geographic, Environmental, and Siting Information System (Gen&SIS). http://gensis.llnl.gov/ (Accessed November 3, 2004).

U.S. Nuclear Regulatory Commission (NRC). 2004c. *Procedural Guidance for Preparing Environmental Assessments and Considering Environmental Issues.* NRC Office of Nuclear Reactor Regulation, NRR Office Instruction LIC-203 Revision 1, Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 2004d. Letter from NRC to P. A. Kurkul, National Oceanic and Atmospheric Administration Fisheries. Subject: "Request for List of Protected Species Within the Area under Evaluation for License Renewal of Point Beach Nuclear Plant Units 1 and 2." Accession No. ML041330494. May 12, 2004.

U.S. Nuclear Regulatory Commission (NRC). 2004e. "Policy Statement on the Treatment of Environmental Justice Matters in NRC Regulatory and Licensing Actions." *Federal Register*, Vol. 69, No. 163, pp. 52040-52048, Washington, D.C. August 24, 2004.

We Energies. 2004a. Letter from S. Schumacher, Environmental Specialist/Ecologist, to R. Dexter, Wisconsin Historical Society. Subject: "License Renewal for the Point Beach Nuclear Plant – Review of Agricultural Lands Owned by We Energies." October 11, 2004.

We Energies. 2004b. Letter from N. J. Cutright, Senior Terrestrial Ecologist, to Nuclear Management Company. Subject: "Response to U.S. Fish and Wildlife Service Letter." May 12, 2004.

We Energies 2004c. Letter from S. Schumacher, Environmental Specialist, to J. DeRose, Wisconsin Historical Society. Subject: "Determination of Eligibility of the Biel Fishing Shed Located on the Point Beach Nuclear Power Plant Property, Two Rivers, Manitowoc." September 1, 2004.

Wei, A., P. Chow-Fraser, and D. Albert. 2004. "Influence of Shoreline Features on Fish Distribution in the Laurentian Great Lakes." *Canadian Journal of Fisheries and Aquatic Sciences*, Vol. 61, pp. 1113-1123.

Wells, L., and A. L. McLain. 1973. "Lake Michigan: Man's Effects on Native Fish Stocks and Other Biota." *Technical Report No. 20.* Great Lakes Fishery Commission, Ann Arbor, Michigan. http://www.glfc.org/pubs/TechReports/Tr20.pdf (Accessed April 26, 2004).

White, A.M., I. Hlohowskyj, and D.M. Loucks. 1987. *The Condition of Fishes Impinged at the Cleveland Electric Illuminating Company Eastlake and Avon Lake Plants Excluding the Gizzard Shad.* Report 78. Prepared by Environmental Resource Associates, University Heights, Ohio for The Centerior Energy Corp., Independence, Ohio. May.

Wisconsin Department of Natural Resources (WDNR). 1978. Letter from T. A. Kroehn, Administrator, Wisconsin Department of Natural Resources, to N. A. Ricci, Senior Vice President Wisconsin Electric Power Company. Subject: "Regarding Cooling Water Intake Structure Final Report."

Wisconsin Department of Natural Resources (WDNR). 2004a. WPDES Permit, effective July 1, 2004. WI-0000957-07-0. Madison, Wisconsin. July 1, 2004.

Wisconsin Department of Natural Resources (WDNR). 2004b. *Wisconsin State Threatened and Endangered Species website.* http://www.dnr.state.wi.us/org/land/er/working_list/taxalists/TandE.asp (Accessed May 5, 2004).

Wisconsin Electric Power Company (WEPCO) and Wisconsin Michigan Power Company. 1971. *Supplement to Applicants' Environmental Report Operating License Stage Point Beach Nuclear Plant 2.* U.S. Atomic Energy Commission, Docket No. 503-01. Milwaukee, Wisconsin. November 1971.

Wisconsin Electric Power Company (WEPCO). 1976. *Point Beach Nuclear Plant Final Report on Intake Monitoring Studies Performed by Wisconsin Electric Power Company in Fulfillment of Condition of Wisconsin Pollution Discharge Elimination System Permit.* No. WI-0000957, Milwaukee, Wisconsin. June 1, 1976.

Wisconsin Electric Power Company (WEPCO). 2000. *Evaluation of Alternative Intake Designs to Prevent the Entry of Cormorants, Point Beach Nuclear Plant.* Prepared for Wisconsin Electric Power Company by Alden Research Laboratory, Inc. Milwaukee, Wisconsin.

Wisconsin Historical Society. 2004. Letter from S. Banker, Office of Preservation Planning, to R. Newton, Point Beach Nuclear Plant. Subject: "SHWS #03-1046/MN Re: License Renewal: Point Beach Nuclear Plant." March 11, 2004.

Wisconsin Public Service Corporation. 1972. *Kewaunee Nuclear Power Plant Environmental Report: Operating License Stage.* Green Bay, Wisconsin. December 1972.

# 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 its 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 licenses (OLs). 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 draft supplemental environmental impact statement (SEIS). A licensee is required to maintain the acceptable design and performance criteria throughout the life of the plant, including any extended-life operation. The consequences for these events are evaluated for the hypothetical 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 Point Beach Nuclear Plant Units 1 and 2 (PBNP), is listed in Table 5-1.

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

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

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

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

Nuclear Management Company, LLC (NMC) stated in its Environmental Report (ER) (NMC 2004) that it is not aware of any new and significant information associated with the renewal of the PBNP OLs. The staff has not identified any significant new information during its independent review of the NMC ER (NMC 2004), the staff's site visit, the scoping process, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts related to 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 PBNP 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 PBNP 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 NMC ER (NMC 2004), the staff's site visit, the scoping process, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts of severe accidents beyond those discussed in the GEIS. However, in accordance with 10 CFR 51.53(c)(3)(ii)(L), the staff has reviewed severe accident mitigation alternatives (SAMAs) for PBNP. 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 PBNP; therefore, the remainder of Chapter 5 addresses those alternatives.

### 5.2.1 Introduction

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

The SAMA evaluations for PBNP were conducted with a four-step approach. In the first step NMC quantified the level of risk associated with potential reactor accidents using the plant-specific probabilistic risk assessment (PRA) and other risk models.

In the second step NMC examined the major risk contributors and identified possible ways (SAMAs) of reducing that risk. Common ways of reducing risk are changes to components, systems, procedures, and training. NMC initially identified 202 potential SAMAs. NMC screened out SAMAs that were not applicable to PBNP or had already been implemented at PBNP (or the PBNP design met the intent of the SAMA). This screening reduced the list of potential SAMAs to 65.

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

Finally, in the fourth step, the costs and benefits of each of the remaining SAMAs were compared to determine whether the SAMA was cost-beneficial, meaning the benefits of the SAMA were greater than the cost (a positive cost-benefit). NMC concluded that none of these 65 SAMAs would be cost-beneficial for PBNP (NMC 2004). However, the staff concluded that two of the SAMAs may be cost-beneficial.

Neither of these 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. NMC's SAMA analysis and the NRC's review are discussed in more detail below.

### 5.2.2 Estimate of Risk

NMC submitted an assessment of SAMAs for PBNP as part of the ER (NMC 2004). This assessment was based on the most recent PBNP 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 PBNP Individual Plant Examination (IPE) (WEPCO 1993) and Individual Plant Examination of External Events (IPEEE) (WEPCO 1995).

The baseline core damage frequency (CDF) for the purpose of the SAMA evaluation is approximately 3.59 x $10^{-5}$ per year. This CDF is based on the risk assessment for internally initiated events. NMC did not include the contribution to risk from external events within the PBNP risk estimates; however, it did account for the potential risk reduction benefits associated with external events by increasing the estimated benefits for internal events by a factor of 2.0. The breakdown of CDF by initiating event is provided in Table 5-3.

As shown in Table 5-3, steam generator tube rupture (SGTR) events, transients without the power conversion system (PCS) available, loss of component cooling water, and loss of offsite power are dominant contributors to the CDF.

**Table 5-3.** Core Damage Frequency

| Initiating Event | CDF (per year) | Percent Contribution |
|---|---|---|
| SGTR | 8.75 x $10^{-6}$ | 24.4 |
| Transient without PCS | 6.40 x $10^{-6}$ | 17.8 |
| Loss of component cooling | 4.39 x $10^{-6}$ | 12.3 |
| Loss of offsite power (dual unit) | 4.13 x $10^{-6}$ | 11.5 |
| Steam/feed break inside containment | 2.76 x $10^{-6}$ | 7.7 |
| Loss of service water | 2.43 x $10^{-6}$ | 6.8 |
| Steam/feed break outside containment | 1.90 x $10^{-6}$ | 5.3 |
| Medium loss-of-coolant accident (LOCA) (>2 to 6 in.) | 1.80 x $10^{-6}$ | 5 |
| Excessive LOCA (vessel failure) | 9.90 x $10^{-7}$ | 2.8 |
| Transient with PCS | 6.84 x $10^{-7}$ | 1.9 |
| Station blackout (SBO) | 4.41 x $10^{-7}$ | 1.2 |
| Small LOCA (3/8 to 2 in.) | 3.77 x $10^{-7}$ | 1.1 |
| Loss of bus D-01 | 2.76 x $10^{-7}$ | 0.8 |
| Loss of instrument air | 2.27 x $10^{-7}$ | 0.6 |
| Large LOCA (>6 in.) | 1.39 x $10^{-7}$ | 0.4 |
| Interfacing systems LOCA (ISLOCA) | 1.10 x $10^{-7}$ | 0.3 |
| Loss of bus D-02 | 6.74 x $10^{-8}$ | 0.2 |
| **Total CDF (from internal events)** | **3.59 x $10^{-5}$** | **100** |

NMC estimated the dose to the population within 80 km (50 mi) of the PBNP site from severe accidents to be approximately 0.0149 person-Sv (1.49 person-rem) per year. The breakdown of the total population dose by containment release mode is summarized in Table 5-4. SGTR events dominate the population dose risk.

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

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

| Containment Release Mode | Population Dose (Person-Rem[1] per Year) | Percent Contribution |
|---|---|---|
| Late SGTR | $1.09 \times 10^{0}$ | 73 |
| Early SGTR | $1.65 \times 10^{-1}$ | 11 |
| Containment Isolation failure | $8.49 \times 10^{-4}$ | <0 .1 |
| ISLOCA | $1.24 \times 10^{-1}$ | 8 |
| Other Core Melt Sequences | $1.04 \times 10^{-2}$ | 7 |
| **Total Population Dose** | **$1.49 \times 10^{0}$** | **100** |

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

### 5.2.3 Potential Plant Improvements

Once the dominant contributors to plant risk were identified, NMC searched for ways to reduce that risk. In identifying and evaluating potential SAMAs, NMC considered insights from the plant-specific PRA, as well as industry and NRC documents that discuss potential plant improvements, such as NUREG/CR-5630 (NRC 1991). NMC identified 202 potential risk-reducing improvements (SAMAs) to plant components, systems, procedures and training.

All but 65 of the the SAMAs were removed from further consideration because they were not applicable to PBNP, or they had already been implemented at PBNP (or the PBNP design met the intent of the SAMA).

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

### 5.2.4 Evaluation of Risk Reduction and Costs of Improvements

NMC evaluated the risk-reduction potential of the remaining 65 SAMAs that were applicable to PBNP. 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. The benefits were increased by a factor of 2.0 to account for benefits in external events.

NMC estimated the cost of implementing the 65 SAMAs through consideration of estimates from other licensee submittals for similar improvements and site-specific cost estimates. For some of SAMAs considered, the cost estimates were sufficiently greater than the benefits calculated that it was not necessary to perform a detailed cost estimate. Cost estimates typically included procedures, engineering analysis, training, and documentation, in addition to any hardware.

The staff has reviewed NMC's bases for calculating the risk reduction for the various plant improvements and concludes that the rationale and assumptions for estimating risk reduction are reasonable and 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 NMC's risk reduction estimates.

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

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

### 5.2.5 Cost-Benefit Comparison

The cost-benefit analysis performed by NMC was based primarily on NUREG/BR-0184 (NRC 1997) and was executed consistent with this guidance. Sensitivity calculations were conducted to examine the potential impact of uncertainties, discount rates other than seven percent, and several parameters and assumptions involved in the severe accident dose calculations. As a result of this analysis, the cost-benefit analysis showed that none of the candidate SAMAs were cost-beneficial. Therefore, NMC's conclusion was that there were no cost-beneficial SAMAs.

The staff reviewed NMC's calculation methods and assumptions and concluded that they were sound. Based on this evaluation, none of the SAMAs are cost-beneficial in the baseline analysis. However, the staff concluded that two SAMAs could be cost-beneficial when uncertainties, alternative discount rates, or broader implementation options are taken into account. These SAMAs involve installing an automatic pump trip on low RWST tank level (a revision to SAMA 126) and providing a portable generator to power the auxiliary feedwater turbine after battery depletion (SAMA 169).

The staff concludes that, with the exception of these two SAMAs, the costs of implementing the SAMAs would be higher than the associated benefits. This conclusion is supported by uncertainty assessment and sensitivity analysis.

### 5.2.6 Conclusions

The staff reviewed the NMC analysis and concluded that the methods used and the implementation of those methods were sound. The treatment of SAMA benefits and costs, the generally large negative net benefits, and the inherently small baseline risks support the general conclusion that the SAMA evaluations performed by NMC are reasonable and sufficient for the license renewal submittal.

Although none of the SAMAs appear cost-beneficial in the baseline analysis, the staff concluded that two SAMAs could be cost-beneficial when uncertainties, alternative discount rates, or broader implementation options are taken into account. These SAMAs involve installing an automatic pump trip on low RWST tank level (a revision to SAMA 126) and providing a portable generator to power the auxiliary feedwater turbine after battery depletion (SAMA 169). However, none of these SAMAs relate to adequately managing the effects of aging during the period of extended operation. Therefore, they need not be implemented as part of the license renewal pursuant to 10 CFR Part 54.

The staff concludes that none of the other candidate SAMAs are cost-beneficial. This conclusion is consistent with the low residual level of risk indicated in the PRA for both units and the fact that PBNP has already implemented many of the plant improvements identified from the IPE and IPEEE processes.

## 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."

Nuclear Management Company, LLC. (NMC). 2004. *Point Beach Nuclear Plant Operating License Renewal Application Environmental Report.* Two Rivers, Wisconsin.

U.S. Nuclear Regulatory Commission (NRC). 1991. "PWR Dry Containment Parametric Studies," NUREG/CR-5630, Washington, D.C.

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

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

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

Wisconsin Electric Power Company (WEPCO). 1993. Letter from Bob Link, to Document Control Desk, Subject: Generic Letter 88-20 (TAC NOS. 74452 and 74453) "Summary Report on Individual Plant Examination for Severe Accident Vulnerabilities, Point Beach Nuclear Plant, Units 1 and 2," dated June 30, 1993.

Wisconsin Electric Power Company (WEPCO). 1995. Letter from Bob Link, to Document Control Desk, Subject: Generic Letter 88-20 (TAC NOS. 74452 and 74453) "Summary Report Examination of External Events for Severe Accident Vulnerabilities Point Beach Nuclear Plant, Unit 1 and 2," June 30, 1995.

# 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 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.

This chapter addresses the issues that are related to the uranium fuel cycle and solid-waste management during the license renewal term that are listed in Table B-1 of Title 10 of the Code of Federal Regulations (CFR) Part 51, Subpart A, Appendix B, and are applicable to Point Beach Nuclear Plant Units 1 and 2 (PBNP). 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

(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.

impacts provided in 10 CFR 51.51(b), Table S-3, "Table of Uranium Fuel Cycle Environmental Data," and in 10 CFR 51.52(c), Table S-4, "Environmental Impact of Transportation of Fuel and Waste to and from One Light-Water-Cooled Nuclear Power Reactor." The staff also addresses the impacts from radon-222 and technetium-99 in the GEIS.

## 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 PBNP 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 |

Nuclear Management Company, LLC (NMC) stated in its Environmental Report (ER) (NMC 2004) that it is not aware of any new and significant information associated with the renewal of the PBNP operating licenses. The staff has not identified any significant new information during its independent review of the NMC ER (NMC 2004), the staff's site visit, the scoping process, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts related to these issues beyond those discussed in the GEIS. For these issues, the staff concluded in the GEIS that the impacts are SMALL except for the collective offsite radiological impacts from the fuel cycle and from 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 Part 51, for each of these issues follows:

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

  > 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 significant new information during its independent review of the NMC ER (NMC 2004), the staff's site visit, the scoping process, or its evaluation of other available information. Therefore, the staff concludes that there are no offsite radiological impacts of the uranium fuel cycle during the renewal term beyond those discussed in the GEIS.

- Offsite radiological impacts (collective effects). 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 significant new information during its independent review of the NMC ER (NMC 2004), the staff's site visit, the scoping process, or its evaluation of other available information. Therefore, the staff concludes that there are no offsite radiological impacts (collective effects) from the uranium fuel cycle during the renewal term beyond those discussed in the GEIS.

- <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 $3 \times 10^{-3}$.

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

The U.S. Environmental Protection Agency (EPA) developed Yucca Mountain-specific repository standards, which were subsequently adopted by the NRC in 10 CFR Part 63. In an opinion, issued July 9, 2004, the U.S. Court of Appeals for the District of Columbia Circuit (the Court) vacated EPA's radiation protection standards for the candidate repository, which required compliance with certain dose limits over a 10,000 year period. The Court's decision also vacated the compliance period in NRC's licensing criteria for the candidate repository in 10 CFR Part 63.

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

Despite the current uncertainty with respect to these rules, some judgment as to the regulatory NEPA implications of offsite radiological impacts of spent fuel and HLW disposal should be made. The staff concludes that these impacts are acceptable in that the impacts would not be sufficiently large to require the NEPA conclusion that the option of extended operation under 10 CFR Part 54 should be eliminated.

The staff has not identified any new and significant information during its independent review of the NMC ER (NMC 2004), 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.

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

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

  The staff has not identified any significant new information during its independent review of the NMC ER (NMC 2004), the staff's site visit, the scoping process, or its evaluation of other available information. Therefore, the staff concludes that there are no nonradiological impacts of the uranium fuel cycle during the renewal term beyond those discussed in the GEIS.

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

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

  The staff has not identified any significant new information during its independent review of the NMC ER (NMC 2004), the staff's site visit, the scoping process, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts of low-level waste 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 significant new information during its independent review of the NMC ER (NMC 2004), the staff's site visit, the scoping process, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts of mixed waste storage and disposal associated with the renewal term beyond those discussed in the GEIS.

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

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

  The staff has not identified any significant new information during its independent review of the NMC ER (NMC 2004), the staff's site visit, the scoping process, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts of onsite spent fuel associated with license renewal beyond those discussed in the GEIS.

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

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

The staff has not identified any significant new information during its independent review of the NMC ER (NMC 2004), the staff's site visit, the scoping process, or its evaluation of other available information. Therefore, the staff concludes that there are no nonradiological waste impacts during the renewal term beyond those discussed in the GEIS.

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

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

  PBNP meets the fuel enrichment and burnup conditions set forth in Addendum 1 to the GEIS. The staff has not identified any significant new information during its independent review of the NMC ER (NMC 2004), the staff's site visit, the scoping process, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts of transportation associated with license renewal beyond those discussed in the GEIS.

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

## 6.2 References

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

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

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

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

Joint Resolution approving the site at Yucca Mountain, Nevada, for the development of a repository for the disposal of high-level radioactive waste and spent nuclear fuel, pursuant to the Nuclear Waste Policy Act of 1982. 2002. Public Law 107-200, 116 Stat. 735.

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

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

*Nuclear Energy Institute, Inc. v. EPA*, 373 F.3d 1251 (D.C. Circuit Court 2004).

Nuclear Management Company, LLC (NMC). 2004. *Point Beach Nuclear Plant Operating License Renewal Application Environmental Report.* Two Rivers, Wisconsin.

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

U.S. Nuclear Regulatory Commission (NRC). 1999. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants, Main Report, Section 6.3—Transportation, Table 9.1, Summary of Findings on NEPA Issues for License Renewal of Nuclear Power Plants, Final Report.* NUREG-1437, Volume 1, Addendum 1, Washington, D.C.

# 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*, NUREG-0586, Supplement 1 (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 Title 10 of the Code of Federal Regulations (CFR) Part 51, Subpart A, Appendix B, that are applicable to Point Beach Nuclear Plant Units 1 and 2 (PBNP) decommissioning following the renewal term are listed in Table 7-1. Nuclear Management Company, LLC (NMC) stated in its Environmental Report (ER) (NMC 2004) that it is aware of no new and significant information regarding the environmental impacts of PBNP license renewal. The staff has not identified any significant new information during its independent review of the NMC ER (NMC 2004), the staff's site visit, the scoping process, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts related to these issues beyond those discussed in the GEIS. For all of these issues, the staff concluded in the GEIS that the impacts are SMALL, and additional plant-specific mitigation measures are not likely to be sufficiently beneficial to be warranted.

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

The staff has not identified any new and significant information during its independent review of the NMC ER (NMC 2004), the staff's site visit, the scoping process, or its evaluation of other available information. Therefore, the staff concludes that there are no radiation dose impacts associated with decommissioning following the license renewal term beyond those discussed in the GEIS.

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

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

The staff has not identified any new and significant information during its independent review of the NMC ER (NMC 2004), the staff's site visit, the scoping process, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts from solid waste associated with decommissioning following the license renewal term beyond those discussed in the GEIS.

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

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

The staff has not identified any new and significant information during its independent review of the NMC ER (NMC 2004), the staff's site visit, the scoping process, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts on air quality associated with decommissioning following the license renewal term beyond those discussed in the GEIS.

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

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

The staff has not identified any new and significant information during its independent review of the NMC ER (NMC 2004), the staff's site visit, the scoping process, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts on water quality associated with decommissioning following the license renewal term beyond those discussed in the GEIS.

- Ecological resources. Based on information 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 NMC ER (NMC 2004), the staff's site visit, the scoping process, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts on ecological resources associated with decommissioning following the license renewal term beyond those discussed in the GEIS.

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

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

The staff has not identified any new and significant information during its independent review of the NMC ER (NMC 2004), the staff's site visit, the scoping process, or its evaluation of other available information. Therefore, the staff concludes that there are no socioeconomic impacts associated with decommissioning following the license renewal term beyond those discussed in the GEIS.

## 7.2 References

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

Nuclear Management Company, LLC. (NMC). 2004. *Point Beach Nuclear Plant Operating License Renewal Application Environmental Report.* Two Rivers, Wisconsin.

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

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

U.S. Nuclear Regulatory Commission (NRC). 2002. *Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities, Supplement 1, Regarding the Decommissioning of Nuclear Power Reactors.* NUREG-0586, Volumes 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 operating licenses (OLs) for the Point Beach Nuclear Plant Units 1 and 2 (PBNP) (i.e., the no-action alternative); electric generating sources other than PBNP; 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 PBNP. The environmental impacts are evaluated using the U.S. Nuclear Regulatory Commission's (NRC's) three-level standard of significance – SMALL, MODERATE, or LARGE – developed using the Council on Environmental Quality guidelines and set forth in the footnotes to Table B-1 of Title 10 of the Code of Federal Regulations (CFR) Part 51, Subpart A, Appendix B:

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

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

## 8.1 No-Action Alternative

The NRC's regulations implementing the National Environmental Policy Act of 1969 (NEPA) specify that the no-action alternative be discussed in an NRC environmental impact statement; see 10 CFR Part 51, Subpart A, Appendix A, Section 4. For license renewal, the no-action alternative refers to a scenario in which the NRC would not renew the PBNP OLs, and Nuclear Management Company, LLC (NMC) would then cease plant operations by the end of the current licenses and decommission Units 1 and 2.

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

NMC will be required to shut down PBNP and to comply with NRC decommissioning requirements in 10 CFR 50.82 whether or not the PBNP OLs are renewed. If the PBNP OLs are renewed, then 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 the results presented in Table 8-1. Plant shutdown will result in a net reduction in power production capacity. The power not generated by PBNP during the license renewal term would likely be replaced by (1) power purchased from other electricity providers, (2) generating alternatives other than PBNP, (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.

(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 (NRC 2002).

**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 are generally positive and terrestrial impacts are not expected because there will not be any land-use changes. |
| Water Use and Quality – Surface Water | SMALL | Impacts are expected to be SMALL because surface-water intake and discharges will decrease. |
| Water Use and Quality – Groundwater | SMALL | Impacts are expected to be SMALL because groundwater use will decrease. |
| Air Quality | SMALL | Impacts are expected to be SMALL because emissions 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 reduced. |
| Socioeconomics | SMALL to MODERATE | Impacts are expected to be SMALL to MODERATE 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 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 | Impacts are expected to be SMALL because very few minority/low-income persons live in the immediate vicinity of PBNP. The staff did not identify any location-dependent disproportionately high and adverse impacts that would affect these minority and low-income populations. |

- **Land Use**

In Chapter 4, the staff concluded that the impacts of continued operation of PBNP on land use would be SMALL. Onsite land use will not be immediately affected 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 transmission line rights-of-way (ROWs) will continue as before. Therefore, the staff concludes that the impacts on land use from plant shutdown would be SMALL.

- **Ecology**

In Chapter 4, the staff concluded that the ecological impacts of continued operation of PBNP would be SMALL. Cessation of operations will be accompanied by a significant reduction in cooling-water flow and elimination of impingement impacts, entrainment impacts, and the thermal plume. The environmental impacts to aquatic species, including threatened and endangered species, associated with these changes are generally positive. The transmission lines associated with PBNP are expected to remain in service after PBNP stops operating. As a result, maintenance of the transmission line 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 the impacts of continued operation of PBNP on surface-water use and quality would be SMALL When the plant stops operating, there will be an immediate reduction in the consumptive use of water because of reduction in cooling-water flow and in the amount of heat rejected to Lake Michigan. There will also be a significant reduction in biocide use. Therefore, the staff concludes that the impacts on surface-water use and quality from plant shutdown would be SMALL.

- **Water Use and Quality – Groundwater**

In Chapter 4, the staff concluded that impacts of continued operation of PBNP on groundwater use and groundwater availability and quality would be SMALL. When the plant stops operating, there will be a reduction in the use of well water because of reduced potable water consumption and sanitary use as the plant staff decreases. Therefore, the staff concludes that impacts on groundwater use and quality from shutdown of the plant would be SMALL.

- **Air Quality**

In Chapter 4, the staff concluded that the impacts of continued operation of PBNP on air quality are SMALL. When the plant stops operating, there will be a reduction in emissions from activities related to plant operations, 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 continued operation of PBNP are discussed in Chapter 6. The impacts of low-level and mixed waste from plant operation are characterized as SMALL. When PBNP stops operating, the plant will stop generating HLW. Generation of low-level and mixed waste associated with plant operation and maintenance will be reduced. Therefore, the staff concludes that the impact of waste generated after shutdown of the plant would be SMALL.

- **Human Health**

In Chapter 4, the staff concluded that the impacts of continued operation of PBNP on human health would be SMALL. After the cessation of operations, the amount of radioactive material released to the environment in gaseous and liquid forms will be reduced. Therefore, the staff concludes that the impact of shutdown of the plant on human health 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, the 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 staff concluded that the socioeconomic impacts of continued operation of PBNP 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 the Shared Utility Payments for the town of Two Creeks and Manitowoc County. The staff concludes that the socioeconomic impacts of plant shutdown would range from SMALL to MODERATE. 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, for additional discussion of the potential socioeconomic impacts of plant shutdown (NRC 2002).

- **Transportation**

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

- **Aesthetics**

In Chapter 4, the staff concluded that the aesthetic impacts of continued operation of PBNP would be SMALL. The plant structures will remain in place upon shutdown. Operational noise would be reduced or eliminated. Noise would be generated during decommissioning operations that may be detectable off site; however, the impact is unlikely to be of large significance and can normally be mitigated. Thus, the aesthetic impacts associated with the shutdown of PBNP are considered SMALL.

- **Historic and Archaeological Resources**

In Chapter 4, the staff concluded that the impacts of continued operation of PBNP on historic and archaeological resources would be SMALL. Onsite land use would not be affected immediately by the cessation of operations. Plant structures and other facilities are likely to remain in place until decommissioning. The transmission lines associated with the project are expected to remain in service after the plant stops operating. As a result, maintenance of transmission line ROWs would 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 impact of continued operation of PBNP on environmental justice would be SMALL because continued operation of the plant would not have disproportionately high and adverse impacts on minority and low-income populations. Shutdown of the plant could result in the loss of employment opportunities at the PBNP site and secondary socioeconomic impacts (e.g., loss of patronage at local businesses). However, shutdown of the plant is unlikely to have disproportionately high and adverse impacts on minority and low-income populations. The staff concludes that the environmental justice impacts of plant shutdown would be SMALL. 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, for additional discussion of these impacts (NRC 2002).

## 8.2 Alternative Energy Sources

This section discusses the environmental impacts associated with alternative sources of electric power to replace the power generated by PBNP, 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 PBNP site and a greenfield[(a)] alternate site (Section 8.2.1)

- Natural gas-fired generation at the PBNP site and a greenfield alternate site (Section 8.2.2)

- Nuclear generation at the PBNP site and a greenfield alternate site (Section 8.2.3).

The alternative of purchasing power from other sources to replace power generated at PBNP 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 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 combined cycle,[(b)] distributed generation, or combustion turbine technology fueled by natural gas is likely to account for approximately 62 percent of new electric generating capacity between the years 2002 and 2025 (DOE/EIA 2004a). Both technologies are designed primarily to supply peak and intermediate capacity, but gas

(a) A greenfield site is assumed to be an undeveloped site with no previous construction, and the environmental impacts are expected to be greater than those at an already developed alternate site.
(b) 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.

combined-cycle technology can also be used to meet baseload[a] requirements. Coal-fired plants are projected by EIA to account for approximately 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 generation cost in 2010, followed by wind generation and then coal-fired plants (DOE/EIA 2004a). By 2025, coal-fired plants are projected by EIA to have the lowest generation cost, followed by gas combined-cycle plants and then wind generation (DOE/EIA 2004a).

EIA projects that oil-fired plants will account for very little of new generation capacity in the United States during the 2002 to 2025 time period because of higher fuel costs and lower efficiencies (DOE/EIA 2004a). Consequently, an oil-fired power plant is not considered to be a reasonable alternative to replace the power generated by PBNP.

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 (DOE/EIA 2004a). In spite of this projection, a new nuclear plant alternative to power generated by PBNP is considered for reasons stated in Section 8.2.3. NRC established a new reactor licensing program organization in 2001 to prepare for and manage future reactor and site licensing applications (NRC 2001). Therefore, a new nuclear plant alternative for replacing power generated by PBNP is considered in this SEIS.

PBNP has a combined net rating of 1036 megawatts electric (MW[e]). For the coal-fired alternative, the staff assumed the construction of two 600 MW(e) units that would operate at about 78 percent efficiency. For the natural-gas alternative, the staff assumed four 380 MW(e) units operating at 85 percent efficiency. For the new nuclear alternative, the staff assumed construction of a plant with a net electric output of 1000 MW(e). The coal and gas alternatives are consistent with the NMC Environmental Report (ER) (NMC 2004). The ER did not discuss a new nuclear alternative.

(a) 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.

### 8.2.1 Coal-Fired Generation

The coal-fired alternative is analyzed for both the PBNP site and an alternate site. For purposes of analysis, the staff assumed the coal-fired alternative would use an integrated coal gasification combined-cycle (IGCC) process, which would have lower impacts than the supercritical pulverizing process. Construction of a rail spur 16 to 24 km (10 to 15 mi) in length would be needed at the PBNP site and likely would be needed at an alternate site. Construction at an alternate site also may require the construction of a new transmission line to connect the coal-fired plant to existing lines.

Unless otherwise indicated, the assumptions and numerical values used in Section 8.2.1 are from the NMC ER (NMC 2004). 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 PBNP would remain in operation while the alternative coal-fired plant was constructed.

The staff assumed the construction of two 600 MW(e) units operating at 78 percent efficiency as potential replacements for PBNP. The coal-fired plant would consume approximately 2.1 million metric tons (MT) (2.3 million tons) per year of pulverized bituminous coal (NMC 2004). NMC assumed a heat rate[(a)] of 2.78 J of fuel /J of electricity (9500 BTU/kWh) and a capacity factor[(b)] of 0.78 in its ER (NMC 2004). The IGCC process would generate about 91,000 MT (100,000 tons) of a vitrified, glass-like waste material rather than ash, which would be collected and disposed of at the PBNP site. In addition, approximately 16,000 MT (18,000 tons) of elemental sulfur would be generated and disposed of at the PBNP site.

In addition to the impacts discussed below for a coal-fired plant at the PBNP site or an alternate site, impacts would occur off site as a result of mining of coal. 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. Partially offsetting this offsite land use would be the elimination of the

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

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

need for uranium mining to supply fuel for PBNP. 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.

Coal for a coal-fired plant sited at PBNP most likely would be delivered by rail line. Rail delivery would also be the most likely option for delivering coal to an alternate site, although barge delivery would also be a possibility.

#### 8.2.1.1 Closed-Cycle Cooling System

The overall impacts of a coal-fired generating system using a closed-cycle cooling system and cooling towers at either the PBNP or alternate sites are discussed in the following sections and summarized in Table 8-2. The magnitude of impacts for an alternate site would depend on the location of the particular site selected. PBNP currently uses a once-through cooling system. For the purposes of comparison with an alternate site, however, it is assumed that a replacement coal-fired plant on the PBNP site would use a closed-cycle cooling system.

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

| | PBNP Site | | Alternate Site | |
|---|---|---|---|---|
| IMPACT CATEGORY | IMPACT | COMMENTS | IMPACT | COMMENTS |
| Land Use | MODERATE to LARGE | Would use approximately 355 ha (880 ac) for plant, waste disposal, and rail spur. There would be additional offsite land impacts from coal mining. | MODERATE to LARGE | Would use approximately 700 ha (1700 ac) for plant, offices, parking, transmission line, and rail spur. There would be additional land impacts from coal mining. |
| Ecology | SMALL to MODERATE | Would use over 320 ha (790 ac) of undeveloped and farmland areas at the current PBNP site, plus rail corridor. There would be potential habitat loss and fragmentation and reduced productivity and biological diversity. | MODERATE to LARGE | Impact would depend on the location and ecology of the site, surface-water body used for intake and discharge, and transmission line and rail spur routes. There would be potential habitat loss and fragmentation and reduced productivity and biological diversity. |

**Table 8-2.** (contd)

| | PBNP Site | | Alternate Site | |
|---|---|---|---|---|
| IMPACT CATEGORY | IMPACT | COMMENTS | IMPACT | COMMENTS |
| Water Use and Quality – Surface Water | SMALL | Would use parts of the existing cooling system (intake and discharge structures). Operational impacts would be similar or less than PBNP. | SMALL to MODERATE | Impact would depend on the volume of water withdrawn and discharged and the characteristics of the surface-water body. |
| Water Use and Quality – Groundwater | SMALL | Groundwater use would be limited. | SMALL to MODERATE | Impact would depend on the volume of water withdrawn and discharged and the characteristics of the aquifers. |
| Air Quality | MODERATE | Sulfur oxides<br>• 795 MT/yr (876 tons/yr)<br>Nitrogen oxides<br>• 1856 MT/yr (2046 tons/yr)<br>Particulates<br>• 291 MT/yr (321 tons/yr) of total suspended particulates including $PM_{10}$<br>Carbon monoxide<br>• 1359 MT/yr (1498 tons/yr)<br><br>Small amounts of mercury and other hazardous air pollutants and naturally occurring radioactive materials – mainly uranium and thorium. | MODERATE | Impacts would be potentially the same as at the PBNP site, although pollution-control standards may vary depending on location. |
| Waste | MODERATE | Total waste volume would be approximately $1.1 \times 10^6$ $m^3$ ($1.4 \times 10^6$ $yd^3$) of waste requiring approximately 76 ha (190 ac) for disposal during the 40-year life of the plant. | MODERATE | Impacts would be the same as at the PBNP site; waste disposal constraints may vary. |
| Human Health | SMALL | Impacts are considered SMALL in the absence of more quantitative risk data. | SMALL | Impacts would be the same as at the PBNP site. |

**Table 8-2.** (contd)

| | PBNP Site | | Alternate Site | |
|---|---|---|---|---|
| IMPACT CATEGORY | IMPACT | COMMENTS | IMPACT | COMMENTS |
| Socioeconomics | MODERATE | During construction, impacts would be MODERATE. Between 500 and 2500 additional workers would be employed during the peak of the 5-year construction period, followed by reduction from current PBNP workforce of 971 to 200; the Shared Utility Payments would continue. Impacts during operation would be SMALL. | MODERATE to LARGE | Construction impacts depend on location, but could be LARGE if the plant is located in an area that is more rural than the PBNP site. Manitowoc County and Two Rivers would experience loss of Shared Utility Payments and employment, potentially offset by proximity to Green Bay. |
| Transportation | SMALL to LARGE | Transportation impacts associated with construction workers could be MODERATE to LARGE. Transportation impacts after PBNP shutdown and startup of the coal plant are considered SMALL.<br><br>For rail transportation of coal and lime, the impact is considered MODERATE to LARGE. For any barge transportation, the impact is considered SMALL. | SMALL to LARGE | Transportation impacts associated with construction workers could be MODERATE to LARGE.<br><br>For rail transportation of coal and lime, the impact is considered MODERATE to LARGE. For any barge transportation, the impact is considered SMALL. |
| Aesthetics | MODERATE | The aesthetic impact of plant units, stacks, and cooling towers would be MODERATE. 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 depend on the characteristics of the site but would generally be similar to PBNP site impacts with additional impacts from the transmission lines and any rail spur that may be needed. |
| Historic and Archaeological Resources | SMALL to MODERATE | Some construction would affect previously developed parts of the PBNP site; a cultural resource inventory should minimize any impacts on undeveloped lands. | SMALL to MODERATE | An alternate site would necessitate cultural resource studies. |

Table 8-2. (contd)

| | PBNP Site | | Alternate Site | |
|---|---|---|---|---|
| Impact Category | Impact | Comments | Impact | Comments |
| 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 might occur during construction. | SMALL to MODERATE | Impacts would vary depending on population distribution and makeup at the site. |

- **Land Use**

The existing facilities and infrastructure at the PBNP 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 require modification and use of the switchyard, offices, and transmission line ROWs. Much of the land that would be used has been previously disturbed. However, it is assumed that PBNP would continue to operate while the new units are built.

The coal-fired generation alternative would necessitate converting roughly an additional 240 ha (600 ac) of the PBNP site for the plant and coal storage, plus an additional 77 ha (190 ac) for waste disposal (NMC 2004). Although the PBNP site has an existing once-through cooling system, the system would need to be significantly modified to accommodate a coal plant with a closed-cycle cooling system. It is assumed that the once-through cooling system would be used for the continued safe operation of PBNP while the new units are built. Therefore, some of the leased farm lands on the PBNP site would be converted to industrial use under this alternative. In addition, 24 to 36 ha (60 to 90 ac) would be disturbed to construct a rail spur for coal delivery. Additional land-use changes would occur off site in an undetermined coal mining area to supply coal for the plant.

The impact of a coal-fired generating unit on land use at the existing PBNP site is best characterized as MODERATE to LARGE. The impact would be greater than the OL renewal alternative.

Construction of the coal-fired plant at an alternate site could impact up to 700 ha (1700 ac) (NRC 1996). While transmission facilities would factor into the site selection process, new transmission lines may be necessary, and additional land may be disturbed if a rail spur is needed for coal delivery. This alternative would result in MODERATE to LARGE land-use impacts.

- **Ecology**

Locating a coal-fired plant at the PBNP site would alter ecological resources because of the need to convert roughly 320 ha (790 ac) of land to industrial use (plant, coal storage, vitrified waste and elemental sulfur disposal). Additional land would be disturbed for the construction and use of the closed-cycle cooling system and rail spur. However, some of the land on PBNP has already been disturbed. Therefore, the impacts to terrestrial resources would be considered SMALL to MODERATE. Impacts to aquatic resources would be reduced and remain SMALL should closed-cycle cooling replace the once-through system.

Locating a coal-fired plant at an alternate site would alter ecological resources because of the need to convert up to roughly 700 ha (1700 ac) (NRC 1996) of previously undisturbed land to industrial use (plant, coal storage, vitrified waste and elemental sulfur disposal). Additional land likely would be disturbed for a rail spur and any new transmission facilities. Impacts could include wildlife habitat loss, reduced productivity, and a local reduction in biological diversity. The closed-cycle cooling system alternative would likely have a SMALL impact to aquatic resources. Overall, the ecological impacts at an alternate site would be MODERATE to LARGE.

- **Water Use and Quality**

Surface Water. Coal-fired generation at the PBNP site would likely 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. Plant discharges would consist mostly of cooling-tower blowdown, primarily characterized 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 wastewater may also be discharged. All discharges would be regulated by the Wisconsin Department of Natural Resources (WDNR) through a Wisconsin Pollutant Discharge Elimination System permit. There would be a consumptive use of water due to evaporation from the cooling towers. Some erosion and sedimentation would likely occur during construction (NRC 1996). 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 PBNP site to be SMALL.

Cooling water at an alternate site would likely be withdrawn from a surface-water body and would be regulated by permit. Depending on the source water body, the impacts of water use for cooling system makeup water and the effects on water quality due to cooling-tower blowdown could have noticeable impacts. Therefore, the staff considers the impacts of a new coal-fired plant utilizing a closed-cycle cooling system at an alternate site to be SMALL to MODERATE.

Groundwater. The staff assumed that groundwater wells would continue to be used for PBNP related activities. Groundwater withdrawals would be equal to or less than the no-action and license renewal alternatives. Overall, impacts of a coal-fired power plant with a closed-cycle cooling system at the PBNP site on groundwater use and quality are considered SMALL. Use of groundwater for a coal-fired plant located at an alternate site is a possibility. Groundwater withdrawals at an alternate site would likely require a State permit. The impacts will depend on the characteristics of the site and the amount of groundwater used. Therefore, the impacts 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 vary considerably from those of nuclear generation because burning coal emits sulfur oxides ($SO_x$), nitrogen oxides ($NO_x$), particulates, carbon monoxide, hazardous air pollutants such as mercury, and naturally occurring radioactive materials.

PBNP is located in the Lake Michigan Intrastate Air Quality Control Region (AQCR), formerly known as the Menominee-Escanaba (Michigan)-Marinette (Wisconsin) Interstate AQCR. The AQCR is currently in attainment for all air-quality criteria pollutants, with the exception of ozone. The U.S. Environmental Protection Agency (EPA) designated Manitowoc County, Wisconsin, as a "basic" nonattainment area for the 8-hour ozone standard, with June 2009 as the latest date to achieve attainment. The county must comply with the more general nonattainment requirements of the Clean Air Act of 1970 (CAA). Therefore, improved emissions controls likely would be required for a new coal-fired plant located at the PBNP site.

A new coal-fired generating plant located in Wisconsin would need an operating permit under the CAA. The plant would need to comply with the new source performance standards set forth in 40 CFR Part 60, Subpart Da. The standards establish limits for particulate matter and opacity (40 CFR 60.42a), for sulfur dioxide ($SO_2$) (40 CFR 60.43a), and for $NO_x$ (40 CFR 60.44a). The facility would be designed to meet best available control technology or lowest achievable emissions rate standards, as applicable, for control of criteria air pollutants.

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. PBNP and nearby alternate sites are in areas designated as being in attainment or unclassified for criteria pollutants with the exception of ozone.

Section 169A of the CAA (42 United States Code [USC] 7491) establishes a national goal of preventing future impairment of visibility and remedying existing impairment of visibility in mandatory Class I Federal areas when impairment results from man-made air pollution. The

EPA issued a new regional haze rule in 1999 (EPA 1999). The rule specifies that for each mandatory Class I Federal area, 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. There are no Class I areas within 160 km (100 mi) of the PBNP site.

Impacts for particular pollutants are as follows:

- Sulfur oxides. 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 purchase allowances from owners of other power plants 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 $SO_2$ emissions, although it might do so locally. Regardless, $SO_2$ emissions would be greater for the coal alternative than the OL renewal alternative.

  NMC estimates that by using the best technology to minimize $SO_x$ emissions, the total annual stack emissions would be approximately 795 MT (876 tons) of $SO_x$ (NMC 2004).

- Nitrogen oxides. Section 407 of the CAA establishes technology-based emission limitations for $NO_x$ emissions. The market-based allowance system used for $SO_2$ emissions is not used for $NO_x$ emissions. A new coal-fired power plant would be subject to the new source performance standards for such plants at 40 CFR 60.44a(d)(1). This regulation (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.

  NMC estimates that the total annual $NO_x$ emissions for a new coal-fired power plant would be approximately 1856 MT (2046 tons) (NMC 2004). This level of $NO_x$ emissions would be greater than the OL renewal alternative.

- Particulates. NMC estimates that the total annual stack emissions would be about 291 MT (321 tons) of total suspended particulates and particulate matter having an aerodynamic diameter less than or equal to 10 μm ($PM_{10}$) (NMC 2004). Fabric filters or electrostatic precipitators likely would be used for control. In addition, coal-handling equipment would introduce fugitive particulate emissions. Particulate emissions would be greater under the coal alternative than the OL renewal alternative.

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

- Carbon monoxide. NMC estimates that the total carbon monoxide emissions would be approximately 1359 MT (1498 tons) per year for a coal-fired power plant (NMC 2004). This level of emissions is greater than the OL renewal alternative.

- Hazardous air pollutants including mercury. In December 2000, the EPA issued regulatory findings on emissions of hazardous air pollutants from electric utility steam-generating units (EPA 2000a). The EPA determined that coal- and oil-fired electric utility steam-generating units are significant emitters of hazardous air pollutants. Coal-fired power plants were found by the EPA to emit arsenic, beryllium, cadmium, chromium, dioxins, hydrogen chloride, hydrogen fluoride, lead, manganese, and mercury (EPA 2000a). The EPA concluded that mercury is the hazardous air pollutant of greatest concern. The EPA found that (1) there is a link between coal consumption and mercury emissions, (2) electric utility steam-generating units are the largest domestic source of mercury emissions, and (3) certain segments of the U.S. population (e.g., the developing fetus and subsistence fish-eating populations) are believed to be at potential risk of adverse health effects due to mercury exposures resulting from consumption of contaminated fish (EPA 2000a). Accordingly, the EPA added coal- and oil-fired electric utility steam-generating units to the list of source categories under Section 112(c) of the CAA for which emission standards for hazardous air pollutants will be issued (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 would be MODERATE. The impacts would be clearly noticeable, but would not destabilize air quality.

  Siting a coal-fired generation plant at a site other than PBNP 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**

The IGCC coal combustion technology would generate a vitrified, glass-like waste material (slag). *Two 600-MW(e) coal-fired plants would generate approximately* $1.1 \times 10^6$ *m*$^3$ ($1.4 \times 10^6$ cu yds) of this waste over 40 years. The waste would be disposed of on site and account for approximately 77 ha (190 ac) of land area over the 40-year plant life. Waste impacts to groundwater and surface water could extend beyond the operating life of the plant if leachate and runoff from the waste storage area occur. 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. Debris would be generated during construction activities.

In May 2000, the EPA issued a "Notice of Regulatory Determination on Wastes From the Combustion of Fossil Fuels" (EPA 2000b). EPA concluded that some form of national regulation is warranted to address coal combustion waste products because (1) the composition of these wastes could present danger to human health and the environment under certain conditions; (2) EPA has identified 11 documented cases of proven damages to human health and the environment by improper management of these wastes in landfills and surface impoundments; (3) present disposal practices are such that, in 1995, these wastes were being managed in 40 percent to 70 percent of landfills and surface impoundments without reasonable controls in place, particularly in the area of groundwater monitoring; and (4) the EPA identified gaps in State oversight of coal combustion wastes. Accordingly, the EPA announced its intention to issue regulations for disposal of coal combustion waste under Subtitle D of the Resource Conservation and Recovery Act. EPA held a stakeholders meeting on minefill practices for coal combustion residue in May 2003 and a series of "listening" meetings on coal combustion byproducts in April and May 2004, but has not yet issued regulations for the disposal of coal combustion waste.

Siting the coal-fired power plant at PBNP or at an alternate site other than PBNP would not alter waste generation, although other sites might have more constraints on disposal locations. Therefore, the waste impacts would be MODERATE.

- **Human Health**

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

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

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

- **Socioeconomics**

Construction of the coal-fired alternative would take approximately 5 years. The staff assumed that construction would take place while PBNP continues operation and would be completed by the time Units 1 and 2 permanently cease operations. The workforce would be expected to vary between 1200 and 2500 workers during the 5-year construction period (NRC 1996); although NMC estimated approximately 500 to 600 construction workers (NMC 2004). These workers would be in addition to the approximately 971 workers employed at PBNP. During construction, the surrounding communities would experience demands on housing and public services that could have MODERATE impacts. These impacts would be tempered by construction workers commuting to the site from other parts of Manitowoc County or from other counties. After construction, the communities would be impacted by the loss of the construction jobs.

If the coal-fired replacement plant were constructed at the PBNP site and Units 1 and 2 were shut down, there would be a loss of approximately 971 permanent jobs. Approximately 200 permanent jobs would be created to operate the coal-fired plant. There would be a reduction in demand on socioeconomic resources and contribution to the regional economy commensurate with the loss of 771 permanent jobs. The economic projections for the area suggest that the slow growth likely would not temper or offset the projected loss of jobs from the shutdown of Units 1 and 2. However, the proximity to Green Bay likely would mitigate the impacts. The coal-fired plants would provide for Shared Utility Payments to at least partially offset the loss of these payments associated with the nuclear units. For all of these reasons, the appropriate characterization of nontransportation socioeconomic impacts for a coal-fired plant constructed at the PBNP site would be 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 PBNP would still experience the impact of PBNP operational job losses, 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 200 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. The PBNP site is within commuting distance of the Green Bay metropolitan area and, therefore, is not considered a rural site. Alternate sites would need to be analyzed on a case-by-case basis. Socioeconomic impacts at a rural site could be MODERATE to LARGE.

- **Transportation**

During the 5-year construction period of replacement coal-fired units, up to 2500 construction workers would be working at the PBNP site in addition to the 971 workers at PBNP. The addition of these workers could place significant traffic loads on existing highways, particularly those leading to the PBNP site. Such impacts would be MODERATE to LARGE.

For transportation related to commuting of plant operating personnel, the impacts are considered SMALL. After PBNP shutdown and startup of the coal-fired plant, the maximum number of coal-fired plant operating personnel would be approximately 200. The current PBNP workforce is approximately 971. 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 PBNP operations.

For rail transportation related to coal and lime delivery to the PBNP site, the impacts are considered MODERATE to LARGE. Approximately 230 trains per year would be needed to deliver the coal and lime for the two coal-fired units. A total of five train trips would be expected per week, or more than one trip per day, because for each full train delivery there would be an empty train.

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

At an alternate site, coal would likely be delivered by rail, although barging would be possible if located on Lake Michigan at a site with the potential for barge dock facilities. Transportation impacts would depend upon the site location. Socioeconomic impacts associated with rail transportation or barging would likely be MODERATE to LARGE.

- **Aesthetics**

If sited at PBNP, the cooling towers, plumes, and exhaust stacks of the two coal-fired units would be visible for many miles in daylight hours. The exhaust stacks would be up to 91 m (300 ft) in height. In addition, the IGCC technology would produce a flare of about 61 m (200 ft). The units and associated stacks would also be visible at night because of outside lighting and the flare. 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 shielding. Overall, the addition of a coal-fired unit and the associated stack at the PBNP site would likely have a MODERATE aesthetic impact.

Coal-fired generation would introduce mechanical sources of noise that would be audible off site. Sources contributing to total noise produced by plant operation are classified as continuous or intermittent. Continuous sources include the mechanical equipment associated with normal plant operations. Intermittent sources include the equipment related to coal handling, solid-waste disposal, transportation related to coal delivery, use of outside loudspeakers, and the commuting of plant employees. The incremental noise impacts of a coal-fired plant compared to existing PBNP operations are considered to be MODERATE.

Noise impacts associated with rail delivery of coal to a plant at the PBNP site would be most significant for residents living in the vicinity of the facility and along the rail route. Although noise from passing trains significantly raises noise levels near the rail corridor, the short duration of the noise reduces the impact. Nevertheless, given the frequency of train transport and the many residents likely to be within hearing distance of the rail route, the impact of noise on residents in the vicinity of the facility and the rail line is 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 would be an aesthetic impact associated with construction of a new rail spur and transmission line. Noise and light from the plant would be detectable off site. 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 would be similar to the impacts at the existing site. Overall the aesthetic impacts associated with a coal-fired plant at an alternate site can be categorized as MODERATE to LARGE.

- **Historic and Archaeological Resources**

A new coal-fired plant at the PBNP site or an alternate site would likely require a cultural resource inventory of any onsite property that has not been previously surveyed. Other lands, if any, that are acquired to support the plant would also likely need an inventory of field cultural resources, identification and recording of existing historic and archaeological resources, and possible mitigation of adverse impacts from subsequent ground-disturbing actions related to physical expansion of the plant site.

Before construction at the PBNP site or an alternate site, studies would likely be needed to identify, evaluate, and address mitigation of the potential impacts of new plant construction on cultural resources. The studies would likely be needed for all areas of potential disturbance at the proposed plant site and along associated corridors where new construction would occur (e.g., roads, transmission line ROWs, rail lines, or other ROWs). Historic and archaeological resource impacts need to be evaluated on a site-specific basis. The impacts can generally be effectively managed, and as such, impacts would vary between SMALL to MODERATE, depending on the historic and archaeological resources that may be present and whether mitigation is necessary.

- **Environmental Justice**

No environmental pathways or locations have been identified that would result in disproportionately high and adverse environmental impacts on minority and low-income populations if a replacement coal-fired plant were built at the PBNP site. Some impacts on housing availability and prices during construction might occur, which could disproportionately affect minority and low-income populations. Shutdown of PBNP would result in a decrease in employment of approximately 771 operating employees, possibly offset by growth in the area. Following construction, it is possible that the ability of local government to maintain social services could be reduced at the same time as diminished economic conditions reduce employment prospects for minority or low-income populations. Overall, impacts would be SMALL to MODERATE and would depend on potential economic growth in the area and the ability of minority or low-income populations to commute to other jobs in the area.

Impacts at an alternate site would depend upon the site chosen and the nearby population distribution but are also likely to be SMALL to MODERATE.

### 8.2.1.2 Once-Through Cooling System

This section discusses the environmental impacts of constructing a coal-fired plant with a once-through cooling system at the PBNP site. The impacts (SMALL, MODERATE, or LARGE) of this option are the same as the impacts for a coal-fired plant using the closed-cycle system. However, there are minor environmental differences between the closed-cycle and once-through cooling systems. Table 8-3 summarizes the incremental differences.

**Table 8-3.** Summary of Environmental Impacts of Coal-Fired Generation with a Once-Through Cooling System at the PBNP Site

| Impact Category | Impact | Comparison with Closed-Cycle Cooling System |
|---|---|---|
| Land Use | MODERATE to LARGE | Impacts may be less (e.g., through elimination of cooling towers). |
| Ecology | SMALL to MODERATE | Possible impacts include entrainment of fish and shellfish in early life stages, impingement of fish and shellfish, and heat shock. |
| Water Use and Quality – Surface Water | SMALL | Increased water withdrawal could lead to possible water-use conflicts; thermal load would be higher than with closed-cycle cooling. |
| Water Use and Quality – Groundwater | SMALL | No change. |
| Air Quality | MODERATE | No change. |
| Waste | MODERATE | No change. |
| Human Health | SMALL | No change. |
| Socioeconomics | MODERATE | No change. |
| Transportation | SMALL to LARGE | No change. |
| Aesthetics | MODERATE | Cooling towers would be eliminated. |
| Historic and Archaeological Resources | SMALL to MODERATE | No change. |
| Environmental Justice | SMALL to MODERATE | No change. |

## 8.2.2 Natural Gas-Fired Generation

The environmental impacts of a natural gas-fired alternative are examined in this section for both the PBNP site and an alternate site. The staff assumed that the plant would use a closed-cycle cooling system. In Section 8.2.2.2, the staff also evaluated the impacts of using the existing once-through cooling system at the PBNP site.

The PBNP site and an alternate site would need a 61-cm (24-in.) diameter natural gas pipeline constructed from the plant site to a supply point where a reliable supply of natural gas would be available. NMC identified that a pipeline to the PBNP site would be approximately 64 km (40-mi) long and disturb about 81 ha (200 ac) of land at the site (NMC 2004).

The staff assumed that a replacement natural gas-fired plant would include four units using combined-cycle technology (NMC 2004). In a combined-cycle unit, hot combustion gases in a combustion turbine rotate the turbine to generate electricity. Waste combustion heat from the combustion turbine is routed through a heat-recovery boiler to make steam to generate additional electricity. The staff assumed that a replacement natural gas-fired plant would use combined-cycle combustion turbines as described by NMC (NMC 2004). NMC estimates that the plant would consume approximately 1.3 billion $m^3$ (46.2 billion $ft^3$) of natural gas annually (NMC 2004).

Unless otherwise indicated, the assumptions and numerical values used in Section 8.2.2 are from the NMC ER (NMC 2004). 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 PBNP site or an alternate site, impacts would occur off site 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.

### 8.2.2.1 Closed-Cycle Cooling System

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

- **Land Use**

The existing facilities and infrastructure at the PBNP site 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 alternative would require modification and use of the switchyard, offices, and transmission line ROWs. Much of the land that would be used has been previously disturbed. The staff assumed that approximately 20 ha (50 ac) at PBNP would be needed for the plant and associated infrastructure (NMC 2004). There would be an additional impact to 81 ha (200 ac) for construction of a 64-km (40-mi) gas pipeline.

For construction at an alternate site, the staff assumed that 20 ha (50 ac) would be needed for the plant and associated infrastructure for a 1000 MW(e) plant (NRC 1996). In addition, construction of an underground pipeline would result in additional land disturbance at an alternate site. Regardless of where the natural gas-fired plant is built, 1500 ha (3600 ac) of additional land would be required for natural gas wells, collection stations, and pipelines (NRC 1996).

These offsite land requirements would be partially offset by eliminating the need for uranium mining to supply fuel for PBNP. In the GEIS (NRC 1996), the staff estimated that uranium mining and processing would affect approximately 400 ha (1000 ac) during the operating life of a nuclear power plant. Additional impacts from uranium mining are discussed in Section 8.2.3.1.

The impact of a natural gas-fired generating unit on land use at the existing PBNP site is best characterized as MODERATE, and the land-use impacts on an alternate site would be MODERATE to LARGE.

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

| | PBNP Site | | Alternate Site | |
|---|---|---|---|---|
| **IMPACT CATEGORY** | **IMPACT** | **COMMENTS** | **IMPACT** | **COMMENTS** |
| Land Use | MODERATE | 20 ha (50 ac) would be required for power block, offices, roads, and parking areas. There would be an additional impact of up to approximately 80 ha (200 ac) for construction and/or upgrade of an underground gas pipeline. | MODERATE to LARGE | 20 ha (50 ac) would be required for powerblock, offices, roads, and parking areas. There would be an additional impact (1500 ha [3600 ac]) for construction and/or upgrade of an underground gas pipeline and transmission line. |
| Ecology | MODERATE | Undeveloped areas at the current PBNP site would be used, and a gas pipeline would be constructed through habitat. Potential habitat would be lost and fragmented; productivity and biological diversity would be reduced. Likely plant sites already have power generation facilities. | MODERATE | Impact would depend on the location and ecology of the site, the surface-water body used for intake and discharge, and transmission and pipeline routes; potential habitat would be lost and fragmented; productivity and biological diversity would be reduced. |
| Water Use and Quality – Surface Water | SMALL | Partial use of existing cooling system (intake and discharge structures). Operational impacts would be similar or less than for PBNP. | SMALL to MODERATE | Impact would depend on the volume of water withdrawal and discharge and characteristics of surface-water body. |
| Water Use and Quality – Groundwater | SMALL | Little groundwater would be used. | SMALL to MODERATE | Impact would depend on the volume of water withdrawal. |
| Air Quality | MODERATE | Sulfur oxides<br>• 15.9 MT/yr (17.5 tons/yr)<br>Nitrogen oxides<br>• 2705 MT/yr (2982 tons/yr)<br>Particulates<br>• 446 MT/yr (492 tons/yr) of total suspended particulates including $PM_{10}$<br>Some hazardous air pollutants.<br>Unregulated $CO_2$ emissions could contribute to global warming. | MODERATE | Emissions would be the same as at the PBNP site. |
| Waste | SMALL | A small amount of ash would be produced. | SMALL | The waste produced would be the same as at the PBNP site. |

**Table 8-4.** (contd)

| | PBNP Site | | Alternate Site | |
|---|---|---|---|---|
| **Impact Category** | **Impact** | **Comments** | **Impact** | **Comments** |
| Human Health | SMALL | Impacts are considered to be minor. | SMALL | Impacts are considered to be minor. |
| 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 971 PBNP workers to a new plant workforce of 30. Manitowoc County would experience a reduced demand on socioeconomic resources as well as a loss of Shared Utility Payments and employment, potentially offset by the proximity of the site to Green Bay, Wisconsin. | SMALL to MODERATE | Construction impacts depend on location, but could be greater than the PBNP 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-year construction period. Operation of the plant would result in 30 permanent jobs. Manitowoc County could experience greater loss of Shared Utility Payments and employment than at the PBNP site if the alternate site is outside of Manitowoc County. |
| Transportation | MODERATE | Transportation impacts associated with construction workers would be MODERATE. Impacts associated with operations would be SMALL. | MODERATE | Transportation impacts associated with construction workers would be MODERATE. Impacts associated with operations would be SMALL. |
| Aesthetics | SMALL to MODERATE | The aesthetic impact of plant units, stacks, and cooling towers would be MODERATE. | SMALL to MODERATE | Impacts would depend on characteristics of the site but would be generally similar to impacts at the PBNP site. |
| Historic and Archaeological Resources | SMALL to MODERATE | Some construction would affect previously developed parts of the PBNP site; a cultural resource inventory should minimize any impacts on undeveloped lands. | SMALL to MODERATE | Impacts would be the same as at the PBNP site; any potential impacts can likely be effectively managed. |
| 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. | SMALL to MODERATE | Impacts would vary depending on the population distribution and makeup at site. |

- **Ecology**

Locating a natural gas-fired plant at the PBNP site would create ecological impacts to land use. Bringing a new underground gas pipeline to the site would also cause substantial ecological impacts. Ecological impacts at an alternate site would depend on the nature of the land converted for the plant and the likely need for a new gas pipeline and/or transmission line. Construction of a transmission line and construction and/or upgrading of a gas pipeline to serve the plant would be expected to have temporary ecological impacts. Ecological impacts to the plant site and utility easements could include impacts on threatened or endangered species and could cause wildlife habitat loss, reduced productivity, habitat fragmentation, and a local reduction in biological diversity. At an alternate site, the cooling makeup water intake and discharge could have aquatic resource impacts. Overall, the ecological impacts are considered MODERATE 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-cycle cooling system with cooling towers sited at PBNP would require the construction of additional cooling infrastructure, although it is possible that some of the existing intake and discharge structures could be used. Surface-water impacts are expected to be 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. The staff assumed that surface water would be used for cooling makeup water and discharge. Intake and discharge would involve relatively small quantities of water compared to the coal-fired alternative. The impact on the surface water would depend on the volume of water needed for makeup water, the discharge volume, and the characteristics of the receiving body of water. Intake from and discharge to any surface body of water would be regulated by the State. The impacts would be SMALL to MODERATE.

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

Groundwater. The staff assumed that the groundwater wells would continue to be used for PBNP activities. Groundwater withdrawals would be equal to or less than the no-action and license renewal alternatives. Overall, impacts of a gas-fired power plant with a closed-cycle cooling system at the PBNP site on groundwater use and quality are considered SMALL. Use of groundwater for a gas-fired plant located at an alternate site is a possibility. Groundwater withdrawals at an alternate site would likely require a State permit. The impacts will depend on the characteristics of the site and the amount of groundwater used. Therefore, the impacts at an alternate site are considered SMALL to MODERATE, depending on the volume of groundwater withdrawn.

- **Air Quality**

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

A new gas-fired generating plant located in Wisconsin would likely need 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 found in 40 CFR Part 60, Subparts Da and GG. These regulations establish emission limits for particulates, opacity, $SO_2$, and $NO_x$.

The EPA has various regulatory requirements for visibility protection in 40 CFR Part 51, Subpart P, including a specific requirement for review of any new major stationary source in an area designated attainment or unclassified under the CAA. PBNP and alternate sites are most likely in areas that are designated as attainment or unclassified for criteria pollutants with the exception of ozone.

Section 169A of the CAA (42 USC 7491) establishes a national goal of preventing future, and remedying existing, impairment of visibility in mandatory Class I Federal areas when impairment results from man-made air pollution. The EPA issued a new regional haze rule in 1999 (EPA 1999). The rule specifies that for each mandatory Class I Federal area located within a state, the State must establish goals that provide for reasonable progress towards achieving natural visibility conditions. The reasonable progress goals must provide for an improvement in visibility for the most impaired days over the period of the implementation plan and ensure no degradation in visibility for the least-impaired days over the same period (40 CFR 51.308(d)(1)). If a natural gas-fired plant were located close to a mandatory Class I area, additional air pollution control requirements could be imposed. There are no Class I areas within 160 km (100 mi) of the PBNP site.

NMC projects the following emissions for the natural gas-fired alternative (NMC 2004):

- Sulfur oxides – 15.9 MT/yr (17.5 tons/yr)
- Nitrogen oxides – 2705 MT/yr (2982 tons/yr)
- $PM_{10}$ particulates – 446 MT/yr (492 tons/yr)

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

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

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

The amount and type of emissions produced would likely be the same at PBNP 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 concluded that the overall air-quality impact for a new natural gas-fired plant at the PBNP site or at an alternate site is considered MODERATE.

- **Waste**

Burning natural gas fuel would produce spent scrubber catalysts from $NO_x$ emissions controls and small amounts of solid-waste products (i.e., ash). In the GEIS, the staff concluded that waste generation from gas-fired technology would be minimal (NRC 1996). Natural gas firing results in very few combustion by-products because of the clean nature of the fuel. Waste-generation impacts would be so minor that they would not noticeably alter any important resource attribute. Construction-related debris would be generated during construction activities. Overall, the waste impacts would be SMALL for a natural gas-fired plant sited at PBNP 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 contributes to health risks. $NO_x$ emissions from any gas-fired plant would be regulated. For a plant sited in Wisconsin, $NO_x$ emissions would be regulated by the WDNR. 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 of the natural gas-fired alternate sited at PBNP or at an alternate site on human health 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); although NMC estimated a construction workforce of 300 workers (NMC 2004). The staff assumed that construction would take place while PBNP continues operation and would be completed by the time PBNP permanently ceases operations. During construction, the communities surrounding the PBNP 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 counties. After construction, the communities would be impacted by the loss of jobs. The current PBNP workforce (971 workers) would decline through a decommissioning period to a minimal maintenance size. The gas-fired plant would introduce a replacement Shared Utility Payment at PBNP or an alternate site and create approximately 30 new permanent jobs. For siting at an alternate site, impacts in Manitowoc County resulting from decommissioning of Units 1 and 2 would be a loss of jobs and Shared Utility Payment that likely would not be rapidly replaced based on the slow growth projected for the region. However, the proximity to Green Bay likely would mitigate the impacts.

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. 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 PBNP or at an alternate site. Depending on other growth in the area, socioeconomic effects could be noticed, but they would not destabilize any important socioeconomic attribute.

- **Transportation**

Transportation impacts associated with construction include temporary commuter traffic for 1200 construction and 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 MODERATE for siting at PBNP or at an alternate site.

Overall, socioeconomic impacts resulting from construction of a natural gas-fired plant at PBNP or an alternate site would be SMALL to MODERATE.

- **Aesthetics**

The turbine buildings, exhaust stacks (approximately 76 m [250 ft] tall), cooling towers, the plume from the cooling towers, and the associated transmission line and gas pipeline compressors would be visible from off site during daylight hours. Noise and light from the plant would be detectable off site. Overall, the aesthetic impacts associated with the construction and operation of a gas-fired plant located at the PBNP site are categorized as SMALL to MODERATE.

At an alternate site, impacts would be similar to impacts at the PBNP site but would also depend on surrounding land uses. Overall, the aesthetic impacts associated with an alternate site are categorized as SMALL to MODERATE.

- **Historic and Archaeological Resources**

Natural gas-fired generation at the PBNP site or an alternate site would likely require a cultural resource inventory of any onsite property that has not been previously surveyed. Other lands, if any, that are acquired to support the plant would also likely need an inventory of field cultural resources, identification and recording of existing historic and archaeological resources, and possible mitigation of adverse impacts from subsequent ground-disturbing actions related to physical expansion of the plant site.

Before construction at the PBNP site or an alternate site, studies would likely be needed to identify, evaluate, and address mitigation of the potential impacts of new plant construction on cultural resources. The studies would likely be needed for all areas of potential disturbance at the proposed plant site and along associated corridors where new construction would occur (e.g., roads, transmission line ROWs, pipelines, or other ROWs). Historic and archaeological resource impacts need to be evaluated on a site-specific basis. The impacts can generally be effectively managed, and as such, impacts would vary between SMALL to MODERATE, depending on the historic and archaeological resources present, and whether mitigation is necessary.

- **Environmental Justice**

Disproportionately high and adverse environmental impacts on minority and low-income populations have not been identified for a natural gas-fired plant built at the PBNP site. Some impacts on housing availability and prices during construction might occur, and this could disproportionately affect the minority and low-income populations. The shutdown of PBNP would result in a loss of approximately 971 jobs. Only 30 employees would be needed to operate the gas-fired plant. The loss of jobs would possibly be offset by growth in the area and proximity to Green Bay. 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 potential economic growth in the area and the ability of minority or low-income populations to commute to other jobs in the area.

Impacts at other sites would depend upon the site chosen and the nearby population distribution, but are likely to also be SMALL to MODERATE.

#### 8.2.2.2 Once-Through Cooling System

This section discusses the environmental impacts of constructing a natural gas-fired generation system at the PBNP site using once-through cooling. The impacts (SMALL, MODERATE, or LARGE) of this option are the same as the impacts for a natural gas-fired plant using the closed-cycle system. However, there are minor environmental differences between the closed-cycle and once-through cooling systems. Table 8-5 summarizes the incremental differences.

**Table 8-5.** Summary of Environmental Impacts of Natural Gas-Fired Generation with Once-Through Cooling at the PBNP Site

| Impact Category | Impact | Comparison with Closed-Cycle Cooling System |
|---|---|---|
| Land Use | MODERATE | Impacts may be less (e.g., through elimination of cooling towers). |
| Ecology | MODERATE | Potential impacts include entrainment of fish and shellfish in early life stages, impingement of fish and shellfish, and heat shock. |
| Water Use and Quality – Surface Water | SMALL | Increased water withdrawal could lead to possible water-use conflicts, and the thermal load would be higher than with closed-cycle cooling. |
| Water Use and Quality – Groundwater | SMALL | No change. |
| Air Quality | MODERATE | No change. |
| Waste | SMALL | No change. |
| Human Health | SMALL | No change. |
| Socioeconomics | SMALL to MODERATE | No change. |
| Transportation | MODERATE | No change. |

**Table 8-5.** (contd)

| Impact Category | Impact | Comparison with Closed-Cycle Cooling System |
|---|---|---|
| Aesthetics | SMALL to MODERATE | Cooling towers would be eliminated. |
| Historic and Archaeological Resources | SMALL to MODERATE | No change. |
| Environmental Justice | SMALL to MODERATE | No change. |

### 8.2.3 Nuclear Power Generation

Since 1997 the NRC has certified three new standard designs for nuclear power plants under 10 CFR Part 52, Subpart B. These designs are the 1300-MW(e) U.S. Advanced Boiling Water Reactor (10 CFR Part 52, Appendix A), the 1300-MW(e) System 80+ Design (10 CFR Part 52, Appendix B), and the 600-MW(e) AP600 Design (10 CFR Part 52, Appendix C). All of these plants are light-water reactors. On September 13, 2004, the Commission issued the Final Design Approval for the AP1000 Design; the staff anticipates that the certification for this design will be finalized in December 2005. 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 PBNP 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 PBNP was not included in the NMC ER.

NRC has summarized environmental data associated with the uranium fuel cycle in Table S-3 of 10 CFR 51.51. The impacts shown in Table S-3 are representative of the impacts that would be associated with a replacement nuclear power plant built to one of the certified designs, sited at PBNP or an alternate site. The impacts shown in Table S-3 are for a 1000-MW(e) reactor and would need only minor scaling to reflect impacts of replacing the 1036 MW(e) of power currently provided by the PBNP plant. The environmental impacts associated with transporting fuel and waste to and from a light-water cooled nuclear power reactor are summarized in Table S-4 of 10 CFR 51.52. The summary of NRC's findings on NEPA issues for license renewal of nuclear power plants in Table B-1 of 10 CFR Part 51, Subpart A, Appendix B, is also relevant, although not directly applicable, for consideration of environmental impacts associated with the operation of a replacement nuclear power plant. Additional environmental impact information for a replacement nuclear power plant using closed-cycle cooling is presented in Section 8.2.3.1, and for one using once-through cooling in Section 8.2.3.2.

In addition to the impacts discussed below for a nuclear plant at either the PBNP 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.

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

| | PBNP Site | | Alternate Site | |
|---|---|---|---|---|
| IMPACT CATEGORY | IMPACT | COMMENTS | IMPACT | COMMENTS |
| Land Use | MODERATE | Would require approximately 200 to 400 ha (500 to 1000 ac) for the plant. | MODERATE to LARGE | Same as PBNP site plus land for transmission line. |
| Ecology | SMALL to MODERATE | Would use up to 400 ha (1000 ac) of undeveloped and farmland areas at the current PBNP site. There would be potential habitat loss and fragmentation and reduced productivity and biological diversity. | MODERATE to LARGE | Impacts would depend on the location and ecology of the site, the surface-water body used for intake and discharge, and transmission line route. There would be potential habitat loss and fragmentation and reduced productivity and biological diversity. |

**Table 8-6.** (contd)

| | PBNP Site | | Alternate Site | |
|---|---|---|---|---|
| IMPACT CATEGORY | IMPACT | COMMENTS | IMPACT | COMMENTS |
| Water Use and Quality – Surface Water | SMALL | Would use parts of the existing cooling system (intake and discharge structures). Operational impacts would be similar or less than PBNP. | SMALL to MODERATE | Impact would depend on the volume of water withdrawn and discharged and the characteristics of the surface-water body. |
| Water Use and Quality – Groundwater | SMALL | Little groundwater would be used. | SMALL to MODERATE | Impact would depend on the volume of water withdrawn and discharged and the characteristics of the surface-water or groundwater source. |
| Air Quality | SMALL | Fugitive emissions and emissions from vehicles and equipment during construction. Small amount of emissions from diesel generators and possibly other sources during operation. | SMALL | Impacts would be the same as at the PBNP site. |
| Waste | SMALL | Waste impacts for an operating nuclear power plant are set out in 10 CFR Part 51, Appendix B, Table B-1. Debris would be generated and removed during construction. | SMALL | Impacts would be the same as at the PBNP site. |
| Human Health | SMALL | Human health impacts for an operating nuclear power plant are set out in 10 CFR Part 51, Subpart A, Appendix B, Table B-1. | SMALL | Impacts would be the same as at the PBNP site. |
| Socioeconomics | SMALL to MODERATE | During construction, impacts would be MODERATE. Up to 2500 workers would be employed during the peak of the 6-year construction period. The operating workforce is assumed to be similar to PBNP; the Shared Utility Payment would be preserved. Impacts during operation would be SMALL. | MODERATE to LARGE | Construction impacts depend on location. Impacts at a rural location could be LARGE. Manitowoc County would experience loss of Shared Utility Payment and employment, possibly offset by proximity to Green Bay. |

Table 8-6. (contd)

| | PBNP Site | | Alternate Site | |
|---|---|---|---|---|
| IMPACT CATEGORY | IMPACT | COMMENTS | IMPACT | COMMENTS |
| Transportation | SMALL to LARGE | Transportation impacts associated with construction workers could be MODERATE to LARGE. Transportation impacts of commuting plant personnel would be SMALL. | SMALL to LARGE | Transportation impacts of construction workers could be MODERATE to LARGE. Transportation impacts of commuting plant personnel could be SMALL to MODERATE. |
| Aesthetics | SMALL to MODERATE | No exhaust stacks would be needed. Cooling towers and plumes would be visible. Impact could be mitigated by landscaping and appropriate color selection for buildings. Visual impact at night could be mitigated by reduced use of lighting and appropriate shielding. Noise impacts would be relatively small and could be mitigated. | SMALL to MODERATE | Impacts would depend on characteristics of the site but would be generally similar to PBNP site impacts. |
| Historic and Archaeological Resources | SMALL to MODERATE | Some construction would affect previously developed parts of the PBNP site; a cultural resource inventory should minimize any impacts on undeveloped lands. | SMALL to MODERATE | Impacts would be the same as at PBNP; any potential impacts can likely be effectively managed. |
| 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 might occur during construction. | SMALL to MODERATE | Impacts would vary depending on population distribution and makeup at the site. Impacts to minority and low-income populations associated with closure of PBNP Units 1 and 2 could be mitigated by proximity to Green Bay. |

- **Land Use**

According to the GEIS, a new nuclear unit at an alternate site would require approximately 200 to 400 ha (500 to 1000 ac) of land (NRC 1996). Additional land could be needed for an electric power transmission line, a rail spur to bring construction materials to the plant site, and/or pipelines to supply cooling-water intake and discharge. Depending particularly on transmission line routing, siting a new nuclear plant with closed-cycle cooling at an alternate site would result in MODERATE to LARGE land-use impacts.

The existing facilities and infrastructure at the PBNP site would be used to the extent practicable, which would limit the amount of new construction that would be required. Specifically, the staff assumed that a replacement nuclear power plant would require a new closed-cycle system including cooling towers; however, the existing intake and discharge structures would be used if practicable. In addition, the staff assumed other existing structures would be used including the switchyard, offices, and transmission line ROWs. Much of the land that would be used has been previously disturbed by farming. It is assumed that PBNP would continue to operate while the new unit is built.

A replacement nuclear power plant at the PBNP site would alter approximately 200 to 400 ha (500 to 1000 ac) of land to industrial use. There would be no net change in land needed for uranium mining because the area of land needed for uranium mining to supply fuel for the new nuclear plant would be the same area as land needed for uranium mining to supply fuel for PBNP.

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

Land-use impacts at an alternate site would be similar to siting at PBNP except for the land needed for a transmission line to connect to existing lines. Assuming a 64-km (40-mi) transmission line, an additional 678 ha (1675 ac) would be needed. In addition, it may be necessary to construct a rail spur to bring in equipment during construction at an alternate site. 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 PBNP site would alter ecological resources because of the need to convert roughly 200 to 400 ha (500 to 1000 ac) of land to industrial use. Most of this land, however, would have been previously disturbed; however, additional land would have to be acquired. Impacts on terrestrial resources would result from cooling tower drift. Impacts to aquatic resources would result from intake makeup water and the possible entrainment and impingement of fish and blowdown from the circulating water system affecting receiving water quality.

Siting at PBNP would have a SMALL to MODERATE ecological impact that would be greater than renewal of the Unit 1 and 2 OLs.

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

- **Water Use and Quality**

Surface Water. The replacement nuclear plant alternative at the PBNP site is assumed to use a new closed-cycle cooling system (including cooling towers) and the existing intake and discharge structures. This would minimize incremental impacts to water use and quality. Surface-water impacts are expected to be SMALL; the impacts would be sufficiently minor that they would not noticeably alter any important attribute of the resource.

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. The impacts would be SMALL to MODERATE.

Groundwater. The staff assumed that a new nuclear power plant located at the PBNP site would obtain potable, process, and fire-protection water from the groundwater wells used for Units 1 and 2, similar to the current practice for PBNP (see Section 2.2.2). Therefore, the impact to groundwater would be SMALL.

Use of groundwater for a nuclear power plant located at an alternate site is a possibility for the cooling system and other uses. Any groundwater withdrawal would require a permit from the WDNR. Therefore, the impact to groundwater would be SMALL to MODERATE depending on the volume of water withdrawn.

- **Air Quality**

Construction of a new nuclear plant located at the PBNP site or an alternate site would result in fugitive emissions during the six-year construction period. Exhaust emissions would also come from vehicles and motorized equipment used during the construction process. An operating nuclear plant would have minor air emissions associated with diesel generators and other minor intermittent sources. Emissions for a plant sited in Wisconsin would be regulated under the CAA. Overall, emissions and associated impacts for a plant located at the existing PBNP site or an alternate site are considered SMALL.

- **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 location other than the PBNP site would not alter waste generation. Therefore, the impacts would be SMALL.

- **Human Health**

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

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

- **Socioeconomics**

The construction period and the peak workforce associated with construction of a new nuclear power plant are currently unquantified (NRC 1996). In the absence of quantitative data, staff assumed a construction period of 6 years and a peak workforce of 2500. The staff assumed that construction would take place while the existing nuclear units continue operation and would be completed by the time PBNP permanently ceases operation. During construction, the communities surrounding the PBNP 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 counties. After construction, the communities would be impacted by the loss of the construction jobs, although this loss would be possibly offset by the proximity to Green Bay.

The replacement nuclear units are assumed to have an operating workforce comparable to the 971 workers currently working at PBNP. The replacement nuclear units would provide a new tax base to offset the loss of tax base associated with decommissioning of PBNP. For all of these reasons, the appropriate characterization of nontransportation socioeconomic impacts for replacement nuclear units constructed at the PBNP site would be SMALL to MODERATE; the socioeconomic impacts would be noticeable, but would be unlikely to destabilize the area.

Construction of a replacement nuclear power plant at an alternate site would relocate some socioeconomic impacts, but would not eliminate them. The communities around the PBNP site would still experience the impact of operational job losses at PBNP (although these losses would be potentially tempered by proximity to Green Bay). 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) superimposed on a refueling outage workforce of approximately 300 and a permanent workforce of approximately 971 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. The PBNP site is within commuting distance of Green Bay and therefore is not considered a rural site. Alternate sites would need to be analyzed on a case-by-case basis. Socioeconomic impacts at a rural site could be LARGE.

- **Transportation**

During the 6-year construction period, up to 2500 construction workers would be working at the PBNP site in addition to the 971 workers at Units 1 and 2. The addition of the construction workers could place significant traffic loads on existing highways especially during normal refueling outages for Units 1 and 2. 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 PBNP 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 PBNP, other associated buildings, cooling towers, and cooling tower plumes would likely be visible over many miles in daylight hours. 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; however, cooling towers constructed for the closed-cycle system would be visible. Therefore, impacts can be characterized as MODERATE.

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

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 an aesthetic impact associated with construction of a new transmission line. Noise and light from the plant would be detectable off site. Overall the aesthetic impacts associated with locating a nuclear power plant at an alternate site can be categorized as SMALL to MODERATE.

- **Historic and Archaeological Resources**

A new nuclear power plant at the PBNP site or an alternate site would likely require a cultural resource inventory of any onsite property that has not been previously surveyed. Other lands, if any, that are acquired to support the plant would also likely need an inventory of field cultural resources, identification and recording of existing historic and archaeological resources, and possible mitigation of adverse impacts from subsequent ground-disturbing actions related to physical expansion of the plant site.

Before construction at the PBNP site or an alternate site, studies would likely be needed to identify, evaluate, and address mitigation of the potential impacts of new plant construction on cultural resources. The studies would likely be needed for all areas of potential disturbance at the proposed plant site and along associated corridors where new construction would occur (e.g., roads, transmission line ROWs, rail lines, or other ROWs). Historic and archaeological resource impacts need to be evaluated on a site-specific basis. The impacts can generally be effectively managed, and as such, impacts would vary between SMALL and MODERATE, depending on the historic and archaeological resources present.

- **Environmental Justice**

Disproportionately high and adverse environmental impacts on minority and low-income populations have not been identified for a replacement nuclear power plant at the PBNP site. Some impacts on housing availability and prices during construction might occur, which could disproportionately affect minority and low-income populations. Shutdown activities at PBNP would result in a decrease in employment of approximately 941 operating employees, with the likelihood that a portion of these losses would be absorbed with the startup and operation of the new nuclear unit. Overall, impacts would be SMALL to MODERATE and would depend on potential economic growth in the area, the ability of minority or low-income populations to commute to other jobs in the area, and the transition of the workforce from the existing Units 1 and 2 to the new unit.

Impacts at other sites would depend upon the site chosen and the nearby population distribution but are also likely to be SMALL to MODERATE.

#### 8.2.3.2 Once-Through Cooling System

This section discusses the environmental impacts of constructing a nuclear power plant at the PBNP site using once-through cooling. The impacts (SMALL, MODERATE, or LARGE) of this option are the same as the impacts for a nuclear power plant using a closed-cycle system. However, there are minor environmental differences between the closed-cycle and once-through cooling systems. Table 8-7 summarizes the incremental differences.

**Table 8-7.** Summary of Environmental Impacts of a New Nuclear Power Plant with Once-Through Cooling at the PBNP Site

| Impact Category | Impact | Comparison with Closed-Cycle Cooling System |
|---|---|---|
| Land Use | MODERATE | Impacts may be less (e.g., through elimination of cooling towers). |
| Ecology | SMALL to MODERATE | Possible impacts include entrainment of fish and shellfish in early life stages, impingement of fish and shellfish, and heat shock. |
| Water Use and Quality – Surface Water | SMALL | Increased water withdrawal could lead to possible water-use conflicts, and the thermal load would be higher than with closed-cycle cooling. |
| Water Use and Quality – Groundwater | SMALL | No change. |
| Air Quality | SMALL | No change. |
| Waste | SMALL | No change. |
| Human Health | SMALL | No change. |
| Socioeconomics | SMALL to MODERATE | No change. |
| Transportation | SMALL to LARGE | No change. |
| Aesthetics | SMALL to MODERATE | Cooling towers would be eliminated. |
| Historic and Archaeological Resources | SMALL to MODERATE | No change. |
| Environmental Justice | SMALL to MODERATE | No change. |

### 8.2.4 Purchased Electrical Power

If available, power purchased from other sources could potentially obviate the need to renew the PBNP OLs. It is unlikely, however, that a firm power supply with a sufficient baseload would be available to replace the capacity of PBNP Units 1 and 2.

Currently, Wisconsin Electric Power Company (WEPCO) purchases about 600 MW(e) of power annually to meet customer demand and supplement power generation (NMC 2004). Similarly, Wisconsin is a net importer of power; it imported 11.4 billion kWh of electricity in 2002 (NMC 2004).

Power imported from Canada or Mexico is unlikely to be available to replace PBNP capacity. In Canada, 60 percent of the country's electrical generation capacity is derived from renewable energy sources, principally hydropower (DOE/EIA 2004b). Canada has plans to continue developing hydroelectric power: more than 6000 MW(e) of hydroelectric capacity are either under construction or planned (DOE/EIA 2004b). Canada's nuclear generation capacity is projected to increase by 23 percent by 2025, by bringing four Pickering reactor units in Ontario Province back into operation over the next several years to assist in replacing coal-fired generation (DOE/EIA 2004b). The EIA projects that total gross United States imports of electricity from Canada and Mexico will gradually increase from 38.4 billion kWh in year 2001 to 48.9 billion kWh in year 2005 and then gradually decrease to 15.2 billion kWh in year 2025 (DOE/EIA 2004b). It is unlikely that electricity imported from Canada or Mexico would be able to replace the existing PBNP capacity through the license renewal period, because less imports of electricity from Canada and Mexico will be available through the license renewal period.

If power to replace the existing PBNP 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 PBNP 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 subsections.

### 8.2.5.1 Wind Power

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

Since 1998, 55 utility scale wind turbines, each rated for 660 kW, have been installed at five locations in Wisconsin (NMC 2004). Wisconsin is in a wind power Class 2 region (average wind speeds at 10-m (30-ft) elevation of 5.6 to 6.4 m/s [12.6 to 14.3 mph]). On the coast, Wisconsin is in a wind power Class 3 region (average wind speeds at 10-m (30-ft) elevation of 6.4 to 7.0 m/s [14.3 to 15.7 mph]) (DOE 2004a). In wind power Class 2 areas, wind turbines are economically marginal for development, but in Class 3 areas, they may be suitable for future technology (DOE 2004a). The staff concludes that locating a wind-energy facility on or near the PBNP site would not be economically feasible given the current state of wind-energy generation technology and because energy storage technologies are too expensive for wind power to serve as a large baseload generator.

Access to many land based wind power sites near the coast would likely require extensive road building, as well as clearing (for towers and blades) and leveling (for tower bases and associated facilities) in variable terrain. Although impacts would depend on the site chosen, common issues of concern include visual impacts, noise generation, and bird and bat collisions. Also, many of the best quality wind sites are on ridges and hilltops that could have greater archaeological sensitivity than surrounding areas. For these reasons, development of large-scale, land based wind power facilities are likely to be costly and also have MODERATE to LARGE impacts on aesthetics, archaeological resources, land use, and terrestrial ecology.

### 8.2.5.2 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 baseload capacity and is not a feasible alternative to license renewal of PBNP. The average capacity factor of photovoltaic cells is about 25 percent, and the capacity factor for solar thermal systems is about 25 percent to 40 percent. Solar power, in conjunction with energy storage mechanisms, might serve as a means of providing baseload power. However, current energy storage technologies are too expensive to permit solar power to serve as a large baseload generator. 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 systems and approximately 5700 ha (14,000 ac) per 1000 MW(e) for solar thermal systems. Neither type of solar electric system would fit at the PBNP site, and both would have large environmental impacts at an alternate site.

The PBNP site receives approximately 3 to 3.5 kWh of solar radiation per square meter per day (NMC 2004), compared to 6 to 8 kWh of solar radiation per square meter per day in areas of the western United States, such as California, which are most promising for solar technologies (DOE/EIA 2000). 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 PBNP 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 PBNP would likely result in LARGE environmental impacts.

#### 8.2.5.3 Hydropower

Wisconsin has an estimated 26.2 MW(e) of undeveloped hydroelectric resources (Idaho National Engineering Laboratory 1996). This amount is far less than needed to replace the 1036 MW(e) capacity of PBNP. In Section 8.3.4 of the GEIS, the staff points out hydropower's percentage of United States 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 PBNP generating capacity would require flooding more than this amount of land. Due to the relatively small number of undeveloped hydropower resources in Wisconsin and the large land-use and related environmental and ecological resource impacts associated with siting hydroelectric facilities large enough to replace PBNP, the staff concludes that local hydropower on its own is not a feasible alternative to renewing PBNP OLs. Any attempts to site hydroelectric facilities large enough to replace PBNP would result in LARGE environmental impacts.

#### 8.2.5.4 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 midwestern location for geothermal capacity to serve as an alternative to PBNP. The staff concludes that geothermal energy is not a feasible alternative to renewal of the PBNP OLs.

#### 8.2.5.5 Wood Waste

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

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

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

#### 8.2.5.6 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 (DOE/EIA 2004a). Municipal waste combustors use three basic types of technologies: mass burn, modular, and refuse-derived fuel (DOE/EIA 2001). Mass burning technologies are most commonly used in the United States. This group of technologies process raw municipal solid waste "as is," with little or no sizing, shredding, or separation before combustion.

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

The decision to burn municipal waste to generate energy is usually driven by the need for an alternative to landfills rather than by energy considerations. The use of landfills as a waste disposal option is likely to increase in the near term; however, it is unlikely that many landfills will begin converting waste to energy because of unfavorable economics, particularly with electricity prices declining in real terms.

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

Currently there are approximately 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 1036 MW(e) of PBNP.

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

#### 8.2.5.7 Other Biomass-Derived Fuels

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

#### 8.2.5.8 Fuel Cells

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

Phosphoric acid fuel cells are generally considered first-generation technology. These fuel cells are commercially available at cost of approximately $4500 per kW of installed capacity (DOE 2004b). Higher-temperature second-generation fuel cells achieve higher fuel-to-electricity and thermal efficiencies. The higher temperatures contribute to improved efficiencies and give the second-generation fuel cells the capability to generate steam for cogeneration and combined-cycle operations.

DOE has a new initiative to reduce costs to as low as $400 per kW by the end of the decade (DOE 2004b). For comparison, the installed capacity cost for a natural gas-fired, combined-cycle plant is about $456 per kW (DOE/EIA 2004a). As market acceptance and manufacturing capacity increase, natural gas-fueled fuel cell plants in the 50- to 100-MW range are projected to become available. At the present time, however, fuel cells are not economically or technologically competitive with other alternatives for baseload electricity generation. Fuel cells are, consequently, not a feasible alternative to renewal of the PBNP OLs.

#### 8.2.5.9 Delayed Retirement

NMC has no current plans to retire any existing generating units. For this reason, delayed retirement of other NMC generating units would not be a feasible alternative to renewal of the PBNP OLs.

#### 8.2.5.10 Utility-Sponsored Conservation

Historically, WEPCO has maintained State-wide residential, commercial, and industrial programs to reduce both peak demands and daily energy consumption. These programs are commonly referred to as demand-side management (DSM). In 1999, these DSM programs resulted in a State-wide reduction of demand of 67 MW(e) and an energy savings of approximately 393,000 MWh (NMC 2004). These load reductions are acknowledged in load forecasts; therefore, they cannot be used as credits to offset the power generated by PBNP. An additional 1000 MW(e) of savings, or a 750 percent increase in the State-wide reduction in peak demand after 2010, would be required to offset the power generated by PBNP. Therefore, the conservation option by itself is not considered a reasonable alternative to renewing the PBNP OLs.

### 8.2.6 Combination of Alternatives

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

As discussed in Section 8.2, PBNP has a combined net electrical output of 1036 MW(e). For the coal-fired alternative, the staff assumed the construction of two 600 MW(e) units that would operate at about 78 percent efficiency (to produce 1045 MW[e]), and for the natural gas-fired alternative, the staff assumed four 380 MW(e) units operating at 85 percent efficiency as potential replacements for PBNP.

There are many possible combinations of alternatives. Table 8-8 contains a summary of the environmental impacts if one assumed a combination of alternatives consisting of two, 380 MW(e) of combined cycle natural gas-fired units generating power at 85 percent efficiency (net 646 MW[e]) using closed-cycle cooling, 200 MW(e) of purchased power, and 190 MW(e) gained from additional DSM measures. The impacts are based on the gas-fired generation impact assumptions discussed in Section 8.2.2, adjusted for the reduced generating capacity. While the DSM measures would have few environmental impacts, operation of the new gas-fired plant would result in increased emissions and environmental impacts. The 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 PBNP OLs.

**Table 8-8.** Summary of Environmental Impacts of 646 MW(e) of Natural Gas-Fired Generation, 200 MW(e) of Purchased Power, and 190 MW(e) from Demand-Side Management Measures (Combination of Alternatives)

| | PBNP Site | | Alternate Site | |
|---|---|---|---|---|
| **Impact Category** | **Impact** | **Comments** | **Impact** | **Comments** |
| Land Use | MODERATE | Would require 10 ha (25 ac) for power block, offices, roads, and parking areas. There would be an additional impact for construction of an underground gas pipeline. | MODERATE to LARGE | Would require 10 ha (25 ac) for power block, offices, roads, and parking areas. There would be additional impacts for construction of an underground gas pipeline and a transmission line. |
| Ecology | MODERATE | Would use undeveloped areas and farmlands at the current PBNP site, plus gas pipeline through habitat. There would be potential habitat loss and fragmentation and reduced productivity and biological diversity. | MODERATE | Impact would depend on the location and ecology of the site, the surface-water body used for intake and discharge, and transmission and pipeline routes. There would be potential habitat loss and fragmentation and reduced productivity and biological diversity. |
| Water Use and Quality – Surface Water | SMALL | Would use part of the existing cooling system (intake and discharge structures). Operational impacts would be similar or less than PBNP. | SMALL to MODERATE | Impact would depend on the volume of water withdrawal and discharge and characteristics of surface-water body. |
| Water Use and Quality – Groundwater | SMALL | Little groundwater would be used. | SMALL to MODERATE | Impact would depend on the volume of water withdrawal and discharge. |
| Air Quality | MODERATE | <u>Natural Gas-Fired Units</u>:<br>Sulfur oxides<br>• 8.0 MT/yr (8.8 tons/yr)<br>Nitrogen oxides<br>• 1353 MT/yr (1491 tons/yr)<br>$PM_{10}$ particulates<br>• 223 MT/yr (246 tons/yr)<br>Some hazardous air pollutants would be released. | MODERATE | Impacts would be the same as siting at PBNP. |
| Waste | SMALL | A small amount of ash would be produced from gas-fired plant. | SMALL | The same waste would be produced as at PBNP. |
| Human Health | SMALL | Impacts are considered to be minor. | SMALL | Impacts are considered to be minor. |

**Table 8-8.** (contd)

| | PBNP Site | | Alternate Site | |
|---|---|---|---|---|
| IMPACT CATEGORY | IMPACT | COMMENTS | IMPACT | COMMENTS |
| Socioeconomics | SMALL to MODERATE | During construction, impacts would be MODERATE. Up to 1200 additional workers would be employed during the peak of the 3-year construction period, followed by a reduction from the current PBNP workforce of 971 to 30; the Shared Utility Payment would be preserved. Impacts during operation would be SMALL. | SMALL to MODERATE | Construction impacts depend on location, but could be significant if the location is in a more rural area than PBNP. Manitowoc County would experience a loss of Shared Utility Payment and employment, potentially offset by proximity to Green Bay. |
| Transportation | SMALL to MODERATE | Transportation impacts associated with construction workers would be MODERATE. Impacts associated with operations would be SMALL. | SMALL to MODERATE | Transportation impacts associated with construction workers would be MODERATE. Impacts associated with operations would be SMALL. |
| Aesthetics | SMALL to MODERATE | Aesthetic impacts of plant units, exhaust stacks, and cooling towers would be MODERATE. | SMALL to MODERATE | Impacts would depend on characteristics of site but would be generally similar to those at the PBNP site. |
| Historic and Archaeological Resources | SMALL to MODERATE | Some construction would affect previously developed parts of PBNP; a cultural resource inventory should minimize any impacts on undeveloped lands and farmlands. | SMALL to MODERATE | Impacts would be the same as siting PBNP; any potential impacts could likely be effectively managed. |
| 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. | SMALL to MODERATE | Impacts would vary depending on the population distribution and makeup at the site. |

## 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 PBNP, 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 PBNP. 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 PBNP 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 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."

Clean Air Act (CAA) of 1970. 42 USC 7491, et seq.

*C & A Carbone, Inc. v. Town of Clarkstown, New York*, 511 U.S. 383, (U.S. Supreme Court 1994).

Dominion Nuclear North Anna, LLC (Dominion). 2003. Letter from D. A. Christian, Dominion, to J. E. Dyer, NRC. Subject: "North Anna Early Site Permit Application." September 25, 2003.

Exelon Generation Company, LLC (Exelon). 2003. Letter from M. C. Kray, Exelon, to NRC. Subject: "Early Site Permit Application." September 25, 2003.

Gabbard, Alex. 1993. *Coal Combustion: Nuclear Resource or Danger, Oak Ridge National Laboratory Review. Oak Ridge National Laboratory: Oak Ridge, Tennessee. Summer/Fall 1993.* http://www.ornl.gov/ORNLReview/rev26-34/text/colmain.html (Accessed June 21, 2004).

Idaho National Engineering Laboratory. 1996. *U.S. Hydropower Resource Assessment for Wisconsin. DOE/ID-10430(WI). Idaho Falls, Idaho. May 1996.* http://hydropower.inel.gov/resourceassessment/wi/wi.pdf (Accessed August 12, 2004).

Integrated Waste Services Association. 2004. *About Waste to Energy.* http://www.wte.org/waste.html (Accessed November 4, 2004).

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

Nuclear Management Company, LLC (NMC). 2004. *Point Beach Nuclear Plant Operating License Renewal Application Environmental Report.* Two Rivers, Wisconsin.

Resource Conservation and Recovery Act of 1976. 42 USC 6901.

System Energy Resources, Inc. (SERI). 2003. Letter from W. A. Eaton, SERI, to NRC. Subject: "Early Site Permit Application." October 16, 2003.

U.S. Department of Energy, Energy Information Administration (DOE/EIA). 2000. *Energy Consumption and Renewable Energy Development Potential on Indian Lands.* SR/CNEAF/2000-01. Washington, D.C. http://www.eia.doe.gov/cneaf/solar.renewables/ilands/ilands.pdf (Accessed August 3, 2004).

U.S. Department of Energy, Energy Information Administration (DOE/EIA). 2001. *Renewable Energy 2000: Issues and Trends.* DOE/EIA-0628(2000), Washington, D.C. http://www.eia.doe.gov/cneaf/solar.renewables/rea_issues/062800.pdf (Accessed August 3, 2004).

U.S. Department of Energy, Energy Information Administration (DOE/EIA). 2004a. *Annual Energy Outlook 2004 With Projections to 2025.* DOE/EIA-0383(2004). Washington, D.C. http://www.eia.doe.gov/oiaf/aeo/index.html/ (Accessed June 21, 2004).

U.S. Department of Energy, Energy Information Administration (DOE/EIA). 2004b. *International Energy Outlook 2004.* DOE/EIA-0484(2004). Washington, D.C. http://www.eia.doe.gov/oiaf/ieo/ (Accessed June 21, 2004).

U.S. Department of Energy (DOE). 2004a. *Map of Wisconsin Annual Average Wind Power.* http://www.eere.energy.gov/windandhydro/wind_potential.html and http://rredc.nrel.gov/wind/pubs/atlas/maps/chap3/3-19m.html (Accessed August 11, 2004).

U.S. Department of Energy (DOE). 2004b. *Future Fuel Cells R&D.* http://www.fossil.energy.gov/programs/powersystems/fuelcells/index.html (Accessed August 3, 2004).

U.S. Environmental Protection Agency (EPA). 1998. "Revision of Standards of Performance for Nitrogen Oxide Emissions From New Fossil-Fuel Fired Steam Generating Units: Revisions to Reporting Requirements for Standards of Performance for New Fossil-Fuel Fired Steam Generating Units, Final Rule." *Federal Register*, Vol. 63, No. 179, pp. 49442–49455. Washington, D.C. September 16, 1998.

U.S. Environmental Protection Agency (EPA). 1999. "Regional Haze Regulations, Final Rule." *Federal Register*, Vol. 64, No. 126, pp. 35714–35774. Washington, D.C. July 1, 1999.

U.S. Environmental Protection Agency (EPA). 2000a. "Regulatory Finding on the Emissions of Hazardous Air Pollutants from Electric Utility Steam Generating Units." *Federal Register*, Vol. 65, No. 245, pp. 79825–79831. Washington, D.C. December 20, 2000.

U.S. Environmental Protection Agency (EPA). 2000b. "Notice of Regulatory Determination on Wastes From the Combustion of Fossil Fuels." *Federal Register*, Vol. 65, No. 99, pp. 32214–32237. Washington, D.C. May 22, 2000.

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

U.S. Nuclear Regulatory Commission (NRC). 1999. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants: Main Report, Section 6.3 – Transportation, Table 9.1, Summary of Findings on NEPA Issues for License Renewal of Nuclear Power Plants, Final Report.* NUREG-1437, Volume 1, Addendum 1, Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 2001. *NRC Organizes Future Licensing Project Organization.* Press Release No. 01-035, March 30, 2001. http://www.nrc.gov/OPA/gmo/nrarcv/01-035.html (Accessed August 3, 2004).

U.S. Nuclear Regulatory Commission (NRC). 2002. *Final Supplement 1 to the Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities.* NUREG-0586, Supplement 1, Volumes 1 and 2, Washington, D.C.

# 9.0 Summary and Conclusions

By letter dated February 25, 2004, the Nuclear Management Company, LLC (NMC) submitted an application to the U.S. Nuclear Regulatory Commission (NRC) to renew the operating licenses (OLs) for Point Beach Nuclear Plant Units 1 and 2 (PBNP) for an additional 20-year period (NMC 2004a). If the OLs are renewed, State regulatory agencies and NMC will ultimately decide whether the plant will continue to operate based on factors such as the need for power or other matters within the State's jurisdiction or the purview of the owners. If the OLs are not renewed, then the plants must be shut down at or before the expiration of the current OLs, which expire on October 5, 2010, for Unit 1 and March 8, 2013, for Unit 2.

Section 102 of the National Environmental Policy Act (NEPA) (42 United States Code 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 Code of Federal Regulations (CFR) Part 51. Part 51 identifies licensing and regulatory actions that require an EIS. In 10 CFR 51.20(b)(2), the Commission requires preparation of an EIS or a supplement to an EIS for renewal of a reactor OL; 10 CFR 51.95(c) states that the EIS prepared at the OL renewal stage will be a supplement to the *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS), NUREG-1437, Volumes 1 and 2 (NRC 1996, 1999).[a]

Upon acceptance of the NMC application, the NRC began the environmental review process described in 10 CFR Part 51 by publishing a notice of intent to prepare an EIS and conduct scoping (NRC 2004a) on May 13, 2004. The staff visited the PBNP site in June 2004 and held public scoping meetings on June 15, 2004, in Mishicot, Wisconsin (NRC 2004b). The staff has reviewed the NMC Environmental Report (ER) (NMC 2004b) 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 PBNP. The public comments received during the scoping process that were considered to be within the scope of the environmental review are provided in Appendix A, Part 1, of this SEIS.

The staff will hold two public meetings in Mishicot, Wisconsin, in February 2005 to describe the preliminary results of the NRC environmental review and to answer questions in order to

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

provide members of the public with information that will assist them in formulating their comments on this draft SEIS. When the comment period ends, the staff will consider and address all of the comments received. These comments will be addressed in Appendix A, Part 2, of the final SEIS.

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

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

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

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

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

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

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

> The supplemental environmental impact statement for license renewal is not required to include discussion of need for power or the economic costs and economic benefits of the proposed action or of alternatives to the proposed action except insofar as such benefits and costs are either essential for a determination regarding the inclusion of an alternative in the range of alternatives considered or relevant to mitigation. In addition, the supplemental environmental impact statement prepared at the license renewal stage need not discuss other issues not related to the environmental effects of the proposed

action and the alternatives, or any aspect of the storage of spent fuel for the facility within the scope of the generic determination in § 51.23(a) 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.

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(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 PBNP OLs) and alternative methods of power generation. These alternative methods of power generation were evaluated assuming that the replacement power generation plant is located at either the PBNP site or some other unspecified greenfield location.

## 9.1 Environmental Impacts of the Proposed Action – License Renewal

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

NMC's license renewal application presents an analysis of the Category 2 issues that are applicable to PBNP, plus environmental justice and chronic effects from electromagnetic fields. The staff has reviewed the NMC analysis for each issue and has conducted an independent review of each issue plus environmental justice and chronic effects from electromagnetic fields. Six Category 2 issues are not applicable because they are related to plant design features or site characteristics not found at PBNP. Four Category 2 issues are not discussed in this draft SEIS because they are specifically related to refurbishment. NMC has stated that its evaluation of structures and components, as required by 10 CFR 54.21, did not identify any major plant refurbishment activities or modifications as necessary to support the continued operation of PBNP for the license renewal period (NMC 2004b). 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 the Operation of Point Beach Nuclear Plant Units 1 and 2* (U.S. Atomic Energy Commission 1972).

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. Five of the Category 2 issues and environmental justice apply to both refurbishment and to operation during the renewal term and are only discussed in this draft SEIS in relation to operation during the renewal term. For all 11 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 PBNP and the plant improvements already made, the staff concludes that none of the candidate SAMAs are cost-beneficial. Although none of the SAMAs appear cost-beneficial in the baseline analysis, the staff concludes that two SAMAs could be cost-beneficial when uncertainties, alternative discount rates, or broader implementation options are taken into account. However, none of these SAMAs relate to adequately managing the effects of aging during the period of extended operation. Therefore, they need not be implemented as part of the license renewal pursuant to 10 CFR Part 54.

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.

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 facility 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 PBNP ceases operation at or before the expiration of the current OLs will not be smaller than those associated with continued operation of these units, and the adverse impacts 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 PBNP during the current license period was made when the facility was built. The resource commitments to be considered in this draft SEIS are associated with continued operation of the plants 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 HLW storage space. Approximately one third of the fuel assemblies in each of the two PBNP units are replaced during every refueling outage, which occurs on a nominal 18-month cycle.

The likely power generation alternatives if PBNP ceases 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 PBNP site was set when the plants were approved and construction began. That balance is now well established. Renewal of the PBNP OLs and continued operation of the plant will not alter the existing balance, but may postpone the availability of the site for other uses. Denial of the application to renew the OLs will lead to a shutdown of the plant and will alter the balance in a manner that depends on subsequent uses of the site. For example, the environmental consequences of turning the PBNP 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 PBNP OLs. Chapter 2 describes the site, the power plant, and interactions of the plant with the environment. As noted in Chapter 3, no refurbishment and no refurbishment impacts are expected at PBNP. Chapters 4 through 7 discuss environmental issues associated with renewal of the PBNP 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-generated power at the PBNP site and an unspecified alternate site; and a combination of alternatives are compared in Table 9-1.

Substitution of once-through cooling for the recirculating cooling system in the evaluation of the nuclear, gas-, and coal-fired generation alternatives would result in somewhat greater environmental impacts in some impact categories.

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 NMC (NMC 2004b); (3) consultation with Federal, State, and local agencies; (4) the staff's own independent review, and (5) the staff's consideration of public comments received during the scoping process, the preliminary recommendation of the staff is that the Commission determine that the adverse environmental impacts of license renewal for PBNP 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 (from Chapters 4 and 8)

| | 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 | PBNP Site | Alternate Site | PBNP Site | Alternate Site | PBNP Site | Alternate Site | PBNP Site | Alternate Site |
| Land Use | SMALL | SMALL | MODERATE to LARGE | MODERATE to LARGE | MODERATE | MODERATE to LARGE | MODERATE | MODERATE to LARGE | MODERATE | MODERATE to LARGE |
| Ecology | SMALL | SMALL | SMALL to MODERATE | MODERATE to LARGE | MODERATE | MODERATE | SMALL to MODERATE | MODERATE to LARGE | MODERATE | MODERATE |
| Water Use and Quality – Surface Water | SMALL | SMALL | SMALL | SMALL to MODERATE | SMALL | SMALL to MODERATE | SMALL | SMALL to MODERATE | SMALL | 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 | SMALL | 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 |
| Socioeconomics | SMALL | SMALL to MODERATE | MODERATE | MODERATE to LARGE | SMALL to MODERATE | SMALL to MODERATE | SMALL to MODERATE | MODERATE to LARGE | SMALL to MODERATE | SMALL to MODERATE |
| Transportation | SMALL | SMALL | SMALL to LARGE | SMALL to LARGE | MODERATE | MODERATE | SMALL to LARGE | SMALL to LARGE | SMALL to MODERATE | SMALL to MODERATE |
| Aesthetics | SMALL | SMALL | MODERATE | MODERATE to LARGE | SMALL to MODERATE | SMALL to MODERATE | SMALL to MODERATE | SMALL to MODERATE | SMALL to MODERATE | SMALL to MODERATE |
| 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 | SMALL to MODERATE | SMALL to MODERATE | SMALL to MODERATE | SMALL to MODERATE | SMALL to MODERATE | SMALL to MODERATE | SMALL to MODERATE | SMALL to MODERATE |

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

National Environmental Policy Act of 1969. 42 United States Code 4321, et seq.

Nuclear Management Company, LLC (NMC). 2004a. *Application for Renewed Operating Licenses, Point Beach Nuclear Plant Units 1 and 2.* Two Rivers, Wisconsin.

Nuclear Management Company, LLC (NMC). 2004b. *Point Beach Nuclear Plant Operating License Renewal Application Environmental Report.* Two Rivers, Wisconsin.

U.S. Atomic Energy Commission. 1972. *Final Environmental Statement Related to the Operation of Point Beach Nuclear Plant Units 1 and 2.* Wisconsin Electric Power Company and Wisconsin Michigan Power Company. Docket Nos. 50-266 and 50-301, Washington, D.C.

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

U.S. Nuclear Regulatory Commission (NRC). 1999. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants: Main Report, Section 6.3, Transportation, Table 9.1, Summary of Findings on NEPA Issues for License Renewal of Nuclear Power Plants, Final Report.* NUREG-1437, Volume 1, Addendum 1, Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 2000. *Standard Review Plans for Environmental Reviews for Nuclear Power Plants, 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, No. 93, pp. 26624-26626, Washington, D.C. May 13, 2004.

U.S. Nuclear Regulatory Commission (NRC). 2004b. *Environmental Impact Statement Scoping Process: Summary Report – Point Beach Nuclear Plant Units 1 & 2, Manitowoc County, Wisconsin.* Washington, D.C.

# Appendix A

# Comments Received on the Environmental Review

# Appendix A

# Comments Received on the Environmental Review

## Part I - Comments Received During Scoping

On May 13, 2004, the U.S. Nuclear Regulatory Commission (NRC) published a Notice of Intent in the *Federal Register* (69 Federal Register 26624) 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 Point Beach Nuclear Plant Units 1 and 2 (PBNP) operating license and to conduct scoping. The plant-specific supplement to the GEIS has been prepared in accordance with the National Environmental Policy Act of 1969 (NEPA), Council on Environmental Quality guidelines, and Title 10 of the Code of Federal Regulations (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, Tribal, and local government agencies; 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 July 14, 2004.

The scoping process included two public scoping meetings, which were held at the Fox Hills Conference Center in Mishicot, Wisconsin, on June 15, 2004. Approximately 60 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. Attendees provided either oral or written statements that were recorded and transcribed by a certified court reporter. The meeting transcripts are an attachment to the Scoping Meeting Summary dated September 3, 2004. In addition to the comments received during the public meetings, 41 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 contractor reviewed the transcripts and all written material to identify individual comments. All comments and suggestions received orally during the scoping meetings or in writing were considered. Each set of comments from a given commenter was given a unique identifier (commenter ID number), so that each set of comments from a commenter could be traced back to the transcript or letter by which the comments were submitted. Several commenters submitted comments through multiple sources (e.g., afternoon and evening scoping meetings and/or written comments). All of the comments received and the staff responses are included in the PBNP Scoping Summary Report, dated September 2004.

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

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

| Commenter ID | Commenter | Affiliation (If Stated) | Comment Source and ADAMS Accession Number[a] |
|---|---|---|---|
| PB-A | Mr. Frank Lasee | (Local) State Representative | Afternoon Scoping Meeting |
| PB-B | Mr. Ken Petersen | Manitowoc County Sheriff | Afternoon Scoping Meeting |
| PB-C | Mr. Greg Buckley | Two Rivers, WI, City Manager | Afternoon Scoping Meeting |
| PB-D | Mr. Meyer | Village of Mishicot, Board Representative | Afternoon Scoping Meeting |
| PB-E | Mr. Rick Kuester | President & CEO of We Energies Generation Group | Afternoon Scoping Meeting |
| PB-F | Mr. Jim Shaw | PBNP Plant Manager | Afternoon Scoping Meeting |
| PB-G | Mr. Curt Andersen | Clean Water Action Council | Afternoon Scoping Meeting |
| PB-H | Mr. Roger Hirst | Citizen | Afternoon Scoping Meeting |
| PB-I | Mr. Tim Schroeder | Secretary/Treasurer, Two Rivers Business Association | Afternoon Scoping Meeting |
| PB-J | Mr. David Jurss | Vice-Chairman, Unit 2, Local 2150 International Brotherhood of Electrical Workers (PBNP) | Afternoon Scoping Meeting |
| PB-K | Mr. Mike Zimmer | Executive Director, Two Rivers Main Street Program | Afternoon Scoping Meeting |
| PB-L | Mr. Tom Kocourek | Executive Director, Big Brothers/Big Sisters of Manitowoc County | Afternoon Scoping Meeting |
| PB-M | Mr. Robert Hermann | Sheriff's Department, Manitowoc County | Evening Scoping Meeting |
| PB-N | Mr. Dan Pawlitzke | Economic Development Supervisor, City of Two Rivers, Wisconsin | Evening Scoping Meeting |
| PB-O | Mr. Rick Kuester | President & CEO of We Energies Generation Group | Evening Scoping Meeting |
| PB-P | Mr. Jim Shaw | PBNP Plant Manager | Evening Scoping Meeting |
| PB-Q | Mr. Dan Rahlf | Community Member | Evening Scoping Meeting |

**Table A-1.** (contd)

| Commenter ID | Commenter | Affiliation (If Stated) | Comment Source and ADAMS Accession Number[a] |
|---|---|---|---|
| PB-R | Mr. John Nikolai | Citizen | Evening Scoping Meeting |
| PB-S | Mr. John Busby | Miller Compressing Company | Letter (ML041600105) |
| PB-T | Mr. Kelly S. Jackson | Lac Du Flambeau Band, Lake Superior Chippewa Nation | Letter (ML041620343) |
| PB-U | Mr. Robert Domrois | Wisconsin Paperboard Corp. | Letter (ML041620340) |
| PB-V | Mr. Mark R. Honadel | Wisconsin State Assembly | Letter (ML041750351) |
| PB-W | D. H. Tredwell | Citizen | Letter (ML041750352) |
| PB-X | C. W. Fay | Citizen | Letter (ML041750353) |
| PB-Y | Mr. Dale Scherbert | Director, Community Memorial Hospital | Letter (ML041750356) |
| PB-Z | Mr. Robert Reynolds | ORBIS Corporation | Letter (ML041750358) |
| PB-AA | Ms. Kathryn L. Smith | Citizen | Letter (ML041750360) |
| PB-AB | Ms. Cheryl Brocher | Citizen | Letter (ML041750361) |
| PB-AC | Mr. Richard Wagner | Trega Foods | Letter (ML041750364) |
| PB-AD | Mr. Kenneth J. Petersen | Sheriff, Manitowoc County | Letter (ML041750365) |
| PB-AE | J. A. Mellowes | Charter Mfg. Co. | Letter (ML041750366) |
| PB-AF | Mr. Richard W. Wanta | Wisconsin Underground Contractors Association | Letter (ML041750367) |
| PB-AG | Mr. David J. Jenkins | Wisconsin Federation of Cooperatives | Letter (ML041750369) |
| PB-AH | Mr. Chad E. Cordle | Cellu Tissue Neenah | Letter (ML041830247) |
| PB-AI | Mr. William J. Welch | Fox Cities Chamber of Commerce and Industry | Letter (ML041830250) |
| PB-AJ | Mr. Zach Pahmahmie | Prairie Band Potawatomi Nation | Letter (ML041890189) |
| PB-AK | Mr. Steve Bongers | Outokumpu Copper Valleycast | Letter (ML041940367) |
| PB-AL | Mr. John H. Goetsch | Citizen | Letter (ML041940378) |
| PB-AM | Mr. Earl Gustafson | Wisconsin Paper Council | Letter (ML041980016) |
| PB-AN | Mr. James J. Graf | Alderman, City of Sheboygan | Letter (ML041980024) |

**Table A-1.** (contd)

| Commenter ID | Commenter | Affiliation (If Stated) | Comment Source and ADAMS Accession Number[a] |
|---|---|---|---|
| PB-AO | Mr. Herman Viets | Milwaukee School of Engineering | Letter (ML041980026) |
| PB-AP | Mr. R. J. Pirlot | Wisconsin Manufacturers and Commerce | Letter (ML042010179) |
| PB-AQ | Mr. John H. Meinke | Neenah Technical Center | Letter (ML041970655) |
| PB-AR | Mr. Donald Kaye | Citizen | Letter (ML041970654) |
| PB-AS | Mr. Orville Krueger | Citizen | Letter (ML041970650) |
| PB-AT | Mr. Bob DeKoch | The Boldt Company | Letter (ML041980013) |
| PB-AU | Mr. Joseph H. Pomeroy | Mercury Marine | Letter (ML041980021) |
| PB-AV | Mr. Allen J. Prochnow | Concordia University | Letter (ML042010181) |
| PB-AW | Mr. Daniel J. Sutheimer | Pierce Manufacturing | Letter (ML042170122) |
| PB-AX | Mr. Kenneth Westlake | U. S. EPA | Letter (ML041910394) |
| PB-AY | Mr. Don C. Markwardt | Chair, Legislative Review Committee, Manitowoc County Board of Supervisors | Letter (ML042150282) |
| PB-AZ | Mr. Joe Leibham | Wisconsin State Senator, 9th Senate District | Letter (ML042170106) |
| PB-BA | Mr. George P. Brown | Regional Director, Humana, Inc. | Letter (ML042170114) |
| PB-BB | Mr. Carl Otter | Citizen | Letter (ML042170117) |
| PB-BC | Ms. Carol Roessler | Wisconsin State Senator, 18th Senate District | Letter (ML042170118) |
| PB-BD | Dr. John G. Gonis | Dental Associates, Ltd. | Letter (ML042170119) |
| PB-BE | Mr. Edward J. Zore | President and Chief Executive Officer, Northwestern Mutual | Letter (ML042170120) |
| PB-BF | Mr. Jeffrey S. Mason | Chief Executive Officer, BayCare Health Systems, LLC | Letter (ML042170121) |
| PB-BG | Mr. Steve Bongers | Outokumpu Copper Valleycast | Letter (ML041970658) |

(a) The afternoon and evening transcripts can be found under accession number ML041960121.

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 PBNP 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.

Each comment applicable to this environmental review and the staff's responses are summarized in this section. This information, which was extracted from the PBNP 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 PBNP are not included here. More detail regarding the disposition of general or inapplicable comments can be found in the summary report, which was assigned an accession number to facilitate access to the document through the Public Electronic Reading Room (ADAMS) at http://www.nrc.gov/reading-rm.html. The ADAMS accession number for the summary report is ML042510283.

The following pages summarize the comments and suggestions received as part of the scoping process that are applicable to this environmental review and discuss the disposition of the comments and suggestions. The parenthetical alpha-numeric identifier after each comment refers to the comment set (commenter ID) and the comment number.

Comments in this section are grouped in the following categories:

A.1.1 Comments Concerning Terrestrial Resource Issues
A.1.2 Comments Concerning Aquatic Ecology Issues
A.1.3 Comments Concerning Water Quality Issues

A.1.4 Comments Concerning Air Quality Issues
A.1.5 Comments Concerning Socioeconomic Issues
A.1.6 Comments Concerning Human Health Issues
A.1.7 Comments Concerning Uranium Fuel Cycle and Waste Management Issues
A.1.8 Comments Concerning Alternatives

### A.1.1 Comments Concerning Terrestrial Resource Issues

**Comment:** We take great strides in our daily activities to ensure that the environment is well protected. Our employees feel fortunate that the location of Point Beach is along Lake Michigan and reaches to within the Point Beach State Park area. The site is home to numerous wildlife, aquatic species and plant life. Our efforts have made Point Beach a safe and sound habitat for many years and it's our commitment to maintain that habitat for years to come.
(PB-F-9)

**Comment:** The trees, the flowers, the weeds and grass, they're still growing, growing good.
(PB-H-5)

**Comment:** We take great strides in our daily activities to ensure that the environment is well protected. Our employees feel fortunate that Point Beach is located on the shores of Lake Michigan. The site is home to numerous wildlife, aquatic species and plant life. Our efforts have made Point Beach a safe and sound habitat for many years and it is our commitment to maintain that habitat for many years to come.
(PB-P-9)

**Response:** *Terrestrial resource issues were evaluated in the GEIS and determined to be Category 1 issues. The comments do not provide significant, new information and therefore, they will not be evaluated further.*

### A.1.2 Comments Concerning Aquatic Ecology Issues

**Comment:** We expect the draft SEIS to discuss the effects of thermal discharge on the lake and fish communities. Currently, the State of Wisconsin does not have active thermal water quality standards, though an advisory group is in the process of developing new standards. The new standards may be in place, or exist in draft form, by the time of license renewal. The draft SEIS should address the applicability of the upcoming State standards to Point Beach. Regardless of permit conditions, however, temperature effects from plant operation should be included in the draft SEIS, as part of assessing impacts to the environment.
(PB-AX-3)

**Comment:** During the plant audit tour it was mentioned that Point Beach will need to comply with the newly revised Clean Water Act Section 316(b), which regulates impacts of cooling water intakes. The draft SEIS should indicate modifications planned by the applicant to comply with the rule.
(PB-AX-4)

**Response:** *The comments relate to aquatic ecology issues and are discussed in Chapters 2 and 4 of the SEIS.*

### A.1.3 Comments Concerning Water Quality Issues

**Comment:** As part of describing site hydrogeology, the draft SEIS should discuss the on-site drinking water wells, drinking water quality, and treatment of the drinking water. In addition, we believe the potential for ground water contamination should be described in the draft SEIS, especially with regard to the abandoned settling pond.
(PB-AX-5)

**Response:** *The comment is noted. Water quality, water use, and other water issues were evaluated in the GEIS and determined to be Category 1 issues. The comment provides no significant, new information on water quality; therefore, the comment will not be evaluated further. Water quality is discussed in Chapters 2 and 4 of the SEIS.*

### A.1.4 Comments Concerning Air Quality Issues

**Comment:** It's protected the environment by not having any $CO_2$ going into the air or mercury or sulfur dioxide.
(PB-H-3)

**Comment:** With respect to environmental concerns, it is significant that the southeast area of Wisconsin has been and remains a closely watched non-attainment area for purposes of federal Clean Air Act enforcement. As a result, all new sources of monitored emissions will carry added burdens of expensive remediation measures which are not required for the commensurate amount of nuclear generation produced at Point Beach. While these costs are known in some cases, as in the instance of sulfur dioxide, other remediation expenses, such as those for nitrogen oxide and mercury emissions are evolving in their estimates and could prove prohibitively expensive for new coal generation sources. The picture gets murkier when regional ozone transport issues and fine particulate emissions regulation are added. It is thus vital for Wisconsin's future air quality to keep a non-emitting source of generation the size of Point Beach in its generation portfolio.
(PB-AP-4)

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

### A.1.5 Comments Concerning Socioeconomic Issues

**Comment:** Now, going back 24 years we, the Sheriff's Department formed what was called an Emergency Response Unit or SWAT Team. At that point, Point Beach was their force. We needed support financially and assist with training in order to get that unit off the ground. (PB-B-4)

**Comment:** The Energy Information Center has provided educational programs for more than 300,000 of these visitors. Most of these are school groups that have made our energy center a staple in their curriculum. We continue to host school groups and other organizations through reservation at this point. (PB-F-10)

**Comment:** And when you go around the plant, you can't get in it anymore, there used to be some good fishing there. The fishermen are gone due to security problems. But the fish are still there. (PB-H-4)

**Comment:** Point Beach itself, as a plant, is very friendly to our community. It supports a lot of our events. One of our biggest events and services is our ethnic festival and they're one of the major sponsors of that event. (PB-I-3)

**Comment:** And additionally, my newest position as executive for Big Brothers/Big Sisters, I can attest that Point Beach Nuclear Power Plant has been very supportive of local non-profit service agencies as well. Without the support of the local community these service agencies could not exist and do the good work that they do for our communities. (PB-L-4)

**Comment:** All previous companies relocated to Mexico, or in Hamilton's case has a potential to leave for Mexico. Power companies do not have the luxury of leaving for Mexico. They are here for the long haul. Point Beach Nuclear Power Plant has been a good corporate citizen by annually contributing to the excellent quality of life for the families right here in Two Rivers. (PB-N-6)

**Comment:** The Energy Information Center has provided educational programs for more than 300,000 of these visitors. Most of these are school groups, most of them are local school groups that have made our energy center a staple in their curriculum. We continue to host school groups and other organizations through reservations.
(PB-P-10)

**Comment:** We also know that when you look at socioeconomic factors that the Point Beach Plant is a huge factor in our local economy with approximately 700 high quality jobs having a significant economic impact in the communities of Two Rivers, Manitowoc and, as Representative Lasee noted, throughout northeast Wisconsin. That's in addition to the significant impact of the many contractors employed at the facility and extensive purchases of goods and services throughout the area.
(PB-C-3)

**Comment:** Point Beach also generates significant economic benefits to the local and state economy. Point Beach provides over 700 full time family supporting jobs. Those families purchase goods and services from local businesses, pay taxes in area communities and contribute to local charities and community organizations. Point Beach is committed to being a good neighbor and fostering continued economic growth in the region.
(PB-E-10)

**Comment:** Regardless of where power is being shipped right now, we believe that power generation is crucial to the future of Wisconsin, to attracting new industries, to attracting the kind of jobs that we need to rebuild from the industries that have left over the last 10 years or so. Point Beach has always provided safe, clean nuclear power to Wisconsin and wherever else that it ships it along the grid.
(PB-K-2)

**Comment:** And as previously stated, they employ 700 people in good quality jobs which are desperately needed in the Manitowoc County area.
(PB-L-5)

**Comment:** Point Beach Nuclear Power Plant started in 1969 and brought 100 employees and has seen a 700 percent increase in its workforce to the existing 700 employees in 2004. Energy production is a significant employer in our community now and hopefully will be well into the future. These are high quality jobs that are hard to find in today's economy.
(PB-N-2)

**Comment:** The economic impact of the 700 employees at Point Beach Nuclear Power can be felt in the local communities where they live. 69 percent of Point Beach Nuclear Plant employees live in Manitowoc County.
(PB-N-5)

**Comment:** Finally and in conclusion, the license renewal of Point Beach Nuclear Power Plant presents a unique opportunity to create a win-win-win scenario for the rate payers, taxpayers, the state and our community by: ...(2) preserving hundreds of well-paying jobs that help attract young, successful people to Wisconsin and the Lake Shore area.
(PB-N-10)

**Comment:** Point Beach also generates significant economic benefits to the local and state economy. Point Beach provides over 700 full-time family supporting jobs. These families purchase goods and services from local businesses, pay taxes in local communities and contribute to local charities and community organizations. Point Beach is committed to being a good neighbor and fostering continued economic growth in the region.
(PB-O-10)

**Comment:** The continued operation of Point Beach is vital to meeting Wisconsin's energy needs. It's important to the local economy and important to more than 700 employees who keep it running everyday safely.
(PB-E-11, PB-O-11)

**Comment:** Finally, Wisconsin benefits from the economic benefit of Point Beach and the 700 family supporting jobs that these nuclear facilities provide.
(PB-S-3)

**Comment:** In response to your letter dated May 14, 2004, the Lac du Flambeau Band of Lake Superior Chippewa Indians would like to express NO CONCERNS with any impacts to historic properties located within the project area of potential effect for the Point Beach Nuclear Plant, located on the western shore of Lake Michigan in Two Rivers, Wisconsin.
(PB-T-1)

**Comment:** Fortunately through both the business and environmental stewardship of We Energies, Wisconsin continues to be a state that supports manufacturing jobs through energy management and growth.
(PB-Z-2)

**Comment:** I see this as a positive item for the community. With all the manufacturing leaving this area, we are about the only place left that is a big contributor to the local economy.
(PB-AA-2)

**Comment:** Another important reason for Point Beach to stay is our economy. We have lost so many industrial jobs in the county. We need the jobs that Point Beach provides. Without it, our county would really be in bad shape.
(PB-AB-4)

**Comment:** In addition, the plant employs over 700 family supporting jobs, while providing significant economic benefits to the state and the local economy.
(PB-AE-4)

**Comment:** Lastly, the Point Beach Nuclear Plant provides 700 family supporting jobs in addition to other significant economic benefits to the State of Wisconsin and the local economy.
(PB-AF-3)

**Comment:** At this time, we are unaware of any historical cultural resources in the proposed development area. However, we do request to be immediately contacted if any inadvertent discoveries are uncovered at anytime throughout the various phases of the project.
(PB-AJ-2)

**Comment:** The continued operation of its two units for another 20 years will be a significant benefit to Wisconsin's economy.
(PB-AM-4)

**Comment:** Located in Two Creeks, the Point Beach facility employs approximately 730 area residents with family-sustaining jobs.
(PB-AN-2, PB-AR-2, PB-AT-2, PB-AU-2, PB-AZ-2, PB-BB-2, PB-BC-2, PB-BD-2, PB-BF-2)

**Comment:** It's significant contribution to Wisconsin's energy generation is priceless to the economic development of our region and quality of life of our residents.
(PB-AN-4, PB-AR-4, PB-AT-4, PB-AU-4, PB-AZ-4, PB-BA-4, PB-BB-4, PB-BC-4, PB-BD-4, PB-BF-4)

**Comment:** The stability of energy availability has been absolutely essential to the growth of my institution and the growth of the business partners who support this institution. Any interruption of these energy sources will have dire consequences, particularly for existing businesses in the area and for Wisconsin's ability to build and attract new business. It is essential to the economic success of this region to have the Point Beach Nuclear Plant's license renewed.
(PB-AO-3)

**Comment:** Continued operation of the Point Beach plant is key to providing an overall climate of economic health and growth in the local area as well as throughout the state.
(PB-AQ-3)

**Comment:** If nuclear power is no longer part of that energy mix, businesses throughout the state will be faced with serious economic issues and the potential for new businesses coming into the area will be limited.
(PB-AV-5)

**Comment:** The Point Beach Nuclear Plant is an important part of keeping Wisconsin business competitive in the nation and around the world.
(PB-AW-4)

**Comment:** The 700 permanent jobs at Point Beach and the extensive use of contracts for ongoing maintenance and special projects are recognized as vitally important to the economy of Manitowoc County and Northeast Wisconsin.
(PB-AY-3)

**Comment:** While the Point Beach facility employees approximately 730 area residents with family-sustaining jobs, clean, reliable, and efficient energy is critical to many businesses affecting many thousands of jobs.
(PB-BA-2)

**Comment:** If nuclear power is no longer part of that energy mix, business throughout the state could be faced with serious economic issues and the potential for new businesses coming into the area will be limited.
(PB-BE-4)

**Response:** *Public services involving education, social services, and recreation were evaluated in the GEIS and were determined to be Category 1 issues. Those comments related to these public service issues provide no significant, new information and therefore, those comments will not be evaluated further. Socioeconomic issues specific to Point Beach are Category 2 issues and are addressed in Chapters 2 and 4 of the SEIS.*

### A.1.6 Comments Concerning Human Health Issues

**Comment:** But I have some very, very serious concerns about public health.
(PB-G-5)

**Comment:** The draft SEIS should discuss planned or potential power uprates at Point Beach 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 consider power uprates to be reasonably foreseeable actions that contribute to a cumulative radiological impact, under 40 CFR § 1508.7 and therefore should be discussed in U.S. NRC's draft SEIS.
(PB-AX-1)

**Response:** *Human health issues were evaluated in the GEIS and were determined to be Category 1 issues. The comments provide no significant, new information on these issues, and therefore, will not be evaluated further. Human health issues are addressed in Chapter 4 of the SEIS.*

*The following paragraph contains additional information that was not included in the scoping summary report dated September 2004:*

*The SEIS contains an evaluation of severe accident mitigation alternatives (SAMAs), as required by NRC regulations. This is contained in Chapter 5 and Appendix G. The staff notes that the NMC ER SAMA analysis included a sensitivity study to assess the impact of a 8.7 percent power uprate, which would increase reactor power level to 1678 MW(t). The sensitivity study found that the power uprate had no significant impact on SAMA benefits.*

*Although the power uprate information was considered in the SAMA analysis, the staff recognizes that the Commission has stated that for NEPA purposes, a possible future action "must at least constitute a proposal pending before the agency" for it to be considered along with the proposed action, which here is license renewal. The Commission's decision is set forth in the following case: Duke Energy Corp. (McGuire Nuclear Station, Units 1 and 2; Catawba Nuclear Station, Units 1 and 2) CLI-02-14, 55 NRC 278, 294-297 (2002). Since NMC does not at this time have a proposal pending before the NRC that relates to a power uprate for PBNP, the SEIS does not address future power uprates. In addition, the Commission in that case stated that for the license renewal action and a separate proposal (such as a power uprate application) to be considered together, both actions must be "interdependent", such that one cannot go forward without the other. Should a power uprate amendment request for PBNP be filed, the staff will then consider whether there are cumulative impacts associated with the power uprate.*

### A.1.7 Comments Concerning Uranium Fuel Cycle and Waste Management

**Comment:** Some people will say that nuclear waste is an issue and I've been to Yucca Mountain and looked at it quite a bit and I'm not a science expert, although I can read things and take a good hard look at it. And I think that's a good place to put spent fuel. (PB-A-3)

**Comment:** So I view Yucca Mountain, unlike the government does, the government I think views it as a permanent repository. I view it as a much more short term repository until we find a better use for that waste that we're generating here and storing on-site. And I would urge the Federal government to get going so we can move some of that stuff out of here and take it to Yucca Mountain. (PB-A-4)

**Comment:** That goes to operational issues, that goes to the dry cask storage issue which we realize is still an interim fix and we want to frankly keep our federal politician's feet to the fire on a permanent solution to that issue which our rate payers have paid for. (PB-C-6)

**Comment:** So the solution to the waste? It looks like it could be Wisconsin, right in our area, and the Canadian Shield, the Wolf River—which is nice and solid. It doesn't have any earthquake problems and I don't like the idea of our area being turned into a nuclear waste repository. (PB-G-3)

**Comment:** Like all nuclear reactors, Point Beach produces spent fuel. The overwhelming majority of both houses of Congress have expressed their will that the spent fuel storage repository at Yucca Mountain, Nevada, be made operational. (PB-AG-4)

**Comment:** In addition, the draft SEIS should discuss spent fuel storage capacity and spent fuel transportation issues that may arise from power uprates. (PB-AX-2)

**Response:** *Uranium fuel cycle and waste management issues were evaluated in the GEIS and were determined to be Category 1 issues. The comments provide no significant, new information on these public service issues, and therefore, will not be evaluated further.*

### A.1.8 Comments Concerning Alternatives

**Comment:** Nuclear power is the way to go. We won't be here, but oil won't last forever, neither will coal.
(PB-H-2)

**Comment:** And I asked him what he thought about nuclear power. And he feels that nuclear power is the safest, most practical form of energy that we can have, outside of solar energy and wind power. Much more practical, much safer than coal, oil or any other forms of energy.
(PB-I-4)

**Comment:** If Point Beach Nuclear Power Plant's license is not renewed, its electrical generation capacity would have to be replaced. The likely replacement is some sort of fossil fuel. As air quality becomes more and more of an issue in Wisconsin, especially along the Lake Shore which sees much of its pollution, air pollution that is imported, the license renewal of Point Beach Nuclear Power Plant can serve to help protect our local environment.
(PB-N-7)

**Comment:** New coal plants are being proposed for southeast Wisconsin but are vigorously opposed by local residents. Wind generators are also planned but nowhere near 1000 megawatts. New natural gas plants are under construction. However, these are presumably peaking plants not base-load as is Point Beach. Further, an article in the June 14 Wall Street Journal points out that not only is natural gas becoming very expensive but that the availability is in question. To quote: "The underlying demand from the power sector is such that you are always going to be strained to meet the demand on the supply side." The Wisconsin transmission system is generally considered inadequate to import large amounts of power and new lines are planned but are also opposed by many residents.
(PB-X-2)

**Comment:** To replace this power production today would not only mean a large capital investment but either the environmental damage of a (sic) burning coal or the use of precious national gas which is needed for heating our homes. Nuclear plants still represent the most environmentally sound form of energy production we have available to us and keeping this plant operational as long as possible is critical to Wisconsin's economy and environment.
(PB-Y-3)

**Comment:** We don't need any more polluted air. Clean production of electricity is crucial to our environment.
(PB-AB-2)

**Comment:** Continued operation of this particular nuclear plant as such will enable our utility to have time to obtain newer nuclear technology as it becomes available. Continued operation of this particular nuclear plant as such will enable our utility to have some breathing room and transition time as they explore and act to bring much more renewable energy supplies on line. (PB-AC-3)

**Comment:** Technically, nuclear energy output comes without any of the environmental impacts to the atmosphere that coal, natural gas, or other fuels have.
(PB-AC-5)

**Comment:** The current trend in the electric industry is to rely more heavily on natural gas-fired plants. We have seen the cost of natural gas for summer rise from $ 3.00/dth to over $ 6.00/dth over the last several years. Siting and constructing of new power plants is expensive and difficult. With consideration to the projected maintenance cost, usually the best investment is to maintain existing facilities.
(PB-AE-2)

**Comment:** Point Beach is a zero-emissions resource. Only hydroelectric and some (not all) renewable resources have zero emissions. This is especially beneficial in an area of the state which has close proximity to Lake Michigan and urban areas such as Milwaukee.
(PB-AG-3)

**Comment:** License renewal is expected to cost $22 million which Wisconsin Energy projects to be $474 million more economical than other options, such as building a new fossil fuel plant or purchasing replacement power.
(PB-AM-5)

**Comment:** Nuclear power also represents, and will continue to represent, the most cost effective electricity to produce in Wisconsin and nationwide. Recent data provided by the Nuclear Energy Institute show nuclear energy surpassing coal in overall fuel production cost effectiveness, with none of the attendant emissions-related concerns of coal-fired generation. In contrast, the alternative generation construction required to replace the output of Point Beach, in the event of an untimely retirement, would necessarily rely upon natural gas or coal. Natural gas prices have reached nearly historic levels of expense and volatility, with further use in electricity production likely to cause further price flux and supply displacement for manufacturing and home heating needs. Coal generation carries very large capital costs, long construction cycles and protracted public opposition. None of these alternatives to Point Beach represent good choices for Wisconsin ratepayers, who already face sizable rate increases once currently pending generation and transmission upgrades begin commercial operation.
(PB-AP-3)

**Response:** *The GEIS included an extensive discussion of alternative energy sources. Environmental impacts from reasonable alternatives to renewal of the operating licenses for the Point Beach Nuclear Plant, Units 1 and 2 will be evaluated in Chapter 8 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, the Los Alamos National Laboratory, Argonne National Laboratory, Lawrence Livermore National Laboratory, Energy Research Incorporated, and the Information Systems Laboratory.

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(a) Los Alamos National Laboratory is operated for the U.S. Department of Energy by the University of California.
(b) Argonne National Laboratory is operated for the U.S. Department of Energy by the University of Chicago.
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# Appendix C

## Chronology of NRC Staff Environmental Review Correspondence Related to Nuclear Management Company, LLC's Application for License Renewal of Point Beach Nuclear Plant Units 1 and 2

# Appendix C

## Chronology of NRC Staff Environmental Review Correspondence Related to Nuclear Management Company, LLC's Application for License Renewal of Point Beach Nuclear Plant Units 1 and 2

This appendix contains a chronological listing of correspondence between the U.S. Nuclear Regulatory Commission (NRC) and Nuclear Management Company, LLC (NMC) and other correspondence related to the NRC staff's environmental review, under Title 10 of the Code of Federal Regulations Part 51, of NMC's application for renewal of the Point Beach Nuclear Plant Units 1 and 2 (PBNP) 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 System (ADAMS), which provides text and image files of NRC's public documents in the publicly available records (PARS) component of ADAMS. The ADAMS accession numbers for each document are included below.

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| December 22, 2003 | Letter from Mr. A. J. Cayia, NMC, to Mr. J. Michael Blaska, Wisconsin Department of Administration, regarding Federal Consistency Certification for license renewal of PBNP (Accession No. ML041210524). |
| January 6, 2004 | Letter from Mr. Richard Dexter, Wisconsin Historical Society, to Mr. A. J. Cayia, NMC, regarding historic and archaeological resources in the area under review for the license renewal of PBNP (Accession No. ML041470098). |
| February 25, 2004 | Point Beach Units 1 and 2, Applicant's Environmental Report-Operating License Renewal Stage (Accession No. ML040580025). |
| February 26, 2004 | Letter from Ms. Janet M. Smith, U.S. Fish and Wildlife Service, to Mr. A. J. Cayia, NMC, regarding the environmental impact of license renewal of PBNP (Accession No. ML040610963). |
| March 1, 2004 | NRC press release No. 04-029, "NRC Announces Availability of License Renewal Application for Point Beach Nuclear Power Plant" (Accession No. ML040611048). |

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| March 2, 2004 | Letter from Mr. Gary Van Middlesworth, NMC, to Mr. Travis Olson, Wisconsin Department of Administration, regarding Federal Consistency Certification for license renewal of PBNP (Accession No. ML041420323). |
| March 2, 2004 | Letter from NRC to Mr. Gary Van Middlesworth, NMC, regarding the receipt and availability of the license renewal application for PBNP (Accession No. ML040640628). |
| March 8, 2004 | Federal Register Notice of Receipt and Availability of Application for Renewal of Point Beach Nuclear Plant, Units 1 and 2; Facility Operating License Nos. DPR-24 and DPR-27 for an Additional 20-Year Period (69 FR 10765). |
| March 11, 2004 | Letter from Mr. Sherman Banker, Wisconsin Historical Society, to Mr. Roger Newtown, NMC, regarding the application for license renewal of PBNP (Accession No. ML041470090). |
| April 7, 2004 | Letter from NRC to Mr. Gary Van Middlesworth, NMC, regarding acceptance of the application for license renewal of PBNP and opportunity for a hearing (Accession No. ML040980219). |
| April 7, 2004 | Letter from NRC to Mr. Nick Niederlander, Lester Public Library, regarding the maintenance of reference material for the PBNP license renewal review (Accession No. ML041050642). |
| April 13, 2004 | Federal Register Notice of Acceptance for Docketing of the Application and Notice of Opportunity for Hearing Regarding the Renewal of Facility Operating License Nos. DPR-24 and DPR-27 for an Additional 20-Year Period (69 FR 19559). |
| April 16, 2004 | NRC press release announcing opportunity for hearing on application for license renewal of PBNP (Accession No. ML041070354). |
| April 21, 2004 | Summary of telecommunication with NMC to discuss environmental review of license renewal application and schedule (Accession No. ML041140404). |
| April 26, 2004 | Letter from Kris McKinney, We Energies, to NRC providing documents requested during April 8, 2004, conference call (Accession No. ML041250592). |

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| April 30, 2004 | E-mail from Kris McKinney, We Energies, to NRC providing follow-up to action items discussed in April 8, 2004, conference call (Accession No. ML041240446). |
| May 5, 2004 | Letter from NRC to Mr. Richard Dexter, Wisconsin Historical Society, inviting participation in the environmental scoping process for license renewal of PBNP and requesting a determination of effects of license renewal on historic properties in accordance with the National Historic Preservation Act (Accession No. ML041270553). |
| May 5, 2004 | Letter from NRC to Mr. Don Klima, Advisory Council on Historic Preservation, inviting comments on the effects of license renewal of PBNP on historic properties in accordance with the National Historic Preservation Act (Accession No. ML041270559). |
| May 5, 2004 | Letter from NRC to Ms. Janet Smith, U.S. Fish and Wildlife Service, requesting a list of protected species within the area under evaluation for license renewal of PBNP (Accession No. ML041280306). |
| May 5, 2004 | Letter from NRC to Mr. Gary Van Middlesworth, NMC, forwarding the Notice of Intent to Prepare an Environmental Impact Statement and Conduct Scoping Process for the license renewal of Point Beach Nuclear Plant (Accession No. ML041280448). |
| May 12, 2004 | Letter from NRC to Ms. Patricia A. Kurkul, National Oceanic and Atmospheric Administration Fisheries, requesting a list of protected species within the area under evaluation for license renewal of PBNP (Accession No. ML041330494). |
| May 13, 2004 | Federal Register Notice of Intent to Prepare an Environmental Impact Statement and Conduct Scoping Process regarding the application for license renewal of Point Beach Nuclear Plant (69 FR 26624). |
| May 14, 2004 | Letter from NRC to Ms. Lisa Bresette, Red Cliff Band of Lake Superior Chippewas, inviting participation in the environmental scoping process for the license renewal of PBNP (Accession No. ML041400252). |
| May 14, 2004 | Letter from NRC to Mr. Robert Chicks, Stockbridge-Munsee Community of Wisconsin, inviting participation in the environmental scoping process for the license renewal of PBNP (Accession No. ML041400405). |

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| May 14, 2004 | Letter from NRC to Ms. Cristina Danforth, Oneida Tribe of Indians of Wisconsin, inviting participation in the environmental scoping process for the license renewal of PBNP (Accession No. ML041410555). |
| May 14, 2004 | Letter from NRC to Ms. Joan Delabreau, Menominee Indian Tribe of Wisconsin, inviting participation in the environmental scoping process for the license renewal of PBNP (Accession No. ML041410534). |
| May 14, 2004 | Letter from NRC to Mr. Ray DePerry, Red Cliff Band of Lake Superior Chippewa Indians of Wisconsin, inviting participation in the environmental scoping process for the license renewal of PBNP (Accession No. ML041410377). |
| May 14, 2004 | Letter from NRC to Mr. Gus Frank, Forest County Potawatomi Indian Community, inviting participation in the environmental scoping process for the license renewal of PBNP (Accession No. ML041410240). |
| May 14, 2004 | Letter from NRC to Mr. David Grignon, Menominee Indian Tribe of Wisconsin, inviting participation in the environmental scoping process for the license renewal of PBNP (Accession No. ML041400392). |
| May 14, 2004 | Letter from NRC to Ms. Kelly Jackson, Lac du Flambeau Band of Lake Superior Chippewa Indians, inviting participation in the environmental scoping process for the license renewal of PBNP (Accession No. ML041410513). |
| May 14, 2004 | Letter from NRC to Mr. George Lewis, Ho-Chunk Nation of Wisconsin, inviting participation in the environmental scoping process for the license renewal of PBNP (Accession No. ML041400343). |
| May 14, 2004 | Letter from NRC to Mr. Donald Moore, Bad River Band of Lake Superior Chippewa Indians, inviting participation in the environmental scoping process for the license renewal of PBNP (Accession No. ML041400150). |
| May 14, 2004 | Letter from NRC to Mr. Jerry Smith, Lac Courte Oreilles Band of Lake Superior Chippewa Indians of Wisconsin, inviting participation in the environmental scoping process for the license renewal of PBNP (Accession No. ML041410206). |

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| May 14, 2004 | Letter from NRC to Mr. Henry St. Germaine, Lac du Flambeau Band of Lake Superior Chippewa Indians of Wisconsin, inviting participation in the environmental scoping process for the license renewal of PBNP (Accession No. ML041410068). |
| May 14, 2004 | Letter from NRC to Mr. Louis Taylor, Lac Courte Oreilles Band of Lake Superior Chippewa Indians of Wisconsin, inviting participation in the environmental scoping process for the license renewal of PBNP (Accession No. ML041410352). |
| May 14, 2004 | Letter from NRC to Ms. Corina Williams, Oneida Nation of Wisconsin, inviting participation in the environmental scoping process for the license renewal of PBNP (Accession No. ML041410094). |
| May 17, 2004 | Letter from NRC to Mr. David Merrill, St. Croix Chippewa Indians of Wisconsin, inviting participation in the environmental scoping process for the license renewal of PBNP (Accession No. ML041410612). |
| May 17, 2004 | Letter from NRC to Ms. Sandra Rachal, Sokaogon Chippewa (Mole Lake) Community of Wisconsin, inviting participation in the environmental scoping process for the license renewal of PBNP (Accession No. ML041410580). |
| May 18, 2004 | Letter from Mr. Gary Van Middlesworth, NMC, to Ms. Janet M. Smith, U.S. Fish and Wildlife Service, responding to concerns raised in February 26, 2004 letter (Accession No. ML041530208). |
| May 21, 2004 | Letter from NRC to Ms. Cassandra Dixon inviting participation in the environmental scoping process for the license renewal of PBNP (Accession No. ML041450240). |
| May 21, 2004 | NRC meeting notice announcing public meeting in Mishicot, Wisconsin, on June 15, 2004, to discuss the environmental scoping process for the application for the license renewal of PBNP (Accession No. ML041420535). |
| May 25, 2004 | Letter from Mr. Sherman Banker, Wisconsin Historical Society, to NRC regarding the application for license renewal of PBNP (Accession No. ML041600062). |

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| May 26, 2004 | Letter from Mr. John E. Busby, Miller Compressing Company, to NRC expressing support for license renewal of PBNP (Accession No. ML041600105). |
| June 1, 2004 | Letter from Ms. Kelly Jackson, Lac du Flambeau Band of Lake Superior Chippewa Indians, to NRC expressing no concerns with impacts to historic properties from the proposed license renewal of PBNP (Accession No. ML041620343). |
| June 1, 2004 | Letter from NRC to Mr. John A. Barrett, Jr., Citizen Potawatomi Nation, inviting participation in the environmental scoping process for the license renewal of PBNP (Accession No. ML041540192). |
| June 1, 2004 | Letter from NRC to Mr. Zachariah Pahmahmie, Prairie Band Potawatomi Tribal Council, inviting participation in the environmental scoping process for the license renewal of PBNP (Accession No. ML041540246). |
| June 2, 2004 | Letter from Mr. Robert Domrois, Newark Paperboard Mills, to NRC expressing support for license renewal of PBNP (Accession No. ML041620340). |
| June 2, 2004 | Letter from NRC to Mr. Kenneth Meshiguad, Hannahville Indian Community, inviting participation in the environmental scoping process for the license renewal of PBNP (Accession No. ML041540263). |
| June 9, 2004 | Letter from Mr. Mark R. Honadel, Wisconsin State Assembly, to NRC providing scoping comments regarding the license renewal review for PBNP (Accession No. ML041750351). |
| June 10, 2004 | Letter from Mr. John A. Mellowes, Charter Manufacturing Company, to NRC providing scoping comments regarding the license renewal review for PBNP (Accession No. ML041750366). |
| June 10, 2004 | Letter from Mr. Zach Pahmahmie, Prairie Band Potawatomi Nation, to NRC expressing no concerns with impacts to historic properties from the proposed license renewal of PBNP (Accession No. ML041890189). |
| June 14, 2004 | E-mail from Mr. Bob Reynolds, ORBIS Corporation, to NRC providing scoping comments regarding the license renewal review for PBNP (Accession No. ML041750358). |

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| June 14, 2004 | E-mail from Mr. Dale Scherbert, Community Memorial Hospital, to NRC providing scoping comments regarding the license renewal review for PBNP (Accession No. ML041750356). |
| June 14, 2004 | Letter from Mr. David J. Jenkins, Wisconsin Federation of Cooperatives, to NRC providing scoping comments regarding the license renewal review for PBNP (Accession No. ML041750369). |
| June 14, 2004 | Letter from Mr. Richard W. Wanta, Wisconsin Underground Contractors' Association, Inc., to NRC providing scoping comments regarding the license renewal review for PBNP (Accession No. ML041750367). |
| June 15, 2004 | E-mail from C. W. Fay to NRC providing scoping comments regarding the license renewal review for PBNP (Accession No. ML041750353). |
| June 15, 2004 | E-mail from D. H. Tredwell to NRC providing scoping comments regarding the license renewal review for PBNP (Accession No. ML041750352). |
| June 15, 2004 | Letter from Mr. Kenneth J. Petersen, Manitowoc County Sheriff's Department, to NRC providing scoping comments regarding the license renewal review for PBNP (Accession No. ML041750365). |
| June 16, 2004 | E-mail from Mr. Richard Wagner, Trega Foods, to NRC providing scoping comments regarding the license renewal review for PBNP (Accession No. ML041750364). |
| June 17, 2004 | E-mail from Ms. Cheryl Brocher to NRC providing scoping comments regarding the license renewal review for PBNP (Accession No. ML041750361). |
| June 17, 2004 | E-mail from Ms. Kathryn L. Smith to NRC providing scoping comments regarding the license renewal review for PBNP (Accession No. ML041750360). |
| June 21, 2004 | E-mail from Mr. Chad E. Cordle, Cellu Tissue Neenah, to NRC providing scoping comments regarding the license renewal review for PBNP (Accession No. ML041830247). |

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| June 21, 2004 | Letter from Mr. Don Markwardt, Manitowoc County Board of Supervisors, to NRC providing scoping comments regarding the license renewal review for PBNP (Accession No. ML042150282). |
| June 21, 2004 | Letter from Mr. William J. Welch, Fox Cities Chamber of Commerce and Industry, to NRC providing scoping comments regarding the license renewal review for PBNP (Accession No. ML041830250). |
| June 25, 2004 | Letter from NRC to Mr. Mitchell "Mickey" J. Maricque regarding hearing request for the license renewal review for PBNP (Accession No. ML041810651). |
| July 1, 2004 | Letter from Dr. John G. Gonis, Dental Associates, Ltd., to NRC providing scoping comments regarding the license renewal review for PBNP (Accession No. ML042170119). |
| July 1, 2004 | Letter from Mr. Donald Kaye to NRC providing scoping comments regarding the license renewal review for PBNP (Accession No. ML041970654). |
| July 1, 2004 | Letter from Mr. Carl Otter to NRC providing scoping comments regarding the license renewal review for PBNP (Accession No. ML042170117). |
| July 1, 2004 | Letter from Ms. Carol Roessler, Wisconsin State Senator, to NRC providing scoping comments regarding the license renewal review for PBNP (Accession No. ML042170118). |
| July 1, 2004 | Letter from Mr. Kenneth A. Westlake, U.S. Environmental Protection Agency, to NRC providing scoping comments regarding the license renewal review for PBNP (Accession No. ML041910394). |
| July 2, 2004 | E-mail from Mr. Steve Bongers, Outokumpu Copper Valleycast, to NRC providing scoping comments regarding the license renewal review for PBNP (Accession No. ML041940367). |
| July 2, 2004 | Letter from Mr. Steve Bongers, Outokumpu Copper Valleycast, to NRC providing scoping comments regarding the license renewal review for PBNP (Accession No. ML041970658). |

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| July 2, 2004 | Letter from Mr. John H. Meinke, Neenah Technical Center, to NRC providing scoping comments regarding the license renewal review for PBNP (Accession No. ML041970655). |
| July 2, 2004 | Letter from NRC to Mr. Dennis L. Koehl, NMC, forwarding request for additional information regarding severe accident mitigation alternatives for PBNP (Accession No. ML041890271). |
| July 5, 2004 | Letter from Mr. Orville Krueger to NRC providing scoping comments regarding the license renewal review for PBNP (Accession No. ML041970650). |
| July 6, 2004 | Letter from Mr. Allen J. Prochnow, Concordia University, to NRC providing scoping comments regarding the license renewal review for PBNP (Accession No. ML042010181). |
| July 7, 2004 | E-mail from Mr. John H. Goetsch to NRC providing scoping comments regarding the license renewal review for PBNP (Accession No. ML041940378). |
| July 7, 2004 | Letter from Mr. Bob DeKoch, The Boldt Company, to NRC providing scoping comments regarding the license renewal review for PBNP (Accession No. ML041980013). |
| July 7, 2004 | Letter from Mr. Joseph H. Pomeroy, Mercury Marine, to NRC providing scoping comments regarding the license renewal review for PBNP (Accession No. ML041980021). |
| July 8, 2004 | Letter from NRC to Mr. James E. Knorr, NMC, announcing project manager change for the license renewal environmental review for PBNP (Accession No. ML041950081). |
| July 8, 2004 | Summary of Public Scoping Meetings To Support Review of PBNP License Renewal Application (Accession No. ML041960121). |
| July 12, 2004 | Letter from Mr. George P. Brown, Humana Inc., to NRC providing scoping comments regarding the license renewal review for PBNP (Accession No. ML042170114). |

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| July 12, 2004 | E-mail from Mr. Earl Gustafson, Wisconsin Paper Council, to NRC providing scoping comments regarding the license renewal review for PBNP (Accession No. ML041980016). |
| July 13, 2004 | E-mail from Mr. James J. Graf, City of Sheboygan Alderman, to NRC providing scoping comments regarding the license renewal review for PBNP (Accession No. ML041980024). |
| July 13, 2004 | E-mail from Mr. Hermann Viets, Milwaukee School of Engineering, to NRC providing scoping comments regarding the license renewal review for PBNP (Accession No. ML041980026). |
| July 13, 2004 | Letter from Mr. Jeffrey S. Mason, BayCare Health Systems, LLC, to NRC providing scoping comments regarding the license renewal review for PBNP (Accession No. ML042170121). |
| July 13, 2004 | Letter from Mr. Edward J. Zore, Northwestern Mutual, to NRC providing scoping comments regarding the license renewal review for PBNP (Accession No. ML042170120). |
| July 14, 2004 | Letter from Mr. Joe Leibham, Wisconsin State Senator, to NRC providing scoping comments regarding the license renewal review for PBNP (Accession No. ML042170106). |
| July 14, 2004 | E-mail from Mr. R. J. Pirlot, Wisconsin Manufacturers and Commerce, to NRC providing scoping comments regarding the license renewal review for PBNP (Accession No. ML042010179). |
| July 16, 2004 | Letter from Mr. Daniel J. Sutheimer, Pierce Manufacturing, to NRC providing scoping comments regarding the license renewal review for PBNP (Accession No. ML042170122). |
| July 19, 2004 | Response to open items from June 16–17, 2004, NRC environmental audit to support license renewal of PBNP (Accession No. ML042020469). |
| July 23, 2004 | Summary of site audit to support review of license renewal application for PBNP (Accession No. ML042080516). |

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| August 5, 2004 | Letter from Ms. Janet M. Smith, U.S. Fish and Wildlife Service, to NRC responding to NRC request for a list of protected species within the area under evaluation for license renewal of PBNP (Accession No. ML042290328). |
| August 20, 2004 | Note to file docketing email pertaining to environmental review for PBNP (Accession No. ML042330285). |
| August 31, 2004 | Letter from Mr. Dennis L. Koehl, NMC, transmitting responses to July 2, 2004, request for additional information regarding severe accident mitigation alternatives for PBNP (Accession No. ML042530218). |
| September 3, 2004 | Letter from NRC to Mr. Dennis L. Koehl, NMC, transmitting environmental scoping summary report associated with the staff's review of the PBNP (Accession No. ML042510283). |
| September 8, 2004 | Letter from Mr. Lars Bengtsson, Stora Enso's North American Division, to NRC providing scoping comments regarding the license renewal review for PBNP (Accession No. ML042750132) |
| September 8, 2004 | Letter from Mr. Thomas G. Scharff, Consolidated Water Power Company, to NRC providing scoping comments regarding the license renewal review for PBNP (Accession No. ML042750138) |
| October 12, 2004 | Note to file docketing email pertaining to comments to request-for-additional-information responses for PBNP (Accession No. ML042870219). |
| October 15, 2004 | E-mail from Mr. Kris McKinney, We Energies, transmitting piping plover habitat survey on PBNP site (Accession No. ML043150318). |
| October 20, 2004 | Letter from NRC to Mr. Dennis L. Koehl, NMC, stating that the license renewal schedule may be impacted by the delay in responses to the October 12, 2004, e-mail (Accession No. ML042940650). |
| October 28, 2004 | Summary of conference call with NMC to discuss responses to the severe accident mitigation alternatives (SAMAs) requests for additional information (Accession No. ML043020631). |

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| November 5, 2004 | Fax from Mr. Kris McKinney, We Energies, to Stacey Imboden, NRC stating that piping plover habitat survey recommendations in the October 15, 2004 e-mail will be implemented. (Accession No. ML043150311). |
| November 22, 2004 | Letter from Mr. Dennis L. Koehl, NMC, to the NRC, providing responses to the additional SAMA RAIs in the October 12, 2004 e-mail (Accession No. ML043360138). |
| November 22, 2004 | Letter from NRC to Ms. Janet Smith, U.S. Fish and Wildlife Service, requesting concurrence on biological assessment (Accession No. ML043280682). |
| December 6, 2004 | Note To File: Docketing of Material in Support of the PBNP Environmental Review and License Renewal Application (Accession No. ML043420094). |

# 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:

Bad River Band of Lake Superior Chippewa Indians, Odanah, Wisconsin

Bay-Lake Regional Planning Commission, Green Bay, Wisconsin

City Manager, Greg Buckley, Two Rivers, Wisconsin

Economic Development Director, Dan Pawlitzke, Two Rivers, Wisconsin

Fire Chief, Mike Pohlman, Two Rivers, Wisconsin

Forest County Potawatomi Indian Community, Crandon, Wisconsin

Hannahville Indian Community, Wilson, Michigan

Ho-Chunk Nation of Wisconsin, Black River Falls, Wisconsin

Lac Courte Oreilles Band of Lake Superior Chippewa Indians of Wisconsin, Hayward, Wisconsin

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

Manitowoc-Two Rivers Chamber of Commerce, Manitowoc, Wisconsin

Manitowoc County Department of Parks and Planning, Manitowoc, Wisconsin

Menominee Indian Tribe of Wisconsin, Keshena, Wisconsin

Mishicot Area Growth and Improvement Committee, Mishicot, Wisconsin

Mishicot School District, Office of the Superintendent, Mishicot, Wisconsin

Oneida Nation of Wisconsin, Oneida, Wisconsin

Prairie Band Potawatomi Tribal Council, Mayetta, Kansas

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

Sokaogon Chippewa (Mole Lake) Community of Wisconsin, Crandon, Wisconsin

St. Croix Chippewa Indians of Wisconsin, Hertel, Wisconsin

Stockbridge-Munsee Community of Wisconsin, Bowler, Wisconsin

U.S. Environmental Protection Agency, Region 5, Chicago, Illinois

U.S. Fish and Wildlife Service, Green Bay Ecological Services Field Office, New Franken, Wisconsin

Wisconsin Department of Health and Family Services, Madison, Wisconsin

Wisconsin Department of Natural Resources, Bureau of Watershed Management, Madison, Wisconsin

Wisconsin Department of Natural Resources (Fisheries), Madison, Wisconsin

Wisconsin Department of Natural Resources (Wildlife), Madison, Wisconsin

Wisconsin Department of Natural Resources, Mishicot Field Office, Mishicot, Wisconsin

Wisconsin State Historic Preservation Office, Madison, Wisconsin

# Appendix E

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

# Appendix E

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

Correspondence issued and received during the process of evaluation of the application for renewal of the operating licenses for Point Beach Nuclear Plant Units 1 and 2 (PBNP) 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 PBNP are listed in Table E-2.

**Table E-1.** Consultation Correspondence

| Source | Recipient | Date of Letter |
|---|---|---|
| U.S. Nuclear Regulatory Commission (P. T. Kuo) | Advisory Council on Historic Preservation (Don Klima) | May 5, 2004 |
| U.S. Nuclear Regulatory Commission (P. T. Kuo) | U.S. Fish and Wildlife Service (Janet Smith) | May 5, 2004 |
| U.S. Nuclear Regulatory Commission (P. T. Kuo) | Wisconsin Historical Society (Richard Dexter) | May 5, 2004 |
| U.S. Nuclear Regulatory Commission (P. T. Kuo) | National Oceanographic and Atmospheric Administration Fisheries (Patricia A. Kurkul) | May 12, 2004 |
| Wisconsin Historical Society (Sherman Banker) | U.S. Nuclear Regulatory Commission (P. T. Kuo) | May 25, 2004 |
| U.S. Fish and Wildlife Service (Janet M. Smith) | U.S. Nuclear Regulatory Commission (P.T. Kuo) | August 5, 2004 |
| U.S. Nuclear Regulatory Commission (P.T. Kuo) | U.S. Fish and Wildlife Service (Janet M. Smith) | November 22, 2004 |

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

| Agency | Authority | Description | Number | Issue Date | Expiration Date | Remarks |
|---|---|---|---|---|---|---|
| NRC | 10 CFR Part 50 | Operating License, Pt. Beach Unit 1 | DPR-24 | 10/5/70 | 10/5/10 | Authorizes operation of Unit 1. |
| NRC | 10 CFR Part 50 | Operating License, Pt. Beach Unit 2 | DPR-27 | 11/16/71 | 3/8/13 | Authorizes operation of Unit 2. |
| FWS | Section 7 of the Endangered Species Act (16 USC 1536) | Consultation | | | | Requires a Federal agency to consult with FWS regarding whether a proposed action will affect endangered or threatened terrestrial species. |
| NOAA Fisheries | Section 7 of the Endangered Species Act (16 USC 1536) | Consultation | | | | Requires a Federal agency to consult with NMFS regarding whether a proposed action will affect endangered or threatened aquatic species. |
| Wisconsin Historical Society | Section 106 of the National Historic Preservation Act (16 USC 470f) | Consultation | | | | The National Historic Preservation Act requires Federal agencies to take into account the effect of any undertaking on any district, site, building, structure, or object that is included in or eligible for inclusion in the National Register of Historic Places. |
| Wisconsin Department of Administration | Section 307 of the Coastal Zone Management Act (16 USC 1456[c][3][A]) | Certification | | | | Requires an applicant to provide certification to the Federal agency issuing the license that license renewal would be consistent with the Federally approved State coastal zone management program. Based on its review of the proposed activity, the State must concur with or object to the applicant's certification. |

## Table E-2. (contd)

| Agency | Authority | Description | Number | Issue Date | Expiration Date | Remarks |
|---|---|---|---|---|---|---|
| USDOT | 49 USC 5108 | Registration | 053003450 005L | 06/02/03 | 06/30/05 | Hazardous materials shipments. |
| EPA | Resource Conservation and Recovery Act (42 USC 6912) and Ch. 101.09 Wisconsin Statutes | Notification of Regulated Waste Activity | WID093422 657 | NA | NA | Hazardous waste generation and transport. |
| WDNR | Clean Water Act (33 USC Section 1251 et seq.) and Ch. 283 Wisconsin Statutes | Individual WPDES Permit | WI-0000957-07-0 | 7/1/04 | 6/30/09 | PBNP discharges to Lake Michigan. Permit remains in effect pending State review of renewal application. |
| WDNR | Clean Water Act (33 USC Section 1251 et seq.) and Ch. 283 Wisconsin Statutes | General WPDES Industrial Storm Water Discharge Permit (Tier 2) | WI-S067857-1 | 05/30/95 | 03/31/06 | Storm water runoff from industrial facilities. |
| WDNR | Federal Clean Air Act (42 USC 7661-7671) and Ch. 285 Wisconsin Statutes | Renewed Air Pollution Control Operation Permit | 436034500-F10 | 10/17/03 | 10/17/08 | Air emissions from a gas turbine, boilers, generators, a fire pump, and a paint spray booth. |
| WDNR | Ch. 280 Wisconsin Statutes | Registration | 436063430 | NA | NA | Nontransient noncommunity water supply registration for PBNP. |
| WDNR | Ch. 280 Wisconsin Statutes | Registration | 43612602, 43601096, and 43603450 | NA | NA | Transient noncommunity water supply registrations for Energy Info. Center, North Gatehouse, and Site Boundary Control Center. |
| WDNR | Ch. 281 Wisconsin Statutes | High-Capacity Well Approval | 52824, 52825, 52826 | NA | NA | Approval for wells with combined capacity >1 × $10^5$ gpd. |

**Table E-2.** (contd)

| Agency | Authority | Description | Number | Issue Date | Expiration Date | Remarks |
|---|---|---|---|---|---|---|
| WDNR | Ch. 29.614 Wisconsin Statutes | Scientific Collecting Permit | SCP-LM-18-9397 | 01/13/02 | 12/31/03 | Collection of fish for radioactivity analysis. Remains in effect pending State review of renewal application. |
| Wisconsin Department of Commerce | Federal Resource Conservation and Recovery Act (42 USC 6912) and Ch. 101.09 Wisconsin Statutes | Underground Storage Tank Registration | Owner ID: 382951 Site ID: 118971 Tank IDs: 764837, 764843, 285454, 930217 and 930224 | 10/20/95<br>10/01/92<br>08/25/03 | NA | Storage of flammable materials in underground tanks. |
| Wisconsin Department of Commerce | Ch. 101.09 Wisconsin Statutes | Aboveground Storage Tank Registration | Owner ID: 382951 Site ID: 118971 Tank IDs: 206578, 206579, 206580, 206581, 206582, 206583, 206584, 455264, 455274 206615, 206616 206690 | 10/01/92<br>10/20/95<br>10/19/95 | NA | Storage of flammable materials in aboveground tanks. |
| South Carolina Department of Health and Environmental Control | South Carolina Radioactive Waste Transportation and Disposal Act (S.C. Code of Laws 13-7-110 et seq.) | Radioactive Waste Transport Permit | 00604805-X | 11/02/04 | 12/31/05 | Transportation of radioactive waste to disposal facility in South Carolina. |

### Table E-2. (contd)

| Agency | Authority | Description | Number | Issue Date | Expiration Date | Remarks |
|---|---|---|---|---|---|---|
| Tennessee Department of Environment and Conservation | Tennessee Code Annotated 68-202-206 | License to Ship Radioactive Material | T-WI002-L03 | 01/01/04 | 12/30/04 | Shipments of radioactive material to processing facility in Tennessee. |

> – greater than
CFR – Code of Federal Regulations
EPA – U.S. Environmental Protection Agency
FWS – U.S. Fish and Wildlife Service
gpd – gallons per day
NA – not applicable, one-time registration
NOAA – National Oceanographic and Atmospheric Administration
NMFS – National Marine Fisheries Service
NRC – U.S. Nuclear Regulatory Commission
USC – United States Code
USDOT – U.S. Department of Transportation
WDNR – Wisconsin Department of Natural Resources
WPDES – Wisconsin Pollutant Discharge Elimination System

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

May 5, 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: POINT BEACH NUCLEAR PLANT, UNITS 1 AND 2 LICENSE RENEWAL REVIEW

Dear Mr. Klima:

The U.S. Nuclear Regulatory Commission (NRC) staff is reviewing an application to renew the operating licenses for Point Beach Nuclear Plant, Units 1 and 2 (PBNP), which is located on the western shore of Lake Michigan in Two Rivers, Wisconsin, approximately 30 miles southeast of Green Bay, Wisconsin. PBNP is operated by Nuclear Management Company, LLC (NMC). The application for renewal was submitted by NMC on February 26, 2004, pursuant to NRC requirements at Title 10 of the *Code of Federal Regulations* Part 54 (10 CFR Part 54). The NRC has established that, as part of the staff review of any nuclear power plant license renewal action, a site-specific Supplemental Environmental Impact Statement (SEIS) to its "Generic Environmental Impact Statement for License Renewal of Nuclear Plants" (GEIS), NUREG-1437, will be prepared under the provisions of 10 CFR Part 51, 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 January 2005, 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 Point Beach project, Mr. William Dam, at 301-415-4014 or WLD@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.: 50-266, 50-301

cc: See next page

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

May 5, 2004

Ms. Janet Smith
Field Supervisor
U.S. Fish and Wildlife Service
Green Bay ES Field Office
2661 Scott Tower Drive
New Franken, WI 54229-9565

SUBJECT: U.S. NUCLEAR REGULATORY COMMISSION (NRC) ENVIRONMENTAL REVIEW AND REQUEST FOR PROTECTED SPECIES WITHIN THE AREA UNDER EVALUATION FOR THE POINT BEACH NUCLEAR PLANT LICENSE RENEWAL

Dear Ms. Smith:

Thank you for providing my staff the opportunity to meet with you on March 17, 2004, to discuss the U.S. Nuclear Regulatory Commission's (NRC) process for reviewing an application to extend the operating licenses of Point Beach Nuclear Plant, Units 1 and 2 (PBNP). Mr. William Dam and our consultant with Los Alamos National Laboratory, Dr. Paul Schumann, found the discussions with you, Ken Stromberg, and Larry Thompson to be very informative and beneficial as we begin the process of collecting information to write a draft Supplemental Environmental Impact Statement (SEIS).

The NRC has established that, as part of the staff review of any nuclear power plant license renewal action, a site-specific SEIS to its "Generic Environmental Impact Statement for License Renewal of Nuclear Plants" (GEIS), NUREG-1437, will be prepared under the provisions of 10 CFR Part 51, the NRC rules that implement the National Environmental Policy Act of 1969 (NEPA). In addition the NEPA interactions satisfy the provisions of the Fish and Wildlife Coordination Act of 1934.

To support the SEIS preparation process and to ensure compliance with Section 7 of the Endangered Species Act of 1973, 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 PBNP and its associated transmission lines. As mentioned in your February 26, 2004 letter to Nuclear Management Company, LLC (NMC), we understand that your office will coordinate and request input from the Wisconsin Department of Natural Resources, which maintains the Natural Heritage Inventory. In addition, our staff received the September 2003 report you sent titled, "Recovery Plan for the Great Lakes Piping Plover," which provides important information that we will include in the SEIS.

Attached is a map of the transmission-line corridors from the NMC license application (Enclosure). NMC has agreed to provide you with an additional detailed geo-referenced map of the site and transmission-line corridors. The proposed action would include the use and continued maintenance of existing plant facilities and transmission lines. The PBNP site

J. Smith 2

located in Manitowoc County, Wisconsin, covers approximately 1260 acres, of which approximately 1050 acres are used for agriculture.

For the specific purpose of connecting PBNP to the regional transmission system, there is a total of approximately 73 miles of transmission lines that occupy approximately 1955 acres of land. These transmission line corridors are being evaluated as part of the SEIS process. The transmission line corridors traverse Brown and Manitowoc Counties. The corridors pass through land that is primarily rolling hills covered with forests or farm land. Three 345-kilovolt (kV) lines connect PBNP to the electric grid. A fourth transmission line connects Kewaunee Nuclear Power Plant to the PBNP substation.

NRC will hold two public scoping meetings for the PBNP license renewal supplement to the GEIS on June 15, 2004, at Fox Hills, 250 West Church Street in Mishicot, Wisconsin. There will be two sessions to accommodate interested parties with the first session convening at 1:30 p.m. and continuing 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. In addition to attending the public meetings, you and your staff are invited to attend our site audit at PBNP on June 16-17, 2004. The audit will include a tour of the area surrounding the facility, examination of the intake structure, screen house, and transmission line corridors, as well as document reviews.

The comment period on the scope of the environmental review closes on July 14, 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 DC 20555-0001, or by e-mail to *PointBeachEIS@nrc.gov*. 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 SEIS for public comment (anticipated publication date, January 2005), 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 PBNP is planned for August 2005. If you have any questions or require additional information, please contact Mr. William Dam, Environmental Project Manager, at 301-415-4014 or WLD@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.: 50-266 and 50-301

Enclosure: As stated

cc: See next page

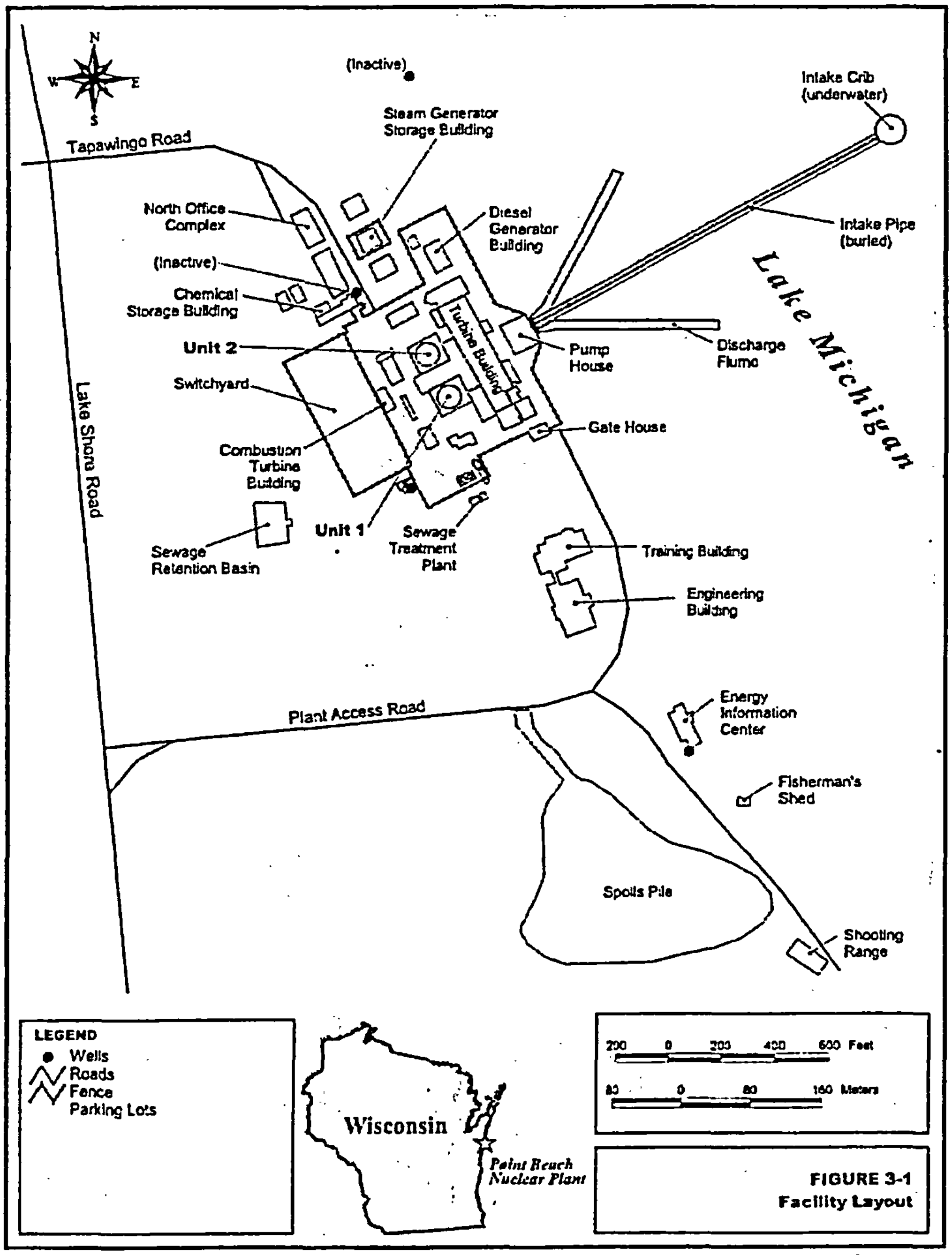


**FIGURE 3-1**
**Facility Layout**

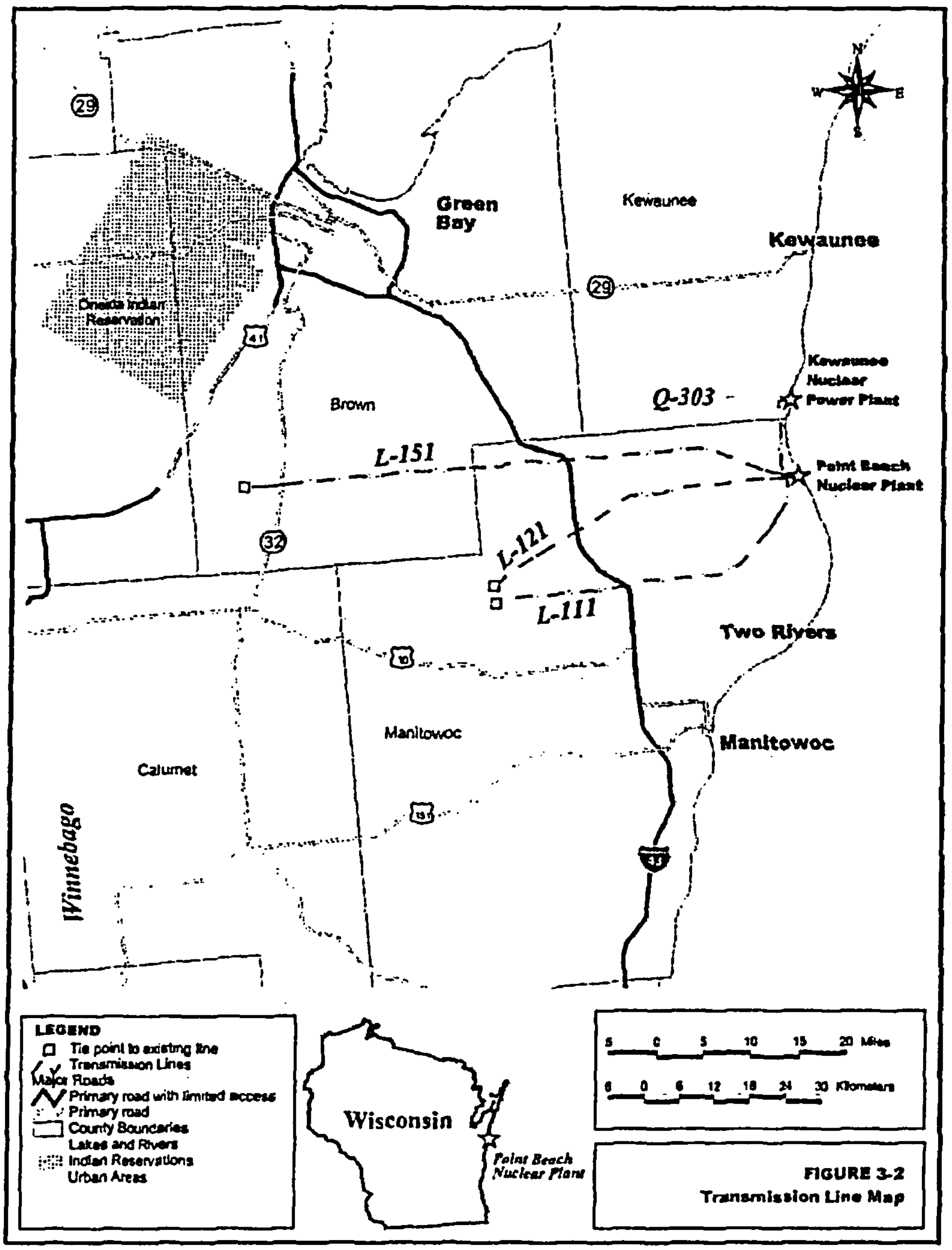


FIGURE 3-2
Transmission Line Map

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

May 5, 2004

Mr. Richard Dexter
Wisconsin Historical Society
Division of Historic Preservation
816 State Street
Madison, WI 53706

SUBJECT: POINT BEACH NUCLEAR PLANT, UNITS 1 AND 2 LICENSE RENEWAL REVIEW

Dear Mr. Dexter:

The U.S. Nuclear Regulatory Commission (NRC) staff is reviewing an application to renew the operating licenses for Point Beach Nuclear Plant, Units 1 and 2 (PBNP), which is located on the western shore of Lake Michigan in Two Rivers, Wisconsin, approximately 30 miles southeast of Green Bay, Wisconsin. PBNP is operated by Nuclear Management Company, LLC (NMC). The application for renewal was submitted by NMC on February 26, 2004, pursuant to NRC requirements at Title 10 of the *Code of Federal Regulations* Part 54 (10 CFR Part 54). The NRC has established that, as part of the staff review of any nuclear power plant license renewal action, a site-specific Supplemental Environmental Impact Statement (SEIS) to its "Generic Environmental Impact Statement for License Renewal of Nuclear Plants" (GEIS), NUREG-1437, will be prepared under the provisions of 10 CFR Part 51, the NRC rules that implement the National Environmental Policy Act of 1969 (NEPA). In accordance with 36 CFR 800.8, the SEIS will include analyses of potential impacts to historic and archaeological resources.

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

While preparing its application, NMC contacted your office by letter dated December 22, 2003. In its letter, NMC stated there are no plans to significantly alter current operations over the license renewal period. NMC further stated that no expansion of existing facilities is planned. In addition, no land-disturbing activities are anticipated beyond those required for routine maintenance and repairs.

R. Dexter 2

On June 15, 2004, the NRC will conduct two public NEPA scoping meetings at Fox Hills, 250 West Church Street in Mishicot, Wisconsin. You and your staff are invited to attend. The anticipated publication date for the draft SEIS is January 2005. Your office will receive a copy of the draft SEIS along with a request for comments. If you have any questions or require additional information, please contact Mr. William Dam, Project Manager at 301-415-4014 or WLD@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.: 50-266 and 50-301

cc: See next page

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

May 12, 2004

Ms. Patricia A. Kurkul
Regional Administrator
NOAA Fisheries
Northeast Regional Office
One Blackburn Drive
Gloucester, MA 09130-2298

SUBJECT: REQUEST FOR LIST OF PROTECTED SPECIES WITHIN THE AREA UNDER EVALUATION FOR POINT BEACH NUCLEAR PLANT, UNITS 1 AND 2, LICENSE RENEWAL

Dear Ms. Kurkul:

The U.S. Nuclear Regulatory Commission (NRC) is reviewing an application submitted by Nuclear Management Company, LLC (NMC) for the renewal of the operating licenses for Point Beach Nuclear Plant, Units 1 and 2 (PBNP). PBNP is located on the western shore of Lake Michigan in Two Rivers, Wisconsin, approximately 30 miles southeast of Green Bay, Wisconsin. 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. The PBNP site covers approximately 1260 acres, of which approximately 1050 acres are used for agriculture. Structures and parking lots occupy about 70 acres, and the remaining acreage is a natural mix of woods, wetlands, and open areas. The area within 6 miles of the plant is mainly farmland, woods, and small residential communities.

Each PBNP unit uses a once-through cooling system with intake and surface discharge to Lake Michigan. The intake structure had been reconfigured in 2001 due to bird mortality rates. The intake structure now stands below the lake surface.

For the specific purpose of connecting PBNP to the regional transmission system, there is a total of approximately 73 miles of transmission lines that occupy approximately 1955 acres of land. These transmission line corridors are being evaluated as part of the SEIS process. The transmission line corridors traverse Brown and Manitowoc Counties. The corridors pass through land that is primarily rolling hills covered with forests or farm land. The enclosed transmission line map shows the transmission system that is being evaluated in the SEIS. Three 345-kilovolt (kV) lines connect PBNP to the electric grid. A fourth transmission line connects Kewaunee Nuclear Power Plant to the PBNP Substation.

P. Kurkul -2-

To support the EIS preparation process and to ensure compliance with Section 7 of the Endangered Species Act of 1973, the NRC requests a list of endangered, threatened, candidate, and proposed species, and designated and proposed critical habitat under the jurisdiction of NOAA Fisheries, that may be in the vicinity of PBNP site and its transmission line corridors. The NRC has also contacted the U.S. Fish and Wildlife Service and the Wisconsin Department of Natural Resources and requested a list of species and information on protected, proposed, and candidate species and critical habitat that may be in the vicinity of PBNP and its associated transmission lines.

We plan to hold two public NEPA scoping meetings on June 15, 2004, at Fox Hills, 250 West Church Street in Mishicot, Wisconsin. From June 16-17, 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 January 2005.

If you have any questions concerning the NRC staff review of this license renewal application, please contact Mr. William Dam, Project Manager, at 301-415-4014 or WLD@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.: 50-266 and 50-301

Enclosures: 1. PBNP Transmission Line Map
2. PBNP Site Layout

cc w/encls.: See next page

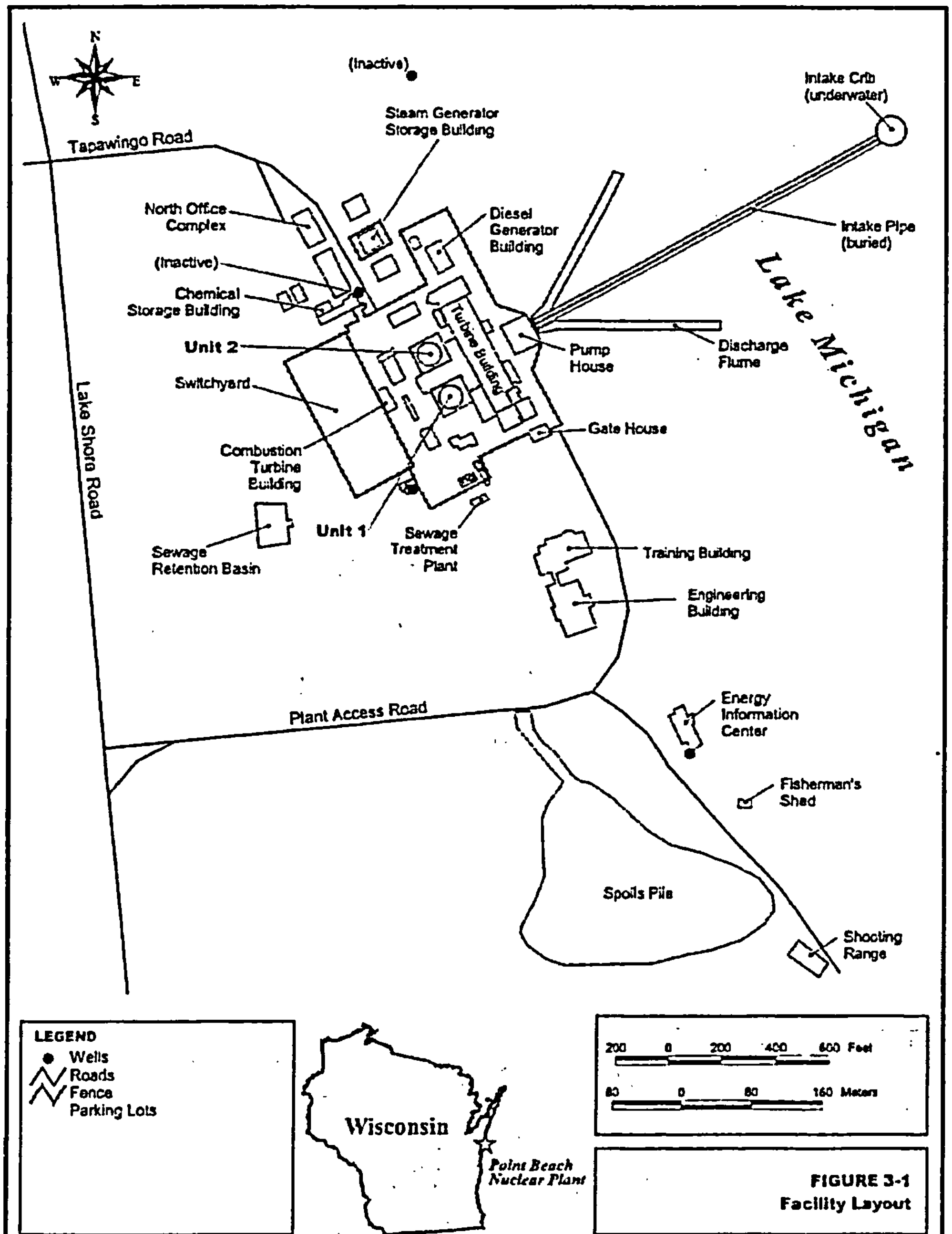


**FIGURE 3-1**
**Facility Layout**

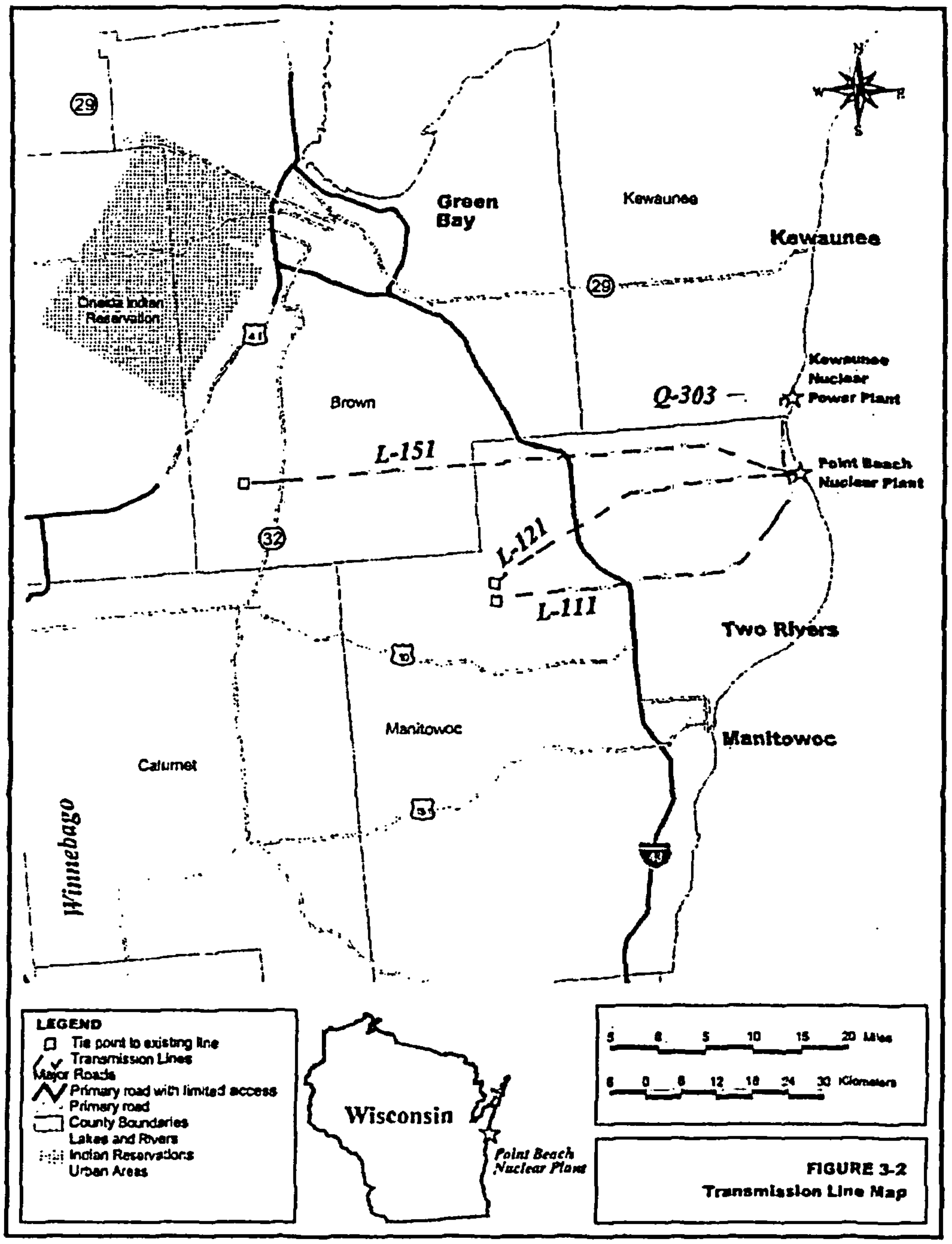


FIGURE 3-2
Transmission Line Map

WISCONSIN HISTORICAL SOCIETY

Headquarters Building
816 State Street
Madison, WI 53706-1482
608-264-6400

May 25, 2004

Mr. PaoTsin Kuo
U.S. Nuclear Regulatory Commission
Washington DC 20555-0001

SHSW#: 03-1046/MN
RE: License Renewal: Point Beach Nuclear Plant

Dear Mr. Kuo:

We have received your submittal of May 5, 2004 regarding the above referenced project. As indicated in our previous correspondence of March 11, 2004 to Roger Newton, it was not possible to determine that the fisherman's shed is not eligible for inclusion in the National Register of Historic Places based on the information that was submitted for review. We recommended that a qualified architectural historian prepare a NPS 10-900 form for the property and submit it to our office for review and comment. To date, we have not received the information needed to determine if the fisherman's shed is eligible for inclusion in the National Register of Historic Places.

As pointed out in our letter of January 6, 2004 to the applicant. it is not possible to determine if project activities, including leased property under cultivation are having an adverse effect on unidentified archeological sites within the proposed project area. As I mentioned in our telephone conversation, there would be two options regarding archeological sites. First, one could complete an archeological survey for all projects lands pursuant to 36 CFR 800.4 or we could develop a Memorandum of Agreement that would detail how and when archeological surveys would be completed for land management activities.

We look forward to working with you to complete the Section 106 review process in a timely manner. If you would like to discuss these matters in greater detail, please call me at (608) 264-6507.

Sincerely,

Sherman Banker
Office of Preservation Planning

United States Department of the Interior

FISH AND WILDLIFE SERVICE

Green Bay ES Field Office
2661 Scott Tower Drive
New Franken, Wisconsin 54229-9565
Telephone 920/866-1717
FAX 920/866-1710

August 5,, 2004

Dr. Pao-Tsin Kuo
Program Director
License Renewal and Environmental Impacts Program
Office of Nuclear Reactor Regulation
Nuclear Regulatory Commission
Washington, D.C. 20555-0001

Dear Dr. Pao-Tsin Kuo:

Your May 5, 2004 letter (received May 10, 2004) requested a list of species and information on the protected, proposed, and candidate species and critical habitat that may be in the vicinity of the Point Beach Nuclear Plant (Plant) and its associated transmission line corridors (Project). In a February 26, 2004 letter to the Nuclear Management Company LLC and copied to Mr. William Dam of the Nuclear Regulatory Commission (Commission), the U.S. Fish and Wildlife Service (FWS) identified the need for a more detailed map of the Project area, one that depicted the Project boundaries more precisely. Your letter attached a map that was also not detailed enough for the FWS to query the Wisconsin Department of Natural Resources' Natural Heritage Inventory database, to obtain information regarding species or habitats that may be in the vicinity of the Project. However, a more detailed map was submitted by the Nuclear Management Company LLC, in a letter dated May 18, 2004 (received by the FWS May 21, 2004), and the FWS relied on that map to prepare this response.

Our understanding is that no Federally-listed threatened or endangered species, proposed species, candidate species, or designated or proposed critical habitat occur within the Project area at this time. However, it is possible that habitats within or near the Project may be used in the future by listed, proposed, or candidate species that are not present within the Project area at this time. For example, while the Federally-listed (endangered) piping plover (*Charadrius melodus*) is currently rare along the Wisconsin shore of Lake Michigan, expanding populations in Michigan increase the likelihood it will disperse and occur with greater frequency in Wisconsin. In our February 26, 2004 letter to the Nuclear Management Company, the FWS recommended evaluation of the shoreline habitat near the Plant, to assess its suitability to the piping plover. The FWS also recommended the description of potential measures to control the levels of human disturbance in any habitats deemed suitable.

A response pertaining to these recommendations, by Dr. Noel Cutright of We Energies (dated May 12, 2004 and addressed to Gary Van Middlesworth of the Nuclear Management Company), was delivered to the FWS Green Bay Ecological Services Field Office as an attachment to a letter from the Nuclear Management Company LLC to the FWS, dated May 18, 2004. Dr. Cutright clarifies that no formal species surveys or habitat evaluations have been conducted at the Plant or its associated lands (p..1). Regarding the piping plover, Dr. Cutright agrees that this species may occupy or nest on the Plant beach area over the term of the new license (p. 2). Regarding controls on human disturbance, Dr. Cutright notes the presence of boulders at the north and south shoreline boundaries, offshore buoy markers to identify restricted waters near the Plant, and the presence of security personnel to prevent unauthorized access (p. 2). Dr. Cutright concludes that other than restricted beach access along the Plant, there do not appear to be other factors that would make the Project shoreline any more attractive to nesting piping plovers than shoreline north or south (p. 2).

As in our February 26, 2004 letter to the Nuclear Management Company, the FWS recommends evaluation of the shoreline habitat near the Plant, to assess its suitability to the piping plover; we are not recommending evaluation of shoreline outside the Project boundaries, north or south of the Plant. The shoreline location of the Point Beach Nuclear Plant, its restricted access (that reduces human disturbances), its proximity to 5 miles of designated critical habitat along the nearby Point Beach State Forest, and low Lake Michigan surface elevations collectively suggest that habitat could be suitable near the Plant for plovers to occupy or nest there in the future. Dr. Cutright agrees that plovers may occupy or nest on the Plant beach area over the term of the new license. An on-site, shoreline evaluation would reveal the presence or absence of factors (e.g., habitat elements) relevant to its attractiveness to plovers, and may also suggest measures to enhance habitat suitability. Procedures should be developed to notify resource agency personnel and provide timely access to the shoreline along the Plant, in the event that plovers occupy or nest there. Measures to control disturbances or nest predation (e.g., by erecting an exclosure) should be proposed, as well as additional monitoring requirements that may be warranted if nests appear.

To avoid delay and confusion, the recommendations discussed above and in our February 26, 2004 letter should be discussed between the Commission (the federal action agency) and the Nuclear Management Company LLC (the non-federal entity in the informal consultation process). Following that coordination, we suggest the Commission contact the FWS to discuss our recommendations and your suggestions for how to proceed. The FWS understands that our point-of-contact with the Commission on this matter is no longer William Dam or Jim Wilson, but is now Stacey Imboden. When the Commission contacts the FWS to consult further on this matter, we can confirm on this point.

Please continue to direct issues regarding this matter to Larry Thompson of my staff at (920) 866-1736, or you may contact me at (920) 866-1725.

Sincerely,

Janet M. Smith

Janet M. Smith
Field Supervisor

3

cc: Wisconsin DNR
Nuclear Management Company LLC

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

November 22, 2004

Ms. Janet Smith
Field Supervisor
U.S. Fish and Wildlife Service
Green Bay ES Field Office
2661 Scott Tower Drive
New Franken, WI 54229-9565

SUBJECT: REQUEST FOR CONCURRENCE - BIOLOGICAL ASSESSMENT FOR POINT BEACH NUCLEAR PLANT, UNITS 1 AND 2 LICENSE RENEWAL

Dear Ms. Smith:

The U.S. Nuclear Regulatory Commission (NRC) has prepared the enclosed biological assessment (BA) to evaluate whether the proposed renewal of the Point Beach Nuclear Plant, Units 1 and 2 (PBNP) operating licenses for a period of an additional 20 years would have adverse effects on listed species. The proposed action (license renewal) is not a major construction activity. PBNP is located on the western shore of Lake Michigan in Manitowoc County, Wisconsin, approximately 48 km (30 mi) southeast of Green Bay and 24 km (15 mi) north-northeast of Manitowoc.

By letter dated May 5, 2004, to the U.S. Fish and Wildlife Service (FWS), the NRC requested a list of Federally threatened or endangered species that may be in the vicinity of PBNP and its associated transmission lines. In a letter dated August 5, 2004, the FWS provided a list of Federally threatened or endangered species. The FWS stated that no Federally-listed threatened or endangered species, proposed species, candidate species, or proposed critical habitat occur at the PBNP site, but that beach habitat near PBNP could be suitable nesting habitat for piping plover (*Charadrius melodus*) at some time in the future. The NRC staff has also included in its evaluation three other potentially-occurring Federally-listed species.

In addition the staff also contacted the National Oceanic and Atmospheric Administration - Fisheries (NOAA Fisheries) by letter dated May 12, 2004, requesting a list of Federally threatened or endangered aquatic species that may be in the vicinity of PBNP. NOAA Fisheries did not respond to the May 12, 2004, letter.

The staff has determined that license renewal for PBNP may affect, but is not likely to adversely affect the bald eagle and the piping plover, and will have no effect on the dwarf lake iris and the dune or Pitcher's thistle.

We are requesting your concurrence with our determination. In reaching our conclusion, the NRC staff relied on information provided by the applicant, on literature research and interviews with experts, and on information provided by FWS.

J. Smith -2-

If you have any questions regarding this Biological Assessment or the staff's request, please contact Ms. Stacey Imboden, Environmental Project Manager, at 301-415-2462 or via e-mail at sxf@nrc.gov.

Sincerely,

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

Docket Nos.: 50-266 and 50-301

Enclosure: As stated

cc w/encl.: See next page

# Biological Assessment

## Point Beach Nuclear Plant
### License Renewal Review

## November 2004

**Docket Numbers**
**50-266**
**50-301**

## U.S. Nuclear Regulatory Commission
## Rockville, Maryland

## 1.0 Introduction

The U.S. Nuclear Regulatory Commission (NRC) issues operating licenses for domestic nuclear power plants in accordance with the provisions of the Atomic Energy Act of 1954, as amended, and NRC implementing regulations. The purpose and need for the proposed action (that is, renewal of an operating license) is to provide an option that allows electric power generation to continue beyond the term of the current nuclear power plant operating license, so future generating needs can be met if the operator and State regulatory agencies pursue that option.

Wisconsin Electric Power Company (WEPCO) owns Point Beach Nuclear Plant, Units 1 and 2 (PBNP), and Nuclear Management Company, LLC (NMC) operates PBNP. WEPCO is doing business as We Energies, and is a wholly owned subsidiary of Wisconsin Energy Corporation. In August 2000, WEPCO transferred operating authority for PBNP to NMC (NMC 2004). NMC has prepared an environmental report in conjunction with its application for renewal of the PBNP operating licenses, as provided for by the following NRC regulations:

- Title 10, Energy, Code of Federal Regulations (CFR) Part 54, Requirements for Renewal of Operating Licenses for Nuclear Power Plants, Section 54.23, Contents of Application - Environmental Information (10 CFR 54.23).
- Title 10, Energy, CFR Part 51, Environmental Protection Requirements for Domestic Licensing and Related Regulatory Functions, Section 51.53, Postconstruction Environmental Reports, Subsection 51.53(c), Operating License Renewal Stage [10 CFR 51.53(c)].

The NRC is reviewing an application submitted by NMC (the applicant) for the renewal of the operating licenses for PBNP for a period of an additional 20 years. There will be no major construction, refurbishment, or replacement activities associated with this action. This biological assessment examines the potential effects of the continued operation of PBNP on four Federally-listed species that could occur within the PBNP site, near the site, or along its associated transmission line rights-of-way (ROWs) pursuant to Section 7(a)(2) of the Endangered Species Act.

In a letter dated May 5, 2004 (NRC 2004), the NRC requested that the U.S. Fish and Wildlife Service (FWS) provide lists of Federally-listed endangered or threatened species and information on protected, proposed, and candidate species, as well as any designated critical habitat, that may be in the vicinity of PBNP and its associated transmission line ROWs. In a response dated August 5, 2004 (FWS 2004a), the FWS Green Bay Field Office noted that beach habitat near PBNP could be suitable nesting habitat for piping plover (*Charadrius melodus*) at some time in the future. Three other potentially-occurring Federally-listed species were identified by NRC staff and are included in this assessment.

## 2.0 Proposed Action

The proposed action is the renewal of the operating licenses for PBNP. The plant is located on the western shore of Lake Michigan in Manitowoc County, Wisconsin, approximately 48 km (30 mi) southeast of Green Bay and 24 km (15 mi) north-northeast of Manitowoc (Figure 1)

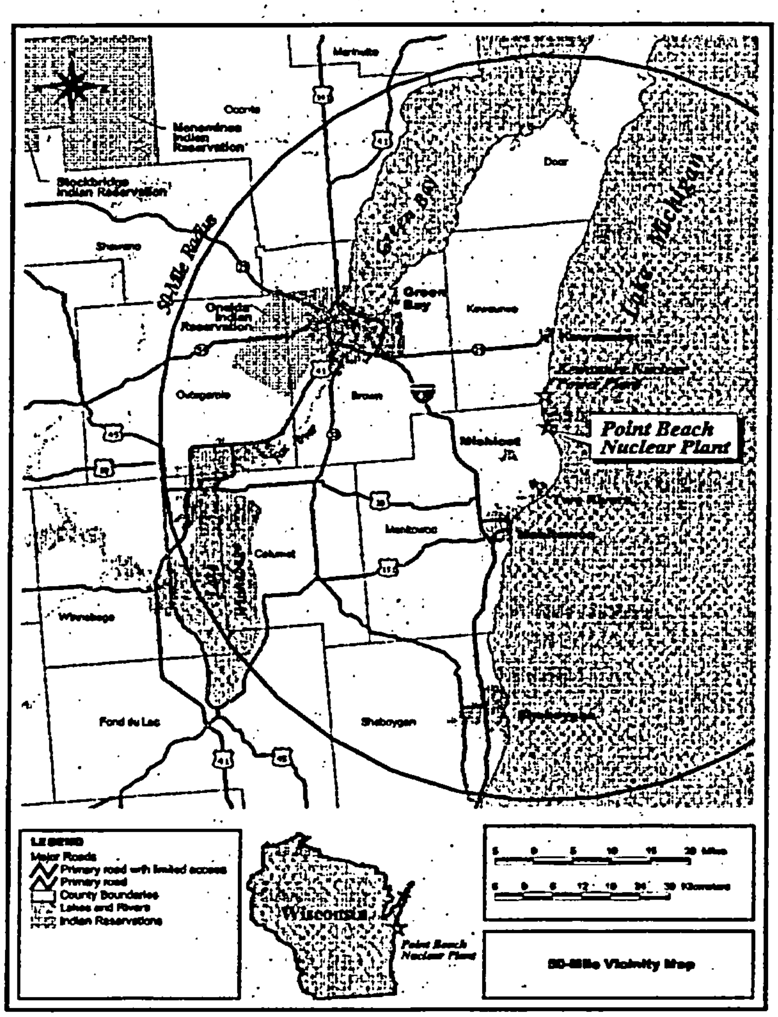


**Figure 1. Location of PBNP.**

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(NMC 2004). The current operating license for Unit 1 expires on October 5, 2010, and for Unit 2 on March 8, 2013. NMC has submitted an application to the NRC to renew these operating licenses for an additional 20 years of operation (i.e., until October 5, 2030, for Unit 1 and March 8, 2033 for Unit 2). The renewed licenses, if issued, will be effective from their date of issuance until 20 years after the expiration date of the current operating licenses.

## 3.0 Environmental Setting

### 3.1 Aquatic Resources

Impacts on Federally-listed terrestrial threatened or endangered species that could potentially occur as a result of continued operation of the plant cooling water system during the renewal period are outlined in this section.

Lake Michigan is the source of water for the cooling and auxiliary water systems at PBNP, which operates as a once-through cooling plant. Water from Lake Michigan reaches PBNP through a submerged offshore intake. Water returns to Lake Michigan through a surface shoreline discharge. The system removes waste heat from the condensers as well as other plant equipment and discharges water through separate flumes for each unit. At peak capacity, water is circulated at a maximum rate of 22 $m^3/s$ (783 $ft^3/s$) through each condenser and then returned to the lake. The water withdrawn for these systems flows first through the intake structure to the forebay, then to the condensers and other equipment. Auxiliary water systems include service water and fire protection.

In May 2001, the intake structure was reconfigured to resolve a bird mortality issue. The modified structure stands approximately 3.4 m (11 ft) above the lake floor, has an outside diameter of about 33 m (110 ft), and has an inside chamber with a diameter of 18 m (60 ft). The top is covered with a steel superstructure and a trash rack made of high-density polyethylene having approximately 18-cm by 45-cm (7-in. by 18-in.) openings (NMC 2001). Water enters the chamber through the trash rack as well as through void spaces around the limestone blocks and through 76-cm (30-in.) pipes that penetrate the blocks in a ring about 1.5 m (5 ft) above the lakebed. The pipes are covered with 3-cm by 5-cm (1.2-in. by 2-in.) bar gratings to prevent debris and large fish from entering the intake system.

### 3.2 Terrestrial Resources

The PBNP site is located on 510 ha (1260 ac) on the shore of Lake Michigan (NMC 2004). The site and surrounding area consist primarily of agricultural land and forest. Approximately 42 ha (104 ac) of the property are devoted to industrial use. The site consists of land leased for farming and woodlots up to 19 ha (47 ac) in size. The woodlots occupy a total of about 40 ha (100 ac), making up about 9 percent of the PBNP property. The plant communities here include a variety of trees such as aspen (*Populus tremuloides*), blue beech (*Fagus grandifolia*), hemlock (*Tsuga canadensis*), and maple (*Acer*) species forming the overstory (AEC 1972). The woodlots are maintained in a natural state and provide food, cover, and nesting sites for a variety of wildlife.

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The terrestrial wildlife that occurs at PBNP site and surrounding areas is typical of that found in similar habitats throughout Wisconsin (AEC 1972). Common mammals include white-tailed deer (*Odocoileus virginianus*), cottontail rabbit (*Sylvilagus floridanus*), raccoon (*Procyon lotor*), gray fox (*Urocyon cineroargenteus*), gray squirrel (*Sciurus carolinensis*), eastern chipmunk (*Tamias striatus*), and masked shrew (*Sorex cinereus*). Upland birds that occur on the property include ring-necked pheasant (*Phasianus colchicus*), wild turkey (*Meleagris gallopavo*), American goldfinch (*Carduelis tristis*), eastern bluebird (*Sialia sialia*), blue jay (*Cyanocitta cristata*), and eastern meadowlark (*Sturnella magna*). Several waterfowl also occur here, including the Canada goose (*Branta canadensis*) and the wood duck (*Aix sponsa*). Additionally, the site is occupied by several common amphibians and reptiles such as the tiger salamander (*Ambystoma tigrinum*), northern leopard frog (*Rana pipiens*), American toad (*Bufo americanus*), and the painted turtle (*Chrysemys picta*).

The PBNP property contains about 3 km (2 mi) of Lake Michigan shoreline. The shoreline here consists of mostly narrow, bare beaches ranging from 6 m to 15 m (20 ft to 50 ft) wide that extend from the water's edge to low bluffs created by years of erosion. Riprap has been placed along the edges of the bluffs to reduce erosion, which had been occurring at the rate of 0.8 m to 1.5 m (2.5 ft to 5 ft) per year (AEC 1972). The shoreline on the PBNP property does not contain any sand dunes.

In its Environmental Report, the applicant identified three 345-kilovolt (kV) transmission lines that connect PBNP to the power grid (Figure 2) (NMC 2004). A fourth 345-kV line connects the Kewaunee Nuclear Power Plant to the substation at PBNP. Currently the four lines are owned and maintained by the American Transmission Company (ATC). The transmission lines are described below and each corridor's characteristics are shown in Table 1.

**Table 1.** PBNP Transmission Line Rights-of-Way

| | | | | Approximate Length | | Approximate Width | | Approximate Area | |
|---|---|---|---|---|---|---|---|---|---|
| **Substation** | **Rights-of-Way** | **Number of Lines** | **kV** | **km** | **(mi)** | **m** | **(ft)** | **ha** | **(ac)** |
| Granville | L-111 | 1 | 345 | 32.0 | 20.0 | 67 | 220 | 210 | 530 |
| Arcadian | L-121 | 1 | 345 | 29.0 | 18.0 | 67 | 220 | 190 | 480 |
| North Appleton | L-151 | 1 | 345 | 47.5 | 29.7 | 67 | 220 | 320 | 790 |
| PBNP | Q-303 | 1 | 345 | 9.0 | 5.6 | 67 | 220 | 61 | 150 |

Source: NMC 2004

Each ROW is 67 m (220 ft) wide. Figure 2 shows the transmission system for PBNP. For the specific purpose of connecting PBNP to the power grid, ATC has a total of 118 km (73.3 mi) of transmission lines occupying approximately 791 ha (1955 ac) of easement (NMC 2004). The ROWs pass through land that is primarily rolling hills covered in forest and farmland. These ROWs pass through rural areas with low population densities. The lines cross numerous State and Federal highways, including Wisconsin Highways 42 and 147 and Interstate 43.

-4-

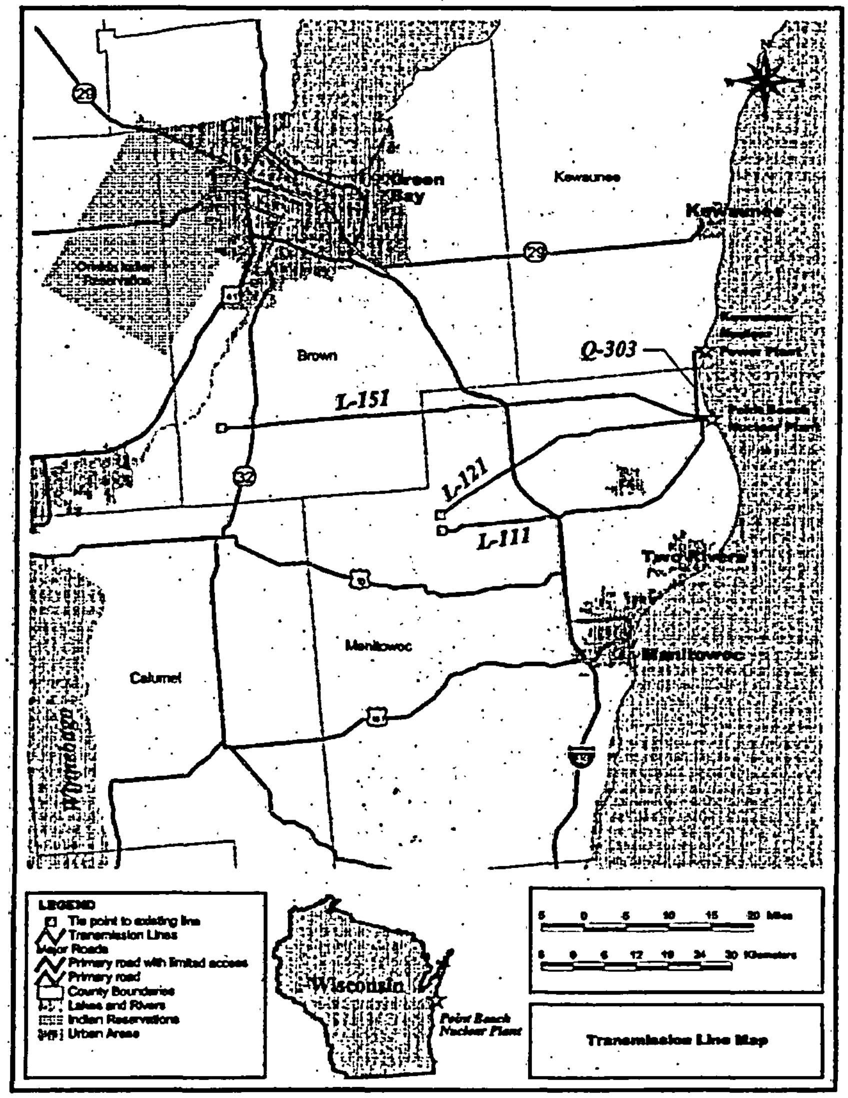


**Figure 2. PBNP transmission lines.**

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ROWs that pass through farmland generally continue to be managed as such. ATC plans to maintain these lines indefinitely as they are an integral part of the larger transmission system. These transmission lines are expected to remain a permanent part of the regional transmission system after decommissioning of PBNP.

ATC implements the ROW inspection and maintenance program for PBNP-associated transmission lines (ATC 2004). ATC manages transmission line ROWs using a wire zone/border zone concept. The wire zone is directly below the transmission lines and vegetation is primarily low growing forbs and grasses. The border zone extends from the wire zone to the edge of the ROW and woody species less than 5 m (15 ft) tall provide a transition to the surrounding habitats. Vegetation management activities may include tractor mowing, manual chainsaw clearing, and application of herbicides by a state-licensed, commercial applicator. Trimming is usually performed every 5 to 7 years, depending on the growth rates of vegetation in a given area. ATC recognizes that transmission line ROWs provide ancillary compatible uses including wildlife habitat, biodiversity corridors, recreation, and aesthetics. ATC practices a vegetation management program that utilizes physical, chemical, and biological treatments to promote stable, diverse, low-growing plant communities in a way that promotes wildlife habitat and reduces environmental impacts.

### 4.0 Assessment of Federally-Listed Species

There are no Federally-listed threatened or endangered aquatic species known to occur at the PBNP site or on habitat crossed by the associated transmission line ROWs (NMC 2004). There are four Federally-listed threatened or endangered terrestrial species that have been identified by the staff as potentially occurring in the vicinity of PBNP and its associated transmission lines. Three species have been recorded in Manitowoc County: the bald eagle (*Haliaeetus leucocephalus*), the piping plover (*Charadrius melodus*), and the dune or Pitcher's thistle (*Cirsium pitcheri*) (WDNR 2004). The dwarf lake iris (*Iris lacustris*), also a Federally-listed species, has been recorded in Brown County, which is traversed by a PBNP transmission line. Table 2 presents those Federally and State-listed species that have been recorded in Brown and Manitowoc Counties and could potentially occur on the PBNP site or transmission line ROWs, if suitable habitat were available.

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**Table 2.** Terrestrial Species Listed as Endangered or Threatened by the FWS and that Occur or Potentially Occur Within the PBNP Site or the Associated Transmission Line Rights-of-Way

| Scientific Name | Common Name | Federal Status[a] |
|---|---|---|
| **Birds** | | |
| *Haliaeetus leucocephalus* | bald eagle | T |
| *Charadrius melodus* | piping plover | E |
| **Plants** | | |
| *Cirsium pitcheri* | dune (or Pitcher's) thistle | T |
| *Iris lacustris* | dwarf lake iris | T |

(a) E = endangered, T = threatened. Sources: FWS 2004b.

**Bald Eagle (*Haliaeetus leucocephalus*)**

The bald eagle is Federally-listed as threatened in the lower 48 states (FWS 2004b). This species is a large raptor that is found along the coastline around lakes and rivers. Eagles generally nest in tall trees or on cliff faces near water and away from human disturbance. No bald eagle nesting occurs on the plant site and none have been observed to forage in the vicinity of the plant (We Energies 2004a). The transmission lines extend for the most part to the west, away from Lake Michigan and bald eagle foraging habitat.

For these reasons, the staff has determined that continued operation of PBNP over the 20-year license renewal period may affect, but is not likely to adversely affect the bald eagle.

**Piping Plover (*Charadrius melodus*)**

The piping plover is Federally-listed as endangered in the Great Lakes region (FWS 2004b). Piping plovers breed only in three North American geographic regions: the Atlantic coast, the Northern Great Plains, and the Great Lakes. Great Lakes piping plovers breed along sparsely vegetated beaches, cobble pans, and sand spits along the shoreline. The FWS defines their essential breeding habitat as greater than 7 m (23 ft) wide beach, greater than 0.4 km (0.25 mi) of shoreline length, dune area of 1.95 ha (4.82 ac), patches of cobble or degree cover, and areas of beach with up to 50 percent of vegetation cover (FWS 2004b). The stretch of shoreline nearest to PBNP that is designated as critical breeding habitat is at Point Beach State Forest, approximately 5 km (3 mi) to the southeast, where about 13 km (8 mi) of shoreline have been designated as suitable, although there are no records of breeding at this location (FWS 2004c). The only breeding plovers known within Wisconsin in recent years are along the shores of Lake Superior (WDNR 2004).

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We Energies conducted an initial piping plover suitability assessment of their Lake Michigan property on October 1, 2004. The assessment concluded that portions of the shoreline appear to be suitable nesting habitat (We Energies 2004b). Based on this result, a series of recommendations was presented:

- No measures should be taken to enhance habitat suitability,
- A piping plover breeding census should be conducted annually between June 1 and June 15 using the International Piping Plover Breeding Census guidelines, and an individual census report should be completed each year,
- The FWS Green Bay Field Office and the Wisconsin Department of Natural Resources Bureau of Endangered Resources should be contacted on the day that nesting piping plovers are discovered on the site, and
- We Energies will collaborate with the above-mentioned agency staffs to determine beach access, nesting habitat protection, and monitoring requirements.

In correspondence dated November 5, 2004, We Energies agreed to implement these recommendations (We Energies 2004c). In addition, NMC restricts unauthorized public access to the Lake Michigan beach area of the PBNP site with a line of boulders at the north and south boundaries, buoy markers off the shoreline to mark restricted waters, and twenty-four hour security personnel surveillance. For these reasons, the staff has determined that continued operation of PBNP over the 20-year license renewal period may affect, but is not likely to adversely affect the piping plover.

**Dune or Pitcher's Thistle (*Circium pitcheri*)**

The dune or Pitcher's thistle is Federally-listed as threatened over its entire range (FWS 2004b). The preferred site for the dune or Pitcher's thistle is an area between a sandy beach and a fully vegetated dune next to the shorelines of the Great Lakes (WDNR 2004). The primary threats to the species are disturbance through recreational activities (ATV use, trampling, etc.) and overstory encroachment (NatureServe 2004). Although no suitable habitat for this species has been identified at the PBNP site or along associated transmission line corridors, beach habitat is protected. NMC restricts unauthorized public access to the Lake Michigan beach area of the PBNP site with a line of boulders at the north and south boundaries, buoy markers off the shoreline to mark restricted waters, and twenty-four hour security personnel surveillance.

For these reasons, the staff has determined that continued operation of PBNP over the 20-year license renewal period will have no effect on the Pitcher's thistle.

**Dwarf Lake Iris (*Iris lacutris*)**

The dwarf lake iris is Federally-listed as threatened over its entire range (FWS 2004b). The dwarf lake iris is endemic to the northern shores of Lake Michigan and Lake Huron. This species is found in association with the Niagara Escarpment, a limestone formation that extends from the Door Peninsula to the north of the PBNP site through Michigan and Ontario to New York. In Wisconsin the dwarf lake iris is found on the northwestern shore of Lake Michigan and the eastern shore of Green Bay in Brown and Door counties (WDNR 2004). The primary threat to this species is habitat degradation due to overstory encroachment (NatureServe 2004). This species apparently thrives with frequent natural disturbance and does not appear to be detrimentally impacted by human disturbance and is reported to do well in old-field conditions (NatureServe 2004). Although this species has not been recorded at the PBNP site or along associated transmission line corridors, potential beach habitat is protected. NMC restricts unauthorized public access to the Lake Michigan beach area of the PBNP site with a line of boulders at the north and south boundaries, buoy markers off the shoreline to mark restricted waters, and twenty-four hour security personnel surveillance.

For these reasons, the staff has determined that continued operation of PBNP over the 20-year license renewal period will have no effect on the dwarf lake iris.

## 5.0 Conclusions

The NRC staff has evaluated the potential impacts of an additional 20 years of continued PBNP operation on four species that are Federally-listed as threatened or endangered and have the potential to occur at the PBNP site or along its associated transmission line corridors. Although none of the four species are known to occur at the site or along transmission line corridors, NMC and ATC have developed and implemented procedures to protect wildlife and habitat.

The staff has determined that license renewal for PBNP may affect, but is not likely to adversely affect the bald eagle and the piping plover, and will have no effect on the dwarf lake iris and the dune or Pitcher's thistle.

## 6.0 References

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

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

Atomic Energy Act of 1954. 42 United States Code (USC) 2011, et seq.

American Transmission Company (ATC). 2004. *Routine Right-of-Way Maintenance.* Accessed at: http://www.atcllc.com/projects_rightofway.shtml. on November 8, 2004.

NatureServe 2004. *NatureServe Explorer: an Online Encyclopedia of Life.* Version 3.1, NatureServe, Arlington, Virginia. Accessed at http://www.natureserve.org. on November 9, 2004.

Nuclear Management Company, LLC (NMC). 2004. *Point Beach Nuclear Plant Operating License Renewal Application Environmental Report.* Mishicot, Wisconsin. February 2004.

U.S. Atomic Energy Commission (AEC). 1972. *Final Environmental Statement Related to Operation of Point Beach Nuclear Plant Units 1 and 2,* Docket Nos. 50-266 and 50-301. Directorate of Licensing.. Washington, DC.

U.S. Fish and Wildlife Service (FWS). 2004a. Letter from U.S. Fish and Wildlife Service to Nuclear Regulatory Commission. Subject: Response to the May 5, 2004 NRC staff letter requesting information regarding threatened and endangered species in the vicinity of the PBNP. (August 5, 2004).

U.S. Fish and Wildlife Service (FWS). 2004b. *Species Information, Threatened and Endangered Animals and Plants website.* Accessed at http://endangered.fws.gov/wildlife.html. on August 2, 2004 through September 23, 2004.

U.S. Fish and Wildlife Service (FWS). 2004c. *All About Piping Plovers.* Accessed at http://plover.fws.gov/facts.html on November 9, 2004.

U.S. Nuclear Regulatory Commission (NRC). 2004. Letter from Nuclear Regulatory Commission to U.S. Fish and Wildlife Service. Subject: Request for information regarding threatened and endangered species in the vicinity of PBNP. (May 5, 2004).

We Energies. 2004a. Letter from We Energies Senior Terrestrial Ecologist, Dr. N. Cutright, to Nuclear Management Company Vice President. Subject: Response to U.S. Fish and Wildlife Service Letter. (May 12, 2004).

We Energies. 2004b. Piping plover Habitat on We Energies Property Near the Point Beach Nuclear Plant. Performed by Dr. N. Cutright, (October 15, 2004).

We Energies. 2004c. Letter from We Energies to Nuclear Regulatory Commission. Subject: Implementation of Piping Plover Habitat Survey Recommendations. (November 5, 2004).

Wisconsin Department of Natural Resources (WDNR). 2004. *Wisconsin State Threatened and Endangered Species website.* Accessed at: http://www.dnr.state.wi.us/org/land/er/working_list/taxalists/TandE.asp on May 5, 2004.

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# Appendix F

## GEIS Environmental Issues Not Applicable to Point Beach Nuclear Plant Units 1 and 2

# Appendix F

## GEIS Environmental Issues Not Applicable to Point Beach 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 Title 10 of the Code of Federal Regulations (CFR) Part 51, Subpart A, Appendix B, Table B-1, that are not applicable to Point Beach Nuclear Plant Units 1 and 2 (PBNP) because of plant or site characteristics.

**Table F-1.** GEIS Environmental Issues Not Applicable to PBNP

| ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1 | Category | GEIS Sections | Comment |
|---|---|---|---|
| **SURFACE WATER QUALITY, HYDROLOGY, AND USE (FOR ALL PLANTS)** | | | |
| Altered salinity gradients | 1 | 4.2.1.2.2<br>4.4.2.2 | The PBNP 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<br>4.4.2.1 | The PBNP cooling system does not use makeup water from a small river with low flow. |
| **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 PBNP. |
| Impingement of fish and shellfish | 1 | 4.3.3 | This issue is related to heat-dissipation systems that are not installed at PBNP. |
| Heat shock | 1 | 4.3.3 | This issue is related to heat-dissipation systems that are not installed at PBNP. |

(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 |
|---|---|---|---|
| GROUNDWATER USE AND QUALITY | | | |
| Groundwater use conflicts (potable and service water and dewatering; plants that use >100 gpm) | 2 | 4.8.1.1<br>4.8.2.1 | PBNP uses <100 gpm of groundwater. |
| Groundwater-use conflicts (plants using cooling towers withdrawing makeup water from a small river) | 2 | 4.8.1.3<br>4.4.2.1 | This issue is related to heat-dissipation systems that are not installed at PBNP. |
| Groundwater-use conflicts (Ranney wells) | 2 | 4.8.1.4 | PBNP does not have or use Ranney wells. |
| Groundwater quality degradation (Ranney wells) | 1 | 4.8.2.2 | PBNP does not have or use Ranney wells. |
| Groundwater quality degradation (saltwater intrusion) | 1 | 4.8.2.1 | PBNP uses <100 gpm of groundwater and is not located near a saltwater body |
| Groundwater quality degradation (cooling ponds in salt marshes) | 1 | 4.8.3 | This issue is related to a heat-dissipation system that is not installed at PBNP. |
| Groundwater quality degradation (cooling ponds at inland sites) | 2 | 4.8.3 | This issue is related to a heat-dissipation system that is not installed at PBNP. |
| TERRESTRIAL RESOURCES | | | |
| Cooling tower impacts on crops and ornamental vegetation | 1 | 4.3.4 | This issue is related to a heat-dissipation system that is not installed at PBNP. |
| Cooling tower impacts on native plants | 1 | 4.3.5.1 | This issue is related to a heat-dissipation system that is not installed at PBNP. |

**Table F-1.** (contd)

| ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1 | Category | GEIS Sections | Comment |
|---|---|---|---|
| | TERRESTRIAL RESOURCES | | |
| Bird collisions with cooling towers | 1 | 4.3.5.2 | This issue is related to a heat-dissipation system that is not installed at PBNP. |
| Cooling pond impacts on terrestrial resources | 1 | 4.4.4 | This issue is related to a heat-dissipation system that is not installed at PBNP. |
| | HUMAN HEALTH | | |
| Microbial organisms (occupational health) | 1 | 4.3.6 | This issue is related to a heat-dissipation system that is not installed at PBNP. |
| 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 a heat-dissipation system that is not installed at PBNP. |

## F.1 References

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

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

U.S. Nuclear Regulatory Commission (NRC). 1999. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants: Main Report, Section 6.3, Transportation, Table 9.1, Summary of Findings on NEPA Issues for License Renewal of Nuclear Power Plants, Final Report.* NUREG-1437, Volume 1, Addendum 1, Washington, D.C.

# Appendix G

## NRC Staff Evaluation of Severe Accident Mitigation Alternatives (SAMAs) for Point Beach Nuclear Plant Units 1 and 2, in Support of License Renewal Application

# Appendix G

# NRC Staff Evaluation of Severe Accident Mitigation Alternatives (SAMAs) for Point Beach Nuclear Plant Units 1 and 2, in Support of License Renewal Application

10 CFR 51.53(c)(3)(ii)(L) requires that license renewal applicants consider alternatives to mitigate severe accidents if the staff has not previously evaluated SAMAs for the applicant's plant in an environmental impact statement (EIS) or related supplement or in an environmental assessment. The purpose of this consideration is to ensure that plant changes (i.e., hardware, procedures, and training) with the potential for improving severe accident safety performance are identified and evaluated. SAMAs have not been previously considered for Point Beach Nuclear Plant Units 1 and 2 (PBNP); therefore, the remainder of Appendix G addresses those alternatives.

## G.1 Introduction

Nuclear Management Company, LLC (NMC) submitted an assessment of SAMAs for PBNP as part of the Environmental Report (ER) (NMC 2004a). This assessment was based on the most recent PBNP 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 PBNP Individual Plant Examination (IPE) (WEPCO 1993), and Revision 3.02 of the PBNP PRA model. In identifying and evaluating potential SAMAs, NMC considered insights from the plant-specific PRA, 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). NMC identified 202 potential SAMA candidates. This list was reduced to 65 unique SAMAs by eliminating SAMAs that were not applicable to PBNP or had already been implemented at PBNP. NMC assessed the costs and benefits associated with each of these 65 SAMAs and concluded that none of the candidate SAMAs would be cost-beneficial for PBNP.

Based on a review of the SAMA assessment, the NRC issued a request for additional information (RAI) to NMC by letters dated July 2, 2004 (NRC 2004a) and October 20, 2004 (NRC 2004b). Key questions concerned: dominant risk contributors at PBNP and the SAMAs that address these contributors, the potential impact of uncertainties on assessment results, the impact of human reliability analysis (HRA) modeling changes on the SAMA identification and screening results, and more detail on some specific SAMA candidates. NMC submitted additional information by letters dated August 31, 2004 (NMC 2004b) and November 22, 2004

(NMC 2004c), including tables showing relative core damage frequency (CDF) contributions, a listing of basic events and importance measures, an uncertainty assessment, and additional information regarding human error-related SAMAs. NMC's responses addressed all of the staff's concerns.

Although none of the SAMAs appear cost-beneficial in the baseline analysis, the staff identified two SAMAs that could become cost-beneficial when uncertainties, alternative discount rates, or broader implementation options are taken into account. However, none of these 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.

An assessment of SAMAs for PBNP is presented below.

## G.2 Estimate of Risk for PBNP

NMC's estimates of offsite risk at PBNP are summarized in Section G.2.1. The summary is followed by the staff's review of NMC's risk estimates in Section G.2.2.

### G.2.1 NMC's Risk Estimates

Two distinct analyses are combined to form the basis for the risk estimates used in the SAMA analysis: (1) the PBNP PRA model, and (2) a supplemental analysis of offsite consequences and economic impacts (essentially a Level 3 PRA model) developed specifically for the SAMA analysis. The SAMA analysis is based on the most recent PRA model available at the time of the ER, referred to as Revision 3.02. It contains a Level 1 analysis to determine core damage frequency (CDF) from internally-initiated events and a Level 2 analysis to assess containment performance during severe accidents. The SAMA analysis is based on the Unit 1 PRA model. The CDF for Unit 2 is within 5 percent of the Unit 1 CDF, thus the results based on the Unit 1 model would be applicable to Unit 2 as well. The scope of the PBNP PRA does not include external events.

The baseline CDF for the purpose of the SAMA evaluation is approximately $3.6 \times 10^{-5}$ per year, and is based on the risk assessment for internally-initiated events. Based on the Individual Plant Examination of External Events (IPEEE) model (WEPCO 1995), seismic events have a CDF of $1.3 \times 10^{-5}$ per year, internal fires have a CDF of $5.1 \times 10^{-5}$ per year, and internal flooding has a CDF of $1.1 \times 10^{-5}$ per year. In the ER, NMC states that the internal flooding and seismic analyses have not been updated since the original IPEEE submittal. However, the fire analysis has been updated once since the IPEEE submittal, and NMC provides the CDF for fire of $1.2 \times 10^{-5}$ per year versus the IPEEE reported value of $5.1 \times 10^{-5}$ per year. Other external events were found to be insignificant contributors to plant risk. NMC did not include the contribution to risk from external events within the PBNP risk estimates; however, it did include the potential risk reduction benefits associated with external events by doubling the estimates for internal events. This is discussed further in Section G.6.2.

The breakdown of CDF by initiating event/accident type is provided in Table G-1. As shown in this table, steam generator tube rupture (SGTR) events, transients without the Power Conversion System (PCS) available, loss of Component Cooling Water (CCW), and loss of offsite power are dominant contributors to the CDF.

**Table G-1.** PBNP Core Damage Frequency for Internal Events

| Initiating Event | CDF (per year) | Percent Contribution |
|---|---|---|
| SGTR | $8.75 \times 10^{-6}$ | 24.4 |
| Transient without PCS | $6.40 \times 10^{-6}$ | 17.8 |
| Loss of component cooling | $4.39 \times 10^{-6}$ | 12.3 |
| Loss of offsite power (dual unit) | $4.13 \times 10^{-6}$ | 11.5 |
| Steam/feed break inside containment | $2.76 \times 10^{-6}$ | 7.7 |
| Loss of service water | $2.43 \times 10^{-6}$ | 6.8 |
| Steam/feed break outside containment | $1.90 \times 10^{-6}$ | 5.3 |
| Medium loss-of-coolant accident (LOCA) (>2 to 6 in.) | $1.80 \times 10^{-6}$ | 5.0 |
| Excessive LOCA (vessel failure) | $9.90 \times 10^{-7}$ | 2.8 |
| Transient with PCS | $6.84 \times 10^{-7}$ | 1.9 |
| Station blackout (SBO) | $4.41 \times 10^{-7}$ | 1.2 |
| Small LOCA (3/8 to 2 in.) | $3.77 \times 10^{-7}$ | 1.1 |
| Loss of bus D-01 | $2.76 \times 10^{-7}$ | 0.8 |
| Loss of instrument air | $2.27 \times 10^{-7}$ | 0.6 |
| Large LOCA (>6 in.) | $1.39 \times 10^{-7}$ | 0.4 |
| Interfacing systems LOCA (ISLOCA) | $1.10 \times 10^{-7}$ | 0.3 |
| Loss of bus D-02 | $6.74 \times 10^{-8}$ | 0.2 |
| **Total CDF (from internal events)** | **$3.59 \times 10^{-5}$** | **100** |

The Level 2 analysis utilized the containment event tree logic from the IPE and fault tree linking to combine the Level 1 core damage sequence failures with the Level 2 containment safeguards systems fault trees. The fault tree linking method was used to resolve dependencies that occur between the Level 1 core damage sequence failures and containment safeguards system failures. The combined sequences were then mapped into plant damage states using the same method employed in the IPE. Only sequences in which the containment is bypassed or containment isolation has failed were found to have volatile fission product release fractions greater than $1 \times 10^{-4}$. Based on these results, the bypass source term categories of early SGTR, late SGTR, interfacing systems LOCA (ISLOCA), and containment isolation failure were defined. An additional category, "other," was defined to represent all other core melt sequences. The updated fission product release fractions were provided in response to an RAI (NMC 2004c). Based on analyses using the Modular Accident Analysis Program (MAAP) computer code, NMC concluded that late containment failures were so low a probability as to be negligible. Containment leakage was, therefore, the release mechanism considered for all sequences other than SGTR, containment isolation failure, and ISLOCA.

The offsite consequence and economic impact analysis uses the MACCS2 code to determine the offsite risk impacts on the surrounding environment and public. Inputs for this analysis include plant-specific and site-specific input values for core radionuclide inventory, source term and release characteristics, site meteorological data, projected population distribution (within a 80 km [50-mi] radius) for the year 2035, emergency response evacuation modeling, and economic data.

NMC estimated the dose to the population within 80 km (50 mi) of the PBNP site to be approximately 0.0149 person-Sv (1.49 person-rem) per year, based on NMC's response to an RAI (NMC 2004c). This represents a correction to the population dose of 0.0183 person-Sv (1.83 person-rem) per year reported 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[1] Per Year) | % Contribution |
|---|---|---|
| Late SGTR | 1.09 | 73 |
| Early SGTR | 0.165 | 11 |
| Containment Isolation Failure | $8.49 \times 10^{-4}$ | <0.1 |
| ISLOCA | 0.124 | 8 |
| Other Core Melt Sequences | 0.0104 | 7 |
| **Total Population Dose** | **1.49** | **100** |

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

### G.2.2 Review of NMC's Risk Estimates

NMC's determination of offsite risk at PBNP is based on the following three major elements of analysis:

- The PBNP Level 1 and 2 risk models that form the bases for the 1993 IPE submittal (WEPCO 1993) and 1995 IPEEE submittal (WEPCO 1995).
- Major modifications to the IPE model that have been incorporated in the PBNP PRA, and
- The MACCS2 analyses performed to translate fission product source terms and release frequencies from the Level 2 PRA model into offsite consequence measures.

Each of these analyses was reviewed to determine the acceptability of NMC's risk estimates for the SAMA analysis, as summarized below.

The staff's review of the PBNP IPE is described in an NRC report dated January 26, 1995 (NRC 1995). In that review, the staff evaluated the methodology, models, data, and assumptions used to estimate the CDF and characterize containment performance and fission product releases. The staff concluded that NMC's analysis met the intent of Generic Letter 88-20 (NRC 1988); that is, the IPE was of adequate quality to be used to look for design or operational vulnerabilities. The staff, however, encouraged NMC to strengthen the HRA by improving the pre-initiator event analysis. The staff believed the improved analysis would increase the usefulness of NMC's PRA in other applications. As described below, the HRA was subsequently updated.

In response to a staff RAI about changes in the various PRA versions since the IPE, NMC provided additional details (NMC 2004b). There have been five revisions of the PBNP Level 1 PRA since the IPE was submitted and before the SAMA analysis was completed. A summary of the differences in these revisions is provided in Table G-3.

The CDF values for PBNP are comparable to the CDF values reported in the IPEs for other Westinghouse two-loop plants. As reported in NUREG-1560, the total internal events CDF for these plants range from approximately $3 \times 10^{-5}$ per year to $2 \times 10^{-4}$ per year.

**Table G-3.** Level 1 PRA Summary

| Level 1 PRA Revision | Summary of Changes from Prior Revision | CDF (per year) |
|---|---|---|
| September 1990 | Base model for IPE. | $1.15 \times 10^{-4}$ |
| December 1993 (PRA-93) | Updated model to reflect plant modifications; added operator-induced auxiliary feedwater system (AFW) failure. | $9.74 \times 10^{-5}$ |
| June 1996 (PRA-96) | Updated plant-specific data; changed Service Water success criteria; reflected addition of two new diesel generators. | $5.77 \times 10^{-5}$ |
| December 1999 (Revision 3.00) | Changed logic modeling structure; added provision for alternate electrical feed lineups; updated various system models and data. | $4.39 \times 10^{-5}$ |
| February 2002 (Revision 3.01) | Reflected modification to motor driven AFW pumps for nitrogen backup supply to mini-recirculation valves. | $3.78 \times 10^{-5}$ |
| May 2002 (Revision 3.02) | Reflected modification to turbine driven AFW pumps for air accumulator backup supply to mini-recirculation valves. | $3.59 \times 10^{-5}$ |

The staff considered the peer reviews performed for the PBNP PRA and the potential impact of the review findings on the SAMA evaluation. Revision 3.00 of the PRA model was reviewed in June 2001 by a Westinghouse Owners Group PRA Peer Review Team. The team concluded that the PRA could be used effectively to support applications involving risk significance determinations supported by deterministic analyses once the items in their report are addressed. A major observation was that the thermal hydraulic bases for system and human action success were largely either conservative design basis analyses or analyses that were not specific to PBNP. These thermal hydraulic bases date from the original IPE PRA. Other observations discussed the shortcomings with the basis and documentation of the common cause failure analysis, a general lack of treatment of miscalibration errors in the model, the need to complete the human reliability analysis update, and the need to complete the documentation of the remainder of the model.

The SAMA analysis for PBNP is based on Level 1 PRA Revision 3.02. NMC subsequently updated the PRA to address all of the Significance Level A peer review findings and many of the Significance Level B findings. The majority of the changes relate to the HRA rather than the system models. The revised Level 1 PRA is denoted Revision 3.13. While the total CDF did not change much ($3.59 \times 10^{-5}$ per year in Revision 3.02 to $4.12 \times 10^{-5}$ per year in Revision 3.13), the dominant contributors to the CDF did change more significantly. The most significant change was a reduction in the importance of the SGTR event and an increase in the importance of the loss of offsite power (LOSP) and loss of DC power events. The impact of the PRA update on SAMA identification and evaluation is discussed in Section G.3.2.

Given that (1) the PBNP PRA has been peer reviewed and the potential impact of the peer review findings on the SAMA evaluation has been assessed, as described above, (2) NMC satisfactorily addressed staff questions regarding the PRA (NMC 2004b and NMC 2004c), and (3) the CDF is in the range of contemporary CDFs for Westinghouse two-loop plants, the staff concludes that the Level 1 PRA model used for the SAMA analysis is of sufficient quality to support the SAMA evaluation.

NMC submitted an IPEEE by letter dated June 30, 1995 (NMC 1995) in response to Supplement 4 of Generic Letter 88-20. NMC did not identify any fundamental weaknesses or vulnerabilities to severe accident risk in regard to the external events related to seismic, fire or other external events. The NRC provided its review of the PBNP IPEEE in 1999 (NRC 1999). The staff concluded that the licensee's IPEEE process is capable of identifying the most likely severe accidents and severe accident vulnerabilities, and therefore, that the PBNP IPEEE met the intent of Supplement 4 to Generic Letter 88-20.

The IPEEE approach to seismic analysis included extensive seismic walkdowns and modification of the IPE Level 1 logic models and the IPE Level 2 containment events for quantification. The dominant contributors to the seismic CDF were failure of cable trays inside the cable spreading room (62 percent), failure of cable trays outside the cable spreading room (7 percent), and failure of a surrogate element (16 percent). (The surrogate element represented the effects of components that were screened out, e.g., soils, buildings/structures, reactor vessel.) The inside cable spreading room sequences consisted of the seismically-induced failure of cable trays leading to loss of control combined with failure to shut down the plant remotely. The outside cable spreading room sequences consisted of the seismically-induced failure of cable trays leading to loss of power to all essential equipment. The dominant contributors to the estimated seismic CDF are operator actions (e.g., failure to shut down the plant from the remote shutdown panel, failure to provide service water backup to auxiliary feedwater), seismic faults that lead directly to core damage (e.g., failure of cable trays, surrogate element), and failures of critical equipment (e.g., transformers, 480 V load centers, level transmitter for condensate storage tank) (NRC 1999). In response to an RAI, NMC stated that it has modified cable tray supports, re-anchored the 480 V load centers, and mitigated the impacts of a 4 kV transformer failure with the addition of a third and fourth diesel generator and associated switchgear. Other seismic issues have been addressed through changes in procedures (NMC 2004b). NMC concluded that no further actions to address seismic events are necessary. The staff notes that it is unlikely that cost-effective SAMAs that address remaining seismic risk contributors will exist, due to the high cost of structural modifications compared to the benefits expected and, therefore, agrees that further analyses of potential SAMAs for seismic events are not warranted.

The IPEEE fire analysis was based on the fire-induced vulnerability evaluation (FIVE) methodology. This methodology employs a graduated focus on the most important fire zones using qualitative and quantitative screening critera. The fire zones were subjected to several screening stages. In the first stage, a zone was screened out if it did not contain any safety-related equipment. In the later stages, a CDF of $1 \times 10^{-6}$ per year was used for screening. The licensee used the IPE model of internal events to quantify the CDF resulting from a fire initiating event. The conditional core damage probability was based on the equipment and systems unaffected by the fire. The CDF for each zone was obtained by multiplying the frequency of a fire in a given fire zone by the conditional core damage probability associated with that fire zone. The screening methodology applied by the licensee makes less and less conservative assumptions (e.g., equipment that may survive the fires in the area) until a fire zone is screened out, the results do not indicate a vulnerability, or a vulnerability is identified and addressed. Using this method, the IPEEE fire CDF was estimated to be about $5.1 \times 10^{-5}$ per year. In the ER, NMC reported that the fire analysis had been updated, and that the CDF has been reduced from $5.1 \times 10^{-5}$ per year to $1.2 \times 10^{-5}$ per year.

The staff requested additional information regarding risk reduction measures taken to date for each significant fire area in the IPEEE fire analysis.

In response, NMC described plant modifications and enhancements to procedures and training to further reduce fire risk in the significant fire areas. NMC noted that the addition of two additional diesel generators reduces the fire impact in the gas-fired turbine generator area, the two diesel rooms (G01 and G02), and the switchgear room. NMC also determined that the transformer oil thought to be combustible in the IPEEE analysis would not actually be combustible, thereby reducing the fire risk in the Cable Spreading Room and the Unit 1 and Unit 2 Electrical Equipment Rooms. NMC identified that the Monitor Tank Room Auxiliary Operator's Station has a high fire initiating event frequency due to the large number of cables routed in this compartment and the number of adjacent compartments. Plant personnel are routinely trained to address fires in this area. NMC concluded that no further modifications would be cost-beneficial for any of the fire compartments.

The staff notes that additional SAMAs to reduce the fire risk contributors might be viable at PBNP. However, given that the fire CDF has been reduced by over a factor of four, and that the plant meets 10 CFR Part 50, Appendix R, fire requirements, it is unlikely that further modifications would both substantially reduce risk and remain cost-beneficial.

The risk associated with other external events is small. The CDF due to external floods is about $2.8 \times 10^{-6}$ per year and the CDF due to high winds is about $3.4 \times 10^{-7}$ per year. Other external events (e.g., transportation and nearby facility accidents) are insignificant risk contributors based on their low hazard frequencies. Accordingly, the staff finds NMC's consideration of external events to be acceptable.

The staff reviewed the process used by NMC to extend the containment performance (Level 2) portion of the PRA to an assessment of offsite consequences (essentially a Level 3 PRA). This included consideration of the source terms used to characterize fission product releases for the applicable containment release category and the major input assumptions used in the offsite consequence analyses. The MACCS2 code was utilized to estimate offsite consequences. Plant-specific input to the code includes the reactor core radionuclide inventory (the reference core inventory, scaled for the PBNP power level), source terms for each release category, site-specific meteorological data, projected population distribution within a 80-km (50-mile) radius for the year 2035, and emergency evacuation modeling. This information is provided in Appendix F of the ER (NMC 2004a).

Even though NMC used the NRC-approved MACCS2 code and scaled the reference pressurized-water reactor (PWR) core inventory for PBNP plant-specific power level, the staff requested that NMC 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 10 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.

NMC characterized the releases for the spectrum of possible radionuclide release scenarios using a set of 5 release categories, defined based on the timing and magnitude of the release. These were early SGTR, late SGTR, containment ISLOCA, containment isolation failure, and other (defined to bound non-bypass releases). Each end state from the Level 2 analysis is assigned to one of the release categories. In the ER, NMC states that the source terms used for the SAMA evaluation are based on the MAAP 4.0.4 computer code for a power level of 1518 MW(t). A 1.4 percent power uprate was subsequently implemented in 2003. In its response to an RAI (NMC 2004c), NMC also provided a correction to the population dose values reported in the ER. The correction to population dose is relatively insignificant and does not impact conclusions of the cost-benefit analyses. 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.

NMC used a composite set of site-specific meteorological data, obtained from the plant meteorological tower, the Kewaunee Nuclear Power Plant (3.6 miles north of PBNP), and the Sheboygan County Memorial Airport (39 miles south of PBNP). The data was processed from hourly measurements for the 2000 calendar year as input to the MACCS2 code. Data from these locations and this year was selected because it provided an adequate representation of the PBNP meteorological data. 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 2000 data to be reasonable.

The population distribution the applicant used as input to the MACCS2 analysis was estimated for the year 2035, based on extrapolation from the census for 1990. The 1990 segment population was obtained by using the SECPOP90 (NRC 1997a) computer program to process block-level census data. The year 1990 segment data was used with the U.S. Census Bureau ratio of the county census growth from 1990 to 2000. Next, the Wisconsin county growth rate data were used to project the 2000 data to the year 2020. Finally, the U.S. Census Bureau state population projections were used to project the 2020 data to 2035. The staff considers NMC's methods and assumptions for estimating population reasonable and acceptable for purposes of the SAMA evaluation.

The emergency evacuation model was modeled as multiple evacuation zones extending out 16 km (10 mi) from the plant. The 0 to 2-mile radius was treated as one 180-degree sector. It was assumed that 100 percent of the population would move at an average speed of approximately 0.715 meters per second (1.6 miles per hour) with a delayed start time of 15 minutes (NMC 2004a). The evacuation assumptions and analysis are deemed reasonable and acceptable for the purposes of the SAMA evaluation.

Much of the site-specific economic data were provided from SECPOP90 (NRC 1997a) by specifying the data for each of the 11 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).

NMC 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.

The staff concludes that the methodology used by NMC to estimate the offsite consequences for PBNP provides an acceptable basis from which to proceed with an assessment of risk reduction potential for candidate SAMAs. Accordingly, the staff based its assessment of offsite risk on the CDF and offsite doses reported by NMC.

## G.3 Potential Plant Improvements

The process for identifying potential plant improvements, an evaluation of that process, and the improvements evaluated in detail by NMC are discussed in this section.

### G.3.1 Process for Identifying Potential Plant Improvements

NMC generated a list of SAMA candidates by considering plant-specific enhancements and reviewing industry and NRC documents that discuss potential plant improvements. Eighteen sources other than plant-specific sources were identified. Plant-specific sources included basic events having the greatest risk reduction potential. From these sources, 202 SAMA candidates were identified. NMC performed an initial, qualitative, screening based on two criteria:

- The SAMA is not applicable to PBNP (e.g., because the enhancement is only for boiling water reactors, the Westinghouse AP600 design or pressurized water reactor (PWR) ice condenser containments, or it is a plant-specific enhancement that does not apply at PBNP)

- The SAMA has already been implemented at PBNP, or the PBNP design meets the intent of the SAMA.

Based on this initial screening, 137 SAMA items were eliminated, leaving 65 SAMAs subject to the final evaluation process.

For the final evaluation, NMC 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. If the estimated implementation cost was more than the estimated benefit (including the multiplier of two to account for not directly evaluating external events), then the SAMA was not considered to be cost-beneficial.

NMC concluded that there are no SAMA candidates that are cost-beneficial.

## G.3.2 Review of NMC's Process

NMC's efforts to identify potential SAMAs focused on areas associated with internal initiating events. The initial list of SAMAs was based on a range of resources, including generic issues, and internal PBNP PRA analyses. In the latter case, the PBNP Level 1 PRA Revision 3.02 importance measures were used to identify the most important basic events, with NMC identifying potential SAMAs that would address these important basic events. The initial list of SAMAs generally addressed the accident categories that are dominant CDF and containment failure contributors, or issues that tend to have a large impact on a number of accident sequences at PBNP.

In order to confirm that the set of SAMAs evaluated in the ER address the dominant risk contributors, the staff requested that NMC provide a cross reference of the dominant PRA contributors to the candidate SAMAs. NMC provided these data (NMC 2004b and NMC 2004c), including a listing of the events with the greatest risk reduction worth importance measure, and the SAMAs that addressed those risk contributors. This table showed that each of the top 52 risk contributors are addressed by at least one candidate SAMA. Based on this additional assessment, the staff concludes that the set of SAMAs evaluated in the ER addresses the major contributors to CDF and offsite dose, and that the review of the top risk contributors does not reveal any new SAMAs.

The staff questioned NMC about lower-cost alternatives to some of the SAMAs evaluated that could achieve much of the risk reduction at a lower cost. In its response (NMC 2004b), NMC stated that it sought low-cost alternatives indirectly, through the identification of plant-specific risk reduction opportunities identified by the PRA results. Examples include SAMAs 161, 162, 164, and 197[a]. These SAMAs all impact AFW reliability. One expensive alternative was SAMA 164, the addition of AFW pump redundancy. SAMA 197 relates to the risk importance of a check valve in the AFW system. The resultant low-cost option was to review the necessity for the check valve, and after investigation, a decision was made to remove the check valve internals.

(a) SAMA 161 - Install manual isolation valves around AFW turbine steam admission valves. SAMA 162- Install accumulators for turbine driven AFW pump flow control valves. SAMA 164 - Add a motor train of AFW to the steam trains. SAMA 197 - Reduce likelihood of check valve in recirculation line from AFW pumps to condensate storage tanks (CSTs) failing to open.

The staff also requested that NMC evaluate several of the SAMAs found to be potentially cost-beneficial in recent SAMA reviews for other plants for applicability to PBNP. Twelve such options were further evaluated by NMC, including:

- Developing procedures for providing temporary ventilation to switchgear and diesel generator rooms in events involving loss of room cooling

- Adding a capability to flash the field on the emergency diesel generator to enhance SBO event recovery

- Providing a portable 120 VAC generator with manual clamps to supply power to the steam generator level instrumentation in SBO events

- Developing procedures to extend the time to refueling water storage tank (RWST) depletion in SGTR events.

NMC's evaluation of these additional SAMAs is discussed in Section G.6.2.

Since PRA Revision 3.13 was not used in the PBNP SAMA analysis, the staff requested that NMC assess the impact of the resolution of the peer review findings (see Section G.2.2) on SAMA identification and evaluation (NRC 2004a). In their response, NMC provided a table of the changes in the CDF and the major contributors to the CDF relative to Revision 3.02. NMC stated that these changes would not have had any impact on the set of SAMAs screened from the cost-benefit analysis, but that it is possible that the operator action to cross-tie 480VAC power between buses 1B03 and 1B04 may have become one of the more important human actions and would have been included in the SAMAs evaluated. While this event might have been part of the set of operator action SAMAs considered if the screening were based on PRA Revision 3.13, NMC reported that the actions taken for the other operator action SAMAs (i.e., implementation of procedure mark-offs for SAMAs 181 through 193) have also been implemented for this additional risk-important operator action identified as a result of PRA Revision 3.13, and no other cost-beneficial action is available (NMC 2004c).

NMC reviewed existing SAMAs relative to loss of power to see if they could become more cost-beneficial based on PRA Revision 3.13. Three SAMAs that could potentially be impacted by the PRA revision were identified (SAMAs 63, 66 and 180). Since two of these SAMAs (SAMAs 63 and 66) affect the plant's response to SBO, which represents only a small portion of LOSP, it is expected that these SAMAs would still be eliminated in the screening. SAMA 180 deals with improving the capability for restoring power to the battery chargers following LOSP.

NMC noted that the Human Error Probability (HEP) for manually restoring power to the battery chargers was directly impacted by the HRA update. NMC concludes in its RAI response (NMC 2004b) that this SAMA would not become cost-beneficial based on PRA Revision 3.13 (see Section G.6.2 for further discussion of this SAMA).

The staff notes that the set of SAMAs submitted is not all inclusive, since additional, possibly even less expensive, design alternatives can always be postulated. However, the staff concludes that the benefits of any additional modifications are unlikely to exceed the benefits of the modifications evaluated and that the alternative improvements would not likely cost less than the least expensive alternatives evaluated, when the subsidiary costs associated with maintenance, procedures and training are considered.

The staff concludes that NMC used a systematic and comprehensive process for identifying potential plant improvements for PBNP, and that the set of potential plant improvements identified by NMC is reasonably comprehensive and, therefore, acceptable. This process included reviewing insights from the IPE and IPEEE and other plant-specific studies, reviewing plant improvements considered in previous SAMA analyses, and using the knowledge and experience of its personnel. While explicit treatment of external events in the SAMA identification process was limited, it is recognized that the prior implementation of plant modifications for seismic events and 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

NMC evaluated the risk reduction potential of the 65 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.

NMC used model re-quantification to determine the potential benefits. The CDF and population dose reductions were estimated using Revision 3.02 of the PBNP PRA. The changes made to the model to quantify the impact of SAMAs are detailed in Section F.2 of Appendix E to the ER (NMC 2004a). Table G-4 provides a summary of the assumptions used to estimate the risk reduction for each of the 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 as used in the staff's assessment. The determination of the benefits for the various SAMAs is further discussed in Section G.6.

NMC did not further evaluate the risk reduction benefits for several of the SAMAs because either the implementation cost was expected to exceed the total present dollar value equivalent associated with completely eliminating all severe accidents at PBNP (SAMAs 71, 72, 158, 166, and 176), or the associated initiating event frequency was extremely small and would result in a benefit far less than the estimated $1M implementation cost for these alternatives (SAMAs 77 and 78).

The staff has reviewed the bases used by NMC 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 NMC, as discussed in Section G.6.2.

## G.5 Cost Impacts of Candidate Plant Improvements

NMC estimated the costs of implementing the 65 candidate SAMAs through the application of engineering judgment, estimates from other licensee submittals for similar improvements, and 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 recurring maintenance and surveillance costs or contingency costs associated with unforeseen implementation obstacles. Cost estimates typically included procedures, engineering analysis, training, and documentation, in addition to any hardware.

NMC did not specifically estimate costs for 8 of the 65 SAMAs because:

- Implementation would require plant modifications that would cost significantly more than any obtainable benefit (SAMAs 47, 108, 158, and 176), or

- Procedure step mark-offs have already been implemented and no further improvement could be gained by making further changes to procedures or training (SAMAs 151, 181, 190, and 196).

Related to the last reason, in response to an RAI, NMC indicated that the SAMA analysis had been performed prior to implementation of the procedure step mark-offs and, therefore, the calculated benefits as reported in the ER are over-estimated. Furthermore, NMC indicated that further improvements to obtain these reduced benefits would require full automation of the SAMA actions, the implementation cost of which would be much greater than the obtainable benefit (NMC 2004).

The ER discussion of cost estimates did not describe how NMC handled the cost of SAMAs for which the implementation costs are incurred once (i.e., on a "per site" basis) but which provide benefits for both units. In response to an RAI, NMC identified 27 SAMAs (14 human error-related and 13 hardware-related) in which the implementation cost for the SAMA on a per unit basis could be conservatively assumed to be one-half the value reported in the ER. The staff adopted these conservative cost estimates for the affected SAMAs.

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 reviewed these estimates and found them to be consistent with estimates provided in support of other plants' analyses.

It is noted that the estimated implementation cost for SAMA 126, automatic switchover to recirculation on RWST depletion, is greater than $1.0M, and is significantly higher than the $265K estimated for the same SAMA in a license renewal SAMA analysis for another plant. However, in response to an RAI, NMC indicated that a site-specific estimate had been performed for this SAMA and resulted in an implementation cost estimate of $2.4M per unit (NMC 2004b). This site-specific cost estimate is considered reasonable given the associated hardware and engineering-related costs; however, a potentially cost-beneficial revision to SAMA 126 was identified by the staff. The potentially cost-beneficial revision is discussed further in section G.6.2.

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

## G.6 Cost-Benefit Comparison

NMC's cost-benefit analysis and the staff's review are described in the following sections.

### G.6.1 NMC Evaluation

The methodology used by NMC was based primarily on NRC's guidance for performing cost-benefit analysis, i.e., NUREG/BR-0184, Regulatory Analysis Technical Evaluation Handbook (NRC 1997b). The guidance involves determining the net value for each SAMA according to the following formula:

Net Value = (APE + AOC + AOE + AOSC) - COE

where,

APE = present value of averted public exposure ($)
AOC = present value of averted offsite property damage costs ($)
AOE = present value of averted occupational exposure costs ($)
AOSC = present value of averted onsite costs ($)
COE = cost of enhancement ($).

If the net value of a SAMA is negative, the cost of implementing the SAMA is larger than the benefit associated with the SAMA and it is not considered cost-beneficial. NMC's derivation of each of the associated costs is summarized below.

Averted Public Exposure (APE) Costs

The APE costs were calculated using the following formula:

APE = Annual reduction in public exposure (Δ person-rem/year)
x monetary equivalent of unit dose ($2,000 per person-rem)
x present value conversion factor (10.76 based on a 20-year period with a 7 percent discount rate).

As stated in NUREG/BR-0184 (NRC 1997b), it is important to note that the monetary value of the public health risk after discounting does not represent the expected reduction in public health risk due to a single accident. Rather, it is the present value of a stream of potential losses extending over the remaining lifetime (in this case, the renewal period) of the facility. Thus, it reflects the expected annual loss due to a single accident, the possibility that such an accident could occur at any time over the renewal period, and the effect of discounting these potential future losses to present value. NMC calculated an APE of approximately $32,000[(a)] for the 20-year license renewal period, which assumes elimination of all severe accidents.

Averted Offsite Property Damage Costs (AOC)

The AOCs were calculated using the following formula:

AOC = Annual CDF reduction
x offsite economic costs associated with a severe accident (on a per-event basis)
x present value conversion factor.

NMC calculated an annual offsite economic risk of about $1,240[(b)] based on the Level 3 risk analysis. This results in a discounted value of approximately $13,400 for the 20-year license renewal period, which assumes all severe accidents are eliminated.

Averted Occupational Exposure (AOE) Costs

The AOE costs were calculated using the following formula:

AOE = Annual CDF reduction
x occupational exposure per core damage event
x monetary equivalent of unit dose
x present value conversion factor.

NMC derived the values for averted occupational exposure from information provided in Section 5.7.3 of the regulatory analysis handbook (NRC 1997b). Best estimate values provided for immediate occupational dose (3,300 person-rem) and long-term occupational dose (20,000 person-rem over a 10-year cleanup period) were used. The present value

(a) An APE value of $39,308 is reported in the ER based on a population dose of 1.83 person-rem per year. As described in response to an RAI, the correct population dose is 1.49 person-rem per year. The corrected APE value corresponding to elimination of severe accidents is approximately $32,000. The change is insignificant to the results of the SAMA analysis.

(b) An AOC of $27,916 is reported in the ER based on an annual offsite economic risk of $2,594. As described in response to an RAI, the correct annual offsite economic risk is about $1, 240. The corrected AOC value corresponding to complete elimination of severe accidents is approximately $13,400. The change is insignificant to the results of the SAMA analysis.

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[a], and a time period of 20 years to represent the license renewal period. NMC calculated an AOE of approximately $13,700 for the 20-year license renewal period, which assumes all severe accidents are eliminated.

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. NMC derived the values for AOSC based on information provided in Section 5.7.6 of the regulatory analysis handbook (NRC 1997b).

NMC divided this cost element into two parts – the Onsite Cleanup and Decontamination Cost, also commonly referred to as averted cleanup and decontamination costs, and the replacement power cost.

Averted cleanup and decontamination costs (ACC) were calculated using the following formula:

ACC = Annual CDF reduction
x present value of cleanup costs per core damage event
x present value conversion factor.

The total cost of cleanup and decontamination subsequent to a severe accident is estimated in the regulatory analysis handbook to be $\$1.5 \times 10^9$ (undiscounted). This value was converted to present costs over a 10-year cleanup period and integrated over the term of the proposed license extension. NMC calculated an ACC of approximately $416,000 for the 20-year license renewal period, which assumes all severe accidents are eliminated.

(a) NRC policy for the preparation and the contents of regulatory analyses is set forth in NUREG/BR-0058, "Regulatory Analysis Guidelines of the U.S. Nuclear Regulatory Commission." Revision 3 of NUREG/BR-0058 (NRC 2000), which was in place at the time the NMC ER was submitted, specifies the use of a 7 percent real discount rate in the base case, and the use of a 3 percent real discount rate for sensitivity purposes. Revision 4 of NUREG/BR-0058 (NRC 2004) was issued after NMC submitted the ER, and states that two sets of base case estimates should be developed; one at 3 percent and one at 7 percent. Since this revision was released after NMC completed and submitted its analysis, the results for a 3 percent discount rate are not specifically reported in this report. However, NMC did provide the 3 percent results as part of its sensitivity analysis of SAMAs.

Long-term replacement power costs (RPC) were calculated using the following formula:

RPC = Annual CDF reduction
x present value of replacement power for a single event
x factor to account for remaining service years for which replacement power is required
x reactor power scaling factor

NMC based its calculations on the value of 564 MW(e). Therefore, NMC applied a power scaling factor of 564 MW(e)/910 MW(e) to determine the replacement power costs. NMC calculated an RPC of approximately $176,000 for the 20-year license renewal period, which assumes all severe accidents are eliminated.

NMC calculated an AOSC of approximately $592,000 for the 20-year license renewal period, which assumes all severe accidents are eliminated.

Using the above equations, NMC estimated the total present dollar value equivalent associated with completely eliminating all severe accidents at PBNP to be about $651,000[a].

<u>NMC's Results</u>

Total benefits associated with each of the 65 SAMAs were evaluated by NMC. These values were determined based on the above equations for the various averted costs, together with the estimated annual reductions in CDF and population dose for each SAMA. In order to account for the contribution of external events, NMC doubled these benefits. As a result, all SAMAs that were evaluated were eliminated because the cost was expected to exceed the estimated benefit. The cost-benefit results for the individual analysis of the 65 SAMA candidates are presented in Table G-4 and include the doubling to account for external events. If the calculated cost of implementation of the SAMA is greater than the calculated benefit, the SAMA would not be considered cost-beneficial.

Based on these results, NMC identified no cost-beneficial SAMAs.

(a) A total present dollar value equivalent of $673,000 is reported in the ER. Based on corrections to the annual population dose and annual offsite economic risk described in an RAI response, the corrected total present dollar value equivalent associated with eliminating all severe accidents is approximately $651,000. The change is insignificant to the results of the SAMA analysis.

Table G-4. SAMA Cost/Benefit Screening Analysis

| | SAMA | Assumptions | Percent Risk Reduction: CDF | Percent Risk Reduction: Population Dose | Total Benefit[1] ($) | Estimated Cost ($) |
|---|---|---|---|---|---|---|
| 4. | Install tornado protection on gas turbine generator to reduce tornado-induced SBO. | Eliminated tornado-induced LOSP. | 14 | 1 | $181,200 | >$500,000[2] |
| 32. | Install MG set trip breakers in control room to reduce anticipated transient without scram (ATWS) CDF. | Eliminated all ATWS events. | 2 | 0 | $29,000 | >$100,000 |
| 45. | Procedural guidance for use of cross-tied CCW or service water (SW) pumps. Reduces the frequency of loss of either system. | Eliminated all small LOCA events, including reactor coolant pump (RCP) seal LOCA. | 1 | 0 | $13,000 | >$30,000 |
| 47. | Provide self-cooled emergency core cooling system (ECCS) seals. Reduces failure frequency of ECCS pumps currently cooled by CCW. | Eliminated the cooling requirement for ECCS pump seals. | < 1 | 0 | $0 | >> benefit |
| 48. | Provide centrifugal charging pump. Current charging pumps are positive displacement pumps. | Eliminated the common cause failure of the charging pumps. | < 1 | 0 | $300 | >$500,000 |
| 50. | Install a containment vent large enough to remove ATWS decay heat. Assuming injection is available, reduces likelihood of decay heat removal failure in ATWS. | Eliminated all ATWS events. | 2 | 0 | $29,000 | >$5,000,000 |
| 52. | Add redundant and diverse limit switch to each containment isolation valve. Enhances isolation valve position indication, reducing frequency of containment isolation failure and ISLOCAS. | Eliminated all isolation failures. | < 1 | 0 | $200 | >$50,000 per valve |
| 53. | Self-actuating containment isolation valves. Reduces likelihood of isolation failure. | Eliminated all isolation failures. | < 1 | 0 | $200 | >$100,000 |
| 54. | Provide containment isolation design per General Design Criteria and Standard Review Plan. Reduces likelihood of isolation failure. | Eliminated all isolation failures. | < 1 | 0 | $200 | >$100,000 |
| 55. | Add penetration valve leakage control system. Enhance capability to detect/control leakage from penetration valves. | Eliminated all isolation failures. | < 1 | 0 | $200 | >$100,000 |

| | SAMA | Assumptions | Percent Risk Reduction | | Total Benefit[1] ($) | Estimated Cost ($) |
|---|---|---|---|---|---|---|
| | | | CDF | Population Dose | | |
| 62. | Provide additional DC battery capability during SBO, reducing frequencies of long term SBO sequences. | Eliminated all station blackout events. | 1 | 0 | $15,100 | $75,000[2] |
| 63. | Use fuel cells instead of lead-acid batteries to extend DC power availability in SBO. | Eliminated all LOSP events. | 14 | 1 | $181,200 | >$1,000,000 |
| 66. | Replace batteries to improve DC power reliability. | Eliminated all LOSP events. | 14 | 1 | $181,200 | >$500,000 |
| 71. | Install a filtered containment vent to remove decay heat. | Not evaluated due to high cost. | Not evaluated | Not evaluated | Not evaluated | >$20,000,000 |
| 72. | Install an unfiltered hardened containment vent. | Not evaluated due to high cost. | Not evaluated | Not evaluated | Not evaluated | >$5,000,000 |
| 77. | Prevent tornado damage to RWST. | Not evaluated due to extremely small initiating event frequency. | Not evaluated | Not evaluated | Not evaluated | >$1,000,000 |
| 78. | Protection for tanks or switchgear in Turbine Building from tornados. | Not evaluated due to extremely small initiating event frequency. | Not evaluated | Not evaluated | Not evaluated | >$1,000,000 |
| 89. | Upgrade feedwater digital control to reduce likelihood of main feedwater (MFW) loss following plant trip. | Eliminated all transients with loss of power conversion system. | 4 | 0 | $52,300 | >$250,000 |
| 93. | Provide Auxiliary building Vent/Seal structure to enhance building ventilation. | Eliminated all ISLOCA events. | < 1 | 0 | $13,600 | >$100,000[2] |
| 96. | Install pressure or leak monitoring instruments between first two pressure isolation valves on low-pressure injection, residual heat removal (RHR) suction, and high pressure injection lines to reduce ISLOCA frequency. | Eliminated all ISLOCA events. | < 1 | 0 | $13,600 | >50,000 per line |
| 97. | Increase frequency of valve leak testing to decrease ISLOCA frequency. | Eliminated all ISLOCA events. | < 1 | 0 | $13,600 | >$100,000 |
| 98. | Improve operator training on ISLOCA coping to decrease ISLOCA impact. | Eliminated all ISLOCA events. | < 1 | 0 | $13,600 | >$25,000[2] |
| 100. | Revise emergency operating procedures (EOPs) to improve ISLOCA identification to ensures LOCA outside containment would be observed. | Eliminated all ISLOCA events. | < 1 | 0 | $13,600 | >$15,000[2] |

| | SAMA | Assumptions | Percent Risk Reduction: CDF | Percent Risk Reduction: Population Dose | Total Benefit[1] ($) | Estimated Cost ($) |
|---|---|---|---|---|---|---|
| 101. | Ensure all ISLOCA releases are scrubbed (e.g., plug drains in the break area so the breakpoint would cover with water). | Eliminated all ISLOCA events. | < 1 | 0 | $13,600 | >$100,000 |
| 102. | Secondary side guard pipes up to main steam isolation valves (MSIVs) to prevents secondary side depressurization should a steam line break occur upstream of the MSIVs. Would also guard against or prevent consequential multiple SGTRs following a main steam line break. | Eliminated all steam line break events. | 13 | 1 | $170,800 | >$1,000,000 |
| 103. | Upgrade large break LOCA instrumentation to identify symptoms/precursors (leak before break) to reduce likelihood of large break LOCA. | Eliminated all large break LOCA events. | < 1 | 0 | $4,800 | >$100,000 |
| 108. | Improve SGTR coping abilities by improving instrumentation to detect SGTR, or additional systems to scrub fission product releases to reduce consequences of SGTR. | Eliminated all SGTR events. | 29 | 79 | $565,000 | >>benefit |
| 119. | Independent reactor coolant pump (RCP) seal injection with dedicated diesel adds redundancy to RCP seal cooling, reducing CDF from loss of CCW, SW, or SBO. | Eliminated small LOCA events, including RCP seal LOCA. | 1 | 0 | $13,000 | >$500,000[2] |
| 126. | Automatic switchover to recirculation on RWST depletion. | Eliminated human error of failure to switchover to recirculation on RWST depletion. | 30 | 48 | $531,400 | >$2,400,000 per unit[3] |
| 127. | Improve RHR sump reliability by eliminating debris in sump as common mode failure. | Eliminated failure due to sump clogging. | < 1 | 0 | $1,100 | >$100,000 |
| 130. | Upgrade chemical and volume control system to decrease CDF due to small LOCAs. | Eliminated small LOCA events, including RCP seal LOCA. | 1 | 0 | $13,000 | >$1,000,000 |
| 137. | Install additional high pressure injection pump with independent diesel. | Perfectly reliable safety injection pumps. | < 1 | 0 | $4,100 | >$500,000[2] |

| | SAMA | Assumptions | Percent Risk Reduction | | Total Benefit[1] ($) | Estimated Cost ($) |
|---|---|---|---|---|---|---|
| | | | CDF | Population Dose | | |
| 138. | Install independent AC high pressure injection system to provide make-up and feed and bleed capabilities during SBO. | Perfectly reliable safety injection pumps. | < 1 | 0 | $4,100 | >500,000[2] |
| 140. | Prevent charging pump flow diversion from the relief valves to reduce frequency of loss of RCP cooling. | Eliminated small LOCA events, including RCP seal LOCA. | 1 | 0 | $13,000 | >$50,000 |
| 142. | Use firewater pumps as a backup seal injection and high-pressure makeup to reduce RCP seal LOCA frequency and SBO core damage frequency. | Eliminated small LOCA events, including RCP seal LOCA. | 1 | 0 | $13,000 | >$500,000[1] |
| 148. | Install nitrogen bottles as backup gas supply for safety relief valves (SRVs) to extend operation of SRVs during SBO. | Removed the air supply dependency to the power operated relief valves. | < 1 | 0 | $0 | >$50,000[2] |
| 149. | Install redundant spray system to depressurize primary system during SGTR to enhanced depressurization ability during SGTR. | Eliminated all human errors related to depressurization. | 17 | 52 | $305,800 | >$1,000,000 |
| 150. | Create/enhance reactor coolant system (RCS) depressurization ability. Low RCS pressure alleviates some concerns about high-pressure melt ejection. | Eliminated all human errors related to depressurization. | 17 | 52 | $305,800 | >$1,000,000 |
| 151. | Make procedural changes only for the RCS depressurization option to reduce RCS pressure without cost of new system. | Eliminated all human errors related to depressurization. | 17 | 52 | $305,800 | No relevant HEP improvement found.[4] |
| 153. | Relief valve system to prevent equipment damage from pressure spike during ATWS. | Eliminated all ATWS events. | 2 | 0 | $29,000 | >$1,000,000 |
| 154. | Consider other SGTR features:<br>a. Highly reliable (closed loop) steam generator shell-side heat removal system<br>b. System that returns the discharge from steam generator relief back to the primary containment<br>c. Increased pressure capability on the steam generator shell-side corresponding increase in safety valve setpoints. | Eliminated all SGTR events. | 29 | 79 | $565,000 | >$10,000,000 |

| | SAMA | Assumptions | Percent Risk Reduction: CDF | Percent Risk Reduction: Population Dose | Total Benefit[1] ($) | Estimated Cost ($) |
|---|---|---|---|---|---|---|
| 155. | Increase secondary side pressure capacity such that a SGTR would not cause relief valves to lift eliminating pathway to release from SGTR. | Eliminated all SGTR events. | 29 | 79 | $565,000 | >$100,000,000 |
| 157. | Revise maintenance practice to inspect 100 percent of tubes in steam generator to reduce frequency of SGTR. | Eliminated all SGTR events. | 29 | 70 | $565,000 | $5,000,000[6] |
| 158. | Create passive secondary side coolers that passively removes heat. Would reduce CDF from loss of feedwater. | Not evaluated as design and installation at an existing plant is not feasible. | Not evaluated | Not evaluated | Not evaluated | Not evaluated |
| 165. | Perform surveillance on manual valves used for backup AFW pump suction (firewater system). | Eliminated failure of firewater valves to open. | < 1 | 0 | $0 | >$10,000 |
| 166. | Either replace old CST with larger tank, or install a backup to increase AFW system reliability. | Not evaluated due to excessive cost. | Not evaluated | Not evaluated | Not evaluated | >$500,000[2] |
| 169. | Provide portable generators to be hooked up to turbine driven AFW after battery depletion. | Removed the dependency of AFW on DC power. | 8 | 0 | $98,400 | >$100,000[2] |
| 176. | Replace reactor vessel with stronger vessel. | Not evaluated due to excessive cost of implementing on existing plant. | Not evaluated | Not evaluated | Not evaluated | Not evaluated. |
| 177. | Provide additional SW pump to reduce likelihood of SW system failure. | Eliminated all SW pump failures. | < 1 | 0 | $6,600 | >$2,500,000[2] |
| 180. | Provide automatic re-powering of battery chargers following a loss of offsite power event. | Always successful reloading battery chargers. | 9 | 1 | $120,400 | >$200,000 |
| 181. | Provide procedural improvements and training to improve operator performance for feed and bleed cooling without safety injection (SI). | Reduced operator error likelihood in related scenarios by a factor of 3. | 8 | 0 | $102, 500 | Not evaluated: Procedure step mark-off implemented after PRA 3.02 and considered adequate. |
| 184. | Provide procedural improvements and training to improve operator performance for manually controlling AFW after loss of instrument air. | Reduced operator error likelihood in related scenarios by a factor of 3. | 2 | 0 | $23,100 | >$15,000[2] Implementation same as 181 |

| | SAMA | Assumptions | Percent Risk Reduction: CDF | Percent Risk Reduction: Population Dose | Total Benefit[1] ($) | Estimated Cost ($) |
|---|---|---|---|---|---|---|
| 185. | Provide procedural improvements and training to improve operator performance for providing alternate water source for AFW following low CST level. | Reduced operator error likelihood in related scenarios by a factor of 3. | 13 | 7 | $178,500 | >$15,000[2] Implementation same as 181 |
| 186. | Provide procedural improvements and training to improve operator performance for manually starting gas turbine generator. | Reduced operator error likelihood in related scenarios by a factor of 3. | 2 | 0 | $22,500 | >$15,000[2] Implementation same as 181 |
| 187. | Provide procedural improvements and training to improve operator performance for opening valve for RWST charging. | Reduced operator error likelihood in related scenarios by a factor of 3. | 7 | 0 | $82,900 | >$15,000[2] Implementation same as 181 |
| 188. | Provide procedural improvements and training to improve operator performance for the task of diagnosing SGTR | Reduced operator error likelihood in related scenarios by a factor of 3. | 2 | 2 | $36,900 | >$15,000[2] Implementation same as 181 |
| 189. | Provide procedural improvements and training to improve operator performance for feed and bleed cooling with SI | Reduced operator error likelihood in related scenarios by a factor of 3. | 2 | 0 | $25,500 | >$15,000[2] Implementation same as 181 |
| 190. | Provide procedural improvements and training to improve operator performance for isolating service water header. | Reduced operator error likelihood in related scenarios by a factor of 3. | 2 | 0 | $19,200 | Not determined. Implementation same as 181 |
| 191. | Provide procedural improvements and training to improve operator performance for opening instrument air valves to containment. This item and #193 are an action/recovery pair | Reduced operator error likelihood in related scenarios by a factor of 3. | 1 | 5 | $23,100 | >$15,000[2] Implementation same as 181 |
| 192. | Provide procedural improvements and training to improve operator performance for opening instrument air valves to containment. | Reduced operator error likelihood in related scenarios by a factor of 3. | 1 | 4 | $22,500 | >$15,000[2] Implementation same as 181 |
| 193. | Provide procedural improvements and training to improve operator performance for opening SW valve following a SI signal. | Reduced operator error likelihood in related scenarios by a factor of 3. | 2 | 7 | $26,500 | >$15,000[2] Implementation same as 181 |
| 195. | Improve running reliability of motor driven AFW pumps. | Motor driven AFW pumps perfect while running. | 2 | 7 | $159,700 | >$500,000[2] |

| | SAMA | Assumptions | Percent Risk Reduction | | Total Benefit[1] ($) | Estimated Cost ($) |
|---|---|---|---|---|---|---|
| | | | CDF | Population Dose | | |
| 196. | Reduce likelihood of RHR full flow test lines being left open. | Reduce operator error likelihood by a factor of 3 in related scenarios. | 4 | 4 | $49,900 | Not evaluated[5]. |
| 197. | Improve reliability of check valve in AFW recirculation line to CSTs. | Check valve failure probability equal to zero. | 1 | 1 | $18,300 | >$11,000[2] Implemented by removal of check valve internals. |
| 199. | Improve reliability of power supply to Bus 1B03 | Bus is perfectly reliable. | 4 | 0 | $49,400 | >$300,000. |

Table Notes:

1. Benefit values are based on NMC's estimated benefits and include a factor of 2 multiplier to account for additional benefits in external events.
2. Cost reported in ER has been reduced by a factor of two to account for shared cost between Unit 1 and Unit 2, per NMC response to an RAI (NMC 2004b).
3. Revised value provided by an RAI response (NMC 2004c).
4. Procedure step mark-offs have been implemented. NMC was not able to identify any further improvement that would substantially reduce the HEP for this accident.
5. The probability for this pre-initiator human error used in PRA Revision 3.02 was a screening value of $1\times10^{-3}$. Because there were actually two valves in series in these lines that are both independently verified and locked closed, both would need to be left open for this event to become important. A more correct value of $6.4\times10^{-6}$ essentially eliminates this event from further consideration.
6. Value based on an estimated cost of $500,000 per outage (NMC 2004a) for 10 outages.

## G.6.2 Review of NMC's Cost-Benefit Evaluation

The cost-benefit analysis performed by NMC was based primarily on NUREG/BR-0184 (NRC 1997b) and was conducted in a manner consistent with this guidance.

In order to account for external events, NMC multiplied each SAMA benefit by two in assessing whether SAMAs were cost-beneficial. Given that the CDF from internal fires, seismic events, and internal flooding as reported by NMC (NMC 2004a) is approximately the same as the CDF for internal events, the staff agrees that the factor of two multiplier was appropriate for NMC's cost-benefit analyses.

Fifteen of the final list of 65 SAMAs have to do with improvements to plant procedures and/or operator training to improve operator performance. Several of these SAMAs appear to be cost-beneficial (or very close to cost-beneficial) in the baseline analysis, specifically, SAMAs 181, 184-193, and 197. One of the factors that contributes to the positive cost-benefit for these SAMAs is the assumption that the implementation costs would be incurred at one unit, but would benefit the second unit at no additional cost. In response to an RAI, NMC indicated that these SAMAs have been implemented at PBNP through the addition of procedure mark-offs (i.e., place-keeping aids) in the associated operating procedures. These changes were implemented subsequent to the PRA revision used in the SAMA analysis (Revision 3.02). The use of such mark-offs improves the overall performance of the operator by maintaining a positive indication of the operator's location in the procedure, eliminating the need for the operator to locate his position by reviewing previously completed steps. In NMC's view, further improvements to procedures or training to address these operator actions are not feasible. NMC notes that these actions are still very important to plant risk and that degradation of operator performance on these actions must be avoided. NMC notes that full automation of each of these actions could further reduce the CDF; however, full automation would significantly increase the cost of implementation and would not be cost-beneficial. The staff agrees that for these operator actions, the potential for further, significant risk reduction through additional procedure and training enhancements is limited due to the implementation of the procedure mark-offs, and that hardware alternatives are not likely to be cost-beneficial.

SAMA 197, improve reliability of check valve in AFW recirculation line to CSTs, also is potentially cost-beneficial in the baseline analysis. In response to an RAI, NMC indicated that this SAMA has effectively been implemented at PBNP. A low-cost approach was taken to eliminate AFW system check valve failures by removing the check valve internals rather than the entire check valve. The staff agrees with NMC that this modification essentially eliminates the risk of these failures.

In response to a staff request, NMC also evaluated several of the SAMAs found to be potentially cost-beneficial in recent SAMA reviews for other plants. Twelve such options were evaluated by NMC, including:

- Developing procedures for providing temporary ventilation to switchgear and diesel generator rooms in events involving loss of room cooling

- Adding a capability to flash the field on the emergency diesel generator to enhance SBO event recovery

- Providing a portable 120 VAC generator with manual clamps to supply power to the steam generator level instrumentation in SBO events

- Developing procedures to extend the time to RWST depletion in SGTR events.

All but two of these alternatives were determined to be either not applicable to PBNP or already implemented at PBNP. The remaining two alternatives (adding a capability to flash the field on the emergency diesel generator to enhance SBO event recovery, and providing a portable 120 VAC generator with manual clamps to supply power to the steam generator level instrumentation in SBO events) were each estimated to have a benefit of approximately $5,000 and an implementation cost of greater than $30,000 for the PBNP site. On the basis of this evaluation, NMC concluded that none of the additional SAMAs would be cost-beneficial for PBNP.

Based on its review of NMC's SAMA evaluation, the staff concluded that two SAMAs could be cost-beneficial when uncertainties, alternative discount rates, or broader implementation options are taken into account. The staff concluded that SAMA 126, automatic switchover to recirculation on RWST depletion, is not cost-beneficial. However, the staff notes that a less extensive modification involving addition of an automatic pump trip on low RWST level could provide much of the risk reduction associated with SAMA 126 at a lower cost; however, there would still be a potential for operator error in performing the actual switchover. Such a modification has been made at some other plants. There would be costs for the engineering, hardware, and training associated with such changes to safety-related systems and components; however, the staff concludes that a revision to SAMA 126 that would include only addition of an automatic pump trip on low RWST level could be cost-beneficial.

For SAMA 169 (provide a portable generator to power the AFW turbine after battery depletion), the benefit is estimated to be $98,400 and the cost is estimated to be greater than $100,000 (which accounts for the fact that the cost is shared between the two PBNP units). Based on cost estimates developed previously for similar modifications at another plant, the staff estimates that the costs associated with providing a portable generator would be approximately

\$100,000 to \$200,000 per unit[a]. Also, the fact that when either uncertainty in the CDF mean (a factor of two between the mean and the 95th percentile) or a lower discount rate are considered, the SAMA could have a positive net value (e.g., a 3 percent discount rate changes the benefit to \$178,000). Therefore, the staff concludes that this SAMA could be cost-beneficial if uncertainties or alternative discount rates were taken into account.

In response to an RAI, NMC considered the uncertainties associated with the internal event CDF and the impact of uncertainties on the SAMA analysis results. Information regarding the uncertainty distribution of the internal events CDF is summarized in Table G-5 (NMC 2004b). The 95th percent confidence level for internal events CDF is approximately 2.0 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 in addition to the factor of two multiplier already included in the baseline benefit estimates to account for external events (NMC 2004a).

**Table G-5.** Uncertainty in the Calculated CDF for PBNP

| Percentile | CDF (per year) |
|---|---|
| 5th | $1.58 \times 10^{-5}$ |
| 50th | $3.09 \times 10^{-5}$ |
| mean | $3.62 \times 10^{-5}$ |
| 95th | $7.21 \times 10^{-5}$ |

Based on information provided in the ER, three additional SAMAs (98, 100, and 180) also appear to be potentially cost-beneficial based on the upper bound benefit. However, in response to an RAI, NMC provided sufficient justification to show that the modeling assumptions used to calculate the benefit for these three SAMAs were extremely conservative, i.e, the SAMAs were assumed to completely eliminate the affected sequences or human errors (NMC 2004b). Further, NMC stated that the HEP for the human error event (SAMA 180) changed from $4.2 \times 10^{-3}$ to $2.1 \times 10^{-3}$ in PRA Revision 3.13, reducing the importance of this SAMA from the original estimates in the ER. The staff concludes that based on more realistic risk reduction estimates, these SAMAs would not be cost-beneficial.

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(a) The cost associated with providing a portable generator to provide power to steam generator level instrumentation was estimated at less than \$100,000 per unit in the SAMA evaluation for another plant. The cost to provide a portable generator for backup power to hydrogen igniters was estimated as \$200,000 per unit as part of the resolution of Generic Safety Issue 189, "Susceptibility of Ice Condenser and Mark III Containments to Early Failure From Hydrogen Combustion During a Severe Accident" (NRC 2002).

NMC also performed a sensitivity analysis that addressed variations in discount rate. The use of a three-percent real discount rate (rather that seven percent used in the baseline) results in an increase in the SAMA benefits of approximately 75 percent. The results of the sensitivity study are bounded by the uncertainty assessment, which considered an increase of a factor of two.

NMC assessed the impact of other factors on the analysis results, such as the use of a plant-specific core fission product inventory and substantially (100 percent) higher offsite doses and economic impacts. 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 impact on the SAMA benefits is small and more than offset by the conservatisms in the risk reduction and cost estimates assumed in the baseline analysis.

The staff concludes that, with the exception of the two SAMAs noted above, the costs of all of the SAMAs assessed would be higher than the associated benefits.

## G.7 Conclusions

NMC compiled a list of 202 SAMA candidates using NRC and industry documents discussing potential plant improvements, and insights from the IPE, IPEEE and current PRA. A qualitative screening removed candidates that (1) were not applicable to PBNP due to design differences or (2) had already been implemented at PBNP. A total of 137 SAMA candidates were eliminated based on these criteria, leaving 65 SAMA candidates for further evaluation.

Using guidance in NUREG/BR-0184 (NRC 1997b), the current PRA model, and a Level 3 analysis developed specifically for SAMA evaluation, a maximum allowable benefit of about $651,000, representing the total present dollar value equivalent associated with completely eliminating severe accidents at PBNP, was derived. For the 65 remaining SAMA candidates, a more detailed assessment and cost estimate were developed. To account for external events, NMC doubled the estimated benefits for internal events before comparing to the cost estimate. NMC concluded in the ER that none of the SAMAs evaluated would be cost-beneficial for PBNP because their implementation costs would exceed their estimated benefits.

The staff reviewed the NMC analysis and concluded that the methods used and the implementation of those methods were sound. The unavailability of a seismic and fire PRA model precluded a detailed quantitative evaluation of SAMAs specifically aimed at reducing risk of these initiators. However, improvements have been realized as a result of the IPEEE process at PBNP that would minimize the likelihood of identifying further cost-beneficial enhancements in these areas. To assess the potential impact of the inclusion of additional benefits in external events, NMC applied a factor of two multiplier to the estimated benefits based on internally-initiated events, and confirmed that none of the SAMAs would become cost-beneficial.

Although none of the SAMAs appear cost-beneficial in the baseline analysis, two SAMAs could become cost-beneficial when uncertainties, alternative discount rates, or broader implementation options are taken into account. These SAMAs involve installing an automatic pump trip on low RWST tank level (a revision to SAMA 126), and providing a portable generator to power the AFW turbine after battery depletion (SAMA 169). Addition of an automatic pump trip on low RWST level could provide much of the risk reduction associated with SAMA 126 at a lower cost; therefore, the staff concludes that this revision to SAMA 126 could be cost-beneficial. Based on the small difference between the cost and benefit of SAMA 169, and considering the uncertainty in the PRA together with the possibility of a lower discount rate (3 percent versus 7 percent, as used in the baseline analysis), the staff concludes that SAMA 169 could be cost-beneficial.

Based on its review of the NMC SAMA analysis, the staff concurs that none of the candidate SAMAs are cost-beneficial, except as noted above. This is based on conservative treatment of cost and benefits. This conclusion is consistent with the low residual level of risk indicated in the PBNP PRA and the fact that PBNP has already implemented all of the plant improvements identified from the IPE and IPEEE process. The staff did conclude that SAMAs 126 (revised) and 169 could be cost-beneficial when uncertainties, alternative discount rates, or broader implementation options are taken into account. However, these SAMAs do not relate to adequately managing the effects of aging during the period of extended operation. Therefore, they need not be implemented as part of license renewal pursuant to 10 CFR Part 54.

## G.8 References

Wisconsin Electric Power Company (WEPCO). 1993. Letter from Bob Link, to Document Control Desk, Subject: Generic Letter 88-20 (TAC NOS. 74452 and 74453) "Summary Report on Individual Plant Examination for Severe Accident Vulnerabilities, Point Beach Nuclear Plant, Units 1 and 2", dated June 30, 1993.

Wisconsin Electric Power Company (WEPCO). 1995. Letter from Bob Link, to Document Control Desk, Subject: Generic Letter 88-20 (TAC NOS. 74452 and 74453) "Summary Report Examination of External Events for Severe Accident Vulnerabilities Point Beach Nuclear Plant, Units 1 and 2", June 30, 1995.

Nuclear Management Company, LLC. (NMC). 2004a. *Point Beach Nuclear Plant Operating License Renewal Application Environmental Report.* Two Rivers, Wisconsin.

Nuclear Management Company, LLC (NMC). 2004b. *Response to Request for Additional Information Regarding the Point Beach Nuclear Plant License Renewal Application (TAC Nos. MC2099 and MC2100),* Two Rivers, Wisconsin. August 31, 2004.

Nuclear Management Company, LLC (NMC). 2004c. *Follow-up Response to Request for Additional Information Regarding the Point Beach Nuclear Plant License Renewal Application (TAC Nos. MC2099 and MC2100),* Two Rivers, Wisconsin. November 22, 2004.

Chanin, D. I., et al, 1997. *Code Manual for MACCS2: Volume 1, User's Guide,* Sandia National Laboratory, SAND97-054, March 1997.

U.S. Department of Agriculture (USDA). 1998. 1997 Census of Agriculture, national Agriculture Statistics Service, 1998., Available online at: http://www.nass.usda.gov/census97/volume1/vol1pubs.htm.

U.S. Nuclear Regulatory Commission (NRC). 1990. NUREG/CR-5575, *Quantitative Analysis of Potential Performance Improvements for the Dry PWR Containment*, Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 1991. NUREG/CR-5630, *PWR Dry Containment Parametric Studies*, Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 1995. "Review of Individual Plant Examination Submittal for Internal Events - Point Beach Nuclear Plant, Units 1 and 2," (TAC Nos. M74452 and M74453)," Washington, D.C., January 26, 1995.

U.S. Nuclear Regulatory Commission (NRC). 1997a. NUREG/CR-6525, *SECPOP90: Sector Population, Land Fraction, and Economic Estimation Program*, Washington, D.C.

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

U.S. Nuclear Regulatory Commission (NRC). 1999. "Point Beach Nuclear Plant, Units 1 and 2 Review of Individual Plant Examination of External Events (IPEEE) Submittal (TAC Nos. M83661 and M83662)," Washington, D.C., September 15, 1999.

U.S. Nuclear Regulatory Commission (NRC). 2000. NUREG/BR-0058, *Regulatory Analysis Guidelines of the U.S. Nuclear Regulatory Commission, Revision 3*, Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 2002. Memorandum from Ashok C. Thadani, RES, to Samuel J. Collins, NRR, Subject: RES Proposed Recommendations for Resolving Generic Safety issue 189: "Susceptibility of Ice Condenser and Mark III Containments to Early Failure from Hydrogen Combustion During a Severe Accident," Washington, D.C., December 17, 2002.

U.S. Nuclear Regulatory Commission (NRC). 2004a. Letter from Stacey Imboden, NRC, to Dennis L. Koehl, NMC, Subject: Request for Additional Information (RAI) Regarding Severe Accident Mitigation Alternatives for Point Beach Nuclear Plant, Units 1 and 2, (TAC NOS. MC2049 and MC2050), Washington, D.C., July 2, 2004.

U.S. Nuclear Regulatory Commission (NRC). 2004b. Letter from Stacey Imboden, NRC, to Dennis L. Koehl, NMC, Subject: Request for Additional Information (RAI) Regarding Severe Accident Mitigation Alternatives for Point Beach Nuclear Plant, Units 1 and 2, (TAC NOS. MC2049 and MC2050), Washington, D.C., October 20, 2004.

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

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11. ABSTRACT *(200 words or less)*


This draft supplemental environmental impact statement (SEIS) has been prepared in response to an application submitted to the NRC by the Nuclear Management Company, LLC (NMC) to renew the OLs for Point Beach Nuclear Plant, Units 1 and 2 (PBNP) for an additional 20 years under 10 CFR Part 54. This draft SEIS includes the NRC staff's analysis that considers and weighs the environmental impacts of the proposed action, the environmental impacts of alternatives to the proposed action, and mitigation measures available for reducing or avoiding adverse impacts. It also includes the staff's preliminary recommendation regarding the proposed action.

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


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