

Appendix B

Contributors to the Supplement

Appendix B

Contributors to the Supplement

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

Name	Affiliation	Function or Expertise
NUCLEAR REGULATORY COMMISSION		
Bo Pham	Nuclear Reactor Regulation	Project Manager
Robert Schaaf	Nuclear Reactor Regulation	Project Manager
William Dam	Nuclear Reactor Regulation	Project Manager
Harriet Nash	Nuclear Reactor Regulation	Aquatic Ecology, Terrestrial Ecology
Leslie Fields	Nuclear Reactor Regulation	Cultural Resources
Jennifer A. Davis	Nuclear Reactor Regulation	Cultural Resources
Richard Emch	Nuclear Reactor Regulation	Health Physics
Alicia Williamson	Nuclear Reactor Regulation	Hydrology, Air Quality, Meteorology
Cristina Guerrero	Nuclear Reactor Regulation	Land Use, Socioeconomics
ARGONNE NATIONAL LABORATORY^(a)		
David Miller		Team Leader
Ellen Moret		Administrative Assistant
Michael Lazaro		Air Quality, Meteorology
Konstance Wescott		Alternatives, Cultural Resources
William Vinikour		Aquatic Ecology
Halil Avci		Health Physics
John Quinn		Hydrology
Timothy Allison		Land Use, Socioeconomics
Patricia Hollopeter		Technical Editor
Kirk LaGory		Terrestrial Ecology
LAWRENCE LIVERMORE NATIONAL LABORATORY^(b)		
Carol Kielusiak		Cultural Resources
<p>(a) Argonne National Laboratory is operated for the U.S. Department of Energy by the University of Chicago.</p> <p>(b) Lawrence Livermore National Laboratory is operated for the U.S. Department of Energy by the University of California.</p>		

Appendix C

Chronology of NRC Staff Environmental Review Correspondence Related to the Nuclear Management Company, LLC Application for License Renewal of Palisades Nuclear Plant

Appendix C

Chronology of NRC Staff Environmental Review Correspondence Related to the Nuclear Management Company, LLC Application for License Renewal of Palisades Nuclear Plant

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 Part 51 of Title 10 of the *Code of Federal Regulations* (10 CFR Part 51), of NMC's application for renewal of the Palisades Nuclear Plant operating license. All documents, with the exception of those containing proprietary information, have been placed in the Commission's Public Document Room, at One White Flint North, 11555 Rockville Pike (first floor), Rockville, Maryland, and are available electronically from the Public Electronic Reading Room found on the Internet at the following web address: <http://www.nrc.gov/reading-rm.html>. From this site, the public can gain access to the NRC's Agencywide Document Access and Management System (ADAMS), which provides text and image files of NRC's public documents in the Publicly Available Records (PARS) component of ADAMS. The ADAMS accession numbers for each document are included below.

March 22, 2005	Palisades, Applicant's Environmental Report – Operating License Renewal Stage (Accession No. ML050940449)
March 22, 2005	Letter from NMC to NRC, forwarding the application for renewal of the operating license for Palisades Nuclear Plant, requesting extension of operating license for an additional 20 years (Accession No. ML050940434)
April 6, 2005	Letter from NRC to NMC, "Receipt and Availability of the License Renewal Application for the Palisades Nuclear Plant" (Accession No. ML050960344)
April 7, 2005	E-mail from Britta Johnson, NMC, regarding U.S. Fish and Wildlife Service (FWS) correspondence (Accession No. ML051430125)
April 7, 2005	E-mail from Britta Johnson, NMC, regarding State of Michigan Department of History, Arts, and Libraries (Accession No. ML051430130)

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- April 8, 2005 Letter from NRC to Ms. Lois Bemis, South Haven Memorial Library, regarding Maintenance of Reference Material at the South Haven Memorial Library at the Palisades Nuclear Plant, License Renewal Application (Accession No. ML051100210)
- April 12, 2005 *Federal Register* Notice of Receipt and Availability Regarding the Renewal of Facility Operating License No. DPR-20 for an Additional 20-Year Period (70 FR 19104)
- April 26, 2005 Letter from the Honorable Fred Upton, United States House of Representatives, to NRC offering support for Palisades Nuclear Plant license renewal (Accession No. ML051220248)
- June 2, 2005 Letter from NRC to NMC transmitting, Determination of Acceptability and Sufficiency for Docketing, Proposed Review Schedule, and Opportunity for a Hearing Regarding the Application from Nuclear Management Company, LLC for Renewal of the Operating License for the Palisades Nuclear Plant (Accession No. ML051530122)
- June 8, 2005 *Federal Register* Notice of Acceptance for Docketing of the Application and Notice of Opportunity for Hearing Regarding the Renewal of Facility Operating License No. DPR-20 for an Additional 20-Year Period (70 FR 33533)
- June 20, 2005 Letter from NRC to NMC, forwarding *Federal Register* Notice of Intent to Prepare an Environmental Impact Statement and Conduct Scoping Process for License Renewal for the Palisades Nuclear Plant (Accession No. ML051710509)
- June 27, 2005 Submittal from Kevin Kamps, providing comments regarding Palisades Nuclear Plant license renewal application (Accession No. ML052420502)
- June 30, 2005 Letter from NRC to Mr. Craig Czarnecki, FWS, Michigan Field Office, "Request for List of Protected Species Within the Area Under Evaluation for the Palisades Nuclear Plant License Renewal" (Accession No. ML051820473)
- June 30, 2005 Letter from NRC to Mr. Brian Conway, Michigan State Historic Preservation Office (SHPO), "Palisades Nuclear Plant License Renewal Review" (Accession No. ML051860359)

June 30, 2005 Letter from NRC to Mr. Don Klima, Director, Office of Federal Agency Programs, Advisory Council on Historic Preservation, "Palisades Nuclear Plant License Renewal Review" (Accession No. ML051870009)

June 30, 2005 Letter from NRC to Mr. Gary L. Randall, Clerk of House, Michigan House of Representatives, "Acknowledgment of Receipt of Your Letter on the Applications for Renewal of the Operating Licenses for Palisades Nuclear Plant and Donald C. Cook, Units 1 and 2, Nuclear Plant" (Accession No. ML051820578)

July 7, 2005 Letter to Mr. Daniel J. Malone, Site Vice President, Palisades Nuclear Plant, from the NRC, "Project Manager Change for the License Renewal Environmental Review for Palisades Nuclear Plant" (Accession No. ML051890081)

July 8, 2005 NRC meeting notice announcing public meeting in South Haven, Michigan, on October 18, 2005, to discuss the environmental scoping process for the application for the license renewal of Palisades (Accession No. ML051920383)

July 13, 2005 Letter from NRC to the Honorable John A. Barrett, Chairperson, Citizen Potawatomi Nation, Oklahoma, "Request for Comments Concerning Palisades Nuclear Plant Application for Operating License Renewal" (Accession No. ML051960002)

July 13, 2005 Letter from NRC to the Honorable Kenneth Meshigaud, Chairperson, Hannahville Indian Community Council, "Request for Comments Concerning Palisades Nuclear Plant Application for Operating License Renewal" (Accession No. ML051950435)

July 13, 2005 Letter from NRC to the Honorable Robert Kewaygoshkum, Chairperson, Grand Traverse Band of Ottawa and Chippewa Indians, "Request for Comments Concerning Palisades Nuclear Plant Application for Operating License Renewal" (Accession No. ML051950495)

July 13, 2005 Letter from NRC to the Honorable Laura Spurr, Chairperson, Nottawaseppi Huron Pottawatomi, "Request for Comments Concerning Palisades Nuclear Plant Application for Operating License Renewal" (Accession No. ML051950614)

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- July 13, 2005 Letter from NRC to the Honorable Lee Sprague, Ogema, Little River Band of Ottawa Indians, "Request for Comments Concerning Palisades Nuclear Plant Application for Operating License Renewal" (Accession No. ML051960069)
- July 13, 2005 Letter from NRC to the Honorable Frank Ettawageshik, President, Little Traverse Bay Bands of Odawa Indians, "Request for Comments Concerning Palisades Nuclear Plant Application for Operating License Renewal" (Accession No. ML051950574)
- July 13, 2005 Letter from NRC to the Honorable David K. Sprague, Chairperson, Match-E-Be-Nash-She-Wish Band of Pottawatomis Indians, "Request for Comments Concerning Palisades Nuclear Plant Application for Operating License Renewal" (Accession No. ML051950602)
- July 13, 2005 Letter from NRC to the Honorable Floyd E. Leonard, Chief, Miami Tribe of Oklahoma, "Request for Comments Concerning Palisades Nuclear Plant Application for Operating License Renewal" (Accession No. ML051960027)
- July 13, 2005 Letter from NRC to the Honorable Charles Todd, Chief, Ottawa Tribe of Oklahoma, "Request for Comments Concerning Palisades Nuclear Plant Application for Operating License Renewal" (Accession No. ML051960011)
- July 13, 2005 Letter from NRC to the Honorable John Miller, Chairperson, Pokagon Band of Potawatomi Indians of Michigan, "Request for Comments Concerning Palisades Nuclear Plant Application for Operating License Renewal" (Accession No. ML051960173)
- July 13, 2005 Letter from NRC to the Honorable Audrey Falcon, Chief, Saginaw Chippewa Indian Tribe of Michigan, "Request for Comments Concerning Palisades Nuclear Plant Application for Operating License Renewal" (Accession No. ML051960103)
- July 15, 2005 Letter from Ms. Tonya Schuitmaker, Michigan House of Representatives, providing comments regarding Palisades Nuclear Plant license renewal application (Accession No. ML052420495)
- July 28, 2005 Submittal from Kenneth Richards, providing comments regarding Palisades Nuclear Plant license renewal application (Accession No. ML052420501)

July 28, 2005 Letter from Nancy Ann Whaley, Supervisor, Geneva Township, providing comments regarding Palisades Nuclear Plant license renewal application (Accession No. ML052420497)

July 29, 2005 Letter to NRC from Mr. Craig Czarnecki, FWS, Michigan Field Office, "Endangered Species List Request, Proposed Palisades Nuclear Plant (Palisades) License Renewal Project, Allegan, Berrien, Kalamazoo, and Van Buren Counties, Michigan" (Accession No. ML052650168)

August 18, 2005 Letter from Wayne Rendell, Supervisor, Covert Township, providing comments regarding Palisades Nuclear Plant license renewal application (Accession No. ML052420503)

August 19, 2005 Letter to NRC from Grant Smith, Cyndi Roper, Michael Keegan, Alice Hirt, James Clift, Chuck Gordon, Maynard Kaufman, David Kraft, Keith Gunter, Kevin Kamps, Mike Shriberg, and Thomas Leonard, "Request for Extension for Comment Period on NRC's Environmental Reviews of the Palisades Nuclear Power Plant" (Accession No. ML052380421)

August 20, 2005 Letter from Swami Tapasanarda, providing comments regarding Palisades Nuclear Plant license renewal application (Accession No. ML052420506)

August 20, 2005 Letter from Kathy Barnes, providing comments regarding Palisades Nuclear Plant license renewal application (Accession No. ML052510393)

August 22, 2005 Letter from Murielle and John Clark, providing comments regarding Palisades Nuclear Plant license renewal application (Accession No. ML052510389)

August 22, 2005 Letter from Kevin Kamps, Nuclear Information and Resource Service, providing comments regarding Palisades Nuclear Plant license renewal application (Accession No. ML052510468)

August 22, 2005 Letter from Gary Karch, providing comments regarding Palisades Nuclear Plant license renewal application (Accession No. ML052510391)

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August 24, 2005	Letter to NMC from NRC, "Request for Additional Information (RAI) Regarding Severe Accident Mitigation Alternatives (SAMAs) for the Palisades Nuclear Plant" (Accession No. ML052370327)
September 7, 2005	Letter from NRC to Mr. Kevin Kamps, Nuclear Information and Resource Service, "Response to Request for Extension of Environmental Scoping Comment Period Regarding the Palisades Nuclear Plant License Renewal" (Accession No. ML052410029)
September 21, 2005	Summary of Public Scoping Meetings to Support Review of Palisades Nuclear Plant License Renewal Application (Accession No. ML052630426)
October 12, 2005	Letter from NRC to Dr. David R. Wade, Director, Michigan Department of Community Health, Division of Environmental & Occupational Epidemiology, "Request for Information on Cancer Incidence Within the Area under Evaluation for the Palisades Nuclear Plant License Renewal" (Accession No. ML052900205)
October 18, 2005	Letter from NMC to NRC, "Palisades Nuclear Plant, Response to Supplemental Questions Concerning Radioactive Solid Waste Management" (Accession No. ML053470428)
November 18, 2005	Letter from NMC to NRC, Supplement to "Response to NRC Request for Additional Information dated August 24, 2005, dated October 21, 2005, and telecon on November 10, 2005A.1" (Accession No. ML053470426)
December 14, 2005	Letter from NRC to Mr. Daniel J. Malone, Site Vice President, Palisades Nuclear Plant, "Issuance of Environmental Scoping Summary Report Associated with the Staff's Review of the Application by Nuclear Management Company, LLC, for Renewal of the Operating License for Palisades Nuclear Plant" (Accession No. ML053490390)
January 24, 2006	E-mail from J. Holthaus, Environmental Project Manager, NMC, Covert, Michigan, to B. Pham, Project Manager, NRC, Rockville, Maryland, with attachments. Subject: "Palisades Cultural Resources Procedures." Attachment 1: "Archaeological, Cultural and Historic Resources," FP-RP-ENV-01; Attachment 2: "Palisades Cultural Resources," LM-330. (Accession No. ML060240597)

February 14, 2006	Letter from NRC to U.S. Environmental Protection Agency, National Environmental Policy Act Compliance Division, "Draft Supplement 27 to the Generic Environmental Impact Statement Regarding License Renewal for Palisades Nuclear Plant" (Accession No. ML060450726)	
February 14, 2006	Letter from NRC to Mr. Daniel J. Malone, Site Vice President, Palisades Nuclear Plant, "Notice of Availability of the Draft Plant-Specific Supplement 27 to the Generic Environmental Impact Statement (GEIS) Regarding License Renewal for Palisades Nuclear Plant" (Accession No. ML060450681)	
May 15, 2006	Letter to NRC from Mr. Michael T. Chezik, U.S. Department of the Interior, providing comments regarding Palisades Nuclear Power Plant license renewal application (Accession No. ML061570025).	
May 22, 2006	Letter to NRC from Mr. Kevin Kamps, Nuclear Information and Resources Service, response to request for comment period extension regarding Palisades Nuclear Plant license renewal review (Accession No. ML061380030).	
May 26, 2006	Letter to NRC from Mr. Kenneth A. Westlake, Chief, U.S. Environmental Protection Agency, NEPA Implementation Section, providing comments regarding Palisades Nuclear Plant license renewal application (Accession No. ML061640114).	
June 19, 2006	Letter to NRC from Ms. Martha MacFarlane Faes, Environmental Review Coordinator, Department of History, Arts, and Libraries, providing comments regarding Palisades Nuclear Plant license renewal application (Accession No. ML061920480).	
September 5, 2006	E-mail from J. Holthaus, Environmental Project Manager, NMC, Covert, Michigan, to B. Pham, Project Manager, NRC, Rockville, Maryland. Subject: "Status of the Federally listed Pitcher's Thistle (<i>Cirsium pitcheri</i>) on the Palisades Nuclear Plant Site" (Accession No. ML062480156).	

Appendix D

Organizations Contacted

Appendix D

Organizations Contacted

During the course of the U.S. Nuclear Regulatory Commission staff's independent review of environmental impacts from operations during the renewal term, the following Federal, State, regional, local, and Native American Tribal agencies were contacted:

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

Citizen Potawatomi Nation, Shawnee, Oklahoma.

City of South Haven Water Filtration Plant.

Covert Township, Covert, Michigan.

Grand Traverse Band of Ottawa and Chippewa Indians, Suttons Bay, Michigan.

Hannahville Indian Community Council, Wilson, Michigan.

Little River Band of Ottawa Indians, Manistee, Michigan.

Little Traverse Bay Bands of Odawa Indians, Harbor Springs, Michigan.

Match-E-Be-Nash-She-Wish Band of Potawatomi Indians, Dorr, Michigan.

Miami Tribe of Oklahoma, Miami, Oklahoma.

Michigan Department of Community Health, Lansing, Michigan.

Michigan Department of Environmental Quality, Kalamazoo, Michigan.

Michigan Department of Environmental Quality, Lansing, Michigan.

Michigan Economic Development Corporation, Lansing, Michigan.

Michigan State Historic Preservation Office, Lansing, Michigan.

Nottawaseppi Huron Potawatomi, Fulton, Michigan.

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Ottawa Tribe of Oklahoma, Miami, Oklahoma.

Pokagon Band of Potawatomi Indians of Michigan, Dowagiac, Michigan.

Saginaw Chippewa Indian Tribe of Michigan, Mt. Pleasant, Michigan.

U.S. Fish and Wildlife Service, East Lansing, Michigan.

Van Buren-Cass Counties Health Department.

Appendix E

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

Appendix E

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

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

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

Table E-1. Consultation Correspondence

Source	Recipient	Date of Letter
U.S. Nuclear Regulatory Commission (P.T. Kuo)	Michigan State Historic Preservation Office (B. Conway)	June 30, 2005
U.S. Nuclear Regulatory Commission (P.T. Kuo)	U.S. Fish and Wildlife Service (C. Czarnecki)	June 30, 2005
U.S. Nuclear Regulatory Commission (P.T. Kuo)	Advisory Council on Historic Preservation (D. Klima)	June 30, 2005
U.S. Nuclear Regulatory Commission (P.T. Kuo)	Citizen Potawatomi Nation (J. Barrett)	July 13, 2005 ^(a)
U.S. Fish and Wildlife Service (C. Czarnecki)	U.S. Nuclear Regulatory Commission (P. T. Kuo)	July 29, 2005
U.S. Department of the Interior (M. Chezik)	U.S. Nuclear Regulatory Commission	May 15, 2006
U.S. Environmental Protection Agency (K.A. Westlake)	U.S. Nuclear Regulatory Commission	May 26, 2006
Michigan State Historic Preservation Office (M.M. Faes)	U.S. Nuclear Regulatory Commission (B. Pham)	June 19, 2006

(a) Similar letters were sent to 10 additional Native American Tribes listed in Appendix C.

Table E-2. Federal, State, Local, and Regional Licenses, Permits, Consultations, and Other Approvals for the Palisades Nuclear Plant

Agency	Authority	Description	Number	Issue Date	Expiration Date	Remarks
NRC	10 CFR Part 50	Operating license, Palisades Nuclear Plant	DPR-20	03/24/71	03/24/11	Authorizes operation of Palisades Nuclear Plant
FWS	Section 7 of the Endangered Species Act (16 USC 1536)	Consultation	-	-	-	Requires a Federal agency to consult with the FWS regarding whether a proposed action will affect endangered or threatened species
MDEQ	Clean Water Act, Section 402 (33 USC Section 1251 et seq.), Michigan Act 451. Public Acts of 1994, as amended, Parts 31 and 41, et. al.; Michigan Executive Orders 1991-31, 1995-4, and 1995-18.	NPDES permit	M10001457	09/23/04	10/01/08	Discharge of wastewater and stormwater to Lake Michigan
MDEQ	Clean Air Act (42 USC 7401, et seq.); Michigan Act 451, Public Acts of 1994 (as amended), Part 55	Renewable Operating Permit (Air Quality)	200200005	02/04/03	02/04/08	Operation of Palisades air emission sources (evaporator heating boiler, plant heating boiler, feedwater purity boiler, emergency generators, cold cleaners).

Table E-2. (contd)

Agency	Authority	Description	Number	Issue Date	Expiration Date	Remarks
MDEQ	Michigan Act 207. Public Acts of 1941, as amended, Section 5; Michigan Executive Order 1998-2	Aboveground Storage Tank Registration	Facility No. 91084220 (Diesel Tanks No. 1)	Annual	Annual	Storage of flammable or combustible liquid (diesel fuel) in aboveground storage tanks
SCDHEC	South Carolina Radioactive Waste Transportation and Disposal Act (Act No. 429 of 1980.)	Radioactive Waste License for Delivery	0006-21-06	01/09/06	12/31/06 Renewed Annually	Shipment of radioactive material to a licensed disposal/processing facility within the State of South Carolina
TDEC	Tennessee Code Annotated 68-202-206	Radioactive Waste License for Delivery	T-M 1003-L06	01/01/06	12/31/06	Shipment of radioactive material to a licensed disposal/processing facility within the State of Tennessee
– = A consultation is not given an identifying number and does not have an issue or expiration date. CFR = Code of Federal Regulations FWS = U.S. Fish and Wildlife Service MDEQ = Michigan Department of Environmental Quality NPDES = National Pollutant Discharge Elimination System NRC = U.S. Nuclear Regulatory Commission SCDHEC = South Carolina Department of Health and Environmental Control TDEC = Tennessee Department of Environment and Conservation USC = United States Code						

Appendix E



UNITED STATES
NUCLEAR REGULATORY COMMISSION

WASHINGTON, D.C. 20555-0001

June 30, 2005

Mr. Brian Conway
Michigan State Historic Preservation Office
Michigan Historical Center
PO Box 30740
717 West Allegan Street
Lansing, MI 48909

SUBJECT: PALISADES NUCLEAR PLANT LICENSE RENEWAL REVIEW

Dear Mr. Conway:

The U.S. Nuclear Regulatory Commission (NRC) staff is reviewing an application to renew the operating license for Palisades Nuclear Plant (Palisades), which is located in Covert Township on the western side of Van Buren County, Michigan. Palisades is operated by Nuclear Management Company, LLC (NMC). The application for renewal was submitted by NMC on March 31, 2005, pursuant to Title 10 of the *Code of Federal Regulations* Part 54 (10 CFR Part 54). The NRC has established that, as part of the staff review of any nuclear power plant license renewal action, a site-specific Supplemental Environmental Impact Statement (SEIS) to its "Generic Environmental Impact Statement for License Renewal of Nuclear Plants" (GEIS), NUREG-1437, will be prepared under the provisions of 10 CFR Part 51, the NRC rules that implement the National Environmental Policy Act of 1969 (NEPA). In accordance with 36 CFR 800.8, the SEIS will include analyses of potential impacts to historic and cultural resources.

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

B. Conway

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On July 28, 2005, the NRC will conduct two public NEPA scoping meetings at the Lake Michigan College, 125 Veterans Boulevard, South Haven, Michigan 49090. You and your staff are invited to attend. Your office will receive a copy of the draft SEIS along with a request for comments. The anticipated publication date for the draft SEIS is February 2006. If you have any questions or require additional information, please contact Mr. Robert Schaaf, Senior Environmental Project Manager, by phone at 301-415-1312 or by email at rgs@nrc.gov, or Ms. Cristina Guerrero, Project Support, by phone at 301-415-2981 or by e-mail at cxg3@nrc.gov.

Sincerely,



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

Docket No.: 50-255

cc: See next page

Appendix E

Palisades Nuclear Plant

cc:

Robert A. Fenech, Senior Vice President
Nuclear, Fossil, and Hydro Operations
Consumers Energy Company
1945 Parnall Rd.
Jackson, MI 49201

Arunas T. Udry, Esquire
Consumers Energy Company
1 Energy Plaza
Jackson, MI 49201

Regional Administrator, Region III
U.S. Nuclear Regulatory Commission
801 Warrenville Road
Lisle, IL 60532-4351

Supervisor
Covert Township
P.O. Box 35
Covert, MI 49043

Office of the Governor
P.O. Box 30013
Lansing, MI 48909

U.S. Nuclear Regulatory Commission
Resident Inspector's Office
Palisades Plant
27782 Blue Star Memorial Highway
Covert, MI 49043

Michigan Department of Environmental
Quality
Waste and Hazardous Materials Division
Hazardous Waste and Radiological
Protection Section
Nuclear Facilities Unit
Constitution Hall, Lower-Level North
525 West Allegan Street
P.O. Box 30241
Lansing, MI 48909-7741

Special Litigation Division
525 West Ottawa St.
Sixth Floor, G. Mennen Williams Building
Lansing, MI 48913

Manager, Regulatory Affairs
Nuclear Management Company, LLC
27780 Blue Star Memorial Highway
Covert, MI 49043

Director of Nuclear Assets
Consumers Energy Company
Palisades Nuclear Plant
27780 Blue Star Memorial Highway
Covert, MI 49043

Mr. Daniel J. Malone
Site Vice President
Palisades Nuclear Plant
27780 Blue Star Highway
Covert, MI 49043

Mr. Douglas F. Johnson
Director, Plant Life Cycle Issues
Nuclear Management Company, LLC
700 First Street
Hudson, WI 54016

John Paul Cowan
Executive Vice President & Chief Nuclear
Officer
Nuclear Management Company, LLC
700 First Street
Hudson, WI 54016

Jonathan Rogoff, Esquire
Vice President, Counsel & Secretary
Nuclear Management Company, LLC
700 First Street
Hudson, WI 54016

Michigan Department of Attorney General

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Palisades Nuclear Plant

cc:

Douglas E. Cooper
Senior Vice President - Group Operations
Palisades Nuclear Plant
Nuclear Management Company, LLC
27780 Blue Star Memorial Highway
Covert, MI 49043

Robert A. Vincent
Licensing Lead - License Renewal Project
Palisades Nuclear Plant
27780 Blue Star Memorial Highway
Covert, MI 49043

Darrel G. Turner
License Renewal Project Manager
Palisades Nuclear Plant
27780 Blue Star Memorial Highway
Covert, MI 49043

Ms. Lois Bemis
South Haven Memorial Library
314 Broadway St.
South Haven, MI 49090



UNITED STATES
NUCLEAR REGULATORY COMMISSION

WASHINGTON, D.C. 20555-0001

June 30, 2005

Mr. Craig Czarnecki
Field Supervisor
U.S. Fish and Wildlife Service
East Lansing Field Office
2651 Coolidge Road, Suite 101
East Lansing, MI 48823

**SUBJECT: REQUEST FOR LIST OF PROTECTED SPECIES WITHIN THE AREA UNDER
EVALUATION FOR THE PALISADES NUCLEAR PLANT LICENSE RENEWAL**

Dear Mr. Czarnecki:

The U.S. Nuclear Regulatory Commission (NRC) is reviewing an application submitted by Nuclear Management Company, LLC (NMC) for the renewal of the operating license for Palisades Nuclear Plant (Palisades). Palisades is located in Covert Township on the western side of Van Buren County, Michigan, and 50 miles west-southwest of Kalamazoo, Michigan. As part of the review of the license renewal application, the NRC is preparing a Supplemental Environmental Impact Statement (SEIS) under the provisions of the National Environmental Policy Act (NEPA) of 1969, as amended, which include an analysis of pertinent environmental issues, including endangered or threatened species and impacts to fish and wildlife. This letter is being submitted under the provisions of the Endangered Species Act of 1973, as amended, and the Fish and Wildlife Coordination Act of 1934, as amended.

The proposed action would include the use and continued maintenance of existing plant facilities and transmission lines and would not result in new construction or disturbance or change in operations. The area surrounding the Palisades property is characterized by agricultural lands and heavily wooded, rugged sand dunes along the Lake Michigan shoreline. Van Buren State Park is located on the northern border of the site.

Palisades uses an closed-cycle cooling system to dissipate waste heat to the environment. Cooling water is drawn from Lake Michigan through offshore, underwater intake cribs at an approximate water depth of 35 ft. After circulating through the condensers and cooling towers, the cooling water is discharged through two tunnels that end offshore with high-velocity underwater discharge elbows.

For the specific purpose of connecting Palisades to the regional transmission system, there is a Palisades-Argenta 345-kV line, which extends approximately 40 miles eastward from the Palisades Substation to the Argenta Substation near Plainwell, north of Kalamazoo, Michigan, and the initial 0.6 mile segment of the Palisades-Cook 345-kV line, transmission line corridors occupy approximately 2200 acres of land. These transmission line corridors are being evaluated as part of the SEIS process. The corridors pass through land that is primarily agricultural and forest land. The enclosed transmission line map shows the transmission

C. Czarnecki

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system that is being evaluated in the SEIS. The switchyards are shown in the enclosed Palisades site layout figure.

To support the SEIS preparation process and to ensure compliance with Section 7 of the Endangered Species Act, the NRC requests a list of species and information on protected, proposed, and candidate species and critical habitat that may be in the vicinity of Palisades and its associated transmission lines. In addition, please provide any information you consider appropriate under the provisions of the Fish and Wildlife Coordination Act.

We plan to hold two public NEPA scoping meetings on July 28, 2005, at the Lake Michigan College, 125 Veterans Boulevard, South Haven, Michigan 49090. On July 26, 2005, we plan to conduct a site audit. You and your staff are invited to attend both the site audit and the public meetings. Your office will receive a copy of the draft SEIS along with a request for comments. The anticipated publication date for the draft SEIS is February 2006.

If you have any questions concerning the NRC staff review of this license renewal application, please contact Mr. Robert Schaaf, Senior Environmental Project Manager, at 301-415-1312 or by e-mail at rgs@nrc.gov or Ms. Cristina Guerrero, Project Support, at 301-415-2981 or by e-mail at cxg3@nrc.gov.

Sincerely,



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

Docket No.: 50-255

Enclosures: 1. Palisades Transmission Line Map
2. Palisades Site Layout

cc w/encls.: See next page

Appendix E

Palisades Nuclear Plant

cc:

Robert A. Fenech, Senior Vice President
Nuclear, Fossil, and Hydro Operations
Consumers Energy Company
1945 Parnall Rd.
Jackson, MI 49201

Arunas T. Udrys, Esquire
Consumers Energy Company
1 Energy Plaza
Jackson, MI 49201

Regional Administrator, Region III
U.S. Nuclear Regulatory Commission
801 Warrenville Road
Lisle, IL 60532-4351

Supervisor
Covert Township
P.O. Box 35
Covert, MI 49043

Office of the Governor
P.O. Box 30013
Lansing, MI 48909

U.S. Nuclear Regulatory Commission
Resident Inspector's Office
Palisades Plant
27782 Blue Star Memorial Highway
Covert, MI 49043

Michigan Department of Environmental
Quality
Waste and Hazardous Materials Division
Hazardous Waste and Radiological
Protection Section
Nuclear Facilities Unit
Constitution Hall, Lower-Level North
525 West Allegan Street
P.O. Box 30241
Lansing, MI 48909-7741

Michigan Department of Attorney General
Special Litigation Division
525 West Ottawa St.
Sixth Floor, G. Mennen Williams Building
Lansing, MI 48913

Manager, Regulatory Affairs
Nuclear Management Company, LLC
27780 Blue Star Memorial Highway
Covert, MI 49043

Director of Nuclear Assets
Consumers Energy Company
Palisades Nuclear Plant
27780 Blue Star Memorial Highway
Covert, MI 49043

Mr. Daniel J. Malone
Site Vice President
Palisades Nuclear Plant
27780 Blue Star Highway
Covert, MI 49043

Mr. Douglas F. Johnson
Director, Plant Life Cycle Issues
Nuclear Management Company, LLC
700 First Street
Hudson, WI 54016

John Paul Cowan
Executive Vice President & Chief Nuclear
Officer
Nuclear Management Company, LLC
700 First Street
Hudson, WI 54016

Jonathan Rogoff, Esquire
Vice President, Counsel & Secretary
Nuclear Management Company, LLC
700 First Street
Hudson, WI 54016

Palisades Nuclear Plant

cc:

Douglas E. Cooper
Senior Vice President - Group Operations
Palisades Nuclear Plant
Nuclear Management Company, LLC
27780 Blue Star Memorial Highway
Covert, MI 49043

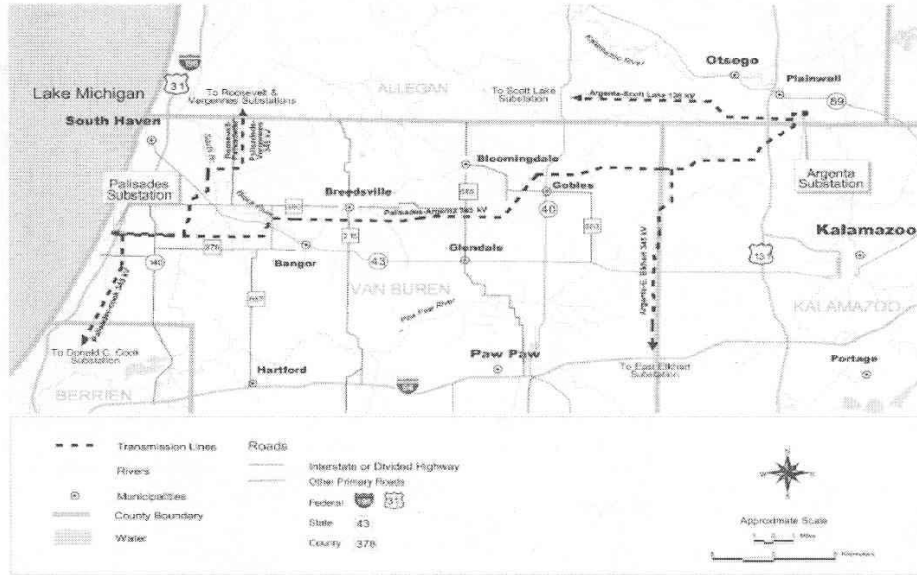
Robert A. Vincent
Licensing Lead - License Renewal Project
Palisades Nuclear Plant
27780 Blue Star Memorial Highway
Covert, MI 49043

Darrel G. Turner
License Renewal Project Manager
Palisades Nuclear Plant
27780 Blue Star Memorial Highway
Covert, MI 49043

Ms. Lois Bemis
South Haven Memorial Library
314 Broadway St.
South Haven, MI 49090

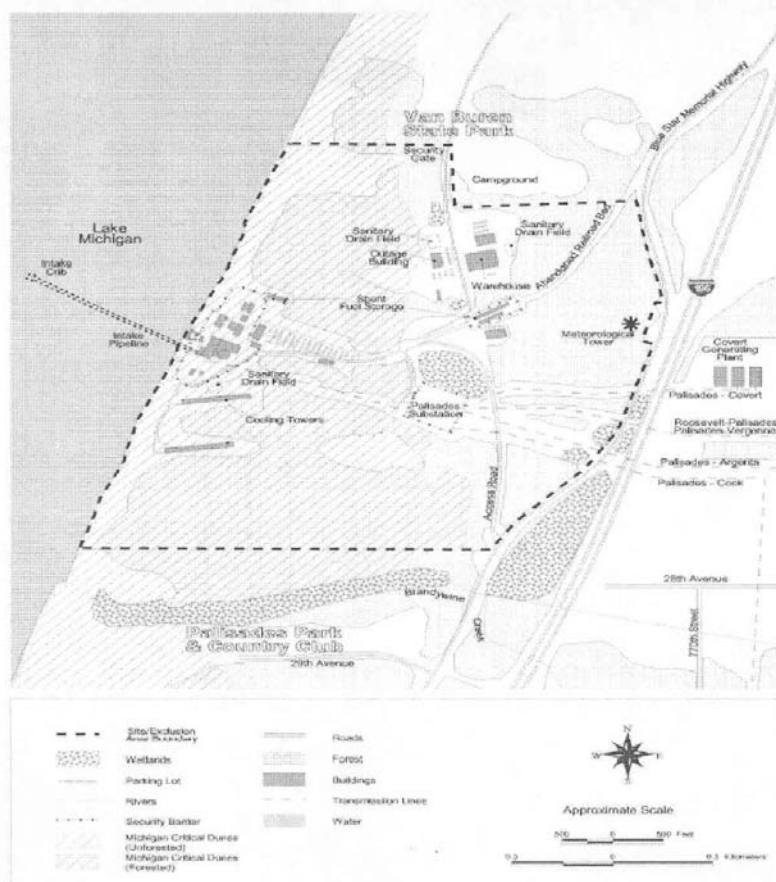
Appendix E

FIGURE 3.1-1
TRANSMISSION LINES



Enclosure 1

FIGURE 2.1-3
SITE MAP



Enclosure 2

Appendix E



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

June 30, 2005

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

SUBJECT: PALISADES NUCLEAR PLANT LICENSE RENEWAL REVIEW

Dear Mr. Klima:

The U.S. Nuclear Regulatory Commission (NRC) staff is reviewing an application to renew the operating licenses for the Palisades Nuclear Plant (Palisades), which is located in Covert Township on the western side of Van Buren County, Michigan. Palisades is operated by the Nuclear Management Company, LLC (NMC). The application for renewal was submitted by NMC on March 31, 2005, pursuant to Title 10 of the *Code of Federal Regulations* Part 54 (10 CFR Part 54). The NRC has established that, as part of the staff review of any nuclear power plant license renewal request, a site-specific Supplemental Environmental Impact Statement (SEIS) to its "Generic Environmental Impact Statement for License Renewal of Nuclear Plants" (GEIS), NUREG-1437, will be prepared under the provisions of 10 CFR Part 51, which implements the National Environmental Policy Act of 1969 (NEPA). In accordance with 36 CFR 800.8, the SEIS will include analyses of potential impacts to historic and cultural resources. A draft SEIS is scheduled for publication in February of 2006, and will be provided to you for review and comment.

If you have any questions or require additional information, please contact Mr. Robert Schaaf, Senior Environmental Project Manager, by phone at 301-415-1312 or by email at rgs@nrc.gov, or Ms. Cristina Guerrero, Project Support, by phone at 301-415-2981 or by e-mail at cxq3@nrc.gov.

Sincerely,

A handwritten signature in black ink, appearing to read "Pao-Tsin Kuo".

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

Docket No.: 50-255

cc: See next page

Palisades Nuclear Plant

cc:

Robert A. Fenech, Senior Vice President
Nuclear, Fossil, and Hydro Operations
Consumers Energy Company
1945 Parnall Rd.
Jackson, MI 49201

Arunas T. Udrys, Esquire
Consumers Energy Company
1 Energy Plaza
Jackson, MI 49201

Regional Administrator, Region III
U.S. Nuclear Regulatory Commission
801 Warrenville Road
Lisle, IL 60532-4351

Supervisor
Covert Township
P.O. Box 35
Covert, MI 49043

Office of the Governor
P.O. Box 30013
Lansing, MI 48909

U.S. Nuclear Regulatory Commission
Resident Inspector's Office
Palisades Plant
27782 Blue Star Memorial Highway
Covert, MI 49043

Michigan Department of Environmental
Quality
Waste and Hazardous Materials Division
Hazardous Waste and Radiological
Protection Section
Nuclear Facilities Unit
Constitution Hall, Lower-Level North
525 West Allegan Street
P.O. Box 30241
Lansing, MI 48909-7741

Michigan Department of Attorney General
Special Litigation Division
525 West Ottawa St.
Sixth Floor, G. Mennen Williams Building
Lansing, MI 48913

Manager, Regulatory Affairs
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27780 Blue Star Memorial Highway
Covert, MI 49043

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Executive Vice President & Chief Nuclear
Officer
Nuclear Management Company, LLC
700 First Street
Hudson, WI 54016

Jonathan Rogoff, Esquire
Vice President, Counsel & Secretary
Nuclear Management Company, LLC
700 First Street
Hudson, WI 54016

Appendix E

-2-

Palisades Nuclear Plant

cc:

Douglas E. Cooper
Senior Vice President - Group Operations
Palisades Nuclear Plant
Nuclear Management Company, LLC
27780 Blue Star Memorial Highway
Covert, MI 49043

Robert A. Vincent
Licensing Lead - License Renewal Project
Palisades Nuclear Plant
27780 Blue Star Memorial Highway
Covert, MI 49043

Darrel G. Turner
License Renewal Project Manager
Palisades Nuclear Plant
27780 Blue Star Memorial Highway
Covert, MI 49043

Ms. Lois Bemis
South Haven Memorial Library
314 Broadway St.
South Haven, MI 49090



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

July 13, 2005

The Honorable John A. Barrett, Jr., Chairperson
Citizen Potawatomi Nation
1601 South Gordon Cooper Drive
Shawnee, OK 74801

SUBJECT: REQUEST FOR COMMENTS CONCERNING PALISADES NUCLEAR PLANT
APPLICATION FOR OPERATING LICENSE RENEWAL

Dear Chairperson Barrett:

The U.S. Nuclear Regulatory Commission (NRC) is seeking input for its environmental review of an application from the Nuclear Management Company, LLC (NMC) to renew the operating licenses for the Palisades Nuclear Plant (Palisades), located in Covert Township on the western side of Van Buren County, Michigan. Palisades is in close proximity to lands that may be of interest to the Citizen Potawatomi Nation. As described below, the NRC process includes an opportunity for public and inter-governmental participation in the environmental review. We want to ensure that you are aware of our efforts and, pursuant to Title 10 of the *Code of Federal Regulations* Part 51.28(b) (10 CFR 51.28(b)), the NRC invites the Citizen Potawatomi Nation to provide input to the scoping process relating to the NRC's environmental review of the application. In addition, as outlined in 36 CFR 800.8, the NRC plans to coordinate compliance with Section 106 of the National Historic Preservation Act of 1966 through the requirements of the National Environmental Policy Act of 1969.

Under NRC regulations, the original operating license for a nuclear power plant is issued for up to 40 years. The license may be renewed for up to an additional 20 years if NRC requirements are met. The current operating license for Palisades will expire in March 2011. NMC submitted its application for renewal of the Palisades operating license on March 31, 2005.

The NRC is gathering information for a Palisades-specific supplement to its "Generic Environmental Impact Statement for License Renewal of Nuclear Plants" (GEIS), NUREG-1437. The supplement will contain the results of the review of the environmental impacts on the area surrounding the Palisades site that are related to terrestrial ecology, aquatic ecology, hydrology, cultural resources, and socioeconomic issues (among others) and will contain a recommendation regarding the environmental acceptability of the license renewal action. Provided for your information is the Palisades Site Layout (Enclosure 1) and Transmission Line Map (Enclosure 2).

The NRC will hold two public scoping meetings for the Palisades license renewal supplement to the GEIS on July 28, 2005, at the Lake Michigan College, 125 Veterans Boulevard, South Haven, Michigan 49090. There will be two sessions to accommodate interested parties. The first session will convene at 1:30 p.m. and will continue until 4:30 p.m., as necessary. The second session will convene at 7:00 p.m., with a repeat of the overview portions of the meeting, and will continue until 10:00 p.m., as necessary. Additionally, the NRC staff will host informal discussions one hour before the start of each session. To be considered, comments must be provided either at the transcribed public meetings or in writing. No formal comments on the proposed scope of the supplement to the GEIS will be accepted during informal discussions.

J. Barrett

- 2 -

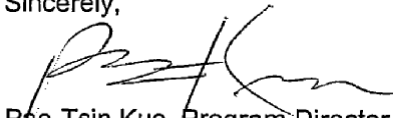
The application is electronically available for inspection from the NRC's Agencywide Documents Access and Management System (ADAMS) under Accession Number ML050940449. ADAMS is accessible at <http://www.nrc.gov/reading-rm/adams.html>. If you do not have access to ADAMS or if there are problems in accessing the documents located in ADAMS, contact the NRC's Public Document Room (PDR) Reference staff at 1-800-397-4209, 1-301-415-4737, or by e-mail at pdr@nrc.gov. In addition, the application can be viewed on the internet at <http://www.nrc.gov/reactors/operating/licensing/renewal/applications.html>.

A paper copy of the application can be viewed at the NRC's PDR, located at One White Flint North, 11555 Rockville Pike (first floor), Rockville, Maryland, 20855-2738. Copies will also be available at the South Haven Memorial Library, 314 Broadway St, South Haven, MI 49090. The GEIS, which assesses the scope and impact of environmental effects that would be associated with license renewal at any nuclear power plant site, can also be found on the NRC's Web site or at the NRC's PDR.

Please submit any written comments that the Citizen Potawatomi Nation may have to offer on the scope of the environmental review by August 22, 2005. Comments should be submitted by mail to the Chief, Rules and Directives Branch, Division of Administrative Services, Mail Stop T-6D59, U.S. Nuclear Regulatory Commission, Washington, D.C., 20555-0001. At the conclusion of the scoping process, the NRC staff will prepare a summary of the significant issues identified and the conclusions reached and will mail a copy to you.

The NRC will issue the draft supplemental environmental impact statement (SEIS) for public comment (anticipated publication date, February 2006), and will hold another set of public meetings in the site vicinity to solicit comments on the draft. A copy of the draft SEIS will be sent to you for your review and comment. After consideration of public comments received on the draft, the NRC will prepare a final SEIS. The issuance of the final SEIS for Palisades is planned for October 2006. If you need additional information regarding the environmental review process, please contact Mr. Robert Schaaf, Senior Environmental Project Manager, at 301-415-1312 or by e-mail at rgs@nrc.gov, or Ms. Cristina Guerrero, Project Support, at 301-415-2981 or by e-mail at cxg3@nrc.gov.

Sincerely,



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

Docket No.: 50-255

Enclosures: 1. Palisades Site Layout
2. Palisades Transmission Line Map

cc w/encls.: See next page

Palisades Nuclear Plant

cc:

Robert A. Fenech, Senior Vice President
Nuclear, Fossil, and Hydro Operations
Consumers Energy Company
1945 Parnall Rd.
Jackson, MI 49201

Arunas T. Udrys, Esquire
Consumers Energy Company
1 Energy Plaza
Jackson, MI 49201

Regional Administrator, Region III
U.S. Nuclear Regulatory Commission
801 Warrenville Road
Lisle, IL 60532-4351

Supervisor
Covert Township
P.O. Box 35
Covert, MI 49043

Office of the Governor
P.O. Box 30013
Lansing, MI 48909

U.S. Nuclear Regulatory Commission
Resident Inspector's Office
Palisades Plant
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Michigan Department of Attorney General
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Sixth Floor, G. Mennen Williams Building
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Manager, Regulatory Affairs
Nuclear Management Company, LLC
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Covert, MI 49043

Director of Nuclear Assets
Consumers Energy Company
Palisades Nuclear Plant
27780 Blue Star Memorial Highway
Covert, MI 49043

Paul A. Harden
Site Vice President
Palisades Nuclear Plant
27780 Blue Star Highway
Covert, MI 49043

Mr. Douglas F. Johnson
Director, Plant Life Cycle Issues
Nuclear Management Company, LLC
700 First Street
Hudson, WI 54016

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Executive Vice President & Chief Nuclear
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Nuclear Management Company, LLC
700 First Street
Hudson, WI 54016

Jonathan Rogoff, Esquire
Vice President, Counsel & Secretary
Nuclear Management Company, LLC
700 First Street
Hudson, WI 54016

Appendix E

Palisades Nuclear Plant

cc:

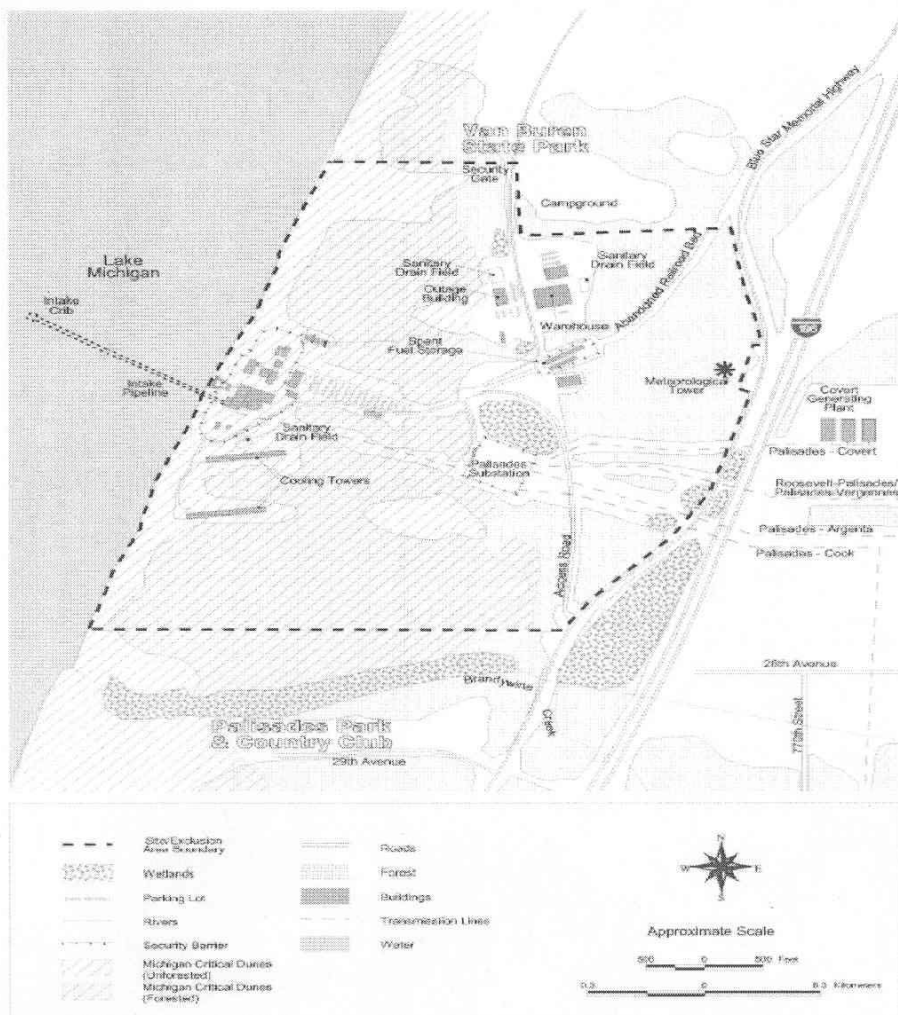
Douglas E. Cooper
Senior Vice President - Group Operations
Palisades Nuclear Plant
Nuclear Management Company, LLC
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Covert, MI 49043

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Licensing Lead - License Renewal Project
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Darrel G. Turner
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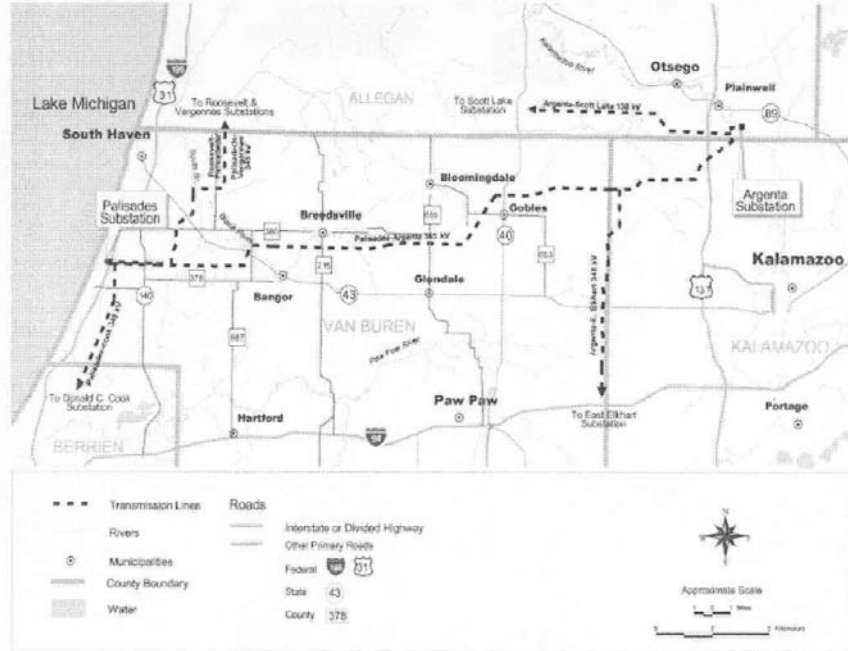
Ms. Lois Bemis
South Haven Memorial Library
314 Broadway St.
South Haven, MI 49090

FIGURE 2.1-3
SITE MAP



Enclosure 1

FIGURE 3.1-1
TRANSMISSION LINES



Enclosure 2



IN REPLY REFER TO:

United States Department of the Interior

FISH AND WILDLIFE SERVICE
 East Lansing Field Office (ES)
 2651 Coolidge Road, Suite 101
 East Lansing, Michigan 48823-6316

July 29, 2005

Mr. Pao-Tsin Kuo, Program Director
 License Renewal and Environmental Impacts Program
 Division of Regulatory Improvement Programs
 Office of Nuclear Reactor Regulation
 One White Flint North
 11555 Rockville Pike
 Rockville, Maryland 20852-2738

Re: Endangered Species List Request, Proposed Palisades Nuclear Plant (Palisades) License Renewal Project, Allegan, Berrien, Kalamazoo, and Van Buren Counties, Michigan

Dear Mr. Kuo:

Thank you for your June 30, 2005 request for information regarding federally listed and proposed threatened and endangered species, candidate species, or critical habitat near your proposed project. Your request and this response are made pursuant to section 7 of the Endangered Species Act of 1973, as amended (Act).

Based on your proposed project area and surrounding landscape, the possibility exists for the endangered Indiana bat (*Myotis sodalis*) to occur within suitable habitat near Palisades and its transmission lines. The summer range of Indiana bats in Michigan includes the southern half and most of the western coastal counties of the Lower Peninsula. Suitable Indiana bat habitat typically consists of highly variable forested landscapes in riparian, bottomland, and upland areas, and is composed of roosting trees with crevices or exfoliating bark.

Our records also indicate the following endangered species: Karner blue butterfly (*Lycæides melissa samuelis*) and Mitchell's satyr butterfly (*Neonympha mitchelli mitchelli*), and threatened Pitcher's thistle (*Cirsium pitcheri*) may occur near Palisades or its associated transmission lines. The Karner blue butterfly may occur near the Argenta-E. Elkhart transmission line in Van Buren County; Mitchell's satyr butterfly may occur near the Palisades-Cook transmission line in Berrien County; and Pitcher's thistle may occur near the Palisades Substation in Van Buren County.

Karner blue butterfly is dependent on wild lupine (*Lupinus perennis*); it's only known larval food plant, grasses and nectar plants. These plants and its habitat occur in remnant barrens and oak savanna ecosystems, as well as other locations such as highway and powerline rights-of-way, gaps within forest stands, young forest stands, forest roads and trails, airports, and military bases. Mitchell's satyr butterflies

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Appendix E

rely on wetland habitats characterized as fen communities, which are dominated by sedges (usually *Carex stricta*), with scattered deciduous and/or coniferous trees, most often tamarack, and red cedar. The Pitcher's thistle is endemic to the non-forested dunes of the western Great Lakes and requires active sand dune processes to maintain its early successional habitat. It is a perennial, herbaceous plant, which flowers once in its lifetime, generally after a five to eight year juvenile stage, after which it dies.

You should assess potential effects of future projects on these species. If you determine that implementation of any projects may affect these species, we recommend you conduct the appropriate habitat and species surveys to determine with certainty whether and where these species occur in relation to your project. The individual performing the survey must possess a current U. S. Fish & Wildlife Service permit specific to the surveyed species and use approved survey techniques. Depending on your assessment, the preparation of a biological assessment may be necessary to determine the potential effects, both direct and indirect, of any proposed action upon listed species or critical habitat, and initiate informal consultation with this office.

Please see Enclosure B for a discussion of the responsibilities of federal agencies under the Act and the conditions that require preparation of a biological assessment by the lead federal agency or its designee. We have provided information concerning the distribution, life history, and habitat requirements of the Indiana bat. This information may help you prepare a biological assessment for this project, should it require one. Additional species information may be located at the Michigan Natural Features Inventory website, <http://web4.msue.msu.edu/mnfi/pub/abstracts.cfm>.

Our records also indicate that a candidate species, eastern massasauga rattlesnake (*Sistrurus catenatus catenatus*), may occur near Palisades and all its associated transmission lines. Eastern massasauga habitat is typically associated with open shallow wetland systems. The rattlesnake prefers habitat with open canopy and a sedge or grass ground cover. If early evaluation of your project indicates that it is likely to adversely impact a candidate, your agency may request technical assistance from this office. While the Act does not extend protection to candidate species, we encourage their consideration in resource planning. Avoidance of unnecessary impacts to candidate species will reduce the likelihood that they will require the protection of the Act in the future.

Section 7 of the Act requires federal agencies, or their designees, to consider impacts to federally listed threatened and endangered species for all federally funded, constructed, permitted, or licensed projects. Should the federal action agency determine that a listed species may be affected (adversely or beneficially) by the project, the action agency should request section 7 consultation with this office. Even if the determination is a "no effect", we would appreciate receiving a copy for our records. We are available to discuss the proposed action and assist you in analyzing potential effects of the action on the species.

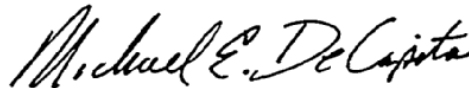
Section 7(d) of the Act underscores the requirement that federal agencies or their designees shall not make any irreversible or irretrievable commitment of resources during the consultation period, which in effect would deny the formulation or implementation of reasonable alternatives regarding their actions on any endangered or threatened species. Therefore, in order to comply with the Act, we advise you not to finalize any construction plans until you assure protection of the species and conclude any requisite section 7 consultation with this office.

Since endangered species data changes continuously, we recommend you contact this office for an updated species list if more than six months passes prior to issuance of a permit for proposed activities. In addition, if the project requires modifications or new information becomes available that indicates the presence of listed species or species proposed for listing, or their critical habitat, you should consult with this office.

The Michigan Department of Natural Resources (MDNR) protects endangered and threatened species through Part 365, Endangered Species Protection, of the Natural Resources and Environmental Protection Act, 1994, P.A. 451. For a preliminary check of your project areas for any State natural resources issues, please refer to the MDNR Endangered Species Assessment website located at www.michigan.gov. Click on Online Services then scroll down to Business Online Services and select Endangered Species Assessment. Upon completing the website search, contact the Endangered Species Coordinator of the MDNR at (517) 373-3337 for information regarding the protection of threatened and endangered species under state law. State law requires a permit in advance of any work that could potentially damage, destroy, or displace state listed species.

The opportunity to provide comments is appreciated. Any questions should be directed to Burr Fisher of this office at 517/351-8286 or burr_fisher@fws.gov.

Sincerely,



for Craig A. Czarnecki
Field Supervisor

Enclosures (2)

cc: MDNR, Wildlife Division, Lansing, MI (Attn: Todd Hogrefe) w/o enclosures
Kirk LaGory, Argonne National Laboratory, Argonne, IL w/o enclosures

g: [admin/archives/july05/Consumers-PalisadesNuclearRelicense.bdf.doc](#)



IN REPLY REFER TO:

United States Department of the Interior

OFFICE OF THE SECRETARY
Office of Environmental Policy and Compliance
Custom House, Room 244
200 Chestnut Street
Philadelphia, Pennsylvania 19106-2904



May 15, 2006

ER 06/144

Chief, Rules Review and Directives Branch
U.S. Nuclear Regulatory Commission
Mail Stop T6-D59
Washington, DC 20555-0001

2/23/06
JFR 9383
(13)

RECEIVED

2006 MAY 24 PM 12:53

RULES AND DIRECTIVES
BRANCH
USNRC

Dear Sir:

The U.S. Department of the Interior (Department) has reviewed the Generic Environmental Impact Statement (EIS) for License Renewal of Nuclear Plants, NUREG-1437, Draft Supplement 27 (dated February 2006), regarding the Palisades Nuclear Plant, Van Buren County, Michigan.

The license renewal does not involve any major construction or physical alteration of the project area. The Generic EIS and Draft Supplement 27 adequately address the concerns of the Department regarding fish and wildlife resources, as well as species protected by the Endangered Species Act. We concur with the preliminary conclusions of the U. S. Nuclear Regulatory Commission staff with respect to the impacts of continued operations on these resources and species. We have no comment on the adequacy of other resource discussions presented in the documents.

We appreciate the opportunity to provide these comments.

Sincerely,

Michael T. Chezik

Michael T. Chezik
Regional Environmental Office

cc:

L. MacLean, FWS, Fort Snelling, MN

EIS Review Complete
Template = ADM-013

E-REDS = ADM-03
Adel = P2 Pham (bump)
C. Guener (ex93)

Mail Envelope Properties (44689C7C.65E : 4 : 38494)

Subject: Palisades Nuclear Plant ER 06/144 (Virus checked)
Creation Date: 5/15/06 11:21AM
From: <Valincia_Darby@ios.doi.gov>

Created By: Valincia_Darby@ios.doi.gov

Recipients

nrc.gov
 TWGWPO02.HQGWDO01
 PalisadesEIS

fws.gov
 Lyn_MacLean CC

Post Office
 TWGWPO02.HQGWDO01

Route
 nrc.gov
 fws.gov

Files	Size	Date & Time
MESSAGE	112	05/15/06 11:21AM
TEXT.htm	217	
06-144.pdf	57238	
Mime.822	80084	

Options

Expiration Date: None
Priority: Standard
Reply Requested: No
Return Notification: None

Concealed Subject: No
Security: Standard



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
77 WEST JACKSON BOULEVARD
CHICAGO, IL 60604-3590

MAY 26 2006

REPLY TO THE ATTENTION OF
B-191
Chief, Rules Review and Directives Branch
U.S. Nuclear Regulatory Commission
Mail Stop T6-D59
Washington, D.C. 20555-0001

4/22/06
NFR-9383
14

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JUN -5 11 9:48

RULES & DIRECTIVES

Re: Generic Environmental Impact Statement for License Renewal of Nuclear Plants, Supplement 27: Palisades Nuclear Plant, Van Buren County, Michigan, Draft Report, NUREG-1437, EIS No. 20060052

Dear Sir or Madam:

In accordance with Section 309 of the Clean Air Act and the National Environmental Policy Act (NEPA), the U.S. Environmental Protection Agency (EPA) has reviewed the Generic Environmental Impact Statement for License Renewal of Nuclear Plants, Supplement 27 (SEIS): Palisades Nuclear Plant, which is a draft report. According to the SEIS, the operating license for Palisades Nuclear Plant will expire on March 24, 2011. The proposed Federal action would renew the current operating license for an additional 20 years.

The Nuclear Regulatory Commission (NRC) developed the Generic Environmental Impact Statement (GEIS) to streamline the license renewal process on the premise that environmental impacts of most nuclear power plant license renewals are similar, in most cases. NRC develops facility-specific SEISs for individual plants as the facilities apply for license renewal. EPA provided comments on the GEIS during its development process—for the draft version in 1992, and for the final version in 1996.

Palisades Nuclear Plant is located in Covert Township, Van Buren County, Michigan, on the southeastern shoreline of Lake Michigan. The plant has a single pressurized light-water reactor. The maximum authorized power level of its reactor is 2,565 megawatts thermal. The plant's current net summer capacity is 786 megawatts electric. The plant is refueled on an 18-month cycle. Palisades Nuclear Plant uses a closed-loop cooling system.

Based on our review of the Palisades Nuclear Plant draft SEIS, we have given the project an EC-2 rating. The "EC" means that we have environmental concerns with the proposed action, and the "2" means that additional information needs to be provided in the final SEIS. Our concerns relate to:

- 1. Adequacy and clarity of the information provided,

SUNSI Review Complete

Template = ADM-013

E-RFS = ADM-03

Add = DR Phm (CMP)

C. Guerrero (CX93)

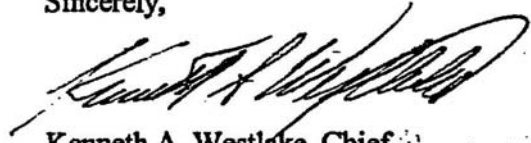
Recycled/Recyclable • Printed with Vegetable Oil Based Inks on 50% Recycled Paper (20% Postconsumer)

2. Risk estimates,
3. Entrainment of fish and shellfish in early life stages, and
4. Threatened and endangered species.

We have enclosed our comments and the U.S. EPA rating system summary.

If you have any questions or wish to discuss any aspect of the comments, please contact Newton Ellens (for NEPA-related issues) at (312) 353-5562, or Michael Murphy (for radiation-related issues) at (312) 353-6686.

Sincerely,



Kenneth A. Westlake, Chief
NEPA Implementation Section
Office of Science, Ecosystems, and Communities

Enclosures..

**U.S. Environmental Protection Agency Comments on
The U.S. Nuclear Regulatory Commission's Generic Environmental Impact Statement for
License Renewal of Nuclear Plants, Supplement 27: Palisades Nuclear Plant, Draft Report,
NUREG-1437**

General Comments:

The supplement to the Generic Environmental Impact Statement (GEIS) for Renewal of Nuclear Power Plant Licenses should be a Site Specific Environmental Impact Statement instead. This would follow after forty years of operation, with a forty year data collection history, and where site specific conditions could be utilized to provide a specific response to the Environmental Impact requirements instead of a generalized one.

Specific Comments:

1. Section 2.1.4.2, *Gaseous Waste Processing Systems and Effluent Controls*, Page 2-12, second paragraph. Citations of dose values should include the dose value, in addition to the citation, to make the values clearer.
2. Section 2.2.7, *Radiological Impacts*, pages 2-49, 2-50. The references to the environmental standards need to be more complete citations, including title of the rule or regulation along with the basic standard for comparison provided consistently. All of the environmental standards that could be used for comparison should be used, including 40 CFR 61 Radionuclide National Emission Standards for Hazardous Air Pollutants values. This will reduce the time needed to look up these citations and verify values that are cited in the text.
3. Section 2.2.7, *Radiological Impacts*, page 2-49. We are concerned about the level of information provided in the draft supplemental environmental impact statement (SEIS) on direct and cumulative radiological impacts. According to the draft SEIS, Nuclear Management Company, LLC (NMC), the applicant for the operating license, has conducted a radiological environmental monitoring program (REMP) around the Palisades site since 1971. Through this program, NMC has monitored and documented radiological impacts to workers, the public, and the environment. The draft SEIS states:

The REMP includes monitoring of the waterborne environment (ground water, surface water, and sediments), ingestion pathways (milk, fish and vegetation), direct radiation (gamma dose at thermoluminescent dosimeter [TLD] locations), and atmospheric environment (airborne radioiodine, particulates, gross beta, and gamma). [Page 2-49]

The draft SEIS cites two annual reports which summarizes information from the REMP, but the draft SEIS does not contain this summary information itself. Summarized

quantitative information about radiation and exposure pathways in the environment is relevant in determining radiological impacts from the continued operation of Palisades. We are unable to make such a determination from the draft SEIS as it is written. In addition, the draft SEIS lacks a comprehensive assessment of cumulative radiological impacts, since it does not include quantitative information about the D.C. Cook Nuclear Plant, located about 28 miles south-southwest of Palisades on Lake Michigan's shores. Therefore, we suggest that the final SEIS include (1) current annual summary information from the REMP, and (2) a quantitative cumulative impact assessment of radiological impacts which accounts for impacts from the D.C. Cook Nuclear Plant.

4. Section 2.2.7, *Radiological Impacts*, pages 2-49, 2-50. Providing the estimated total effective dose equivalents (TEDEs) for comparisons helps in providing the public with additional assurances that doses are monitored and do meet the As Low As Reasonably Achievable (ALARA) principals of the U.S. Nuclear Regulatory Commission (NRC).
5. Section 4.2.2, *Electromagnetic Fields - Chronic Effects*, page 4-17. We commend NRC for providing the reference to the National Institute of Environmental Health Sciences results and recommendations on chronic exposures to electromagnetic fields. This will provide the public with valuable information on these types of exposures.
6. Section 4.8.3, *Cumulative Radiological Impacts*, page 4-38; 4-39. Information or procedures used to generate values to support the assertions in this section need to be provided in a clearer manner to reduce the possibility of misunderstandings and the reasoning on procedures to reach these conclusions.
7. Section 5.2.2, *Estimate of Risk*, page 5-6. It is stated that "The baseline core damage frequency (CDF) for the purpose of the SAMA [Severe Accident Mitigation Alternatives] evaluation is approximately 4.05×10^{-3} per year. This CDF is based on the risk assessment for internally-initiated events. NMC did not include the contribution to risk from external events within the Palisades risk estimates; however it did account for the potential risk reduction benefits associated with external events by increasing the estimated benefits for internal events by a factor of two."

The estimates for risks from both types of events should be evaluated and presented, along with a rationale for not basing risk decisions on the external events or including them in the considerations as necessary to get an accurate portrayal of the risk of the licensing renewal.

8. Section 6.1, *The Uranium Fuel Cycle*, page 6-3. Under the bullet point for Off-site radiological impacts (individual effects from other than disposal of spent fuel and high level waste disposal), no consideration appears to be given to the potential long-term storage of the spent fuel and high-level waste materials on site until such time as a

- permanent facility is finally licensed and begins to accept these materials for disposal. A reference to other sections that this evaluation may have been included in should be provided here as well as in other sections, or if this evaluation has not been adequately conducted, the issue needs to be considered and an appropriate evaluation conducted.
9. Section 6.1, *The Uranium Fuel Cycle*, page 6-8, under the bullet point for On-Site Spent Fuel. A more thorough evaluation for the volume of spent fuel expected to be generated during the additional licensed time needs to be provided, along with more specific information as to site specific circumstances that may impair or improve the risk values for potential exposures to this spent fuel storage.
 10. Section 7.1, *Decommissioning*, page 7-2, under bullet point Radiation Doses. As the GEIS is based on a forty-year licensing period, an extension of this period would have an impact that needs to be quantified and reported. This information should have been included specifically in the draft SEIS as part of the risk that would be associated with the license extension. The specific methodology needs to be provided and explained.
 11. Section 8.1, *No-Action Alternative*, page 8-5, under the bullet point Human Health. The actual value representing the cited percent value should be specifically provided in addition to the citation. This will reduce unnecessary additional research by readers, except for value verifications, and potential misunderstandings or confusion as to the actual value(s) being specified.
 12. Section 8.2.1, *Coal-Fired Generation*, page 8-17, under bullet point Human Health. Any dose estimate that would have the potential to fall in the risk range of 10^{-6} to 10^{-4} or greater needs to be specifically evaluated for potential regulatory requirements or risk impacts to the public health. This should be estimated conservatively using the data that is currently available or that can be logically extrapolated from currently available information.
 13. Section 8.2.3, *Nuclear Power Generation*, page 8-34. The changes in power production would provide a difference in potential risk to the public and needs to be specified, rather than merely referenced, to provide a clearer understanding of the risk determination in this section of the document.
 14. Section 8.2.3.1, *Closed -Cycle Cooling System*, page 8-39, under bullet point Waste. Waste impacts need to be specified, rather than merely referenced, to provide a clearer understanding of the risk determination made in this section of the document.
 15. Section 8.2.3.1, *Closed -Cycle Cooling System*, page 8-40, under bullet point Human Health. Human-health impacts need to be specified, rather than merely referenced, to provide a clearer understanding of the risk determination in this section of the document.

16. Section 2.1.4.1, *Liquid Waste Processing Systems and Effluent Controls*, Page 2-12. The draft SEIS does not provide quantitative details about the planned modification of the liquid radioactive waste processing system. The draft SEIS states that NMC is planning to replace the current system, which is based on evaporation, to a system using resins for ion exchange. The draft SEIS does not provide quantitative details about the estimated change in collection efficiency between the two systems. This information should be provided in the final SEIS.
17. Section 4.1, *Cooling System*, page 4-9. We are concerned about entrainment of fish and shellfish in early life stages. Under a U.S. EPA rule, codified in 40 C.F.R. § 125 (U.S. EPA Rule), Palisades Nuclear Plant is required to reduce its entrainment of fish and shellfish in early life stages. Under the U.S. EPA Rule, Palisades Nuclear Plant is required to choose one of five compliance alternatives to reduce entrainment, and the compliance alternative must meet a regulatory performance standard. We understand that Palisades will comply with the U.S. EPA rule through conditions in a NPDES permit issued by the Michigan Department of Environmental Quality. However, we believe that the project proponents should have a proposed compliance alternative and regulatory performance standard for Palisades, because the project proponents must assess the feasibility of complying with the rule. Listing this information would provide a comprehensive public disclosure of plans to reduce entrainment. Therefore, we request the project proponents to determine and disclose the proposed compliance alternative and performance standard that would most likely be proposed in the NPDES permit application for Palisades in the final SEIS.
18. Section 4.6, *Threatened and Endangered Species*, pages 4-32 to 4-35. We are concerned because the draft SEIS does not evaluate impacts on state-listed threatened and endangered species. The draft SEIS includes an evaluation of federal and state-listed threatened and endangered species in the study area. However, the draft SEIS only evaluates impacts to federal-listed threatened and endangered species. We believe that the final SEIS should include a more comprehensive evaluation of threatened and endangered species, by including an evaluation of impacts to state-listed species.

SUMMARY OF RATING DEFINITIONS AND FOLLOW UP ACTION*

Environmental Impact of the Action

LO-Lack of Objections

The EPA review has not identified any potential environmental impacts requiring substantive changes to the proposal. The review may have disclosed opportunities for application of mitigation measures that could be accomplished with no more than minor changes to the proposal.

EC-Environmental Concerns

The EPA review has identified environmental impacts that should be avoided in order to fully protect the environment. Corrective measures may require changes to the preferred alternative or application of mitigation measures that can reduce the environmental impacts. EPA would like to work with the lead agency to reduce these impacts.

EO-Environmental Objection

The EPA review has identified significant environmental impacts that must be avoided in order to provide adequate protection for the environment. Corrective measures may require substantial changes to the preferred alternative or consideration of some other project alternative (including the no action alternative or a new alternative). EPA intends to work with the lead agency to reduce these impacts.

EU-Environmentally Unsatisfactory

The EPA review has identified adverse environmental impacts that are of sufficient magnitude that they are unsatisfactory from the standpoint of public health or welfare or environmental quality. EPA intends to work with the lead agency to reduce these impacts. If the potential unsatisfactory impacts are not corrected at the final EIS state, this proposal will be recommended for referral to the CEQ.

Adequacy of the Impact Statement

Category 1-Adequate

The EPA believes the draft EIS adequately sets forth the environmental impact(s) of the preferred alternative and those of the alternatives reasonably available to the project or action. No further analysis or data collecting is necessary, but the reviewer may suggest the addition of clarifying language or information.

Category 2-Insufficient Information

The draft EIS does not contain sufficient information for the EPA to fully assess the environmental impacts that should be avoided in order to fully protect the environment, or the EPA reviewer has identified new reasonably available alternatives that are within the spectrum of alternatives analyzed in the draft EIS, which could reduce the environmental impacts of the action. The identified additional information, data, analyses, or discussion should be included in the final EIS.

Category 3-Inadequate

EPA does not believe that the draft EIS adequately assesses potentially significant environmental impacts of the action, or the EPA reviewer has identified new, reasonably available alternatives that are outside of the spectrum of alternatives analyzed in the draft EIS, which should be analyzed in order to reduce the potentially significant environmental impacts. EPA believes that the identified additional information, data analyses, or discussions are of such a magnitude that they should have full public review at a draft stage. EPA does not believe that the draft EIS is adequate for the purposes of the NEPA and/or Section 309 review, and thus should be formally revised and made available for public comment in a supplemental or revised draft EIS. On the basis of the potential significant impacts involved, this proposal could be a candidate for referral to the CEQ.

*From EPA Manual 1640 Policy and Procedures for the Review of the Federal Actions Impacting the Environment



JENNIFER GRANHOLM
GOVERNOR

STATE OF MICHIGAN
DEPARTMENT OF HISTORY, ARTS AND LIBRARIES
LANSING

DR. WILLIAM ANDERSON
DIRECTOR

June 19, 2006

MR BO PHAM
U S NUCLEAR REGULATORY COMMISSION
OFFICE OF NUCLEAR REACTOR REGULATION
WASHINGTON DC 20555-0001

RE: ER-05-249 Palisades Nuclear Power Plant License Renewal, Covert Township, Van Buren County (NRC)

Dear Mr. Pham:

Under the authority of Section 106 of the National Historic Preservation Act of 1966, as amended, we have reviewed the above-cited undertaking at the location noted above. With respect to archaeological resources, *Supplement 27: Regarding Palisades Nuclear Plant* to the *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* makes reference to a letter from Malone and Wawro to MacFarlane-Faes, dated February 11, 2005 (page 2-64). That letter outlines policies and procedures to be followed in the course of construction or modification activities or projects that will insure that archaeological resources are taken into account. It is our opinion that adherence to those policies and procedures will result in the renewal of the Palisades Nuclear Power Plant license having no effect on historic archaeological resources. Based on the information provided for our review, it is the opinion of the State Historic Preservation Officer (SHPO) that **no historic properties are affected** within the area of potential effects of this undertaking.

The views of the public are essential to informed decision making in the Section 106 process. Federal Agency Officials or their delegated authorities must plan to involve the public in a manner that reflects the nature and complexity of the undertaking, its effects on historic properties and other provisions per 36 CFR § 800.2(d). We remind you that Federal Agency Officials or their delegated authorities are required to consult with the appropriate Indian tribe and/or Tribal Historic Preservation Officer (THPO) when the undertaking may occur on or affect any historic properties on tribal lands. **In all cases**, whether the project occurs on tribal lands or not, Federal Agency Officials or their delegated authorities are also required to make a reasonable and good faith effort to identify any Indian tribes or Native Hawaiian organizations that might attach religious and cultural significance to historic properties in the area of potential effects and invite them to be consulting parties per 36 CFR § 800.2(c-f).

This letter evidences the U. S. Nuclear Regulatory Commission's compliance with 36 CFR § 800.4 "Identification of historic properties", and the fulfillment of the U. S. Nuclear Regulatory Commission's responsibility to notify the SHPO, as a consulting party in the Section 106 process, under 36 CFR § 800.4(d)(1) "No historic properties affected".

The State Historic Preservation Office is not the office of record for this undertaking. You are therefore asked to maintain a copy of this letter with your environmental review record for this undertaking. If the scope of work changes in any way, or if artifacts or bones are discovered, please notify this office immediately.

STATE HISTORIC PRESERVATION OFFICE, MICHIGAN HISTORICAL CENTER
702 WEST KALAMAZOO STREET • P.O. BOX 30740 • LANSING, MICHIGAN 48909-8240
(517) 373-1630
www.michigan.gov/hal

Appendix E

If you have any questions, please contact Brian Grennell, Environmental Review Specialist, at (517) 335-2721 or by email at ER@michigan.gov. **Please reference our project number in all communication with this office regarding this undertaking.** Thank you for this opportunity to review and comment, and for your cooperation.

Sincerely,

A handwritten signature in black ink, appearing to read "Martha MacFarlane Faes". The signature is fluid and cursive, with a large initial "M" and "F".

Martha MacFarlane Faes
Environmental Review Coordinator

for Brian D. Conway
State Historic Preservation Officer

MMF:DLA:BGG

Appendix F

GEIS Environmental Issues Not Applicable to Palisades Nuclear Plant

Appendix F

GEIS Environmental Issues Not Applicable to Palisades Nuclear Plant

Table F-1 lists those environmental issues listed in the *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS) (NRC 1996, 1999)^(a) and in Part 51 of Title 10 of the *Code of Federal Regulations* (10 CFR Part 51), Subpart A, Appendix B, Table B-1, that are not applicable to Palisades Nuclear Plant (Palisades) because of plant or site characteristics.

Table F-1. GEIS Environmental Issues Not Applicable to Palisades

ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1	Category	GEIS Sections	Comment
SURFACE-WATER QUALITY, HYDROLOGY, AND USE (FOR ALL PLANTS)			
Impacts of refurbishment on surface-water quality	1	3.4.1	No refurbishment is planned at Palisades.
Impacts of refurbishment on surface-water use	1	3.4.1	No refurbishment is planned at Palisades.
Altered salinity gradients	1	4.2.1.2.2	The Palisades cooling system does not discharge to an estuary.
Water-use conflicts (plants with once-through cooling systems)	1	4.2.1.3	Palisades does not use a once-through cooling system.
Water-use conflicts (plants with cooling ponds or cooling towers using makeup water from a small river with low flow)	2	4.3.2.1	The Palisades cooling system does not use makeup water from a small river with low flow.

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

Table F.1 (contd)

ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1	Category	GEIS Sections	Comment
AQUATIC ECOLOGY (FOR ALL PLANTS)			
Refurbishment	1	3.5	No refurbishment is planned at Palisades.
AQUATIC ECOLOGY (FOR PLANTS WITH ONCE-THROUGH AND COOLING POND HEAT DISSIPATION SYSTEMS)			
Entrainment of fish and shellfish in early life stages	2	4.2.2.1.2 4.4.3	This issue is related to heat-dissipation systems that are not installed at Palisades.
Impingement of fish and shellfish	2	4.2.2.1.3 4.4.3	This issue is related to heat-dissipation systems that are not installed at Palisades.
Heat shock	2	4.2.2.1.4 4.4.3	This issue is related to heat-dissipation systems that are not installed at Palisades.
GROUNDWATER USE AND QUALITY			
Impacts of refurbishment on groundwater use and quality	1	3.4.2	No refurbishment is planned at Palisades.
Groundwater-use conflicts (potable and service water, and dewatering; plants that use >100 gpm)	2	4.8.1.1 4.8.2.1	Palisades uses <100 gpm of groundwater.
Groundwater-use conflicts (plants using cooling towers withdrawing makeup water from a small river)	2	4.8.1.3 4.4.2.1	The Palisades cooling system does not use makeup water from a small river.

Table F.1 (contd)

ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1	Category	GEIS Sections	Comment
Groundwater-use conflicts (Ranney wells)	2	4.8.1.4	Palisades does not have or use Ranney wells.
Groundwater-quality degradation (Ranney wells)	1	4.8.2.2	Palisades does not have or use Ranney wells.
Groundwater-quality degradation (saltwater intrusion)	1	4.8.2.1	Palisades 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 heat-dissipation systems that are not installed at Palisades.
Groundwater-quality degradation (cooling ponds at inland sites)	2	4.8.3	Palisades is not located at an inland site.
TERRESTRIAL RESOURCES			
Refurbishment impacts	2	3.6	No refurbishment is planned at Palisades.
Cooling-pond impacts on terrestrial resources	1	4.4.4	This issue is related to a heat-dissipation system that is not installed at Palisades.
AIR QUALITY			
Air quality during refurbishment (nonattainment and maintenance areas)	2	3.3	No refurbishment is planned at Palisades.

Table F.1 (contd)

ISSUE–10 CFR Part 51, Subpart A, Appendix B, Table B-1	Category	GEIS Sections	Comment
HUMAN HEALTH			
Radiation exposure to the public during refurbishment	1	3.8.1	No refurbishment is planned at Palisades.
Occupational radiation exposures during refurbishment	1	3.8.2	No refurbishment is planned at Palisades.
Microbial organisms (public health) (plants using lakes or canals, or cooling towers or cooling ponds that discharge to a small river).	2	4.3.6	The Palisades cooling system does not discharge to a small river.
SOCIOECONOMICS			
Public services, education (refurbishment)	2	3.7.4.1	No refurbishment is planned at Palisades.
Offsite land use (refurbishment)	2	3.7.5	No refurbishment is planned at Palisades.
Aesthetic impacts (refurbishment)	1	3.7.8	No refurbishment is planned at Palisades.

F.1 References

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

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

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

Appendix G

NRC Staff Evaluation of Severe Accident Mitigation Alternatives (SAMAs) for Palisades Nuclear Plant in Support of License Renewal Application

Appendix G

NRC Staff Evaluation of Severe Accident Mitigation Alternatives (SAMAs) for Palisades Nuclear Plant in Support of License Renewal Application

Section 51.53(c)(3)(ii)(L) of Title 10 of the *Code of Federal Regulations* (10 CFR) requires that license renewal applicants consider alternatives to mitigate severe accidents if the U.S. Nuclear Regulatory Commission (NRC) staff has not previously evaluated severe accident mitigation alternatives (SAMAs) for the applicant's plant in an Environmental Impact Statement (EIS) or related supplement or in an environmental assessment. The purpose of this consideration is to ensure that plant changes (i.e., hardware, procedures, and training) with the potential for improving severe accident safety performance are identified and evaluated. SAMAs have not been previously considered for Palisades Nuclear Plant (Palisades); therefore, the remainder of Appendix G addresses those alternatives.

G.1 Introduction

Nuclear Management Company, LLC (NMC), submitted an assessment of SAMAs for Palisades as part of the Environmental Report (ER) (NMC 2005a). This assessment was based on the most recent Palisades Probabilistic Safety Assessment (PSA) available at that time, a plant-specific offsite consequence analysis performed using the MELCOR Accident Consequence Code System 2 (MACCS2) computer program, and insights from the Palisades Individual Plant Examination (IPE) (Consumers Power 1993) and Individual Plant Examination of External Events (IPEEE) (Consumers Power 1995). In identifying and evaluating potential SAMAs, NMC considered SAMA candidates that addressed the major contributors to core damage frequency (CDF) and population dose at Palisades, as well as SAMA candidates for other operating plants that have submitted license renewal applications. NMC identified 23 potential SAMA candidates. The list was reduced to eight unique SAMA candidates by eliminating SAMAs that are not applicable at Palisades because of (1) design differences; (2) the required extensive changes that would involve implementation costs known to exceed any possible benefit; (3) the excessive dollar value associated with completely eliminating all internal and external event severe accident risk at Palisades, or (4) having only effects on systems with low risk significance based on the plant-specific PSA. NMC assessed the costs and benefits associated with each of the potential SAMAs and concluded that several of the candidate SAMAs evaluated would be cost-beneficial and warrant further review for potential implementation.

On the basis of a review of the SAMA assessment, the NRC issued a request for additional information (RAI) to NMC by letter dated August 24, 2005 (NRC 2005), and in a teleconference with NMC on November 10, 2005. Key questions concerned peer reviews of the PSA and the potential impact of unresolved peer review comments; major plant and modeling changes

Appendix G

incorporated within each evolution of the PSA model; source term and economic assumptions used in the Level 3 PSA; detailed information on some specific candidate SAMAs; and consideration of additional lower cost SAMAs. NMC submitted additional information by letters dated October 21, 2005 (NMC 2005b), and November 18, 2005 (NMC 2005c). In the responses, NMC provided summaries of PSA peer review comments and the resolution status of each; a summary of the major changes made to each PSA model version and resultant changes to dominant risk contributors to CDF; additional detail on source term and economic assumptions used in the Level 3 PSA; additional information regarding specific SAMAs; and a description of future plans for evaluating potentially cost-beneficial SAMAs. NMC's responses addressed the NRC staff's concerns and resulted in the identification of additional potentially cost-beneficial SAMAs.

An assessment of SAMAs for Palisades is presented below.

G.2 Estimate of Risk for Palisades

NMC's estimates of offsite risk at Palisades are summarized in Section G.2.1. The summary is followed by the NRC staff's review of NMC's risk estimates in Section G.2.2.

G.2.1 NMC's Risk Estimates

Two distinct analyses were combined to form the basis for the risk estimates used in the SAMA analysis: (1) the Palisades Level 1 and 2 PSA model, which is an updated version of the IPE (Consumers Power 1993), and (2) a supplemental analysis of offsite consequences and economic impacts (essentially a Level 3 PSA model) developed specifically for the SAMA analysis. The SAMA analysis was based on the most recent Palisades Level 1 and Level 2 PSA model available at the time of the ER, referred to as PSA version PSAR1c. The scope of the Palisades PSA does not include external events.

The baseline CDF for the purpose of the SAMA evaluation was approximately 4.05×10^{-5} per year. The CDF was based on the risk assessment for internally initiated events. NMC did not include the contribution from external events within the Palisades risk estimates; however, it did account for the potential risk reduction benefits associated with external events by doubling the estimated benefits for internal events. This is discussed further in Section G.6.2.

Table G-1 provides the breakdown of CDF by initiating event. As shown in this table, events initiated by loss of offsite power (LOOP), small break loss-of-coolant accidents (LOCAs), and steam generator tube rupture (SGTR) are the dominant contributors to CDF. The contribution of internal flooding to the CDF is approximately 1.0×10^{-7} per year (NMC 2005a).

Table G-1. Palisades Core Damage Frequency for Internal Events

Initiating Event	CDF (per year)	% Contribution to CDF
LOOP (including station blackout)	1.24×10^{-5}	31
Small break LOCA	1.02×10^{-5}	25
SGTR	6.06×10^{-6}	15
General transient with main condenser available	2.94×10^{-6}	7
Loss of instrument air	2.41×10^{-6}	6
Loss of service water	1.84×10^{-6}	5
Loss of main feedwater	9.07×10^{-7}	2
Loss of the main condenser	6.46×10^{-7}	2
Pressurizer safety valve spurious opening	4.08×10^{-7}	1
Other Initiators	2.69×10^{-6}	6
Total CDF (internal events)	4.05×10^{-5}	100 ^(a)
(a) Total may not equal 100% because of rounding.		

The Level 2 Palisades PSA model is based on the original 1993 IPE submittal. Subsequent to the IPE submittal, the containment event tree (CET) was updated to reflect improvements in the state of knowledge on severe accidents and the implementation of a plant modification to prevent early core relocation into the Palisades auxiliary building. The Level 2 PSA consists of a detailed CET to represent dependencies among phenomenological assumptions. The CET was quantified by a relatively detailed process involving the development of probability distributions for a number of key phenomena, along with point estimate values for other issues. The CET end states were grouped into release categories by magnitude and timing of the expected releases. The result of the Level 2 PSA was a set of release categories with their respective frequency and release characteristics. The results of the updated analysis for Palisades are provided in Table E.3-5 of the ER. The frequency of each release category was obtained from the quantification of the CET for each Level 1 accident sequence. The release characteristics were obtained from the results of accident analyses of representative sequences for each release category using the Modular Accident Analysis Program (MAAP) computer code.

The offsite consequences and economic impact analyses use the MACCS2 code to determine the offsite risk impacts on the surrounding environment and public. Inputs for this analysis include plant-specific and site-specific input values for core radionuclide inventory, source term and release characteristics, site meteorological data, projected population distribution (within a 50-mi radius) for the year 2031, emergency response evacuation modeling, and economic data. The core radionuclide inventory is based on Palisades plant-specific Oak Ridge Isotope

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Generator (ORIGEN) calculations. In response to an RAI (NMC 2005b), NMC stated that the core inventory calculations were developed in response to Generic Letter (GL) 2003-01 concerning control room habitability (NRC 2003a) and represent best-estimate fuel cycle data for Palisades for 23 GWd/MTU, 18-month fuel cycles. The magnitude of the onsite impacts (in terms of cleanup and decontamination costs and occupational dose) is based on information provided in NUREG/BR-0184 (NRC 1997a).

In response to an RAI (NMC 2005b), NMC estimated the dose to the population within 50 mi of the Palisades site to be approximately 31.9 person-rem per year. The breakdown of the total population dose by containment release mode is summarized in Table G-2. Basemat failures and SGTRs dominate the population dose risk at Palisades.

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

Containment Release Mode	Population Dose (Person-rem ^(a) per year)	% Contribution
SGTR	7.6	23.9
Early containment failure	1.6	5
Intermediate containment failure	0	0
Late containment failure	0.3	0.9
Intact containment	0.6	1.9
Basemat failure	21.6	67.8
Containment isolation failure	0.2	0.6
Total population dose	31.9	100 ^(b)

(a) One person-rem = 0.01 person-Sv.
(b) Total may not equal 100% because of rounding.

G.2.2 NRC Staff's Review of NMC's Risk Estimates

NMC's determination of offsite risk at Palisades is based on the following three major elements of analysis:

- The Level 1 and 2 risk models that form the bases for the 1993 IPE submittal (Consumers Power 1993) and the original and revised IPEEE submittals (Consumers Power 1995, 1996).
- The major modifications to the IPE model that have been incorporated into the Palisades PSA, and

- The MACCS2 analyses performed to translate fission product source terms and release frequencies from the Level 2 PSA model into offsite consequence measures.

Each of these analyses was reviewed to determine the acceptability of NMC's risk estimates for the SAMA analysis, as summarized below.

The Palisades PSA model evolved through several stages, starting with development of an initial Level 1 PSA model in 1982 to address the risk associated with failing to satisfy single failure design criteria with respect to the main steam isolation valves (MSIVs). This model was subsequently updated and submitted to NRC in 1993 in response to GL 88-20 (NRC 1988). Palisades has several atypical design features that can affect accident progression. Consequently, instead of relying on the results of previous Level 2 PSAs, plant-specific, detailed, deterministic evaluations were performed in support of the IPE submittal for the key severe accident phenomena. These evaluations included reviewing available experimental data, as well as creating a plant-specific version of MAAP, version 3.0B, referred to as CPMAAP.

The NRC staff's review of the Palisades IPE is described in an NRC report dated February 7, 1996 (NRC 1996). On the basis of a review of the IPE submittal and responses to RAIs, the NRC staff concluded that the IPE submittal met the intent of GL 88-20 (NRC 1988); that is, the IPE was of adequate quality to be used to look for design or operational vulnerabilities. The NRC staff, however, encouraged the licensee to improve the human reliability analysis "to make it a valuable tool for other applications."

Numerous revisions have been to the IPE model since its submittal. A comparison of internal events risk profiles between the IPE and the PSA used in the SAMA analysis indicates a decrease of approximately 1.0×10^{-5} per year in the total internal events CDF (from 5.07×10^{-5} per year in the IPE to 4.05×10^{-5} per year in PSAR1c). The PSA updates have involved the examination of plant operating logs, corrective action documents, out-of-service time histories for selected components, industry data, implemented plant modifications, model review comments, and suggested peer review changes. A summary listing of those changes that resulted in the greatest impact on the internal events CDF was provided in the ER (NMC 2005a) and further discussed in the response to an RAI (NMC 2005b). The major changes are summarized in Table G-3.

The CDF values for Palisades are comparable to the CDF values reported in the IPEs for other combustion engineering plants. Figure 11.6 of NUREG-1560 shows that the IPE-based total internal events CDF for combustion engineering plants ranges from approximately 1.0×10^{-5} per year to 2.0×10^{-4} per year, with an average CDF for the group of 7.0×10^{-5} per year (NRC 1997c). It is recognized that other plants have updated the values for CDF subsequent to the IPE submittals to reflect modeling and hardware changes. The current internal events CDF

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Table G-3. Palisades PSA Historical Summary

PSA Version	Summary of Changes from Prior Version	CDF (per year)
IPE (1993)	IPE submittal	5.07×10^{-5}
PSAR1 (1999)	Moved the internal events CDF model from Set Equation Transformation System (SETS) to Systems Analysis Programs for Hands-On Integrated Reliability Evaluations (SAPHIRE)	5.95×10^{-5}
PSAR1a (2000)	Removed the auxiliary feedwater (AFW) alternate steam supply line to AFW pump P-8B from the model to reflect a plant modification Updated the main steam line break and SGTR initiating event frequencies	5.47×10^{-5}
PSAR1b (2000)	Updated selected human error probabilities Updated selected common cause failure logic for control and solenoid valves Incorporated a plant modification that swapped the high-pressure air power supplies for motor control centers MCC-7 and MCC-8; added additional direct current (DC) bus faults and added certain DC demand failure modes Set the summertime emergency diesel generator heating, ventilation, and air-conditioning system success criteria to True for all nominal baseline calculations Eliminated the independent anticipated transient without scram (ATWS) event trees by transferring all event trees to a single ATWS event tree	6.18×10^{-5}
PSAR1b-modified (2001)	Corrected a conservative shutdown cooling heat exchanger modeling assumption	6.16×10^{-5}
PSAR1b-modified w/HELB (2002)	Updated the model to include main steam line breaks in the component cooling-water (CCW) rooms	6.24×10^{-5}
PSAR1c (SAMA; 2004)	Corrected diesel generator repair/recovery logic Added modeling of failure of the primary coolant pump seals, inadvertent primary coolant system safety relief valve opening, and failure of the AFW flow control valves to close Incorporated modifications to the plant recirculation actuation system and instrument air compressor Removed modeling conservatism in the service-water header valve logic	4.05×10^{-5}

Table G-3. (contd)

PSA Version	Summary of Changes from Prior Version	CDF (per year)
PSAR1c (SAMA; 2004) (contd)	<p>Modified modeling of fire protection system (FPS) makeup to AFW pump P-8C logic to include failure of condensate storage tank T-2; FPS logic to include reliance on traveling screens; condensate pump logic to include availability of both the gland seal condenser and air ejector after condenser rupture; CCW pumps P-52A, P-52B, and P-52C logic to include failures as a result of steam line breaks outside of containment; and MSIV autoclose logic for “containment high pressure” and “low steam generator pressure” to correctly account for steam line break and LOCA event initiators</p> <p>Updated common cause failure data</p>	

results for Palisades are comparable to the updated estimates for other plants of similar vintage and characteristics.

The NRC staff considered the peer reviews performed for the Palisades PSA and the potential impact of the review findings on the SAMA evaluation. In the ER and in response to an RAI, NMC described the Combustion Engineering Owners Group (CEOG) Peer Review of the PSA. The CEOG peer review of the PSAR1a model resulted in 9 Level A comments (important and necessary to address before the next regular PSA update) and 50 Level B comments (important and necessary to address, but disposition may be deferred until the next PSA update). The resolution of the peer review comments is described in the ER (NMC 2005a) and in response to an RAI (NMC 2005b). All Level A and Level B comments have either been addressed in the PSAR1c model used for the SAMA analysis, or further evaluated and judged to have no significant impact on the SAMA evaluation.

Given that the Palisades PSA has been peer reviewed and the peer review findings have either been addressed or judged to have no impact on the SAMA evaluation, that NMC has satisfactorily addressed the NRC staff’s questions regarding the PSA (NMC 2005b), and that the CDF falls within the range of contemporary CDFs for combustion engineering plants, the NRC staff concludes that the Level 1 PSA model is of sufficient quality to support the SAMA evaluation.

As indicated above, the current Palisades PSA does not include external events. In the absence of such an analysis, NMC used the Palisades IPEEE in the SAMA analysis to identify the highest risk accident sequences and the potential means of reducing the risk posed by those sequences, as discussed below.

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NMC submitted an IPEEE by letter dated June 30, 1995 (Consumers Power 1995), in response to Supplement 4 of GL 88-20. NMC did not identify any fundamental weaknesses or vulnerabilities to severe accident risk in regard to the external events related to seismic, fire, or other external events. However, a number of areas were identified for improvement in both the seismic and fire areas and were subsequently addressed as discussed below. In a letter dated November 29, 1999, the NRC staff concluded that the Palisades IPEEE met the intent of Supplement 4 to GL 88-20, and that the licensee's IPEEE process is capable of identifying the most likely severe accidents and severe accident vulnerabilities (NRC 1999).

Palisades performed a relatively robust seismic analysis as part of the IPEEE. The seismic analysis utilized the existing plant PSA with event trees specifically developed to evaluate seismic events. The resulting seismic CDF was estimated as 8.88×10^{-6} per year (NMC 2005a), about 20 percent of the internal events CDF. While the seismic analysis did not identify any significant seismic concerns, several insights were gained about the most important equipment failures during and after seismic events. The IPEEE identified four groups of equipment that contributed most of the seismic CDF; specifically, the fire protection system (FPS), the MSIVs, the emergency diesel generator (EDG) fuel oil supply (storage tank T-10), and the bus under-voltage relay for safety bus 1D. NMC reviewed these groups to identify potential SAMAs. For three of these contributors, no additional SAMAs were identified. That is, (1) the FPS failures (and possible SAMAs) were already identified as important contributors to the Class 1A and 1B sequences from the internal events analysis; (2) given MSIV modeling more closely representing actual operation, MSIV seismic interactions would not be risk significant; and (3) since EDG fuel storage tank T-10 is not necessary to support a 24-hour mission duration, there is no measurable benefit to strengthening or replacing tank T-10. For the fourth contributor, NMC identified that the under-voltage relay for bus 1D was important to start the EDG, and a SAMA was added to the list of candidate SAMAs to replace this relay with one that is less susceptible to seismic activity (i.e., SAMA 22).

On the basis of consideration of important random failures in the Palisades seismic analysis, NMC also identified the importance of EDG 1-2 during a seismic event because it provides power to auxiliary feedwater (AFW) pump P-8C, which is the only AFW pump with a seismically durable water supply. Adding an electrical cross-tie to provide alternate power to this pump (SAMA 9), which had been identified to address internal initiating events based on the PSA results, was also identified as a plant improvement that would limit the impact of this random failure.

The IPEEE also found that some relays were vulnerable to seismic activity and that some equipment anchorage improvements were required. These were addressed as part of the closeout of unresolved safety issue (USI) A-46 (NRC 1997b), and all actions with respect to USI A-46 have now been completed. The NRC review and closure of USI A-46 for Palisades is documented in a letter dated September 25, 1998 (NRC 1998). Completion of the last item requiring resolution was documented in a letter to the NRC in June 2003 (NMC 2003).

Based on the licensee's IPEEE efforts to identify and address seismic outliers and their incorporation into the SAMA process, the NRC staff concludes that the opportunity for seismic-related SAMAs has been adequately explored.

A revised internal fire analysis for the Palisades IPEEE was submitted in Revision 1 of the IPEEE, dated May 31, 1996 (Consumers Power 1996). The internal fire analysis was revised as the Fire Protection Program and Appendix R analyses were in the process of being upgraded when the original IPEEE was submitted (Consumers Power 1995). The Palisades fire analysis was based on the Electric Power Research Institute's (EPRI's) fire-induced vulnerability evaluation (FIVE) methodology. The methodology employs a graduated focus on the most important fire zones using qualitative and quantitative screening criteria (EPRI 1992). The fire zones or compartments were subjected to at least two screening phases. In the first phase, a compartment was screened out if it was found to not contain any equipment or cables associated with safe shutdown or an initiating event. In the second phase, the licensee used the IPE model of internal events to estimate the CDF resulting from a fire initiating event. The conditional core damage probability associated with each fire compartment was based on the equipment and systems unaffected by the fire. The CDF for each compartment was obtained by multiplying the frequency of a fire in a given fire compartment by the conditional core damage probability associated with that fire compartment. The most important fire areas/rooms identified in Revision 1 of the IPEEE are the cable spreading room, the control room, the 1D switchgear room, the turbine building, and the 1C switchgear room. The resulting fire CDF was estimated as 3.31×10^{-5} per year (NMC 2005a), about 80 percent of the internal events CDF.

Revision 1 of the IPEEE fire document also provides a summary of the most important contributors to each of the accident classes. NMC used the event rankings within these categories to identify the largest contributors to risk and to identify additional SAMAs to prevent or mitigate the loss of functions represented by these events. For example:

- The contribution from failures to initiate once-through cooling following a successfully suppressed fire, failures of AFW pump P-8B, or random failures of the AFW system could all be mitigated by providing an alternate means of secondary heat removal. The installation of a direct drive diesel-driven injection pump (DDDIP) to back up the AFW system was identified by NMC to address these failures and was included as SAMA 3. The DDDIP also provides long-term steam generator makeup, assuming a portable generator is included.
- Failure to control AFW steam supply or injection could be mitigated by enhancing primary side cooling. The addition of another high-pressure injection (HPI) pump or the conversion of AFW pump P-8C back to a high-pressure safety injection (HPSI) pump was identified to address these failures and included as SAMA 4.

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- Station blackout (SBO) sequences were identified as important contributors in the Level 1 model. A SAMA to proceduralize the use of a steam-driven AFW pump to operate without support systems was included to address these events (SAMA 10).

Each of these SAMAs had also been identified to address internal initiating events established on the basis of the PSA results.

The licensee noted that in the IPEEE fire analysis, operator action was required to manually open subcooling valves to the suction of the HPSI pumps after the recirculation actuation signal to ensure adequate HPSI net positive suction head, and that the alignment of these valves was subsequently automated. The hardware modification addressed the importance of the action to align the subcooling valves; accordingly, no additional SAMAs were suggested for this contributor.

On the basis of the licensee's IPEEE efforts to identify and address internal fire outliers and their incorporation into the SAMA process, the NRC staff concludes that the opportunity for internal fire-related SAMAs has been adequately explored.

Other external events considered in the IPEEE included high wind events, external flooding, transportation, and nearby facility accidents. The risk associated with these events is small, with the total CDF from other external events about 1.0×10^{-6} per year. The licensee reviewed the insights from previous assessments of these events performed as part of the NRC Systematic Evaluation Program and the IPEEE, and considered the potential for additional SAMAs to reduce these risks. A detailed discussion is provided in Section E.5.1.6 of the ER. NMC concluded that no further modifications would be cost-beneficial. It is noted that the risks from deliberate aircraft impacts were explicitly excluded since this was being considered in other forums along with other sources of sabotage.

In light of the external events CDF being approximately equal to the internal events CDF, NMC doubled the benefit that was derived from the internal events model to account for the contribution from external events. This doubling was not applied to the one SAMA that specifically addressed seismic risks (i.e., SAMA 22), since this SAMA is specific to only seismic risk and does not have a corresponding risk reduction in internal events. However, this doubling was applied to those SAMAs that addressed both fire or seismic and internal events (i.e., SAMAs 3, 4, 9, and 10), since these SAMAs do have a corresponding risk reduction in internal events. The fire risk analysis is described in the IPEEE and in the ER as producing conservative CDF results. While conservative assumptions were used for the majority of fire areas, other aspects of the analysis were considered to be optimistic (NRC 1999). Thus, the degree of conservatism in the result is not clear. Furthermore, the risks due to external events that are discussed above are the results of analyses that were performed at varying times prior to the current Palisades internal events PSA. The methodologies also vary in the degree of completeness and conservatism. Consequently, the results cannot be directly compared with

those from the current PSA. Notwithstanding the above, the NRC staff agrees with the applicant's conclusion that the risk posed by external events is approximately equal to that due to internal events. Therefore, the NRC staff concludes that the applicant's use of a multiplier of 2 to account for external events is reasonable for the purposes of the SAMA evaluation.

The NRC staff reviewed the general process used by NMC to translate the results of the Level 1 PSA into containment releases, as well as the results of this Level 2 analysis. NMC characterized the releases for the spectrum of possible radionuclide release scenarios using a set of six release categories, defined on the basis of the timing and magnitude of the release. The frequency of each release category was obtained from the quantification of a linked Level 1-Level 2 model, which effectively evaluates a CET for each Level 1 accident sequence. Each end state from the Level 2 analysis is assigned to one of the release categories. The process for assigning accident sequences to the various release categories and selecting a representative accident sequence for each release category is described in the ER. The release categories and their frequencies are presented in Section E.2.5.5 of the ER (NMC 2005a), as are the source terms used for the SAMA evaluation based on the MAAP 3.0B computer code. The NRC staff concludes that the process used for determining the release category frequencies and source terms is reasonable and appropriate for the purposes of the SAMA analysis.

In response to an RAI (NMC 2005b), NMC identified that the core inventory used for the Palisades MACCS2 analysis was based on plant-specific data, and that fuel cycle parameters were best estimates and consistent with expected Palisades fuel cycles. The NRC staff concludes that the best plant-specific estimate provides a reasonable basis for estimating the reactor core radionuclide inventory in the consequence assessment.

The NRC staff reviewed the process NMC used to extend the containment performance (Level 2) portion of the PSA to an assessment of offsite consequences (essentially a Level 3 PSA). This included consideration of the major input assumptions used in the offsite consequence analyses. The MACCS2 code was utilized to estimate offsite consequences. Plant-specific input to the code includes the source terms for each release category and the reactor core radionuclide inventory (both discussed above), site-specific meteorological data, projected population distribution within a 50-mi radius for the year 2031, emergency evacuation modeling, and economic data. This information is provided in Appendix E of the ER (NMC 2005a).

NMC used a composite set of site-specific meteorological data obtained from the plant meteorological tower and the nearby Benton Harbor Ross Field National Weather Station (for hourly precipitation). The data were processed from hourly measurements for the 2000 calendar year as input to the MACCS2 code. The data for 2000 were nearly complete, missing only 4 hours of scattered data. Data from these locations and from this year were selected because they provided an adequate representation of the Palisades meteorological

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data. Site meteorological data for 2001, 2002, and 2003 were also evaluated as sensitivity cases to ensure that the 2000 data composed a representative data set. Population dose and economic costs were only minimally impacted (less than 8 percent change) because of the use of different data sets. The meteorological data for 2000 were found to result in the highest population dose and economic costs, and were therefore chosen as the basis for the SAMA analysis. The NRC staff notes that previous SAMA analyses results have also shown little sensitivity to year-to-year differences in meteorological data and considers use of the 2000 data to be reasonable.

The population distribution that the applicant used as input to the MACCS2 analysis was estimated for 2031, based on extrapolation from U.S. Census population data for 1990 and 2000. U.S. Census data from 1990 and 2000 were used to determine a total annual average population growth rate (1.1 percent per year). It was assumed that the growth rate would remain the same as that reported between 1990 and 2000. The annual population growth was applied uniformly to all sectors to calculate the 2031 population distribution. A population sensitivity case was performed by using a 30 percent uniform increase in population for all sectors. The 30 percent population case showed about a 20 percent change in population dose and about a 50 percent change in cost risk. The NRC staff considers NMC's methods and assumptions for estimating population doses reasonable and acceptable for purposes of the SAMA evaluation.

The emergency evacuation model assumed a single evacuation zone extending out 10 mi from the plant. It was assumed that 95 percent of the population would move at an average speed of approximately 0.81 m/s with a delayed start time of 15 to 30 minutes (NMC 2005a). This assumption is conservative relative to the NUREG-1150 study (NRC 1990), which assumed evacuation of 99.5 percent of the population within the emergency planning zone. Two evacuation sensitivity cases were performed, one with an evacuation speed of 0.41 m/s (a factor of 2 decrease), and one with a 90-minute delay. The results demonstrated that the population dose and economic costs are relatively insensitive to this parameter. The evacuation assumptions and analysis are deemed reasonable and acceptable for the purposes of the SAMA evaluation.

Much of the site-specific economic data were provided from SECPOP2000 (NRC 2003b) by specifying the data for each of the counties surrounding the plant, to a distance of 50 mi. 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 nonfarm wealth, and fraction of farm wealth from improvements (e.g., buildings). In response to an RAI, NMC provided additional information on several economic parameter input values used in the MACCS2 calculations.

The NRC staff concludes that the methodology NMC used to estimate the offsite consequences for Palisades provides an acceptable basis from which to proceed with an assessment of risk reduction potential for candidate SAMAs. Accordingly, the NRC staff based its assessment of offsite risk on the CDF and offsite doses reported by NMC.

G.3 Potential Plant Improvements

The process for identifying potential plant improvements, an evaluation of that process, and the improvements evaluated in detail by NMC are discussed in this section.

G.3.1 Process for Identifying Potential Plant Improvements

NMC's process for identifying potential plant improvements (SAMAs) consisted of the following elements:

- Review of the most significant basic events from the Palisades PSAR1c Levels 1 and 2 PSA;
- Review of potentially cost-beneficial SAMAs from license renewal applications for six other U.S. nuclear sites;
- Review of potential plant improvements identified in the Palisades IPE and IPEEE; and
- Review of the dominant fire areas and seismic risk contributors, and SAMAs that could reduce the associated fire and seismic risk at Palisades.

To provide consistency with previous industry SAMA analyses and to provide a recognized source of ideas for the types of enhancements that could be proposed to address plant-specific insights, NMC also reviewed a generic list of 266 SAMAs developed from previous industry SAMA analyses.

On the basis of this process, an initial set of 23 candidate SAMAs, referred to as Phase 1 SAMAs, was identified. In Phase 2 of the evaluation, NMC performed a qualitative screening of the initial list of SAMAs and eliminated SAMAs from further consideration using the following criteria:

- The SAMA is not applicable at Palisades because of design differences;
- The SAMA requires extensive changes that would involve implementation costs known to exceed any possible benefit; or

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- The SAMA costs more than \$5.6 million to implement (the modified maximum averted cost-risk (MMACR), which represents the dollar value associated with completely eliminating all internal and external event severe accident risk at Palisades).

Based on this screening, 14 SAMAs were eliminated, leaving 9 for further evaluation. These remaining SAMAs, referred to as Phase 2 SAMAs, are listed in Table E.5-4 of the ER (NMC 2005a). During the initial stage of the Phase 2 evaluation, NMC qualitatively screened out one of the nine remaining SAMA candidates based on plant-specific insights regarding the low risk significance of systems affected by the SAMA (i.e., SAMA 17), bringing the number of remaining SAMAs to eight. A detailed cost-benefit analysis was performed for each of the eight remaining SAMA candidates. To account for the potential impact of external events, the estimated benefits based on internal events were multiplied by a factor of 2 (except for the SAMA specific to seismic risk, since this SAMA would not have a corresponding benefit on the risk from internal events).

NMC also assessed the impact on initial screening if the MMACR were based on a 3 percent discount rate rather than 7 percent, or if the MMACR were increased by a factor of 2.3 to reflect the potential impact of uncertainties. As a result, four additional SAMAs would have been retained for the Phase 2 analyses. These SAMAs are discussed further in Section G.6.2.

G.3.2 Review of NMC's Process

NMC's efforts to identify potential SAMAs focused primarily on areas associated with internal initiating events, but also included explicit consideration of SAMAs for seismic and fire events. The initial list of SAMAs generally addressed the accident sequences considered to be important to CDF and population dose from functional, initiating event, and risk reduction worth (RRW) perspectives at Palisades, and included selected SAMAs from other plants.

A preliminary review of NMC's SAMA identification process raised some concerns regarding the set of 23 SAMAs evaluated in the initial screening and how this set relates to the generic list of 266 SAMAs developed from industry sources. In response to an RAI, NMC clarified that the generic list of 266 SAMAs was used only as a source of ideas for the types of enhancements that could be proposed to address the plant-specific risk insights for Palisades (NMC 2005b).

In its ER (NMC 2005a), NMC provided a list of basic events ranked by RRW for both CDF (Level 1 PSA) and population dose (Level 2 PSA). For the Level 1 importance list, NMC considered all basic events with a RRW greater than 1.01. For the Level 2 importance list, NMC reviewed a composite file composed of those basic events representing the top 97 percent of all population doses and again considered all basic events with a RRW greater than 1.01. NMC correlated the top risk contributors to CDF and population dose with the SAMAs evaluated in the ER. The two tables provided basic event identifiers, RRW, and potential SAMAs for each basic event. Two events in the CDF importance list (Table E.5-1 of the ER) were estimated by the

NRC staff to have a very large risk achievement worth (e.g., RXC-MECH-FAULTS and RXC-ELEC-FAULTS). In the case of mechanical faults alone, the NRC staff estimated that an order-of-magnitude increase in the failure probability would increase the CDF to 6.8×10^{-5} per year. The NRC staff requested an NMC assessment of whether a SAMA is warranted to ensure that these subsystems do not degrade (NRC 2005). In its response, NMC agreed that there may be demonstrable value in assuring that there is no degradation in performance over time. However, given the significant routine testing that already is required by existing plant procedures, NMC stated that what would be considered appropriate as a SAMA has already been implemented at Palisades (NMC 2005b). On the basis of this information, the NRC staff concludes that the set of SAMAs evaluated in the ER addresses the major contributors to CDF and offsite dose, and that the review of the top risk contributors does not reveal any new SAMAs.

NMC identified Palisades-specific candidate SAMAs for seismic and fire events using a combination of the Palisades PSA models and insights from the IPEEE. As a result, one SAMA related specifically to seismic events was identified and retained for evaluation. Furthermore, four SAMAs already identified and retained for evaluation to address internal initiating events were also recognized as being effective in seismic and fire events. Potential plant enhancements for other external events (high wind events, external flooding and probable maximum precipitation events, and transportation and nearby facility accidents) were determined to be too costly, sufficiently addressed by existing plant features/capabilities, or already addressed by an existing SAMA. The NRC staff considers the applicant's rationale for eliminating these enhancements from further consideration to be reasonable.

The NRC staff questioned NMC about several candidate SAMAs that were identified as potentially cost-beneficial at other combustion engineering plants but not addressed by NMC (NRC 2005). In response, NMC provided an assessment of the applicability/feasibility of each of these enhancements and concluded that most of these SAMAs would not be warranted at Palisades because they are not applicable to Palisades, would not provide a significant benefit at Palisades, or are already addressed by existing SAMAs for Palisades (NMC 2005b,c). However, NMC determined that two of the NRC-staff-identified enhancements could be applicable to Palisades. These enhancements are as follows:

- Add the capability to flash the field on the EDG to enhance SBO recovery, and
- Replace an existing air-operated containment sump valve with a motor-operated valve to reduce common cause failures.

NMC did not provide a further assessment of these SAMAs as part of its response, but instead, indicated that these two SAMAs have been entered into the Palisades corrective action system for further review and, if determined to be cost-beneficial, they will be further evaluated for possible implementation in accordance with Palisades plant design processes (NMC 2005c).

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The NRC staff requested further justification from NMC concerning the elimination of three SAMAs as part of the Phase 1 screening (NRC 2005). The qualitative arguments presented for eliminating these SAMAs were either incomplete, unclear, or unconvincing to the NRC staff. In its response to the RAIs, NMC provided further information (NMC 2005b). The NRC staff's concern and NMC's response for each of the three SAMAs are discussed below:

- SAMA 12 – automate boron injection for anticipated transient without scram (ATWS) conditions. NMC eliminated this SAMA because it is a boiling-water reactor mitigation feature that is not applicable to a pressurized-water reactor. The NRC staff then questioned why it was identified as a modification to the existing chemical volume control system injection system to reduce ATWS sequences. In its response, NMC noted that the basic events impacted by this SAMA were conservatively modeled in the PSA, thus artificially increasing their RRW importance measure. NMC reevaluated the RRWs, considering both updated reliability data and hardware changes made at Palisades in the 1990s, and showed that none of the basic events would be above the 1.01 RRW threshold for SAMA consideration. On the basis of this, SAMA 12 was screened from further consideration in the final evaluation.
- SAMA 19 – provide an HPI suction cross-tie to the opposite heat exchanger. This SAMA specifically addresses failures of the HPSI pump suction subcooling valves between the heat exchangers and the HPI pumps, and was eliminated by NMC because failure of these same valves is addressed by SAMA 17. The NRC staff questioned whether the two different sets of plant enhancements would accomplish the same effect since each of these SAMAs addresses different initiating events. In its response, NMC noted that the basic events impacted by this SAMA were conservatively modeled in the PSA, thus artificially increasing their RRW importance measure. NMC indicated that, if containment integrity is preserved, adequate net positive suction head is available regardless of the state of the two HPSI pump suction subcooling valves. Given that the conditional likelihood of containment failure is about 1×10^{-2} , the importance of these valve failures is actually much less than the current PSA model results. On the basis of this, SAMA 19 was screened from further consideration in the final evaluation.
- SAMA 20 – improve performance of the traveling screens. NRC eliminated this SAMA based on the assumption that existing plant procedures were adequate to prevent traveling screen failure. The NRC staff questioned whether this was a good assumption given the potential for human error during procedure implementation. In its response, NMC noted that the current analysis does not include a human error. NMC reevaluated the RRW by incorporating the impact of human error and showed that the event would be below the 1.01 RRW threshold for SAMA consideration. On the basis of this, SAMA 20 was screened from further consideration in the final evaluation.

The NRC staff considers the applicant's rationale for eliminating these three enhancements from further consideration to be reasonable.

On the basis of the initial screening, NMC eliminated SAMAs 1, 15, and 18 from further consideration because their implementation cost was estimated to exceed the MMACR. The NRC staff identified possible lower cost alternatives for these SAMAs and requested that NMC provide an evaluation of these alternatives (NRC 2005). In its response, NMC provided further information (NMC 2005b):

- SAMA 1 – This SAMA involves installing an additional EDG. The NRC staff questioned whether there were lower cost alternatives such as providing nonsafety-grade backup power from the gas turbine generating facility co-located near the Palisades Plant or installation of a nonsafety-grade diesel generator. NMC responded that it had previously looked into the possibility of an agreement with the gas facility to reduce plant risk from SBO events. However, the gas plant is operated as a peaking unit, is online only when there is a need for additional power, and does not have a black start capability. This alternative is therefore not considered feasible. Relative to the installation of a nonsafety-grade diesel generator, NMC noted that 87 percent of the CDF from LOOP events is associated with the dominant SBO scenario. While SAMA 1 was identified to address the broad category of LOOP events, SAMA 10 was developed as a mitigating strategy to deal specifically with the SBO scenario. NMC's position is that SAMA 10 is a lower cost alternative to the nonsafety-grade EDG and will provide a significant percentage of the expected benefit of SAMA 1. However, NMC did commit to conducting an evaluation to determine the potential risk reduction and cost benefit of installing a nonsafety-grade diesel generator as a lower cost alternative to an additional EDG, subsequent to the evaluation of SAMA 10, and has entered this action into the Palisades corrective action program for further review. If determined to be cost-beneficial, the lower cost alternative will be evaluated for possible implementation in accordance with Palisades plant design processes (NMC 2005c).
- SAMA 15 – This SAMA involves adding a bypass line around the safety injection and refueling water tank (SIRWT) return lines. Adding this line would increase the number of potential leakage paths for contaminated containment sump water back to the SIRWT during the recirculation phase of an accident. Because of the proximity of the SIRWT vent to the main control room heating, ventilation, and air-conditioning (HVAC) normal intakes, this SAMA would increase the control room dose consequences significantly during an accident, thereby requiring plant modifications to the control room HVAC if implemented. The NRC staff questioned whether there were lower cost alternatives that would eliminate the need to modify the main control room HVAC system, such as locking open one of the return line valves as an alternative to adding a bypass line. NMC responded that the recirculation line valves perform two distinct functions, and that they are required to be open during the injection phase and closed when the SIRWT level

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falls to the low-low setpoint. Improving the probability of opening by locking open one of the valves would increase the probability of failure of the isolation function. Accordingly, locking open one valve is not considered a viable option. However, NMC also indicated that Palisades is currently in a study phase with respect to GL 2003-01 (NRC 2003a) and Generic Safety Issue 191 (“Assessment of Debris Accumulation on PWR Sump Performance”), in which the performance of these valves is being analyzed. Required actions in response to these issues will override any changes considered solely for SAMA. Based on this, SAMA 15 was screened from further consideration in the final evaluation.

- SAMA 18 – This SAMA involves installing a permanent, dedicated pump and line to the EDGs to serve as the primary EDG cooling source. The NRC staff questioned whether there were lower cost alternatives such as installing an additional line or temporary connection directly from the FPS and bypassing the service-water lines. NMC did not provide a further assessment of these SAMAs as part of its response, but instead committed to conducting an evaluation to identify a lower cost alternative, and has entered this action into the Palisades corrective action system program for further review. If determined to be cost-beneficial, the lower cost alternative will be evaluated for possible implementation in accordance with Palisades plant design processes (NMC 2005c).

The NRC staff considers NMC’s rationale for eliminating SAMA 15 from further consideration to be reasonable, and NMC’s commitment to further evaluate lower cost alternatives for SAMAs 1 and 18 through the Palisades corrective action program to be acceptable.

The NRC staff notes that the set of SAMAs submitted is not all inclusive, since additional, possibly even less expensive, design alternatives can always be postulated. However, the NRC staff concludes that the benefits of any additional modifications are unlikely to exceed the benefits of the modifications evaluated and that the alternative improvements would not likely cost less than the least expensive alternatives evaluated, when the subsidiary costs associated with maintenance, procedures, and training are considered.

The NRC staff concludes that NMC used a systematic and comprehensive process for identifying potential plant improvements for Palisades, and that the set of potential plant improvements identified by NMC is reasonably comprehensive and therefore acceptable. This process included reviewing insights from the plant-specific risk studies, reviewing plant improvements considered in previous SAMA analyses, and using the knowledge and experience of its PSA personnel.

G.4 Risk Reduction Potential of Plant Improvements

NMC evaluated the risk reduction potential of the eight remaining SAMAs that were applicable to Palisades. Most of the SAMA evaluations were performed in a bounding fashion in that the SAMA was assumed to completely eliminate the risk associated with the proposed enhancement. Such bounding calculations overestimate the benefit and are conservative.

NMC used model requantification to determine the potential benefits. The CDF and population dose reductions were estimated using Palisades PSA model PSAR1c. The changes made to the model to quantify the impact of SAMAs are detailed in Section E.6 of Attachment E to the ER (NMC 2005a) and in response to an RAI (NMC 2005b). Table G-4 lists the assumptions considered to estimate the risk reduction for each of the evaluated SAMAs, the estimated risk reduction in terms of percent reduction in CDF and population dose, and the estimated total benefit (present value) of the averted risk based on a 7 percent and a 3 percent discount rate. This analysis methodology was also used for the three SAMAs (SAMAs 3, 4, and 10) that were originally identified and retained for evaluation to address internal initiating events, but that were also recognized as being effective in fire events. The determination of the benefits for the various SAMAs is further discussed in Section G.6.

For the one SAMA that specifically addresses seismic events only (SAMA 22), the reduction in CDF and population dose was not directly calculated. For this SAMA, a bounding estimate of the impact of the SAMA was made by assuming that the contribution to risk from external events is approximately equal to that from internal events, that seismic events contribute 21 percent of the external events risk, and that 69 percent of the seismic risk could potentially be eliminated by this SAMA based on information from the IPEEE.

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

G.5 Cost Impacts of Candidate Plant Improvements

NMC estimated the costs of implementing the remaining candidate SAMAs through the application of engineering judgment, use of estimates from other licensees' submittals for similar improvements, and development of site-specific cost estimates. The cost estimates conservatively did not include the cost of replacement power during extended outages required to implement the modifications, nor did they include contingency costs associated with unforeseen implementation obstacles (NMC 2005b). Estimates were presented in terms of dollar values at the time of implementation or estimation and were not adjusted to present-day

Table G-4. SAMA Cost-Benefit Screening Analysis for Palisades

SAMA ^(a)	Assumptions	% Risk Reduction		Total Benefit Using 7% Discount Rate (\$)	Total Benefit Using 3% Discount Rate (\$)	Cost (\$)
		CDF	Population Dose			
3. Install a direct drive diesel-driven injection pump (DDDIP). Reduces the risk of station blackout (SBO) scenarios by providing an injection method to supplement the turbine-driven auxiliary feedwater (AFW) pump.	Reduced the existing AFW pump failure probabilities by factors ranging from 7 to 19 to simulate the addition of a DDDIP. Also eliminated common cause failures and random system failures to represent the independence of the DDDIP.	15	14	793,000	1,050,000	1,100,000
4. Install an additional high-pressure injection (HPI) pump. Increases HPI diversity and reduces the probability of requiring reactor pressure valve (RPV) depressurization early in an accident.	Reduced the "A" train pump and valve failure rates to reflect the installation of the additional pump and the fact that only one pump train of three is required for success. Modeled by squaring each of the independent failure probabilities of the "A" train, which ranged originally from 2.5E-07 to 2.6E-03. Also reduced the common cause failure term by an order of magnitude.	3	1	85,400	108,000	1,620,000

Table G-4. (contd)

SAMA ^(a)	Assumptions	% Risk Reduction		Population Dose	Total Benefit Using 7% Discount Rate (\$)	Total Benefit Using 3% Discount Rate (\$)	Cost (\$)
		CDF	Dose				
10. Modify the turbine-driven AFW train so that it can operate indefinitely without alternating current (AC), direct current (DC), or pneumatic support.	Eliminated all AC power recovery failures to simulate the indefinite operation of the turbine-driven AFW pump.	27	33		1,750,000	2,340,000	200,000
13. Provide a nitrogen station that would automatically provide a backup air supply to the CV-2010 valve. Reduces the importance of Loss of Instrument Air to the valve.	Assumed a failure probability of 1E-02 for the nitrogen station.	5.2	4.4		262,000	346,100	220,000
14. Enhance the main control room to include controls for the cross-tie between the service-water system and the fire protection system. Reduces the time required to establish the cross-tie.	Eliminated seal loss-of-coolant accidents (LOCAs) that would occur on loss of seal cooling.	5	7		344,000	463,000	2,900,000

Table G-4. (contd)

SAMA ^(a)	Assumptions	% Risk Reduction		Total Benefit Using 7% Discount Rate (\$)	Total Benefit Using 3% Discount Rate (\$)	Cost (\$)
		CDF	Population Dose			
16. Install new insulation and lagging on the emergency diesel generator (EDG) exhaust ducts inside the EDG rooms and make procedural changes to align alternate room cooling.	Eliminated the EDG room cooling recovery event.	4	4	237,000	316,000	160,000
22. Replace the under-voltage relays for EDGs 1-1 and 1-2 with seismically qualified relays.	Eliminated all Class IA and IB external events.	15	15	414,000	550,000	110,000
23. Make procedural changes to direct the cooldown of the primary coolant pump (PCP) seals on loss of PCP seal cooling.	Eliminated seal LOCAs that would occur on loss of seal cooling.	5	7	344,000	463,000	100,000

(a) SAMAs in bold are potentially cost-beneficial when either a 7 percent or 3 percent real discount rate is used in the NRC staff's analysis.

dollars. For some of the SAMAs considered, so little, if any, benefit would be obtained from implementation of the proposed enhancement that it was not necessary to develop a cost estimate.

The NRC staff reviewed the bases for the applicant's cost estimates (as presented in Section E.6 of Appendix E of the ER and in a response by NMC to an RAI (NMC 2005b)). For certain improvements, the NRC staff also compared the cost estimates to estimates developed elsewhere for similar improvements, including estimates developed as part of other licensees' analyses of SAMAs for operating reactors and advanced light-water reactors. The NRC staff reviewed the costs and found them to be consistent with estimates provided in support of other plants' analyses.

The NRC staff questioned the applicant about the cost estimate for SAMA 21 and the use of the FPS as backup for the containment spray system. In the ER, the implementation cost for this SAMA is estimated to be \$7,000,000. A similar SAMA at Brunswick was estimated to cost only \$100,000. In response to an RAI, NMC provided a detailed breakdown of how the site-specific cost estimate was derived and noted that the Brunswick SAMA is for a procedural change, while SAMA 21 is a major plant modification (NMC 2005b). On the basis of a review of this additional information, the NRC staff considers the cost estimate for SAMA 21 to be reasonable.

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

G.6 Cost-Benefit Comparison

NMC's cost-benefit analysis and the NRC staff's review are described in the following sections.

G.6.1 NMC Evaluation

The methodology used by NMC was based primarily on NRC's guidance for performing cost-benefit analysis, that is, NUREG/BR-0184, *Regulatory Analysis Technical Evaluation Handbook* (NRC 1997a). The guidance involves determining the net value for each SAMA according to the following formula:

$$\text{Net Value} = (\text{APE} + \text{AOC} + \text{AOE} + \text{AOSC}) - \text{COE}$$

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 (\$),

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- | AOSC = present value of averted onsite costs (\$), and
COE = cost of enhancement (\$).

If the net value of a SAMA is negative, the cost of implementing the SAMA is larger than the benefit associated with the SAMA and it is not considered cost-beneficial. NMC's derivation of each of the associated costs is summarized below.

NUREG/BR-0058 has recently been revised to reflect the agency's revised policy on discount rates. Revision 4 of NUREG/BR-0058 states that two sets of estimates should be developed: one at 3 percent and one at 7 percent (NRC 2004). NMC provided both sets of estimates (NMC 2005a).

Averted Public Exposure (APE) Costs

The APE costs were calculated using the following formula:

$$\begin{aligned} \text{APE} = & \text{Annual reduction in public exposure } (\Delta \text{ person-rem/year}) \\ & \times \text{monetary equivalent of unit dose } (\$2000 \text{ per person-rem}) \\ & \times \text{present value conversion factor } (10.76 \text{ based on a 20-year period with a} \\ & \text{7 percent discount rate}). \end{aligned}$$

As stated in NUREG/BR-0184 (NRC 1997a), it is important to note that the monetary value of the public health risk after discounting does not represent the expected reduction in public health risk due to a single accident. Rather, it is the present value of a stream of potential losses extending over the remaining lifetime (in this case, the renewal period) of the facility. Thus, it reflects the expected annual loss due to a single accident, the possibility that such an accident could occur at any time over the renewal period, and the effect of discounting these potential future losses to present value. NMC calculated an APE of approximately \$688,000 for the 20-year license renewal period, which assumes elimination of all severe accidents.

Averted Offsite Property Damage Costs (AOC)

The AOCs were calculated using the following formula:

$$\begin{aligned} \text{AOC} = & \text{Annual CDF reduction} \\ & \times \text{offsite economic costs associated with a severe accident (on a per-event basis)} \\ & \times \text{present value conversion factor}. \end{aligned}$$

For the purposes of initial screening, which assumes all severe accidents are eliminated, NMC calculated an annual offsite economic risk of about \$125,000 based on the Level 3 risk analysis. This results in a discounted value of approximately \$1,345,000 for the 20-year license renewal period.

Averted Occupational Exposure (AOE) Costs

The AOE costs were calculated by using the following formula:

$$\begin{aligned} \text{AOE} &= \text{Annual CDF reduction} \\ &\quad \times \text{occupational exposure per core damage event} \\ &\quad \times \text{monetary equivalent of unit dose} \\ &\quad \times \text{present value conversion factor.} \end{aligned}$$

NMC derived the values for averted occupational exposure from information provided in Section 5.7.3 of the regulatory analysis handbook (NRC 1997a). Best estimate values provided for immediate occupational dose (3300 person-rem) and long-term occupational dose (20,000 person-rem over a 10-year cleanup period) were used. The present value of these doses was calculated by using the equations provided in the handbook in conjunction with a monetary equivalent of unit dose of \$2000 per person-rem, a real discount rate of 7 percent, and a time period of 20 years to represent the license renewal period. For the purposes of initial screening, NMC calculated an AOE of approximately \$15,400 for the 20-year license renewal period, which assumes all severe accidents are eliminated.

Averted Onsite Costs

The AOOSC 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 AOOSC based on information provided in Section 5.7.6 of the regulatory analysis handbook (NRC 1997a).

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:

$$\begin{aligned} \text{ACC} &= \text{Annual CDF reduction} \\ &\quad \times \text{present value of cleanup costs per core damage event} \\ &\quad \times \text{present value conversion factor.} \end{aligned}$$

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. For the purposes of initial screening, which assumes all severe accidents are eliminated, NMC calculated an ACC of approximately \$479,000 for the 20-year license renewal period.

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Long-term replacement power costs (RPC) were calculated using the following formula:

$$\begin{aligned} \text{RPC} = & \text{Annual CDF reduction} \\ & \times \text{present value of replacement power for a single event} \\ & \times \text{factor to account for remaining service years for which replacement power is} \\ & \text{required} \\ & \times \text{reactor power scaling factor} \end{aligned}$$

NMC based its calculations on the value of 816 megawatts electric (MW(e)). Therefore, NMC applied a power scaling factor of 816 MW(e)/910 MW(e) to determine the replacement power costs. NMC calculated an RPC of approximately \$287,000 for the 20-year license renewal period, which assumes all severe accidents are eliminated.

For the purposes of initial screening, which assumes all severe accidents are eliminated, NMC calculated an AOSC of approximately \$766,000 for the 20-year license renewal period.

Using the above equations, NMC estimated the total present dollar value equivalent associated with completely eliminating all severe accidents at Palisades to be about \$2,814,000. To account for additional risk reduction in external events, NMC doubled this value to \$5,630,000, which is the MMACR and represents the dollar value of completely eliminating all internal and external event severe accident risk at Palisades.

NMC's Results

If the implementation costs for a candidate SAMA were greater than the MMACR of \$5,630,000, then the SAMA was screened from further consideration. A more refined look at the costs and benefits was performed for the remaining SAMAs. If the expected cost for those SAMAs exceeded the calculated benefit, the SAMA was considered not to be cost-beneficial. The cost-benefit results for the individual analysis of the SAMA candidates are presented in Table G-4. In the baseline analyses contained in the ER (using a 7 percent discount rate), NMC identified five potentially cost-beneficial SAMAs. Based on an analysis using a 3 percent discount rate, as recommended in NUREG/BR-0058 (NRC 2004), no additional SAMA candidates were determined to be potentially cost-beneficial. The potentially cost-beneficial SAMAs are:

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

- SAMA 13 – add a nitrogen station. This SAMA involves the use of a nitrogen station to automatically provide backup air supply for critical instrumentation and reduce the importance of loss of instrument air.
- SAMA 16 – add insulation to the EDG exhaust ducts. This SAMA involves insulating the EDG exhaust ducts and making procedural modifications to prevent overheating of EDG engines.
- SAMA 22 – replace under-voltage relays with a seismically qualified model. This SAMA involves replacing relays to reduce the likelihood of failure of automatic start of the EDGs and to reduce the contributions from loss of power due to the relays.
- SAMA 23 – modify procedures for primary coolant system cooldown and provide associated training. This SAMA involves procedural modifications to reduce the probability of reactor coolant pump seal failures related to long-term high-temperature exposure after recovery of component cooling water.

NMC performed additional analyses to evaluate the impact of parameter choices and uncertainties on the results of the SAMA assessment (NMC 2005a). NMC considered the impact of analysis uncertainties on the results of the SAMA analysis by increasing the benefits by a factor of 2.3. The result of the analysis is that one additional Phase 2 SAMA candidate was determined to be potentially cost-beneficial:

- SAMA 3 – add a DDDIP. This SAMA involves installing a non-safety-related DDDIP to supplement the turbine-driven AFW pump and reduce the risk of SBO scenarios.

In the ER, NMC stated that it will implement or continue to consider the above six SAMAs identified in the analysis (SAMAs 3, 10, 13, 16, 22, and 23) through the appropriate Palisades design process.

In response to RAIs by the NRC staff, NMC committed to further evaluate possible lower cost alternatives for two SAMAs originally eliminated in the Phase 1 screening analysis and to further evaluate two additional SAMAs determined to be applicable to Palisades but not yet evaluated by NMC:

- Lower cost alternative to SAMA 1 – installing an additional EDG,
- Lower cost alternative to SAMA 18 – installing a permanent, dedicated pump and line to the EDGs,

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- Additional SAMA to add the capability to flash the field on the EDGs, and
- Additional SAMA to replace an existing air-operated containment sump valve with a motor-operated valve.

The potentially cost-beneficial SAMAs and NMC's plans for further evaluation of these SAMAs are discussed in more detail in Section G.6.2.

G.6.2 Review of NMC's Cost-Benefit Evaluation

The cost-benefit analysis performed by NMC was based primarily on NUREG/BR-0184 (NRC 1997a) and was executed consistent with this guidance.

To account for external events, NMC multiplied the internal event benefits by a factor of 2 for each SAMA, except the one Phase 2 SAMA that specifically addressed seismic risk only (SAMA 22). Doubling the benefit for SAMA 22 is not appropriate since this SAMA is specific to seismic risk only and would not have a corresponding benefit on the risk from internal events. While SAMAs 3, 4, and 10 were recognized as being effective in fire events, doubling of the benefit for these SAMAs is appropriate since they were also identified based on their importance in internal events. Given that the CDF of 4.3×10^{-5} per year from internal fires, seismic events, and other external events as reported by NMC (NMC 2005a) is about the same as the CDF of 4.0×10^{-5} per year from internal events, the NRC staff agrees that the factor of 2 multiplier for external events is reasonable.

NMC considered the impact that possible increases in benefits from analysis uncertainties would have on the results of the SAMA assessment. Information regarding the uncertainty distribution of the internal events CDF is summarized in Section E.7.2 of the ER (NMC 2005a). In the uncertainty assessment described therein, the 95th percent confidence level for the internal events CDF is approximately 2.3 times the point estimate CDF. NMC reexamined the initial set of SAMAs to determine if any additional Phase 1 SAMAs would be retained for further analysis if the benefits (and MMACR) were increased by a factor of 2.3. Four such SAMAs were identified: SAMA 11 – install an additional high-pressure boron injection system to increase the means of injecting boron into the reactor in an ATWS; SAMA 15 – add a bypass pipeline around the SIRWT return valves to prevent injection pump failure given failure of the return valves to open; SAMA 18 – provide a dedicated pump and pipeline to the EDGs for cooling, thereby reducing system dependencies; and SAMA 21 – enable the FPS as a backup for the containment spray system. However, based on further consideration of their costs and the limited benefit of eliminating the basic events addressed by three of these SAMAs, NMC concluded that SAMAs 11, 15, and 18 would not be cost-beneficial even if the systems were completely reliable. The specific rationale is provided in Section E.7.2.1 of the ER. The NRC staff considers the applicant's rationale for eliminating SAMAs 11, 15, and 18 from further

consideration in the final evaluation to be reasonable. SAMA 21 was retained for consideration in the final evaluation as discussed below.

NMC also considered the impact on the Phase 2 screening if the estimated benefits were increased by a factor of 2.3 (in addition to the factor of 2 multiplier already included in the baseline benefit estimates to account for external events). Of the SAMAs evaluated in the Phase 2 analysis, only SAMA 3, add a DDDIP, was found to be potentially cost-beneficial after having been classified as not cost-beneficial in the baseline analysis. Although not cost-beneficial in the baseline analysis, NMC included SAMA 3 within the set of potentially cost-beneficial SAMAs that it intends to evaluate further for potential implementation.

SAMA 21, which was retained for further evaluation as a result of an uncertainty assessment, was subsequently eliminated by NMC. The detailed cost-benefit analysis for this SAMA assumed that all loss of containment spray events would be eliminated. The PSA model result was about a 40 percent reduction in the population dose and, since the containment spray system has a minimal impact on CDF, no reduction in the CDF. The estimated total benefit (present value) of the averted risk, assuming a 7 percent discount rate, was calculated to be about \$3,570,000 (which assumes a doubling of the benefit to account for external events). Since this total estimated benefit is significantly less than the estimated cost of implementation of \$7,000,000, NMC concluded that this SAMA would not be cost-beneficial. The NRC staff has reviewed NMC's bases for calculating the risk reduction for this SAMA and concludes that the rationale and assumptions for estimating risk reduction are reasonable and generally conservative (i.e., the estimated risk reduction is higher than what would actually be realized). The NRC staff also reviewed the bases for the estimated implementation cost of this SAMA and found it to be consistent with estimates provided in support of other plants' analyses. Accordingly, the NRC staff agrees with the NMC conclusion that this SAMA is not cost-beneficial.

During its review, the NRC noted that the offsite economic cost risk estimated for Palisades is larger than that estimated at other sites having similar CDF and population dose. The NRC staff asked NMC to provide additional information on the input assumptions used in the MACCS2 model and other factors that may contribute to this difference (NRC 2005). In response to the RAI, NMC provided additional detail on the input assumptions made for several MACCS2 economic parameters (NMC 2005b). The NRC staff concludes that the input assumptions are consistent with those used in other recent industry analyses, and that the noted differences in offsite economic cost risk are most likely due to population differences.

In its ER, NMC stated that several SAMAs are cost-beneficial based on the methodology applied in the analysis and warrant further review for potential implementation. Five SAMAs were found to have positive net values in NMC's baseline analysis (SAMAs 10, 13, 16, 22, and 23). One additional SAMA candidate was determined by NMC to be potentially cost-beneficial based on consideration of uncertainties (SAMA 3). NMC noted that three SAMAs in particular

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show the largest potential for delivering a cost-beneficial risk reduction at Palisades, specifically, SAMAs 10, 13, and 16.

NMC performed a probabilistic evaluation to investigate the impact on the remaining cost-beneficial SAMAs if SAMA 10 were to be implemented. On the basis of information provided in Section E.6.9 of the ER, implementation of SAMA 10 would alter the cost-effectiveness of the remaining SAMAs such that several of the aforementioned SAMAs would no longer be cost-beneficial.

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

The NRC staff notes that all of the potentially cost-beneficial SAMAs identified in either the baseline analysis or the uncertainty analysis are included within the set of SAMAs that NMC plans to further evaluate. Several additional SAMAs, representing lower cost alternatives to SAMAs originally eliminated in the Phase 1 screening analysis and SAMAs determined to be applicable to Palisades but not yet evaluated by NMC, will be assessed as part of this evaluation. The NRC staff concludes that, with the exception of the 10 potentially cost-beneficial SAMAs discussed above, the costs of the SAMAs evaluated would be higher than the associated benefits.

G.7 Conclusions

NMC compiled a list of 23 SAMA candidates based on a review of the most significant basic events from the plant-specific PSA, Phase 2 SAMAs from license renewal activities for other plants, and insights from the plant-specific IPE and IPEEE. A qualitative screening removed 14 SAMA candidates that (1) were not applicable at Palisades because of design differences, (2) require extensive changes that involve implementation costs known to exceed any possible benefit, or (3) cost more than \$5,600,000 to implement (the modified maximum averted cost-risk). An additional SAMA candidate was eliminated based on plant-specific insights regarding the low risk significance of systems affected by the SAMA, leaving eight SAMA candidates for further evaluation.

For the remaining SAMA candidates, a more detailed design and cost estimate was developed as shown in Table G-4. The cost-benefit analyses showed that five of the SAMA candidates were potentially cost-beneficial in the baseline analysis (SAMAs 10, 13, 16, 22, and 23). NMC performed additional analyses to evaluate the impact of parameter choices and uncertainties on the results of the SAMA assessment. As a result, one additional SAMA was identified as potentially cost-beneficial (SAMA 3). NMC has indicated that a further evaluation of these six potentially cost-beneficial SAMAs will be performed.

In response to RAIs by the NRC staff, NMC committed to further evaluate possible lower cost alternatives for two SAMAs originally eliminated in the Phase 1 screening analysis (SAMAs 1 and 18) and to further evaluate two NRC-staff-identified plant enhancements determined to be applicable to Palisades but not yet evaluated by NMC (add the capability to flash the field on the EDG, and replace an existing air-operated containment sump valve with a motor-operated valve). NMC has entered these 10 potentially cost-beneficial items into the Palisades corrective action system for further review. If determined to be cost-beneficial, they will be further evaluated for possible implementation in accordance with Palisades plant design processes.

The NRC staff reviewed the NMC analysis and concluded that the methods used and the implementation of those methods were sound. The treatment of SAMA benefits and costs support the general conclusion that the SAMA evaluations performed by NMC are reasonable and sufficient for the license renewal submittal. Although the treatment of SAMAs for external events was somewhat limited by the unavailability of an external event PSA, the likelihood of there being cost-beneficial enhancements in this area was minimized by inclusion of a candidate SAMA related to dominant seismic events, inclusion of several candidate SAMAs related to dominant fire events, improvements that have been realized as a result of the IPEEE process, and inclusion of a multiplier to account for external events.

The NRC staff concurs with NMC's identification of areas in which risk can be further reduced in a cost-beneficial manner through the implementation of all or a subset of the identified, potentially cost-beneficial SAMAs. Given the potential for cost-beneficial risk reduction, the NRC staff agrees that further evaluation of these SAMAs by NMC is warranted. However, these SAMAs do not relate to adequately managing the effects of aging during the period of extended operation. Therefore, they need not be implemented as part of the license renewal pursuant to 10 CFR Part 54.

G.8 References

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11. ABSTRACT (200 words or less)

This final supplemental environmental impact statement (SEIS) has been prepared in response to an application submitted to the Nuclear Regulatory Commission (NRC) by Nuclear Management Company, LLC (NMC) to renew the operating license for the Palisades Nuclear Plant (Palisades) for an additional 20 years under 10 CFR Part 54. This final SEIS includes the NRC staff's analysis that considers and weighs the environmental effects of the proposed action, the environmental impacts of alternatives to the proposed action, and mitigation measures available for reducing or avoiding adverse impacts.

The NRC staff's recommendation is that the Commission determine that the adverse environmental impacts of license renewal for Palisades are not so great that preserving the option of license renewal for energy-planning decision makers would be unreasonable. This preliminary recommendation is based on the following: (1) the analysis and findings in the Generic Environmental Impact Statement for License Renewal of Nuclear Plants (NUREG-1437); (2) the Environmental Report submitted by NMC; (3) consultation with other Federal, State, Tribal, and Local agencies; (4) the staff's own independent review; and (5) the staff's consideration of public comments.

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